ORIGINAL

RECEIVED
CLERK'S OFFICE
MAY 14 2001
STATE OF ILLINOIS
Pollution Control Board

Vermilon Coal Company

Public Comments & Exhibits

PCB01-112
P.C. #10

Before the Illinois Pollution Control Board,

Case PCB01-112; Prairie Rivers Network v

IEPA and Black Beauty Coal Company

May 14, 2001

Vermilion Coal Company

1979 Johns Drive Glenview IL 60025
Tel: 847.832.9007 Fax: 847.832.9010

May 14, 2001

Dorothy Gunn, Clerk
Illinois Pollution Control Board
100 W. Randolph St.
Street Suite 11-500
Chicago IL 60601

Re: PCB 01-112; Prairie Rivers Network v IEPA and Black Beauty Coal Company

Ladies and Gentlemen:

Prairie Rivers Network ("Appellant") has appealed the issuance of an NPDES permit (the "Permit") to Black Beauty Coal Company ("Permittee") for the occasional discharge of treated storm water into an unnamed tributary of the Little Vermilion River from the surface property relating to Vermilion Grove underground coal mine, by the Illinois EPA ("IEPA"). Frederick Keady, President of Vermilion Coal Company ("Vermilion") provided public and written comments during the pendency of Permittee's application. Vermilion sought standing as a party in this matter, which was denied. However, Vermilion was given the opportunity to submit public comment and an *Amicus Curiae* brief. This letter is Vermilion's public comment. Vermilion's *Amicus Curiae* Brief is being submitted under separate cover.

The Permits have significant environmental benefits: The Vermilion Grove mine will have significant environmental benefits. Production and use of more than 40 million tons of coal from the proposed Vermilion Grove mine will avoid the emission of an estimated 1,600,000 tons of sulfur dioxide, relative to typical 3.5% sulfur Illinois coal.

The proposed coal mining and processing complex is a paragon of enlightened environmental engineering. Underground mining operations and coal preparation, storage and shipping will be conducted in accordance with the strictest environmental standards. Treated stormwater that would be infrequently discharged pursuant to the permit (and only during heavy storms (when large quantities of water from other sources ensures heavy dilution) would have an "immeasurable" on water quality in the Little Vermilion River (the "River"), and, is a dramatic improvement over the unregulated farm runoff previously discharged from the same property. Exhibit C hereto shows that a much of the acreage of the permitted property is dedicated to water treatment facilities

Petitioner falsely alleged that water discharged pursuant to the Permits would degrade the quality of the River. The River is known to suffer from high nitrates as a result of agricultural runoff, and questions have been raised about phosphates, pesticide residues, and coliform bacteria. The small and intermittent discharges permitted pursuant to the Permits will not contain any of these substances, are certain to be cleaner and smaller in quantity than the runoff from the previous land use or the surrounding lands, and are

certain to improve the water quality of the River. Frederick Keady, Vermilion's president has offered to cheerfully drink several glasses of the water from the Permitted discharge as evidence of his confidence in this regard; and to present evidence of that fact.

The Permits have significant energy benefits: The coal to be produced by Permittee will be used to produce more than 100 billion kilowatt-hours of electric energy, at less than one-fifth the fuel cost of natural gas. Natural gas is primarily a space-heating fuel for homes and commercial buildings, and supplies are inadequate to service a major part of the electric utility industry's fuels requirement. Recent uptake of natural gas by electric utilities has crowded out city-gate uses of natural gas and resulted in prices exceeding $10.00/mcf. Electric energy shortages here during the past few summers are ample evidence that Illinois is precariously close to an electric energy crisis like California is now suffering.

Vermilion's Property Rights Would be Adversely Affected: Vermilion is the owner of the coal and mineral to be mined under lease by Permittee pursuant to the Permits. Vermilion also owns 32 acres of fee land whose surface comprises most of the North bank of Lake Georgetown, and whose coal is included in Permittee's Lease. Virtually all of the coal leased by Permittee from Vermilion is within the watershed of the Little Vermilion River. Production of Vermilion's coal will require one or more NPDES permits to be issued to Permittee for stormwater discharge into the Little Vermilion River or its tributaries, regardless of where Permittee's surface facilities are sited. Accordingly, denial or significant impairment of Permittee's permits amounts to a taking of Vermilion's property.

Vermilion's Property is Very Valuable: The coal to be mined at Permittee's Vermilion Grove coal mine includes at least 40 million salable tons of Vermilion's coal. Vermilion has a contractual and business expectation of receiving an estimated $1.00 per ton in earned royalties in regard of this coal, in addition to additional revenues as minimum royalties and wheelage fees. This income is expected to be received at the rate of $250,000 per month from the time the Vermilion Grove mine reaches its capacity until the coal is exhausted.

The coal lands to be mined by Permittee are part of one of the largest low-sulfur coal reserves in the State of Illinois. Vermilion and its predecessors have owned these lands since 1920. More than 80 million tons of low-sulfur coal was produced between 1920 and 1972, and a similar quantity remains to be produced. Vermilion and its predecessors have paid millions of dollars in property taxes to the Vermilion County, the State of Illinois, and various other taxing bodies. Proceeds arising from the lease between it and Permittee are Vermilion's principal source of revenue.

Vermilion Made Substantial Financial Commitments: Vermilion has a sunk investment of $20 million in its property. The property is secured by a $4,425,000 deed of trust mortgage from a local bank. The balance of the sunk investment was provided by predecessor companies and by borrowings and equity investments of shareholders of Iron

Carbide Technologies Inc. Vermilion's parent corporation. Many of these have invested a substantial part of their savings.

Vermilion Relied on Existing Regulations: These financial commitments were made in express reliance upon the established permitting rules and regulations of the IEPA, USEPA, IL PCB, Illinois Department of Natural Resources ("IDNR"), and US Office of Surface Mining ("ÖSM"); and for the express purpose of making available substantial quantities of coal that would permit electric utilities to comply with the Acid Rain provisions of the Clean Air Act Amendments of 1991.

Vermilion was Denied its Right to Due Process: The facts set forth in this letter are well documented and would have been placed into evidence if Vermilion had been granted status as a party in the above captioned case, in accordance with its constitutional right to due process. Vermilion made all reasonable efforts to obtain status in the case, which were denied; and therefore must allege these facts through the public comment process. Vermilion remains ready, able and willing to prove these facts.

IEPA Acted Properly: It is Vermilion's position that the IEPA lawfully and properly issued the Permit; and that IEPA relied on the rules and regulations of the State of Illinois and the United States Government, its own experience and a vast body of scientific and engineering know-how. IEPA acted within its reasonable discretion. The USEPA expressly consented to issuance of the Permit. From a practical standpoint, the issuance of the Permit will have a beneficial effect on the Little Vermilion River.

Any Errors or Omissions by IEPA were Immaterial, and the Permit Should Remain in Force: Appellant alleged procedural errors by IEPA, and insists that it be given a greater role in the permitting process for NPDES and similar permits. Appellant claims it was disadvantaged by IEPA's reliance on its substantial expertise in water quality matters. While it may be prudent for IEPA to "include by reference" certain foundation authorities (including but not limited to prior IL PCB rulemaking and other proceedings, and the authorities relied upon therein. See Exhibits A and B hereto for examples of such foundation authorities.).

Permit Denial Would be an Unlawful Taking of Vermilion's Property: Denial or impairment of the Permit will certainly result in a drastic loss of value of Vermilion's coal property. Vermilion conducted extensive due diligence on Illinois and United States environmental regulations, and relied upon those laws and regulations in undertaking to commit its investment in its Vermilion county coal rights. Acceding to the demands of Appellant would require arbitrary changes in the letter or the spirit of these laws and regulations subsequent to the time of Permittee application.

Permit Denial Would be Bad Public Policy: Ironically, Vermilion's investment in these coal lands was driven by an incentive to increase production of Illinois low-sulfur coal in order to facilitate the efforts of Midwestern electric utilities to comply with the Acid-Rain provisions of the Clean Air Act Amendments of 1991. If such supply-side investments are

perceived to be at risk of being wasted by sudden, arbitrary, "Catch-22", zigzags in regulatory policy, in response to *ad hoc* complaints by third-party intervenors, producers of all forms of energy and environmental goods will invest elsewhere, or will require higher returns to compensate for higher regulatory risks.

Vermilion Could Not Oversee IEPA's Review of Permittee's Application: Vermilion must rely on IEPA's procedures. It would be inappropriate, and perhaps unlawful, for Vermilion to afford itself access to, or influence on, the permit review processes of Illinois State Agencies. If the Permit is denied or impaired for procedural reasons, Vermilion, as a helpless pawn of procedural differences amongst regulatory entities of the State of Illinois will certainly suffer loss or diminution of its property values. IL PCB's peremptory denial of Vermilion's motion to intervene further diminished Vermilion's ability to protect and conserve its property rights.

Appellant's Conduct Raises Conflict-of-Interest Issues: Ominously, Appellant has afforded itself a remarkable degree of access into the regulatory process. Appellant Prairie Rivers Network, perhaps assisted by the Environmental law and Policy Center, has acted in concert with numerous employees of the IDNR in order to implement their particular notions of State Environmental Regulatory Policy. While no evidence has emerged, as yet, that IEPA staff have been similarly co-opted, the greatest degree of collaboration has occurred regarding endangered species and nature preserves—key factors in granting NPDES permits; and in Appellants appeal of the Permit.

According to Appellant's' web site, a member of Appellant's Board of Directors, Virginia Scott, is a key employee of the IDNR. According to Appellant, ***"Her experience working with governmental entities is particularly valuable to Prairie Rivers' Board."*** (emphasis added). While Appellant would doubtless dismiss conflict concerns with reassurances that Ms. Scott has no involvement with permitting, it would stridently object to a similarly situated IDNR or IEPA manager acting as a board member of Permittee or Vermilion. Most of Appellant's board members are State of Illinois Employees.

The September 1, 2000 letter of Carolyn Taft Grosboll, Executive Director of the Illinois Nature Preserve Commission, to the IEPA Water Pollution Control Division, Permit Section has and continues to play a prominent role in the adjudication of the Permit. Ms. Grosboll has admitted in sworn depositions that *this letter were drafted in their entirety by Commission employee Mary Kay Solecke, a three-year member of Appellant.* Aside from the threatening and coercive tone of the Grosboll/Solecke letters, Ms. Grosboll's September 1, 2000 letter misleadingly cited the Illinois Natural Areas Inventory as an authority for denying or limiting the Permit without disclosing that the INAI began its report with the caveat that the Little Vermilion River has been subject to continuing effects of human activities for at least 150 years. *[Fred Hubbard to confirm reference to INAI]* According to her testimony, Ms. Grosboll did not suspect at the time that she was being used by Ms. Solecke to implement Appellant's agenda, and perhaps to set up grounds for this appeal.

The conduct of IDNR's Endangered Species Office is perhaps the most troubling of the numerous apparent conflicts of interest in the records of the Agencies that forms the evidentiary basis for this Appeal. Deanna Glosser, the director of the IDNR Endangered Species office during the pendency of the Permit application, sent a strongly worded letter on Department letterhead to IEPA hearing Officer Seltzer, with copies to many other IEPA and IDNR officials. Ms. Glosser's letter dwelt on the proposed antidegradation regulations now pending before the IPCB, even though those regulations are not applicable to the Vermilion Grove NPDES permit. Patrick Malone, a Glosser subordinate, busied himself to provide legal research in regard to unlawful takings, which suggests this was their intent all along.

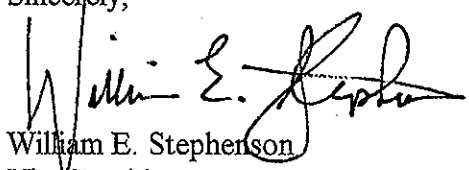
Both the Glosser and Grosboll letters knowingly, falsely, and willfully stated that the permitted discharge would result in significant degradation during dry periods, even though they were well aware that the discharge would only flow during major storms, and then to a lesser extent than other watershed contributors. Both cited papers from other regions to suggest that even minute contacts of water with coal anywhere in the watershed would have disastrous effects on the Little Vermilion River, even though both were aware that the LVR naturally flows through the coal seams throughout Vermilion County; and that a major part of the riverbed in the Carl Flierman's nature preserve is comprised of old coal mining strip pits (Ex. D). As illustrated by the photograph in Ex. G, Vermilion Grove area residents seem to have viewed the unnamed tributary as a disposal area for old white goods.

Appellant and the Environmental Law and Policy Center have not acted as responsible advocates in this matter; rather they have misrepresented facts, co-opted employees of Illinois regulatory agencies; and generally abused the privilege they have been afforded as responsible environmental organizations. The Executive Director of Appellant, made false and defamatory statements without bothering to conduct or obtain any scientific or engineering analysis. He himself is unqualified by education or experience to hold a technically or managerially demanding position. His main qualifications seems to be a smarmy, vaguely defined affection for rivers; and a gift for inflammatory rhetoric. Any pending or future comments or contribution by these persons or entities should be regarded by the IL PCB as prejudiced, lacking in objectivity, and aimed at misusing the regulatory process to achieve mainly political goals.

The conduct of Appellant and its counsel, Environmental Law & Policy Center, suggests that they and certain individuals politically activist persons within the IEPA and IDNR are acting in concert to set up the Black Beauty Permit matter as a "Poster Child" that illustrates the dire need for stricter antidegradation regulations. Any future efforts by them to influence Illinois antidegradation rules should be viewed with great skepticism.

Appellant has failed to meet its burden of proof in this matter. Further, Appellant has acted in bad faith. Equity demands equity. Vermilion Coal Company respectfully requests that the appeal be denied in its entirety.

Sincerely,



William E. Stephenson
Vice President

Before the Illinois Pollution Control Board, Case PCB01-112
Prairie Rivers Network v IEPA and Black Beauty Coal Company
Exhibit List to Public Comments of Vermilion Coal Company

Exhibit A: IL PCB Rulemaking Proceedings (1980)

Exhibit B: IL PCB Rulemaking Proceedings (1983)

Exhibit C: Plan View of Vermilion Grove Mine Water Treatment Facilities

Exhibit D: Little Vermilion Riverbed Map Showing Old Strip Pits

Exhibit E: September 1, 2000 Letter of Carolyn Grosboll (IEPA Ex. 72)

Exhibit F: September 12, 2000 Letter of Deanna Glosser (IEPA Ex. 1)

Exhibit G: Photo of LVR Unnamed Tributary Showing Discarded White Goods

Exhibit H: Biologically Significant Illinois Streams (Page 25, 1992) (IEPA/WPC/93-139)

Exhibit A

BBC #36

LEXSEE 1980 Ill. ENV LEXIS 379

IN THE MATTER OF: PROPOSED AMENDMENTS TO CHAPTER 4 OF THE REGULATIONS OF THE ILLINOIS POLLUTION CONTROL BOARD

Nos. R76-20; 77-10

Illinois Pollution Control Board

1980 Ill. ENV LEXIS 379

January 24, 1980

OPINIONBY: [*1]

SATCHELL

OPINION: PROPOSED OPINION OF THE BOARD (by Dr. Satchell):

This matter comes before the Board upon two proposals for regulatory change. On September 21, 1976 Ohio Power Company filed a petition for a change in the definition of mine storage facility, docketed R76-20. On April 20, 1977 the Environmental Protection Agency (Agency) filed a petition proposing to repeal Chapter 4: Mine Related Pollution and substitute a new version, docketed R77-10. On August 18, 1977 the proceedings were consolidated on motion of Ohio Power Company. The proposal in R76-20 was published in Environmental Register Number 135 on August 15, 1976. R77-10 was published in Environmental Register Number 146 on May 2, 1977. Public hearings on the proposal were held in Springfield on October 31, 1977 and in Carbondale on November 2 and 3, 1977. During the course of these hearings, two amended proposals were presented by the Agency.

On November 21, 1978 the Institute of Natural Resources (Institute), pursuant to suggestion made by the Illinois Coal Association at the merit hearings, filed with the Board a proposal for interim regulations (R. 141). On December 14, 1978 the Board ordered the record in this [*2] proceeding held open to take evidence on the proposal for an interim regulation concerning total dissolved solids in mine discharge (Rule 605; 32 PCB 321).

An Economic Impact Study (EcIS) was prepared by the Institute. Public hearings on the EcIS were held in Springfield on July 31 and in Carbondale on August 2, 1979. At these hearings evidence was also taken on the merits of the Institute's interim proposal. On September 5, 1979 the Agency filed a third amended proposal. On October 2, 1979 the Illinois Coal Association filed a set of comments. On October 4, 1979 Monterey Coal Company filed its comments. On that same date the Illinois Mine Related Pollution Task Force filed a position paper. On October 11, 1979 the Board received the comment of Directors Michael Mauzy of the Agency and Brad Evilsizer of the Illinois Department of Mines and Minerals.

The hearings were attended by members of the public and representatives of various coal companies and the Illinois Coal Association (Coal Association). Some of the latter were also members of the Task Force. The industry representatives presented testimony and cross-examined witnesses.

SUMMARY OF PROPOSED CHANGES

The Chapter [*3] 4 revisions, drafted on the Order dated December 13, 1979, are largely to accommodate the NPDES permit requirement. Currently mines require two environmental permits in Illinois: they must have a Chapter 4 state

permit, and, in most cases, an NPDES permit under Chapter 3. The new Chapter 4 provides specifically for Chapter 4 NPDES permits. The Agency regards this permit requirement as essentially duplicative. The new Chapter 4 will exempt from the state permit requirement those mines which hold an NPDES permit (Rule 402).

The Proposal also contains a significant expansion of the scope of Chapter 4 to include coal transfer stations. This was the proposal of Ohio Power Company which was denominated R76-20 and consolidated with the Agency's proposal. This will allow coal transfer and similar facilities to take advantage of the more lenient effluent standards contained in Part VI of Chapter 4 (Rule 201: "Mining Activities"). Since the inclusion of coal transfer facilities under Chapter 4 would represent a significant expansion of the permit requirement, there are also provided exemptions from the permit requirement for smaller facilities (Rule 403).

The effluent limitations contained [*4] in Chapter 4 have been revised to more closely follow the federal guidelines. The averaging rule has also been changed to be similar to that found in federal guidelines and in the proposal in R76-21 (Rules 601, 606).

The present Chapter 4 requires an abandonment permit before a mine is abandoned. The Agency has found these provisions to be unworkable. The new Chapter 4 will provide for an abandonment plan which is filed with the permit application and incorporated into the permit as a condition (Rule 509).

Most of the technical rules governing coal mining have been removed from Chapter 4. The remaining document is largely procedural. There is, however, provision for publication of an Agency guidance document which would contain design criteria for coal mines and treatment works (Rule 501). There is a similar provision in the water rules (Water Pollution Rule 967).

Most of the controversy has controversy has centered around Rule 605 which is unchanged from the old Chapter 4. This rule requires that coal mine effluents not cause violation of the water quality standards contained in Chapter 3. Apparently most of the coal mines in the state cause such water quality violations [*5] with respect to total dissolved solids (TDS), chloride and sulfate. Late in the proceeding the Institute of Natural Resources and the Agency proposed a temporary rule to exempt coal mines from Rule 605 into the year 1981, at which time the Institute intends to propose an alternative to Rule 605 (32 PCB 321). In the interim, compliance will be required with good housekeeping practices contained in a code of good mining practices promulgated by a joint government-industry task force.

STATE OR NPDES PERMIT

Although elimination of duplicate permits and provision for exemption from the state permit requirements will result in dollar savings to the Agency and to the industry, it adds considerable complexity to Chapter 4. A facility carrying out mining activities may fall into one of the following categories:

1. Combined Chapter 3 and Chapter 4 NPDES permit;

2. Chapter 4 NPDES permit;

3. State permit; or

4. Exempt from state permit (and not required to have an NPDES permit).

The following outline determines into which permit category a facility will fall:

1. Does the applicant already possess a Chapter 4 state or NPDES permit for the facility?

-- If so, is [*6] permit modification required under Rules 304(b) or 407?

2. If not, does the applicant propose to carry out "mining activities" within the meaning of Rule 201?

-- If the applicant does not propose to carry out mining activities a Chapter 4 permit is not required under Rule 401.

3. If the application proposes mining activities, then does the applicant already possess a Chapter 3 NPDES permit for the facility [Rule 402(a)]?

-- If so, then the Chapter 4 requirements will be written into the Chapter 3 NPDES permit (Rule 302).

4. If the applicant has no NPDES permit, then does the application propose a discharge from a point source into navigable waters within the meaning of the FWPCA (Rule 402)?

-- If so, then under Rules 300(a) and 302 the requirements of Chapter 3 and Chapter 4 will be written into one NPDES permit for the facility subject to the standard for permit issuance contained in Rule 502.

5. If an NPDES permit is neither held nor required, then does the facility qualify for an exemption from the state permit requirement under Rule 403?

-- If not, a state permit is required under Rule 401.

6. If so, has the Agency notified the facility that a state [*7] permit is nevertheless required under Rule 403(c)?

-- If so, a state permit will be written pursuant to Rule 401, subject to the general standard for permit issuance contained in Rule 502; otherwise, a Chapter 4 permit is not required, provided the operator notifies the Agency of the location of the facility and claims exemption prior to the filing of an enforcement action [Rule 403(b)].

There are also construction permits (Rule 401) and construction authorizations (Rule 304). These are special, limited state and NPDES permits, respectively. In the case of a facility which already has a Chapter 4 permit, their issuance will amount to a permit modification in the above outline. In the case of a new Chapter 4 facility, the state or NPDES permit first issued will ordinarily be a construction permit or authorization, although there is flexibility on this point.

ECONOMIC IMPACT STUDY

The Economic Impact Study was prepared for the Institute by Dr. William C. Hood and Dr. Donald W. Lybecker. The study found few identifiable costs and benefits and concluded that the economic impact of proposed changes would be minimal. The specific findings will be discussed with the individual [*8] sections which were found to have an economic impact.

The transcripts of the two sets of hearings are not numbered sequentially. It is therefore necessary to distinguish page numbers. "E" refers to a page

number in the economic impact hearings, while "R" refers to a page number in the merit hearings.

AGENCY PROPOSAL

At the hearings it was suggested that the Agency's proposal needed to be more carefully drawn (R. 119). It was further suggested that for clarity it was desirable to separate the provisions applicable to: (1) NPDES permits, (2) state permits and (3) both (R. 100). The Agency's response to these criticisms was three amended proposals which adjusted specific rules to meet specific objections. The Agency suggested that the editorial changes were up to the Board (R. 120). Accordingly, the Board has regrouped the provisions from the arrangement in the Agency proposal. After the proposal had been rearranged it became apparent that its lack of structure had hidden a number of circular definitions and conflicting provisions. An effort has been made to eliminate these difficulties. Specific alterations in the Agency's proposal will be discussed with each section. [*9] To aid in cross referencing the proposed Opinion and Order to the proposal and the old Chapter 4, the comparable section numbers have been listed in parentheses after the heading of each rule in this Opinion, For example, "P-305" refers to Rule 305 in the Agency proposal and "O-605" is Rule 605 in the old Chapter 4.

PART I: GENERAL PROVISIONS

101 Authority (P-101; O-101)

Rule 101 sets forth the Board's authority to regulate mine related pollution under ß ß 12 and 13 of the Act which concern water pollution. The old Chapter 4 also listed ß ß 9, 21, and 22 of the Act which related to air pollution and land pollution and refuse disposal. These have been omitted from the revision. Mining activities are subject to these provisions of the Act and to the Board regulations adopted under them -- Chapter 2: Air Pollution Control Regulations and Chapter 7: Solid Waste Rules and Regulations, as well as other Board regulations (R. 43).

Mine refuse disposal is regulated by Chapter 4 pursuant to ß 12(d) of the Act which concerns depositing contaminants upon the land so as to cause a water pollution hazard. It is arguable that mine refuse is also "refuse" within the meaning of ß ß 21 and [*10] 22. However, it is not the Board's intention that disposal of mine refuse on a permitted Chapter 4 facility be subject to Chapter 7 as well as Chapter 4.

Since Chapter 3 and Chapter 4 both govern water pollution there must be special rules establishing the respective jurisdictions. Chapter 4 governs mining activities which include mine related facilities as defined by Rule 201. Part VI establishes effluent limits for mine discharges (Rule 600). Other discharges and facilities are regulated under Chapter 3.

102 Policy (P-102; O-102)

This is largely unchanged from the Agency proposal and the old Chapter 4. The wording has been changed to include the defined terms "mining activities" and "mine related facility" (R. 201).

103 Purpose (P-103; O-102)

This has been taken largely unchanged from the second paragraph of old Rule 102.

104 Compliance with Other Laws Required (P-105; 0-701)

This has been changed to indicate required compliance with "The Surface Coal Mining Land Conservation and Reclamation Act." The title of the law passed in 1979 differs slightly from the old title (R. 43, 58, 67).

105 Validity Not Affected (P-106; 0-702)

This is unchanged.

106 Repealer [*11]

This has been added to the Agency proposal. There is a proviso that if the entire Chapter 4 is found invalid or if its enforcement is stayed, then the old Chapter 4 will again come into effect. There is also a provision in Rule 704 which continues the abandonment permit requirements of old Rule 502 until permits containing abandonment plans are issued.

PART II: DEFINITIONS

200 Terms Defined Elsewhere

This contains a listing of terms used in Chapter 4 which are defined in the Act, Chapter 3 or the FWPCA.

201 Definitions

Abandon: The definition of abandon has been enlarged to include "transfer of ownership." An operator who sells a mine may be obliged to execute an abandonment plan under Rule 509. Under the old Chapter 4 persons attempted to evade their responsibilities for properly closing a site by transfer to a party with insufficient resources to close the site. This change seeks to remedy this (R. 9,; E. 41).

The Agency proposal included "fail to open" under the definition of abandonment. This has been deleted on the Agency's motion. Failure to open will not therefore require execution of the abandonment plan. However, any construction activity related to [*12] preparation for mining amounts to opening a mine. Therefore, execution of the abandonment plan will be required unless the operator takes no action whatsoever preparatory to mining.

Acid-producing Material: The definition has been changed slightly to clarify the relationship between pyrite, iron and sulfur. Pyritic compounds include pyrite, marcasite and other compounds of iron and sulfur. These are acid-producing. Other compounds of sulfur include sulfates and organic sulfur. Sulfates are totally oxidized and hence do not, as such, produce acid. Organic and elemental sulfur do not occur in large amounts in Illinois coal, but are acid-producing. The definition has also been changed slightly to specify consideration of the "quality of drainage produced by mining on sites with similar soils." This is in recognition of the fact that little mining actually occurs in the soil itself (R. 84).

Affected Land: The definition has been expanded to include all land owned, controlled or used by the operator in connection with mining activities with the exception of the surface area above underground mines. The old definition included only the actual mined area, refuse area, etc, [*13] The definition has also been altered to exclude land once it has been reclaimed and abandoned to the satisfaction of the Agency (R. 10). Under Rule 513 the affected land cannot be outside the permit area during the permit term.

Coal Transfer Facilities or Coal Storage Yard: This is a new definition. Transfer and storage facilities have been included in the definitions of mining activities and mine related facilities and have thus been brought under Chapter 4 regulation. These facilities have much in common with coal mines and often are larger than small mines and pose a similar pollution threat. Effluents from these facilities will now be regulated under Part VI rather than under Chapter 3. Facilities which have NPDES permits will now fall under Part III rather than the permitting provisions of Chapter 3. Facilities which are not required to have NPDES permits may be required to obtain a state permit under Part IV (R. 10, 19, 60; E. 41, 45, 49, 61, 101).

This modification potentially represents a large expansion of the permit requirement. However, Rule 403 provides exemptions from the state permit requirements for domestic retail sales yards and consumer stockpiles. [*14] Larger facilities are probably already required to have an NPDES permit, in which event Chapter 4 provisions will be written into the Chapter 3 permit.

The Agency proposal specified that coal transfer facilities and coal storage yards were included not only in the definition of "mining activity," but also in "mining" and "mine area." This usage was in conflict with the general definitions of these terms in the proposal and it is not clear what its purpose was. These have therefore been deleted. However, the definition has been expanded to specify that transfer facilities and coal storage yards are "mine related facilities."

The Economic Impact Study concluded that inclusion of coal transfer facilities and storage yards under Chapter 4 would result both in costs and benefits to the industry. They would have to prepare an abandonment plan at a cost of a few hundred to a few thousand dollars. On the other hand, they will not have to invest as much to construct larger treatment facilities to meet the more stringent effluent standards of Chapter 3 (EcIS 35; E. 41, 45, 61). The looser effluent standards would have some negative effect on the environment. However, most of these facilities [*15] are located near major rivers where ample dilution is available (EcIS 17; E. 49, 101).

Construction Authorization: Authorization under Rule 304 to prepare land for mining activities or to construct mine related facilities. Construction authorization is issued to a person who holds or is required to have an NPDES permit (R. 11).

Construction Permit: A permit under Rule 401 allowing the operator to prepare to carry out mining activities or to construct mine related facilities (R.11). A construction permit is a state permit issued to an operator who does not hold an NPDES permit. Under Rule 304 it is possible to issue a construction permit to a person who may be required to apply for an NPDES permit. This will not affect the requirement to obtain an NPDES permit for operation, but may simplify administration in case there is doubt as to which type of permit is required.

Construction of mine related facilities is a mining activity. Construction may therefore be permitted by an operating permit as well as a construction permit. The question is not what the title of the permit is but what the language of the permit allows. The construction permit is a special type of [*16] operating permit which will usually be issued for a short period of time to allow the operator to undertake something out of the ordinary routine of mining. The construction permit contemplates eventual application for an operating permit before daily operation is begun.

It would be better to exclude from the definition of mining activities the construction of mine related facilities. Mining could be separated neatly into two worlds of construction and operation, each with its own permit. However,

such definition would be difficult because mining is essentially an ongoing construction process. It is not the Board's intent to require operators to make continuous application for construction permits or authorizations as mining proceeds (Comments of Coal Association).

Domestic Retail Sales Yard: A coal stockpile which supplies only homeowners, businesses or small industries or other institutions for individual consumption. This does not include a sales yard located at a mine or mine related facility. On the Agency's motion, a specific exclusion for sales yards which supply large industrial operations has been excluded from the proposal. The word "small" has been inserted [*17] in front of industries in the first half of the definition. This does not change the meaning (R. 11, 28; E. 43).

Domestic retail sales yards are excluded from the state permit requirement by Rule 403. This does not, however, exempt such a facility from the requirement of obtaining an NPDES permit if the facility is otherwise required to obtain such a permit, in which case the coal pile will be permitted under Part III of Chapter IV (E. 84).

Drainage Course: Definition unchanged.

Facility: This definition has been added to the Agency proposal. The term was used in that proposal, although undefined, along with "mine," "mining facility," and "operation." A facility is a contiguous area of land, including all structures above or below ground, which is owned or controlled by one person. Two permits are required if there are either two isolated pieces of land with one operator or adjacent tracts with two operators.

The definition of mining activity in the proposal specified "activities on land owned or controlled by the operator. . . ." This has been changed to "activities on a facility." The implication that a permit is limited to one operator on one site is now contained [*18] in the definition of facility.

The one-site/one-operator limitation, although self-evident, is of central importance deserving clarification in a separate definition. Furthermore, it is logically remote from the definition of mining activity, except to the extent that offsite activities are not mining activities within the meaning of Chapter 4.

The facility may be larger than the affected land. It may include undisturbed land and contain within it facilities which are regulated under Chapter 3 as well as mine related facilities. The permit area must be contained within one facility, but the permit area may be less than the entire facility.

It is the Board's intention that a site under control of one operator but bisected by a roadway or other easement should be one facility. In the event there are two closely related, but noncontiguous facilities under the control of one operator, the Agency may allow a combined permit application and issue combined permits, if it is convenient to do so. In the event there are separate surface installations serving a single mine, there will be one facility.

The phrase "owned or controlled" does not require permits of both the owner of record [*19] title and, for instance, a lessee. However, in the event control of mining activities is in dispute, the owner may be required to obtain a permit also. Otherwise the permit will be required of the person in control of the mining activities. The fact that two or more persons may be in control of part of the facility is irrelevant so long as only one controls mining activities; e.g., utility easements or farm operations have no effect on "control" for the purpose of determining the extent of the facility.

During the hearings the Agency sought to amend the proposed definition of "operator" to specifically include co-op preparation plants (R. 12, 29; Agency

Amendment). The argument had been made that, since there was no one operator, Chapter 4 was not applicable to the co-op. However, "operator" has been redefined to include any person who carries out mining activities. The question centers not on the legal character of the person, but on whether he carries out mining activities. Even if a co-op falls under no other characterization in the definition of "person" in the Act, then it will probably be a partnership within the meaning of Chapter 106 1/2, ß 6, Illinois Revised Statutes. [*20] If the facility if physically separated, then multiple permits may be required. However, if one site is operated by several persons, the Agency may require them to enter into a formal agreement fixing control prior to permit issuance.

Mine Area or Mined Area: Although the definition is largely unchanged, it has been altered to exclude the unmined surface land directly above underground mine workings that is not otherwise disturbed by mining activities. The changes in wording more clearly state the definition (R. 91).

Mine Discharge: Part VI regulates mine discharges. The production of a mine discharge is a mining activity. The AGency proposal did not include a definition of mine discharge. This definition has been taken from Rule 600 (P-301). Since the definition is fairly long it was thought better to set it forth in definitions and then simply use the term "mine discharge" in Part VI.

The proposal brings preparation and milling plant effluents into Chapter 4 for the first time (R. 15). The definition has also been expanded somewhat to include discharge from affected land and runoff from land. The Agency definition was somewhat more limited in scope. This [*21] may have been inadvertently omitted from the Agency proposal since it is contained in the old version of Chapter 4 [0-601(a), P-301(a)] (R. 51).

Coal mining is closely connected with activities affecting the land. The exclusion of runoff from part of the affected land from Chapter 4 regulation could have unintended results. It could be argued under the Agency proposal that runoff from the affected land other than from the mining area or the mine refuse area or processing plant, etc., would be regulated by Chapter 3. This could be used to justify required segregation of waste streams where there was no sound environmental reason for doing so. This is not intended, however, to limit the Agency's power under Rule 604 to require segregation of waste streams.

A definition of other discharges is also included. These include sanitary sewers and discharges from facilities and activities which are not directly related to mining activities. Other discharges are regulated under Chapter 3. If a facility with an NPDES permit has both mine discharges and other discharges, they will be regulated by Chapter 4 or Chapter 3 respectively, although there will be one permit only (Rule 302). [*22]

Mine Refuse: Definition unchanged (R. 48).

Mine Refuse Area: Definition unchanged.

Mine Refuse Pile: Definition unchanged.

Mine Related Facility: A portion of a facility which is related to mining activities. This is a new definition taken from the Agency's amended proposal, the rule on construction authorization (Rule 304; P-204). That amendment required a construction permit for "any facilities related to mining activities." This has been shortened to "mine related facility" and used throughout. There may be several mine related facilities within a facility. There may also be other facilities, including facilities regulated under Chapter 3.

Mining: The Agency proposal contained an exception from the definition of mining for "dredging operations contained solely in natural bodies of water." In

a letter to the Board dated September 26, 1977 the Illinois Department of Conservation objected to this exemption. At the hearings the Agency was unable to explain why this was excluded from the definition of mining (R. 97). This exception has therefore been deleted from the proposal. These operations may, however, be exempt from the state permit requirement under [*23] Rule 403. An example of a regulated dredging operation is found in Votava v. Material Service Corp., 2<d> District, #78-489 (July 19, 1979).

The wording of the definition has been somewhat changed to include the surface and underground extraction or processing of natural deposits of coal, clay, fluorspar, gravel, lead bearing ores, sand, stone, peat, zinc bearing ores or other minerals. It was pointed out at the hearing that lead and zinc do not occur in their native state in Illinois and that peat is mined in Illinois (R. 93).

Mining Activities: All activities on a facility which are directly in furtherance of mining. This definition, together with the permit requirement of Rule 401, defines the scope of Chapter 4 (R. 11, 70). The Agency's definition has been essentially adopted. However, a listing of specific mining activities mentioned in the proposal have been listed with the definition.

The Agency proposal contained many permit requirements (P-200, 201, 204, 251, 256, 257, 259, 260, 261, 262, 263 and 265). All of these were in conflict with the requirement of an operating permit to carry out mining activities. Many also conflicted with other permit requirements [*24] through the use of different language to cover similar activities. These have been brought together under the definition of mining activities. There is now only one permit requirement, the state permits of Rule 401. NPDES permits have been made an exception to Rule 401. This has eliminated conflicting language and provides a simple statement of the scope of Chapter 4.

The Agency's proposal contained several rules stating generally that a permit was required to carry out mining activities or to carry out a special type of mining activity. The proposed Chapter 4 contains several rules of the form: "Do not do A or B," where B is a subset of A. These have been retained for clarity even though they are redundant (Rules 304, 400, 401, 501, 502, 505). It is possible to interpret this as excluding the special type from the definition of mining activity. Therefore the definition of mining activities has been altered to make it clear that the special type is still a mining activity.

Opening a Mine: Any construction activity related to the preparation for mining on a facility. This is a new definition. Once a mine has been opened, it cannot be abandoned without execution of the [*25] abandonment plan as provided by Rule 510 (R. 11). Outstanding permits for mines which have never been opened expire on the effective date of this Chapter as provided by Rule 703. Permits issued in the future will include a definite expiration date as provided by Rules 301 and 409.

The Agency proposal specified preparation for mining on "the affected land." This has been changed to "facility" to avoid logical problems since the land cannot be affected prior to opening a mine.

Opening a mine is a mining activity and hence a state permit, construction or operating, is required under Rule 401. A construction permit is required by that section to "Prepare to carry out mining activities or construct a mine related facility which could generate refuse, result in a discharge or have the potential to cause water pollution . . ." Ordinarily a permit will be obtained before the mine is opened. Whether a permit is required for construction activity preliminary to that specified in Rule 401 depends on intent. Turning a spadeful of earth or driving a nail with the intent of ultimately mining is opening a mine, which is a mining activity requiring a state permit. However,

the question of [*26] intent vanishes once it can be said that a mine related facility has been constructed which could generate refuse, etc. In this case a construction permit is required even if the operator has no intention of mining.

Operating Permit: A state permit required of a person carrying out mining activities as required by Rule 401. An operating permit is not required for a person holding an NPDES permit as provided by Rule 402. Other exemptions from state permit requirements are provided by Rule 403.

Construction permits and operating permits are referred to jointly and severally as state permits. Since mining activities include construction, an operating permit may authorize construction. There is no legal significance to the designation "operating permit" or "construction permit." The language of the permit controls what is permitted.

Operator: A person who carries out mining activities. An operator must have a state permit under Rule 401 unless one of the exemptions of Rules 402 and 403 applies.

The definition has been considerably shortened from the Agency proposal which listed various sorts of persons. This list is quite similar to that found in the definition of "person" [*27] found in the Act. This term has been substituted for the list for clarity. It is doubtful the Board has the power to regulate any person who falls outside the scope of the Act (R. 12).

The proposal specified "engages in mining or the generation or disposal of mine refuse or the operation of any coal storage yard or stockpile area." This has been expanded to include all mining activities. The listed practices have been moved to the definition of mining activities.

Under the Agency proposal state permits were required of operators who carried out mining activities (P-251, 256, 257). Apparently there were two tests: Was the person an operator; and, (or?) was he carrying out mining activities? This confusion has been eliminated by making the permit requirement depend on the definition of mining activity only.

Permittee: A person who holds a state or NPDES permit. This is a new term taken from the new Reclamation Law. The Agency proposal spoke of "persons" and "operators." Where from the context a rule seems to apply only to permit holders the term "permittee" has been substituted. A person who holds a combined Chapter 3 and Chapter 4 NPDES permit will be a "permittee" since [*28] he will hold an NPDES permit issued under Chapter 4.

Slurry: This definition has been somewhat changed and expanded to include mill tailings.

Spoil: This definition is unchanged, but has been clarified to include "mineral seams or other deposits." This is in recognition of the fact that some minerals do not occur in seams, but occur in lenses or other formations (R. 99).

State Permit: A construction permit or operating permit.

Surface Drainage Control: This definition has been added to the original proposal. An Agency amendment expanded the scope of Rule 505 beyond diversion of surface water around the active mining area to include diversion around mine refuse areas and diversion, redirection or impoundment of streams. At this point it became simpler to define a term for use in the operative rule.

Surface drainage control also includes flow augmentation and controlled release of effluents. These are suggested methods of avoiding violation of the TDS water quality standards which involve stream diversion and/or impoundment. They will require a permit under Rule 401.

Surface Mining: Definition unchanged.

Consideration has been given to bringing this definition [*29] into line with the similar definition in the Reclamation Act. However, that act refers only to coal mining, while Chapter 4 covers mining activities in general. It is the Board's intention to include "surface mining operations" as defined by ß 1.03(24) of the Reclamation Act within the definition of "surface mining" used in Chapter 4.

Underground Mining: The definition has been changed slightly for clarification (R. 12).

Underground Water Resources: Definition unchanged.

Use of Acid-producing Mine Refuse: This definition is derived from the Agency's proposal (Rule 508; P-259). Use of acid-producing mine refuse has been included in the definition of "mining activity" and the permit requirement, by implication, moved to Rule 401: State Permits. Under the old Chapter 4, use of acid-producing mine refuse was illegal (0-404). Under the proposal, the Agency may issue permits (R. 112).

PART III: NPDES PERMITS

300 Preamble (P-200)

The wording of the original proposal has been changed to clarify the NPDES/state permit relationship. Part III applies to mining activities carried out by any person who holds an NPDES permit, regardless of whether he is required to have [*30] an NPDES permit because of his mining activities. This part does not seek to alter the law of who must obtain an NPDES permit. However, if a person must obtain an NPDES permit, the Chapter 4 requirements will be written into that permit (R. 12, 19, 69, 100, 103, 167; E. 43, 82, 84). Take, for example, a large mining operation which would not be subject to the NPDES permit requirements except for a small sanitary waste facility. If the sanitary waste facility must have an NPDES permit, then the entire facility is governed by Part III and any Chapter 4 requirements will be written into the NPDES permit. The facility will be exempt from the requirement of obtaining a state permit under Rule 402.

Part III also applies to mining activities carried out by persons required to obtain an NPDES permit. It will be a violation of Part III to carry out mining activities without an NPDES permit if those activities are required to have such a permit. In this case there will also be a violation of Part IV since the exemption from obtaining a state permit will not be applicable if there is no NPDES permit.

301 Incorporation of NPDES Water Rules (P-202)

Except to the extent contradicted [*31] in Chapter 4, the rules contained in subpart A of Part IX of Chapter 3 apply to Chapter 4 NPDES permits. This incorporates Rules 901-916 of Chapter 3 into Chapter 4. The permit requirement of Rule 901 is identical to the permit requirement of Rule 302. The application requirement of Rule 902 has been supplanted by the requirements of Rule 504. Rule 903 is incorporated. Rules 904 through 909 set forth the permit application procedure before the Agency. These are generally incorporated except to the extent they may be contradicted.

Rule 910(a) on general conditions is included in Chapter 4 subject to the special conditions and Agency guidance document provided by Rule 501. Rules 910(b), (c) and (d) concerning water quality standards, wasteload allocation,

effluent limitations and new source standards of performance are included. Rules 910(e), (f), (g) and (h) concerning duration of permits, reporting and monitoring, entry and inspection, schedules of inspection and compliance are included. Rules 910(i) and (j) are generally incorporated. Rule 910 (k) on maintenance and equipment is incorporated subject to the Agency guidance document of Rule 501. Rules 910(l) and (m) on [*32] toxic pollutants and deep well disposal are incorporated. Rule 910(n) on authorization to construct is supplanted by Rule 304.

Rules 911 through 915 are generally included. These are appeal, authority to suspend, modify or revoke, revision of scheduled compliance, variance and public access to information. Rule 916, effective date, is not applicable.

Rule 301 generally incorporates procedural rules applicable to NPDES permit applications except to the extent that these are contradicted by the more particular provisions applicable to mines. This is to be contrasted to Rule 600 which concerns the applicability of the effluent and water quality standards of Parts II, III and IV of Chapter 3. The standards contained in Chapter 3 are generally inapplicable to mine discharges unless otherwise provided.

302 NPDES Permit Required of Certain Discharges (P-201)

Rule 302 establishes the requirement of an NPDES permit for a Chapter 4 discharger. This merely repeats Rule 901 of Chapter 3 and the requirements of section 301(a) of the FWPCA as applicable to mining activities.

The Agency proposal also specified that an NPDES permit was required of all discharges of pollutants or combination [*33] of pollutants from all point sources as defined in the FWPCA into navigable waters. The Board does not disagree with this statement of the NPDES permit requirement. However, this language has been omitted out of concern that it might be construed not as a guideline to aid persons unfamiliar with the permit requirement but as a new standard for the permit requirement. It is not the Board's intention to change the NPDES requirements in this Chapter 4. Whether the permit is required will be judged solely by Chapter 3 and the FWPCA.

303 Application (P-203)

Rule 303 requires a person to apply for an NPDES permit if he is to engage in a mining activity requiring such a permit. This rule contradicts the present Rule 902(c) of Chapter 3.

303(b) makes it clear that a person who has applied for an NPDES permit need not apply for a state permit. If a person is in doubt as to whether an NPDES or state permit is required, he should first apply for an NPDES permit. If the Agency determines that a state permit is required, it will notify the person and request him to apply for a state permit. There will be no penalty for application for the wrong permit.

303(b) will also be applicable [*34] in the event the Agency loses NPDES authority and notifies the permit holders that state permits are required as provided by Rule 402.

304 Construction Authorization (P-204)

Rule 304(b) provides for modification of a mining activity or mine related facility for which the operator already holds an NPDES permit. Modification can be undertaken only pursuant to a construction authorization which will take the form of a condition of a new or supplemental NPDES permit (R. 13, 68).

Rule 304(a) covers the more complicated case in which a person:

1. Seeks to open a mine for which an NPDES permit will or may be required; or

2. Seeks to modify a facility in such a manner that an NPDES permit will be required after the modification but was not before, either because it operated under a state permit or was exempt; or

3. Seeks to modify a facility in such a manner as to bring part of it under Chapter 4 where the facility prior to modification held an NPDES permit but was regulated under Chapter 3.

Rule 304(b) covers the usual situation in which a person operating under an NPDES permit seeks to modify. This will be handled exclusively with a construction authorization. However, [*35] flexibility is allowed in the less common situation involving new construction which will bring a facility under Chapter 4 for the first time. These situations could result in confusion. They may be handled either by construction authorization or state construction permit as provided by Rule 401. Rule 304(c) provides that application must be made at least 180 days in advance. Rule 304(d) provides that a person seeking construction authorization will proceed just as though he were applying for an NPDES permit. The Agency may provide construction criteria in its guidance document promulgated pursuant to Rule 501.

The original proposal contained a requirement that the construction authorization not cause a violation of the conditions of the NPDES permit. This has been deleted. The standard for issuance of a construction authorization will be the same as the standard for the issuance of a permit. The question will be whether the modified facility will cause a violation of the Act or Rules. If not, the conditions of the permit will be adjusted to allow the modification. Similar requirements have been dropped from USEPA regulations [40 C.F.R. ß 124.52(b); 44 Fed. Reg. 32,854, [*36] 32,899 (June 7, 1979)]. However, Rule 301 incorporates a similar provision from the present Rule 902(i) of Chapter 3. On December 13, 1979 the Board proposed to delete this in R79-13. The Agency proposal was also specifically conditioned on the validity of existing permits. This has been deleted as unnecessary. The term permit always means valid permit unless otherwise specified. Subsequent to the hearings the Agency proposed an amended version of this rule [P-204(a)]. This amendment has been substantially adopted in altered form.

Deleted (P-205)

The Agency proposal contained a rule listing the rules which were applicable to NPDES permits (P-205). This rule has been deleted since the chapter has been restructured to make this clear (R. 101).

PART IV: STATE PERMITS

400 Preamble [P-250; 0-203(a)]

Part IV governs in theory all mining activity and hence anything regulated under Chapter 4. However, the exemptions for holders of NPDES permits and for domestic retail sales yards, consumer stockpiles and some small mines will, as things presently stand, relegate Part IV to a minor role (R. 69). However, in the event the Agency loses NPDES authority, this will become the [*37] principal part of Chapter IV.

401 Construction and Operating Permits: State Permits (P-251, 256, 257; 0-201)

Rule 401 sets forth the requirements of state permits. There are two types of state permits -- construction permits and operating permits. These are referred to individually or collectively as state permits (R. 12). Rule 401(c) provides for a joint construction and operating permit to be issued whenever it is not worth the administrative trouble to issue separate permits.

An operating permit is required for a person to carry out mining activities. The definition of mining activities includes construction activities. Therefore an operating permit is sufficient for construction. However, Rule 401(a) provides for a separate construction permit. There has been difficulty with the old Chapter 4 in that it is not clear that construction is a mining activity. In some cases, coal has actually been removed from the ground and sold. Persons have claimed that this was construction and not governed under Chapter 4 so as to require an operating permit. A construction permit is provided in order to make this clear (R. 33).

The separate construction permit will also allow [*38] the Agency to review and inspect a facility prior to issuance of the operating permit. In some instances this will provide more flexibility in the permitting process.

It makes no legal difference whether a state permit is denominated a construction permit or an operating permit. The language of the permit will determine what is permitted regardless of the name.

The Agency's original proposal contained two separate rules for when a construction permit was required (P-251, 256). The standard adopted is from the Agency's amended proposal (A.P.-251).

The standard for issuance of a joint permit in the Agency's proposal was that the activities were "sufficiently standard to obviate the need" for separate construction and operating permits. This has been changed to allow a joint permit "for administrative convenience." The Agency should issue a joint permit not only when a standard design is involved, but also in the case of an innovative design if it is more efficient to issue the joint permit. The Agency may also require two permits even if the design is standard (P-251, 256).

The original proposal specified various mining activities for which a permit was required. This has been [*39] changed to include all mining activities as defined by Rule 201. The specifics have been moved to the definition of mining activities.

402 Exemption from State Permit: NPDES Holder (P-252, 200)

Rule 402 provides that an operator who holds an NPDES permit for a facility need not have a state permit for mining activities on the facility. Whatever mining activities an NPDES permit holder engages in will be permitted under Part III (R. 12, 19, 69, 100, 167; E. 84). The NPDES exemption will terminate when and if the Agency ceases to administer the NPDES permit program. The Agency's proposal set forth the requirements of the FWPCA and specified that the exemption would not apply unless they were met. Even though the exemption and the Agency's NPDES authority might be conditioned upon the same facts, this construction would raise the possibility of an inconsistent determination of the facts. The proposal has been changed to provide that the exemption ceases whenever the Agency ceases to administer the program for any reason whatsoever.

Rule 402(b) also provides for notice to the NPDES permit holders by the Agency in the event the Agency ceases to administer the program. This [*40] is the only way of guaranteeing that the permit holders will learn that a state permit is required. The notification procedure also allows the Agency to determine whether or not it has NPDES authority. The Agency need not give notice until it is convinced it has actually lost the authority with sufficient

certainty to justify the inconvenience of processing a large number of state applications. The wording has also been changed to give the Agency authority to set dates upon which applications must be received for state permits. If the Agency deems it necessary, it may spread these dates out over a period for administrative convenience.

The EcIS concluded that elimination of the present system of requiring duplicate state and NPDES permits would result in an annual savings to the Agency of $ 3000 to $ 5000 and $ 200 to $ 400 to the mines (E. 43).

403 Exemption from State Permit: Coal Piles and Small Mines (P-252)

Rule 403 provides a further exemption from the state permit requirement for some small mines, domestic retail sales yards and consumer stockpiles located at the consuming facility. The revision has increased the scope of Chapter IV by including under the definition [*41] of mining activities coal transfer facilities and coal storage facilities. These definitions would include domestic retail sales yards and consumer stockpiles. They are also able to take advantage of the more lenient discharge standards found in Part VI. However, it would unduly burden retail sales yards to require them to obtain permits (R. 13, 20, 28, 104). Although consumer stockpiles could include very large facilities, it is expected that most of these will already have NPDES permits. This provision does not create exemption from the NPDES permit requirement (R. 64; E. 84). However, Chapter 4 requirements concerning, for example, a consumer stockpile will be written into the NPDES permit. The Agency retains the right to require a state permit in the event a non-NPDES facility threatens to cause water pollution or violation of the regulations.

Rule 403(a) (3) provides an exemption for any mine affecting less than ten acres of land per year which is not a coal, fluorspar, lead or zinc mine. It is contemplated that among other things, this will provide an exemption for small sand and gravel operations. Since there is a large potential for abuse, the Board has added to [*42] the Agency's proposal the requirement of notification by a small mine. This will afford the Agency an opportunity to investigate and will allow it to maintain an accurate list of mining operations in the state.

Since the exemption will date only from the time the Agency is notified of the claim of exemption, this provision will be of limited utility as a defense to operation without a permit. For the exemption to apply, operators who have a mine with a doubtful exemption will have to notify the Agency and submit themselves to an inspection in advance of an enforcement proceeding.

Rule 403(c) sets forth the requirement that the Agency notify the operator that a permit is required and that the exemption is found inapplicable. In the event the operator promptly applies for a permit, he can continue operating without being subject to an enforcement action for operating without a permit.

404 Applications: Deadline to Apply (P-253)

A person who is required to have a state permit must file the application at least ninety days before the date on which the permit is required. This is similar to rules found in Chapter 3 (Rules 902 and 960). Under the Administrative Procedure Act, [*43] if a timely permit application is made, the old permit continues in effect after expiration until the new permit is issued [Ill. Rev. Stat. ch 127, ß 1016 (1977)]. An applicant will not be able to avail himself of this statute if the application is not filed ninety days prior to expiration.

405 Permit Applications: Signatures and Authorizations Required (P-254)

This rule is virtually identical with Rule 902(h) of Chapter 3 which is applicable to NPDES permits.

406 Permit Applications: Registered or Certified Mail or Hand Delivery Required (P-255)

This rule is similar to Rule 959 of Chapter 3.

407 Supplemental State Permits [P-251, 263; 0-203(b)]

Rule 407 sets forth the rule for when supplemental state permits are required. Rule 407(a) specifies that an operator may apply for a new or supplemental permit whenever circumstances arise such that there could be a violation of the previous permit.

The Agency's amended proposal specified that additional state permits are required "whenever mine drainage, mining or mine refuse disposal enters an area not covered by a previous permit or when the treatment or pollution control plans are modified in design or operation" (AP-251). [*44] This provoked comment from the Illinois Coal Association and Monterey Coal Company. They objected to dropping the word "substantially" before "modified in design or operation" and to the proposal to require a supplemental permit whenever the mine entered any "area" as opposed to a "new drainage area."

The supplemental permit requirement on entering a new drainage area is taken from the old Chapter 4 [0-203(b)]. Under that rule an operator could mine for an indefinite period at a given location once a permit was issued. The only limitation was a new permit when a new drainage area was entered. The new Chapter 4 is different in that the permit can have a duration of not more than five years. It is possible to project the progress of the mining with greater specificity for a limited period of time. Therefore, Rule 513 has been added to the Agency's proposal. This requires that a state or NPDES permit specify a permit area, the maximum extent of the affected land during the permit term. From the coal operators' comments, this appears to make Chapter 4 more in agreement with the Department of Mines and Minerals' permitting system.

The Agency's proposal contained a substantive [*45] rule requiring supplemental permits under certain circumstances. However, application for supplemental permit is a defensive move on the part of an operator. Therefore, a rule requiring a supplemental permit is unnecessary. Rule 407 has been modified to make it clear that an operator may apply for a new or supplemental permit whenever a change occurs such that there could be a violation of his permit.

Under the Agency proposal, for example, an operator mining beyond the permitted area would violate not only the rule requiring an additional permit, but also the rule against violating a permit condition. The redundancy is unnecessary. The permit should specify with some particularity what it permits. If the operator goes outside the bounds of the permit it is a violation of the permit condition. He must either cease the activity or apply for a supplemental permit.

Inspection of Chapter 3 reveals no similar rule applying to state permits. A substantive rule requiring supplemental permits is not only unnecessary but is redundant and conflicts with the various permit requirements contained in Part V of Chapter 4. For instance, Rule 506 requires a supplemental permit before implementation [*46] of a revised disposal plan. Retention of a rule requiring supplemental state permits could also be used as a defense to a complaint alleging operation in violation of a permit condition not specifically listed in the rule requiring supplemental permits. An operator could contend that under

his circumstances a supplemental permit was not required and therefore he could change his method of operation without applying for a supplemental permit.

The modified rule gives the Agency control by permit over the supplemental permit requirement. For example, under Rule 501 the Agency is authorized to impose special conditions, which could include details of the design and operation of treatment or pollution control plans. The Agency can be more or less specific about these details in the permit. The degree of specificity will determine the latitude within which the permittee can operate without making a supplemental application.

408 Violation of Conditions or Standards in a Permit (P-270; 0-206)

Rule 408 requires operators to comply with conditions of their state permit. Rule 408(b) provides for revocation of permits.

The Agency proposal merely stated that a permit could be revoked [*47] without giving any standard for revocation. In the Proposed Order, four circumstances warranting permit revocation are listed. These are taken in part from Rule 912(b) of Chapter 3 and in part by analogy with case law developed in connection with solid waste permits (EPA v. Harold Broverman, et al., 28 PCB 123, November 10, 1977).

In connection with an enforcement action, the Board may revoke a state permit if, because of existing geological conditions, an operator cannot carry out mining activities so as not to cause a violation of the law; or, the complainant demonstrates a history of chronic disregard by the permittee of the mining regulations; or, the complainant demonstrates that the permit was obtained by misrepresentation or failure to disclose fully all relevant facts; or, the complainant demonstrates affirmatively that the general standard for permit issuance contained in Rule 502 would not be met if a new application for permit were made. This last circumstance is intended to be the converse for the general standard for permit issuance.

409 State Permit Term [P-268; 0-203(a)]

Rule 409 provides that state permits shall be of a duration not to exceed five years [*48] as specified in the permit. The Agency may specify any expiration date up to five years from the effective date of a state permit (R.267). The Agency proposal specified that permits had a duration of one to five years. This has been changed to remove the requirement that the permit have a duration of at least one year. Rule 910(e), Chapter 3 specifies that NPDES permits be issued for specific terms not to exceed five years. In the past the Agency has issued to coal mines NPDES permits expiring less than one year after issuance. (See EPA v. Zeigler Coal Company, PCB 79-123, Order of November 1, 1979). The minimum requirement has been dropped in keeping with the general policy of this revision of keeping the NPDES and state permits as similar as possible.

The Agency's proposal specified that operating permits, but not construction permits, could have such duration except as provided in paragraph d of Section 33 of the Act. That section establishes the Board's authority to revoke permits. It is unclear why the Board should not have the authority to revoke construction permits also. This exception has been dropped from the rule since it is not only redundant, but appears [*49] to conflict with the general rule on revocation of permits found in Rule 407.

The Agency proposal also contained a provision that all operating permits now in effect expire when the earliest NPDES permit expires, but not later than three years after the effective date of this Chapter. This has been moved to

Part VII. Not only is this a temporary rule that doesn't belong with the body of the Chapter, but also it does not apply to state permits within the meaning of Part IV. An Agency amendment to the rule on duration of permits which specifies a 180 day period for abandonment plans after effective date of this regulation has also been moved to Part VII.

410 Permit No Defense to Certain Violations (P-269; O-207)

Rule 410 provides that possession of a state permit is not a defense except to a complaint alleging mining activity without a permit. This is similar to Rule 966 in Chapter 3 and Rule 207 of the old Chapter 4. In an amendment the Agency also sought to expand this rule to cover NPDES permits. The Board rejects this change. Rule 966 of Chapter 3 is not applicable to NPDES permits and there is no similar provision covering NPDES permits. Although the Board has not [*50] so held, there is authority for the proposition that compliance with the conditions of an NPDES permit is a defense to a complaint charging violation of related regulations.

On motion of the Agency, language relating to abandonment plans has been stricken. Under the original proposal, operator compliance with its abandonment plan was a defense to abandonment violations. This language was vague and unnecessary since abandonment plans are covered in Rule 509 (R. 53, 77). The Illinois Coal Association objected to this proposed modification. However, the modification is in keeping with the general rule that Illinois permits are no defense to complaints charging violation of the Act or rules.

411 Permit Review (P-272; O-703)

This follows the general policy of the other Chapters that grant of a permit with objectionable conditions is a permit denial under section 40 of the Act allowing the applicant to appeal. This provision is substantially unchanged from the old Chapter 4, although the language has been altered from that and from that of the Agency proposal. Language has been inserted providing that Agency notification of modification or revocation of an existing permit is also [*51] a permit denial. Rule 503 covers permit modification when new regulations are adopted. The added language will allow a permit appeal in the event of Agency notification of modification in such a case. In some cases Rule 503 notification of modification could amount to revocation of the permit. Language has been added to make certain that there is a right to appeal in this case also.

PART V: STATE AND NPDES PERMITS

500 Preamble

Part V governs mining activities and issuance of permits to operators regardless of whether they hold a state or NPDES permit.

501 Special Conditions; Agency Guidance Document [P-261, 266; O-205(c)]

Rule 501(a) allows the Agency to impose special conditions on a permit which are consistent with the rules and necessary to accomplish the purposes of the Act. This restates the Agency's authority under § 39 of the Act to translate the body of water pollution law into specific requirements which a discharger must meet.

The Agency proposal with regard to special conditions has been reworded to track the language of § 39 of the Act [Rule 501(a), P-205(b) and P-266]. The

requirement found in ß 39(a) that permit conditions not be inconsistent with the [*52] Board rules was not included in the Agency proposal and has been added.

Section 39 of the Act sets forth the Agency's authority to impose special conditions in permits. The wording is slightly different depending on whether the permit is state or NPDES. Section 39(a), which applies to permits required by Board regulations, reads as follows: "In granting permits the Agency may impose such conditions as may be necessary to accomplish the purposes of this Act, and as are not inconsistent with the regulations promulgated by the Board hereunder." However, ß 39(b) of the Act sets forth that: "All NPDES permits shall contain those terms and conditions, including but not limited to schedules of compliance, which may be required to accomplish the purposes and provisions of this Act." Therefore, assuming ß 39(a) of the Act is inapplicable to NPDES permits, the Act does not require NPDES permit conditions to be not inconsistent with Board regulations. This does not necessarily imply that the Agency must ignore Board rules in writing NPDES permit conditions. Section 39(a) provides that the Agency "may impose" conditions necessary to accomplish the Act's purpose which are not inconsistent [*53] with Board rules. However, ß 39(b) provides that, in the case of NPDES permits, the Agency "shall impose" conditions required to accomplish the Act's purposes. The Act is silent about what additional conditions the Agency may impose in NPDES permits.

Rule 501(b) allows the Agency to adopt permitting procedures. These should include rules of procedure and application forms. They shall be included in the Agency guidance document provided for below.

Rule 501(c) allows the Agency to adopt engineering criteria which will be published with the Agency guidance document. These should represent minimal designs and practices which the Agency will accept for permit issuance.

Rule 501(e) has been added to the Agency proposal. Although ß 39 of the Act confers authority on the Agency to adopt rules governing permit procedures, the Agency has no authority to promulgate substantive rules pursuant to ß ß 12 and 13 of the Act. This authority is given to the Board and there is no authority for subdelegation to the Agency (E. 80). Rule 501(e) has been added to clarify the nature of the criteria which the Agency may promulgate.

The Agency necessarily has the power to develop guidelines for [*54] permit issuance to be used within the Agency. Rules 501(c) and (d) contemplate publication of these guidelines as criteria. The criteria will represent a formal statement of what the Agency will not challenge in a permit application. The criteria are not rules and will not bind any party other than the Agency.

Although these are not rules in the usual sense of the word, they are rules within the meaning of the Administrative Procedure Act, Ill. Rev. Stat. ch. 127, ß 1003.09:

"Rule" means each Agency statement of general applicability that implements, applies, interprets, or prescribes law or policy, but does not include (a) statements concerning only the internal management of an agency and not affecting private rights or procedures available to persons or entities outside the agency, (b) informal advisory rulings issued pursuant to Section 9, (c) intra-agency memoranda or (d) the prescription of standardized forms.

The criteria will amount to an Agency statement that interprets law or policy. They will be of general applicability and not informal advisory rulings issued to individual petitioners as contemplated by ß 1009 of ch. 127. Publication of the rules in conformity with [*55] the Administrative Practices Act is therefore required (E. 82; Third Amended Proposal).

502 Standard for Permit Issuance or Certification (P-267; O-202)

Rule 502(a) sets forth the standard for permit issuance. This is the usual standard for permit issuance that the operator present evidence to demonstrate that there will not be a violation of the Act or rules (§ 39 of the Act).

Rule 502(b) further sets forth the function of the Agency guidance document. Where the guidance document contains criteria with respect to some part or condition of the permit, then the applicant may demonstrate conformity with the criteria of the guidance document in lieu of demonstrating that there will be no violation of the Act or Rules. However, since the guidance document does not constitute rulemaking, nonconformity with the criteria will not be grounds for permit denial, provided the general standard for issuance is met. For an Agency interpretation of the comparable Rule 967 of Chapter 3, see 3 Ill. Reg. 36, p. 226 (September 7, 1979).

As an example of the function of the guidance document, consider that the Agency might issue criteria to the effect that refuse piles shall have a slope no [*56] greater than 10%. The permit applicant will be free to offer evidence that a slope of 12% under the circumstances will not cause a violation of the Act or Chapter 4. However, the Agency will not be allowed to argue that under the circumstances a maximum slope of 8% is required. The function of the guidance document is to provide guidance by permitting the Agency to set forth minimal standards. An applicant can assure himself of prompt permit issuance by conforming to the criteria of the guidance document.

The Agency's proposal required that as a condition for permit issuance the applicant demonstrate that he had conformed with all conditions in the construction permit. If such a requirement is to be imposed at all, it should also be applicable to construction authorizations. However, it has been deleted from the proposal altogether. The permit will be issued if it is shown that no violation will occur regardless of whether the applicant conformed to the conditions of the construction permit. If the applicant breached the construction permit this will be grounds for an enforcement action, but standing alone it should not prevent issuance of an operating or NPDES permit if [*57] the general standard for permit issuance is met. Revocation of the permit could, however, be imposed as a sanction in the enforcement action in an appropriate case under Rule 408 or under Rule 916 of Chapter 3.

503 Permit Modifications When New Regulations Are Adopted (P-271)

Rule 503 provides that the Agency may issue a supplemental permit setting forth affected terms and conditions in the event the Board adopts new regulations (R. 116). This has been completely changed from the Agency's proposal which would have provided for modification of permits by operation of law. Violation of permit conditions frequently carries more severe penalties than violation of regulations. The more severe penalties are warranted in part because the operator has been afforded notice of particular provisions in regulations by way of the permit and because regulations have been made more specific when incorporated into the permit. Modification of the permit by operation of law would defeat these policies of the permit system. Rule 503 as adopted conforms with the similar provision contained in Rule 968 of Chapter 3.

504 Permit Applications (P-258; O-204)

Rule 504 sets forth what information [*58] must be provided in a permit application. This is further specified in the sections which follow (E. 26).

The Agency proposal specified that soil classification was to be according to Grandt and Lang, Reclaiming Illinois Strip Coal Land with Legumes and Grasses.

This book is out of print. The Agency will reproduce it in the guidance document (R. 106).

The Agency proposal specified that the application must comply with the conditions of the Agency guidance document. This has been deleted. If the Agency were empowered to specify conditions which had to be met, the result would be an improper delegation of rulemaking authority. However, the Agency is permitted to request more information or more particular information than that listed in Rule 504. It may do this either through an application form, the Agency guidance document or specific requests for information. However, failure to comply with criteria of the guidance document or inability to supply all information will not alone be grounds for permit denial absent a showing that the criteria or information is necessary in the particular case. The Coal Operators' comment that this is "beyond the bounds of reason" is answered [*59] by the requirement of "necessary information."

Subsequent to the hearings the Agency specified certain additional information. This has been rearranged and incorporated into Rule 504. The Coal Operators' comments are discussed in connection with Rule 505.

505 Surface Drainage Control [P-260; O-301(a), 301(b)]

Rule 505 provides for control of surface drainage by permit. Surface drainage must be diverted around or away from the active mining area. Other mining activities and mine refuse disposal must be planned to minimize contact with waters of the state if such contact could result in pollution. Stream diversion is to be avoided.

The original proposal provided only for diversion around the active mining area. An Agency amendment expanded the scope of Rule 505 to include diversion, redirection or impoundment of streams and a rule requiring that mining activities and deposition of spoil be conducted so as to avoid contact or interference with waters of the state. These amendments have been incorporated in altered form.

The Agency amendment sought to expand the scope of Rule 505 to afford the Agency the level of control it presently has under old Rule 301 of Chapter 4. [*60] Apparently in its original proposal the Agency restricted its authority inadvertently.

Some specific requirements of old Rule 301 have been omitted. These include certain mandatory diversion and impoundment provisions. In dropping these requirements the Board does not intend to disavow them. They are mining practices which carry a risk of water pollution. The Agency may provide for these matters in the Agency guidance document and may write specific requirements into permits to prevent water pollution.

Rules 505(b), (c) and (d) set forth substantive rules governing the conduct of mining activities. Rule 504(b)(7) requires a plan for surface drainage control as part of a permit application. This plan will be incorporated into the permit as a condition. Rule 201 defines surface drainage control as control of surface water on the affected land by a person who is engaged in mining activities. Surface drainage control includes the practices governed by Rule 505(b), (c) and (d). In permitting surface drainage control, the Agency shall consider not only whether compliance with the requirements of Rule 505 has been shown, but also whether the plan will avoid other violations of [*61] the Act and Chapter 4.

The definition of surface drainage control has been expanded to include flow augmentation and controlled release of effluents as a method of avoiding violation of the TDS and related water quality standards. These practices may

previously have been considered illegal, although this Opinion clarifies this. They will require a permit under Rule 401 since they will involve stream diversion or impoundment. There is no special rule governing permit issuance in this case other than the general standard of Rule 502.

Rule 505(a) requires the Agency to impose a surface drainage plan as a permit condition. The Coal Association objected to this and in general to the incorporation of the specific rules on stream relocations. Their contention was that this was provided in the Department of Mines and Minerals permit and application form which was reviewable by the Agency. They also objected that the Agency did not presently have control over the permitting of stream relocations. However, inspection of the old Chapter 4 at Rule 301(a) and (b) reveals that the Agency does presently have such control.

At the hearings the Agency indicated that the various state agencies [*62] responsible for permitting coal mines would develop a single application form which would be circulated. The Coal Association's objection that the surface drainage control provisions would be burdensome is answered by their contention that the application is already required by Mines and Minerals (R. 27).

The Coal Association's comments further infer that there is a legislative intent in the Reclamation Act to exempt coal operators from the permit requirements of the Act. Of course the bulk of the coal mines are required to have NPDES permits and the state permit requirement will be inapplicable to them. It is beyond the power of the state legislature to provide exemptions from the NPDES permit requirement.

The Reclamation Act does, as the Coal Association contends, provide for Agency input and comment in the mines and minerals permitting procedure. However, a careful examination of the Reclamation Act indicates that the Agency's function is advisory. There is no provision for a veto by the Agency in permit issuance from Mines and Minerals. Furthermore, section 3.20 of the Reclamation Act provides that "all requirements of the Illinois Environmental Protection Act and rules [*63] and regulations thereunder shall be complied with fully at all times during mining, reclamation and after reclassification." The Board cannot find from this a legislative intent to exempt coal mines from the state permit requirements.

506 Refuse Disposal (P-262; 0-401, 402)

Rule 506(a) requires that a state or NPDES permit contain a refuse disposal plan. An applicant must submit a plan under Rule 504(b) (12). The plan will be made a permit condition if it satisfies the standard for permit issuance contained in Rule 502. The applicant must show that there will be no violation of the Act or rules, including Rules 504(c), (d) and (e) which are substantive rules governing mining. The Agency may promulgate mine refuse criteria under Rule 501.

Rule 506(c) provides that runoff, etc., from the affected land must meet the standards contained in Part VI. Note that runoff from the affected land is a mine discharge under Rule 201 [0-401 (a) (1)]. Rule 506(d) provides that refuse areas must not be located in an area of natural springs or aquifer recharge area or intercept a drainage course without special protective measures [0-401(a) (2)].

Rule 506(e) establishes rules on spreading [*64] and compacting. These are reminiscent of the solid waste rules. The original proposal specified only that acid producing solid mine refuse be spread and compacted and covered when necessary with "non-acid-producing material." This has been modified to include the word "suitable" before "non-acid-producing material." Impermeable clay would

be a suitable cover material in that it would prevent water and air from reaching the acid-producing material. However, the Agency may approve other suitable materials. Rule 506(e) permits alternate refuse disposal methods at the Agency's discretion (R. 15, 114). These will be subject to Rule 502.

Rule 506(f) and (g) govern revised refuse disposal plans. This establishes a special rule on when a new or supplemental permit is required. A new permit is required if the revised plan contains any change from the permitted plan. Rule 506(d) requires that a revised disposal plan result in a new permit application which must be made prior to implementation of the revised plan, ninety days before for a state permit and 180 days for an NPDES permit.

The original proposal defined revised disposal plan as one with a "substantial" change. On the Agency's [*65] motion and over the Coal Association's objections the word "substantial" has been deleted. A new permit is required before there is any deviation from the permitted plan. Of course the Agency can be more or less specific in permit conditions as required to assure that the standard of Rule 502 will be met.

The original proposal also required application to be made ninety or 180 days prior to "completion" of the plan. The Agency recommended deletion of this word, but the amended proposal could still have been interpreted to require application ninety or 180 days prior to mere possession of the plan. This would be difficult to administer since submission of a plan is a necessary condition for the new application under Rule 504. The adopted rule specifies "implementation" of the plan. Implementation will occur when the first action is taken pursuant to the revised plan and contrary to the permitted plan.

507 Experimental Permits for Refuse Disposal (P-264; 0-403)

Rule 507 provides for experimental permits for refuse disposal. The standard for issuance of experimental permit is not the same as usually applied to permit issuances by Rule 502. The experimental permit may issue [*66] if the operator demonstrates a reasonable chance for compliance with the Act and Chapter 4. The rule sets forth special monitoring and reporting requirements. The procedure is laid out for notice and termination of the experimental permit (R. 114).

The original proposal required that the disposal area not be the "principal area for disposal of acid-producing refuse unless approved by the Agency." This language has been deleted. It adds nothing to the proposal since no permit would issue without Agency approval. It is not the Board's intention, however, that experimental permits should often be issued for a principal disposal area.

508 Permit for Use of Acid-producing Mine Refuse (P-259; 0-404)

Rule 508 requires that a state or NPDES permit include as a condition a plan for the use of acid-producing mine refuse if the operator is to use such. The definition of acid-producing mine refuse has been moved from its place in the proposal to definitions. Use of acid-producing mine refuse is a mining activity as defined by Rule 201 for which a permit is required under Rule 401 (R. 112).

The original proposal specified that use of acid-producing mine refuse was restricted to holders [*67] of operating permits. On the Agency's motion, this requirement has been deleted. There is no obvious reason why this rule should not also be applicable to holders of NPDES and construction permits.

Rule 504(b) (17) requires a plan for use of acid-producing mine refuse in a permit application. The Agency may set forth in an Agency guidance document under Rule 501 criteria for the use of acid-producing mine refuse. The standard

for issuance of a permit for use of acid-producing mine refuse is that contained in Rule 502.

Rule 404 of the old Chapter 4 contained an absolute proscription of use or offer of acid-producing mine refuse. This proposal would allow such use by permit.

509 Abandonment Plan (P-261; 0-502)

Rule 509 provides that an application for a permit include an abandonment plan. The permit will include an adequate plan as a condition. This represents a drastic departure from the present Chapter 4 which requires an abandonment permit subsequent to abandonment of the mine. The Agency has had considerable difficulty with enforcing the requirement of an abandonment permit. Requiring the abandonment plan will force the operator to confront the problem prior to abandonment [*68] and the operator will no longer be able to claim ignorance of the requirement to take steps on abandonment (R. 14, 20, 39, 54, 66, 78, 112).

The EcIS was able to quantify the economic costs of this. This represents one of the few identifiable costs associated with this revision. An abandonment plan likely involves an engineering fee of $ 1000 or more. This fee will have to be paid prior to application for the permit. This requirement therefore increases the capital investment required to open a mine and obtain a permit. The cost of mining is increased somewhat by the cost of tying up this capital for the period of time the mine is open (E. 42, 44, 99).

Rule 509(b) defines an adequate abandonment plan. The plan must provide a time schedule for completion of abandonment work within one year. Subsequent to abandonment, however, the Agency may approve departures from the plan that would allow for completion over a period of more than one year.

Rule 509(c) provides that the Agency may further define an adequate abandonment plan by means of the Agency guidance document. However, the Agency must approve an abandonment plan upon a demonstration that it will provide protection against [*69] violations regardless of whether it conforms with the Agency guidance document.

Rules 509(d) and (e) provide for revised abandonment plans. A revised abandonment plan is one constituting a substantial change from the permitted one. Substantial will be defined on a case by case basis. It will be a violation if an operator implements a revised abandonment plan without having applied for a revised permit ninety days prior to implementation (R. 166, 168).

510 Cessation; Suspension or Abandonment [P-261; 0-501(a)]

Rule 510 covers cessation, suspension or abandonment. The original proposal covered the abandonment plan, permitting requirements and substantive rules on abandonment in one rule. These have been separated into two rules.

Rule 510(a) provides that the operator notify the Agency within thirty days of abandonment, cessation or suspension of mining. The original proposal provided that notification was unnecessary if abandonment was caused by a labor dispute. The language has been clarified and the labor dispute section applies only to cessation or suspension. The Agency must be notified of abandonment regardless of the cause.

Rule 510(b) makes it clear that the operator [*70] must provide interim impoundment, etc. to avoid violations of the Act during cessation or suspension of active mining. The operator will also be required to avoid violations during excution of the abandonment plan.

Rule 510(c) sets forth the rule that the abandonment plan must be executed upon abandonment. The definition of abandonment includes transfer of ownership. This represents a substantial change from the existing Chapter 4. In the past operators have avoided their responsibilities for properly abandoning a mine by transfer of ownership to an insolvent corporation. Such a transfer will be an abandonment under the new Chapter 4 and the transfer will not allow the operator to escape responsibility for adequately closing the site (R. 14, 20, 39, 54, 66, 78, 112).

Rule 510(c) provides a defense to the requirement to execute the abandonment plan in the event the operator demonstrates that the transfer of ownership was to a responsible party. A responsible party is someone who has already obtained permits to operate the same mine. If the mine is transferred to a party who does not have a permit at the time of transfer but subsequently obtains one, the transferor will be [*71] relieved of the obligation of further executing the abandonment plan. However, if the transferor has failed to perform part of the plan during the interim, there will have been a breach of the permit condition which will not be excused.

It is assumed that a transferree who will be financially unable to execute an abandonment plan will be unable to obtain the necessary permits to operate the mine. In particular he will be unable to meet the bonding requirements of the Mine Reclamation Act.

511 Emergency Procedures to Control Pollution [P-265; 0-205(a), 205(b)]

Rule 511 sets forth emergency procedures. The original proposal required that the operator notify the Agency "immediately" of an emergency situation. The requirement of immediate notification has been changed to notification within one hour. It is feared that immediate notification may be impossible and hence would not be enforced. It appears that notification within one hour would be in all events possible and hence enforceable (R. 114).

The Agency proposal was also limited to "sudden discharges." This has been changed to include any discharges caused or threatened by an emergency. The Agency should be notified of [*72] any emergency that could result even in a slow leak.

512 Mine Entrances [0-301(a) and (c)]

Bore holes, openings, drill holes, entrances to underground mines and auger or punch mine entries must be plugged and sealed to the extent necessary to avoid the threat of water pollution. This is taken from the old version of Chapter 4, Rule 301. It has been added to the Agency proposal on the assumption that it was inadvertently omitted in the revisions.

513 Permit Area [P-263; 0-203(b)]

Rule 513 requires that a state or NPDES permit specify a permit area. During permit term no portion of the affected land may be outside the permit area. This is a new provision which was not in the Agency proposal. The term "permit area" is taken from the Reclamation Act.

Subsequent to the hearing, the Agency sought to amend its proposal to specify that additional state permits were required whenever mine drainage, mining or mine refuse disposal entered an area not covered by a previous permit. The Coal Association objected to this and apparently construed it to mean a new application was required each time a shovel took a bite out of a coal seam. Consideration of this dispute led to the recognition [*73] that there was no

provision in the Agency proposal requiring that the permit specify a geographical area. Accordingly, Rule 513 has been added to clarify this.

Under Rule 504(b)(1) the permit applicant must specify the location of the affected land and the maximum extent of the affected land during the term of the requested permit. If there is some area in the proximity of the facility into which mining cannot proceed without violation of the general standard for permit issuance under Rule 502, the Agency should exclude that area from the permit area. Otherwise the Agency should grant a permit area which will be consonant with the permit term.

PART VI: EFFLUENT AND WATER QUALITY STANDARDS [P-301; O-601(a)]

600 Preamble

Part VI applies to mine discharges as defined by Rule 201. If a mining activity has both a mine discharge and another discharge, it will be subject to both Chapter 3 and Chapter 4. Chapter 4 will govern the mining activities, including mine discharges. Chapter 3 will govern the other discharges (R. 15).

Rule 600(b) provides that except to the extent provided in Part VI, Parts II, III, and IV of Chapter 3 are inapplicable to mine discharges. In particular [*74] the effluent standards of Part IV are inapplicable to mine discharges and are supplanted by the discharge limitations specified in Rule 606. The old Chapter 4 did not make this altogether clear. The parameters of Chapter 3 which are not mentioned in Rule 606 are unregulated for mine discharges (R. 56). The water quality standards of Parts II and III are incorporated by Rule 605 which provides for water quality related effluent standards. This is substantially unchanged from the present Chapter 4.

Part VI applies to mine discharges from facilities even if they may be exempt from the state permit requirements under Rule 403. Likewise Part VI applies to any incidental mine discharge from a facility which possesses a Chapter 3 NPDES permit.

601 Averaging [P-301; O-601(d)]

Rule 601 sets forth the averaging procedure. Compliance with the numerical standards is determined by averaging 24-hour composite samples over a calendar month. No 24-hour composite sample may exceed two times the numerical standard and no grab sample may exceed five times the standard.

On motion of the Agency the period was changed from thirty consecutive days to a calendar month. This is in line with [*75] federal rules and R76-21 where objection was voiced to the thirty day period. Although the calendar month is somewhat arbitrary, it is in line with other reporting requirements and eliminates one degree of freedom in determining compliance (R. 15, 51; First Amended Proposal).

This averaging rule is a substantial change from the averaging rule set forth in Rule 601(d)(1) and (2) of the old Chapter 4. The old rule made a distinction as to whether treatment other than impoundment is provided. Where no other treatment was provided, the discharge limits had to be met at all times, but where treatment other than impoundment was provided, the standards were determined on the basis of 24-hour composite samples with no grab sample over five times. This has been eliminated.

In the Agency proposal the averaging rule was contained within the rule on reporting and monitoring. It has been placed in a separate rule to emphasize importance of averaging and to more clearly distinguish the difference between

averaging and reporting. Averaging is a substantive rule of evidence whereas reporting and monitoring are rules relating to permits and permit conditions. In addition, placement of the [*76] averaging rule within the provision for reduced monitoring and reporting after demonstration of sample reliability implied that the averaging rule itself could be altered by permit. This is not the case.

602 Sampling, Reporting and Monitoring [P-301, 302; O-601(b) and (c), 603, 604]

Rule 602 provides for sampling, reporting and monitoring. A similar provision is Rule 501 of Chapter 3. Rules 602(a) and (c) provide for sampling points. Where treatment is provided, sampling is to be between final treatment and mixture with waters of the state. Where treatment is not provided, samples are to be taken at the nearest point of access, but again before mixture with the waters. Rule 602(b) provides that the operator shall design and modify structures so as to permit the taking of effluent samples. The Agency proposal only required design and modification of "structures for discharging treated wastes." This has been changed to "structures" in general. It may be necessary to design or modify structures other than the discharge facility itself in order to provide access.

Rule 602(d) provides that an operator report the actual concentration or level of any parameter identified in the [*77] permit at a reasonable frequency to be determined by the Agency. The reporting requirement will be specified in the permit (R. 16). Recent cases have challenged the authority of the Agency to require monitoring and reporting of parameters other than those for which effluent limits are specified in the permit. The intent of this section is that the Agency may specify not only those parameters for which effluent limits are set, but also parameters for which water quality levels are set by regulation or any other parameter it deems necessary to have monitored.

Rule 602(e) sets forth that reporting and monitoring are presumptively on the basis of 24-hour composite samples averaged over a calendar month. However, the Agency may permit lesser reporting. Rule 602(f) provides for monitoring after abandonment. Rule 602(g) incorporates the USEPA's current manual of practice. This was a separate section under the Agency proposal, but it has been included since it logically relates to reporting and monitoring.

603 Background Concentration [P-303; O-601(e)]

Rule 603 provides that the background level of contaminants in intake water are not to be deducted in order to determine compliance [*78] with the effluent standards. This is the same as Rule 601(e) of the old Chapter 4 and is largely the same as Rule 401(b) of Chapter 3 (R. 16).

Because mining activity necessarily disturbs the land and the flow of water over and through the land it is the intent of this Chapter to regulate certain discharges which in other contexts might be deemed background concentrations. As used in this Chapter, background concentration does not include contaminants naturally occurring in underground waters which are brought to the surface as a result of mining activity or which are pumped from one underground formation to another. Also it does not include contaminants picked up by surface water as it flows through the affected area.

604 Dilution (P-304; O-602)

Rule 604 provides that dilution of effluents is not an acceptable treatment method. This is similar to Rule 602 of the present Chapter 4 and virtually identical with Rule 401(a) of Chapter 3 (R. 17, 116). Language relating to

place of sampling has been deleted from the Agency proposal. This language is also contained in Rule 401(a) in Chapter 3. It has been eliminated because it is provided in and may conflict with the sampling [*79] point rules provided by Rule 602.

The dilution rule interacts with Rule 605 which provides that effluents may not cause a violation of water quality standards. In the hearings on this proposal and in R76-7, concern was expressed that the dilution rule prevents certain treatment methods for chlorides, sulfates and TDS. In particular it was feared that controlled release of impounded water was proscribed by this rule. Controlled release of high TDS water during periods of naturally occurring high flow in streams is not dilution. In this case the mixing occurs at a point after the discharge.

Another possible technique of avoiding a TDS water quality violation would be impounding surface water during wet periods and augmenting the flow of the receiving stream during dry periods to dilute effluents. This would not constitute a violation of the rule against dilution. However, it could constitute surface drainage diversion. A permit would be required under Rule 401.

605 Violation of Water Quality standards [P-305; 0-605(a)]

Rule 605 incorporates the water quality standards contained in Parts II and III of Chapter 3 into Chapter 4. This is the same as Rule 605(a) of the present [*80] Chapter 4 and is similar to Rule 402 of Chapter 3.

The second sentence of Rule 605 provides that the Agency shall take appropriate action under Section 31 or 39 of the Act. This is redundant because under the remainder of Chapter 4 the Agency must take such action. However, certain operators have recently contended before the Board that incorporation of water quality related effluent standards is not authorized by Board regulations. The second sentence is to make it clear that water quality related effluent standards can be incorporated into permit conditions (R. 17).

605.1 Temporary Exemption from Rule 605

This rule will allow the Agency to issue permits through July 1, 1981 to authorize discharges which violate Rule 605 by causing water quality violations of TDS, chloride, sulfate, iron and manganese. For the remainder of the discussion of this rule only, these will sometimes be referred to collectively as TDS. An operator desiring such exemption may apply for a new state or NPDES permit containing the exemption. Rule 605.1(c) sets a special standard for permit issuance different from that contained in Rule 502. The burden will be on the Agency to demonstrate significant [*81] adverse effect on the environment in and around the receiving water in order to deny the permit. The operator, however, will have to submit adequate proof that the discharge will not adversely affect any public water supply. In order to qualify for the exemption the operator will have to adopt "good mining practices," housekeeping measures designed to minimize TDS discharges.

Rule 605.1 was first proposed on November 21, 1978 by the Institute. This was after merit hearings on the proposal were concluded. On December 14, 1978 the Board ordered the record in this case held open to take evidence on Rule 605.1. Merit hearings on the proposal were held at the same time as the economic impact hearings. This proposal has generated the bulk of the controversy in this proceeding.

Mine discharges are often high in TDS. Much of this comes from water pumped from mine areas or runoff from spoil banks. A substantial number of mines in

the state produce mine discharges which cause water quality violations in the receiving streams. Coal mines can seldom be located adjacent to large rivers, but rather must be located where coal deposits are located. Their discharges are frequently into [*82] intermittent streams so that the discharge comprises the bulk of the flow of the stream. Therefore the discharge is limited, not by the effluent standards of Rule 606, but by the more stringent water quality standards referenced in from Chapter 3 (R. 129, 142, 151; E. 6, 11).

In a related proceeding, R76-7 the Coal Association sought to exempt coal mines from application of Rule 605 with respect to TDS. Entry of a Final Order in that proceeding has been stayed pending final resolution of this proceeding.

Presently relief from Rule 605 is available only through the variance procedure. At the hearings, the Coal Association stated that a variance application can cost as much as $ 10,000 (E. 126). There was discussion at the hearings of a class action variance. However, this was rejected (E. 19, 80).

Under the auspices of the Institute a joint Agency/industry group called the Mine Related Pollution Task Force has been formed. The Task Force is conducting a study to propose an eventual permanent replacement for Rule 605. It expects to present this proposal before July 1, 1981 (E. 106).

A large amount of earth must be disturbed during the process of coal mining. Some of the [*83] TDS in the discharge results from direct leaching of soluble minerals from the rock by groundwater or rainwater falling on spoil banks. This is the source of chlorides, which is not generally the main problem in Illinois. Much of the problem in Illinois is sulfates. These are formed when air or dissolved oxygen comes into contact with sulfur-containing minerals which have been disturbed. Sulfuric acid is formed, producing acid mine drainage. Neutralization of that discharge to meet the pH requirements of Rule 606 may further increase the TDS concentration of the discharge.

The Economic Impact Study in R76-7 has been incorporated into this proceeding by reference (E. 103; Economic Impact of Dissolved Solids Regulation upon the Coal Mining Industry, Institute Document No. 77/28). Although there is treatment available to reduce the iron and manganese levels, treatment to reduce the soluble components of TDS is not economically available. Available technology includes reverse osmosis and distillation. These are energy intensive and very expensive on a scale that would be required to meet most mine discharges. The Economic Impact Study in R76-7 concluded that for the mines in [*84] the state to meet the present TDS water quality standard would involve a capital investment of $ 138.4 million and annual operating costs of $ 37.4 million (E. 69).

The Task Force has promulgated, as an interim measure, a code of good mining practices. The approach taken is not end-of-the-pipe treatment of the discharge, but rather a series of housekeeping measures which are likely to reduce the TDS concentration resulting from mining activities. These are summarized on page 4 of Exhibit 4. These involve practices which may minimize water from coming in contact with disturbed areas, including bypass diversions, slope and gradient reduction, stabilization, sealing of bore holes, introduction of mine barriers, special steps for disposal of potential contaminant producing materials and fracture zone sealing. There are also measures involving retention and control of waters exposed to disturbed materials, including erosion and sedimentation controls, reuse of discharges and minimization of exposure of water to disturbed materials. Other methods include a rerouting of discharges to larger streams where the dilution would be provided, augmentation of flow of receiving streams to provide [*85] dilution and controlled release of effluents during times of high flow when there is ample dilution.

Many of these practices are novel and reliable cost estimates are not available. Therefore it is not possible at this time to do an actual economic impact study evaluating the cost of requiring the code of good operating practices. However, the Board incorporates the Economic Impact Study in R76-7 as an economic impact study on Rule 605.1. Although that study does not address the code of good operating practices, it does conclude that enforcement of the present standard by requiring end-of-the-pipe treatment would be very expensive. There is expert testimony in the record to substantiate that, although the costs of good operating practices are unknown, they will be substantially less than the cost of end-of-the pipe treatment (E. 146).

The eventual rule may include some combination of these good housekeeping procedures together with the proposal to increase the water quality standard for TDS in intermittent streams receiving coal drainage (E. 73, 110, 128).

The Board notes that none of the parties in these proceedings has addressed the dilution rule (Rule 604). Part of the [*86] rationale of the rule against dilution of effluents goes to accumulation of toxic pollutants. Chlorides and sulfates are generally soluble and should not accumulate under ordinary circumstances. Furthermore, they are not at all toxic below a certain concentration. Therefore, the Board suggests the Task Force consider amending Rule 604 to allow dilution of effluents by permit where good housekeeping practices cannot reduce the TDS levels to an acceptable level. However, dilution of effluents should not be permitted where groundwater must be used for the dilution or where there is available only surface water which has more valuable uses.

Concern was expressed at the hearing that the Board was being asked to adopt a rule requiring compliance with a code of good operating practices which had not yet been promulgated (E. 111, 134). Subsequent to the economic impact hearings, the code was completed and submitted to the Board. Further concern was expressed that the record was deficient in that there was no technical testimony to the effect that compliance with the code of good operating practices would in fact reduce water pollution (E. 17, 80, 144). Control of mining practices which [*87] are not related to the Board's statutory jurisdiction would, of course, be beyond the Board's authority. Further consideration of this problem led to the recognition that the proposed version of Rule 605.1 required compliance with the code and that this was an unauthorized delegation of rulemaking authority to the Agency. The proposal has therefore been rewritten to provide that the Agency issue the exemption if the operator submits proof that he is utilizing good mining practices designed to minimize discharge of TDS. The Agency is authorized to promulgate the code of good mining practices. Compliance with the code will be deemed evidence that the operator is utilizing good mining practices. However, should the Agency deny the exemption due to non-compliance with the code, the operator will be free on permit appeal to argue that his practices, though not conforming to the code, are designed to minimize the discharge of TDS. With this construction, the Board is not requiring compliance with the code and therefore technical evidence to substantiate the code is not required. If provisions of the code are not reasonably related to prevention of water pollution, this will be an [*88] issue before the Board upon permit appeal.

Rule 605.1(b) has been added to the Agency proposal. This provides specifically that the permittee requesting exemption must file a permit application. The Agency indicated at the hearing that this was the case and it has been added to the proposal for clarity (E. 26, 121).

The Agency proposal was vague on the question of the burden of proving adverse effect on the environment. At the hearing the parties agreed that the Agency should have the burden of demonstrating adverse effects. This is at

variance with the usual burden of proof in permit issuance. Section 39 of the Act provides that it shall be the duty of the Agency to issue such a permit "upon proof . . . that the facility . . . will not cause a violation of this Act or regulations hereunder." The Board in this situation is by regulation reversing the burden of proof (E. 16, 30, 34, 37, 79, 81, 112, 118).

At the hearings there was a discussion of whether the intent of the proposal was that the Agency fix an interim limitation on the TDS. The conclusion was that under the proposal the Agency could not set such an interim limit. If the Agency can demonstrate significant adverse [*89] effect on the environment, then it must deny the exemption. In this case the applicant will have to proceed by way of the variance route (E. 74, 78).

The original proposal specified "significant adverse effects on aquatic life or existing recreational areas of the receiving streams." This has been changed to "effect on environment in and around the receiving water." The exemption should be denied if there is significant adverse effect to riparian areas and in general to the environment in and around the receiving water (E. 115).

606 Effluent Standards (P-306; O-606)

Rule 606 sets effluent standards for mine discharges. Rule 606(a) has been added to the Agency proposal. This makes it clear that the effluent limitations contained in Part IV of Chapter 3 do not apply to mine discharges. This has always been the law. However, it is not clearly set forth in the proposal or the Old Chapter 4 (E. 56).

Compliance with the effluent standards other than acidity and pH is determined by the averaging rule contained in Rule 601. Compliance is based on a thirty day average with no 24-hour composite exceeding two times the standard and no grab sample exceeding five times the standard. [*90]

New Storet numbers have been specified for acidity, ammonia nitrogen, zinc and fluoride. The old Rule 606 regulated nitrogen at 5 mg/l whereas the new rule specifies ammonia nitrogen, measured as N.

The standards for zinc, lead and acidity are unchanged except for the Storet number. The pH range has been tightened from five to ten to six to nine (E. 45, 51). The EcIS concluded that this would benefit the environment (EcIS 27; E. 52). The cost will be minimal since only one additional mine will be out of compliance with the new standard (EcIS 6, 39).

The standard for iron has been decreased from 7 to 3.5 mg/l and the standard for total suspended solids (TSS) has been tightened from 50 to 35 mg/l (R. 46, 51, 53). These changes are environmentally beneficial (EcIS 25, 31; E. 51, 53). Under the averaging rule, these standards must be met on a thirty day average. They are doubled when measured on a daily composite. The new numbers are the same as federal guidelines applicable to coal mines under 40 CFR 434. A recent permit appeal to the Board revealed that there is some dispute as to whether the federal or the existing Chapter 4 standards are more stringent (Peabody Coal [*91] Co. v. EPA; PCB 78-296, September 20, 1979). This is because the federal standard, when coupled with the averaging rule and precipitation exception, sometimes yields a higher number on a 24-hour composite. However, the Board concludes that it is more difficult to meet the lower thirty day average than what the discharger must now meet and that this is a more stringent standard (EcIS 25). The economic impact will be minimal since most mines subject to the rule must meet the federal guidelines anyway (EcIS 42).

Footnote 3 provides an exception for flows resulting from a 10-year, 24-hour precipitation event. This exception applies only to a facility designed, constructed and maintained to contain or treat discharge from less than a 10-

year, 24-hour precipitation event, but designed to bypass a larger precipitation event. This exception is taken from the federal standards of 40 CFR 434. Federal mine safety regulations mandate that holding ponds be designed to bypass such rainfall for safety reasons. This exception has been added in order to bring the effluent standards into line with these other regulations (E. 47, 56, 124).

The original Agency proposal was unclear as to which [*92] parameters were subject to the exception in footnote 3. During discussion of the EcIS it became clear that the Agency's intent was that the 10-year, 24-hour footnote apply to all parameters except pH and acidity (E. 124). The federal guidelines apparently except pH and acidity also. pH and acidity are not exempt under this version of Rule 606. However, one would not expect to see excursions with respect to these parameters during overflows caused by a large rainfall. The large rainfall should not result in increased production of acid in disturbed materials. A large flux of water has some buffer capacity and should dilute the acidity so as to moderate pH.

The Economic Impact Study found that it would cost $ 40,000 to $ 90,000 per mine to construct holding basins to contain a 10-year, 24-hour storm (EcIS 42; E. 56, 124). However, this conclusion may be affected by confusion in the proposal concerning the extent of footnote 3 to Rule 606. It has been argued by the industry that the old Chapter 4 required construction of indefinitely large holding basins and that 10-year/24-hour basins therefore represent a cost savings over the present requirements of Chapter 4 (Peabody Coal [*93] Co. v. EPA, op. cit.)

The fluoride standard has been increased from 8 mg/l to 15 mg/l. In the hearings evidence was presented to substantiate this relaxation of the standard. The old standard was based on experiments which were done in deionized water containing fluoride. In water containing other ions of hardness equivalent to typical Illinois mine drainage water, the fluoride is not nearly so toxic to aquatic life as had been previously believed (R. 117; E. 52).

607 Offensive Discharges [P-307; 0-605(b)]

Rule 607 proscribes drainage containing settleable solids, floating debris, visible oil, grease, scum or sludge solids. Color, odor and turbidity should be reduced below obvious levels. This is Rule 605(b) of the present Chapter 4 and Rule 403 of Chapter 3 (R. 47, 51).

608 Deleted (P-308)

The Agency proposal contained a rule to the effect that an operator shall conduct mining activities so as not to violate the Act and Chapter 4. This has been deleted. A number of substantive rules are set forth in Chapter 4 and the Act. It is unnecessary to make a rule against violating the other rules. Furthermore, a charge in a complaint that an operator had violated this [*94] rule could be a violation of due process in that it would not adequately inform him of what he had done.

PART VII: COMPLIANCE AND EFFECTIVE DATES

Part VII contains transitional rules covering situations which will arise after the effective date of Chapter 4. Rule 701 provides that the Chapter will become effective ten days after filing with the Secretary of State. Rule 703 provides that the state permit requirement of Rule 401 becomes effective only on expiration of outstanding permits. Outstanding permits will expire no later

than three years after the effective date or upon the first expiration of an NPDES permit held for the facility.

Rule 702 provides that a person holding an outstanding permit may make application for a new permit either before or after the effective date of this Chapter. It is anticipated that operators of coal transfer and storage facilities will want new permits. After the effective date the Agency may require a new permit application on 180 days notice. Rule 703(d) provides for expiration of the outstanding permit if the application is not made by this date. Rule 703(c) provides for expiration upon issuance of a new state or NPDES permit for the [*95] facility. If the Agency denies the new permit or takes no action, the outstanding permit will remain effective for up to three years as provided by Rule 703(a).

The NPDES permit requirement of Rule 302 is the same as that found in Rule 901 of Chapter 3. There is no need to stay enforcement of that rule since this revision does not impose an NPDES permit requirement on any additional facilities.

The provisions of Chapter 4, other than Rule 401: State Permits, are effective ten days after filing. At this time the other rules of Chapter 4 become immediately effective. This includes all of Part VI, including the new effluent standards of Rule 606. Holders of outstanding operating permits may be subject to enforcement actions based on Rule 606 as provided by Rule 410 even if their discharges conform with their old permit conditions.

Rule 704 provides the requirement of old Rule 502 of an abandonment permit continues to apply to operators who have opened mines prior to the effective date. This will continue indefinitely until the operator is issued for the facility a state of NPDES permit which contains an abandonment plan. Such a permit may be issued under the procedures of Rule [*96] 702 and 703.

This Opinion, together with the Board Order of December 13, 1979, constitute the Proposed Opinion and Order of the Board in this proceeding.

Exhibit B

LEXSEE 1983 Ill. ENV LEXIS 72

IN THE MATTER OF: PROPOSED AMENDMENTS TO TITLE 35, SUBTITLE D: MINE RELATED WATER POLLUTION, CHAPTER I, PARTS 405 and 406

No. R83-6 (Docket A)

Illinois Pollution Control Board

1983 Ill. ENV LEXIS 72

December 15, 1983

PBLEX 30

OPINIONBY: [*1]

ANDERSON

OPINION; PROPOSED RULE. FIRST NOTICE

PROPOSED OPINION OF THE BOARD (by D. Anderson):

On February 7, 1983 the Illinois Environmental Protection Agency (Agency) and the Illinois Coal Association (ICA) proposed that the Board amend 35 Ill. Adm. Code 405 and 406 to add an effluent standard for manganese and to set a permanent rule specifying the application of water quality standards to coal mine discharges. Amended proposals were filed on May 27 and August 26, 1983. The proposal was the result of a joint industry/government group called the Mine-Related Pollution Task Force (MRP).

On May 5, 1983 the Board designated this proposal as Docket A of R83-6. Docket B was utilized to extend the expiration date of Section 406.201 beyond July 1, 1983 (Final Order, Adopted Rule, October 6, 1983; 7 Ill. Reg. 14515, October 28, 1983).

Public hearings were held on May 12, 1983 at Springfield, and on May 27, 1983 at Ina. Since the pages are not numbered sequentially, Roman numerals will be used to indicate the volume. Thus, (II-17) will refer to page 17 of the second day of hearings.

On July 5, 1983 the Department of Energy and Natural Resources notified the Board that a negative declaration [*2] had been made. On August 26, 1983 the Hearing Officer closed the record except for final comments (Section 102.163). No comments were received during this period.

Summary of the Proposal

The proposal will be discussed in detail in the order of sections affected. The following is a summary in a more informative order.

The proposal adds an effluent standard of 2.0 mg/l manganese, with a modified pH standard where necessary for manganese treatment (Section 406.106).

The proposal repeals the temporary exemption from the water quality standards contained in Section 406.201. This is replaced with a permanent procedure. Mine discharges will have permit conditions based on the permanent procedure for total dissolved solids (TDS), chloride and sulfate if:

1. There is no impact on public water supplies;

2. The applicant utilizes "good mining practices" to reduce TDS production; and,

3. The discharge is less than 1,000 mg/l chloride and 3,500 mg/l sulfate.

If the discharge exceeds the numerical levels, the permittee will need to prove no adverse effect to the receiving stream (Section 406.203).

Finally, the proposal extends the TDS water quality provisions to abandoned mine [*3] impoundments and discharges (Sections 409.109 and 409.110).

Discussion of Proposed Amendments

Section 405.109 Abandonment Plan

Paragraphs (b)(3) and (b)(4) have been added, and the old paragraphs with these numbers moved down. These paragraphs specifically address the impact of the special TDS provision of Section 406.203 on discharges from abandoned mines and on waters remaining in impoundments at such mines. This point first arose in a case decided during the process of adoption of new Chapter 4 (IEPA v. Material Service Corp. and Freeman United Coal Mining Co., PCB 75-488, 37 PCB 275, February 7, 1980) (I-42).

Strip mines frequently leave a final cut which fills with water after abandonment; slurry ponds and other impoundments may also be left (I-40). Some of these may have a surface water discharge. Paragraph (b)(3) addresses the discharge, while paragraph (b)(4) addresses the waters in the lake or impoundment.

Discharges from abandoned impoundments will have to meet the effluent standards of Section 406.106. If there was no TDS water quality condition imposed under special procedures during active mining, the discharge will have to avoid water quality violations. [*4] If there was such a TDS water quality condition, the waters of the impoundment will have to meet the effluent standards and make a part of the showing required under the TDS water quality Section 406.203(c)(1) and (c)(2) (I-38, II-10, 14, 18).

Paragraph (b)(4) applies to the waters in the impoundments, which may not be required to meet water quality standards during active mining, as for example, treatment lagoons and settling basins. Impoundments which will not meet such standards on abandonment will be required to meet the effluent standards after abandonment, and to make part of the showing under the TDS water quality Section 406.203 (c)(1) and (c)(2) (II-21).

Section 406.109(b)(4) applies the effluent standards as though they were water quality standards (I-38, II-11, 14, 18). This will be sufficient to ensure that any discharge will at least meet the effluent standards.

The second and third proposals limited the TDS procedure to impoundments which did not meet the water quality standards during active mining. The Board has deleted this requirement, since the water quality problems in a final cut lake may not appear until after abandonment (I-40).

The Board has added paragraph [*5] (e) to the proposal: this requires conditions in abandonment plans to assure continued application of the TDS water quality procedure (I-37).

Section 405.110 Cessation, Suspension or Abandonment

Paragraph (e)(2) has been added to specifically require a showing that Sections 405.109(b)(3) and (b)(4) have been met before a certificate of

abandonment is issued. The permittee will have to show that those sections will be met to get approval of the abandonment plan, and also show that they were in fact met before the certificate of abandonment is issued (I-37, II-10, 15).

Section 406.104 Dilution

This section was taken from Section 304.102, which it tracks almost verbatim. Paragraph (a) has been amended to make it clearer that the dilution rule refers only to the effluent standards. This may have been lost when the language was moved from Part 304 to Part 406, which deals with both effluent and water quality standards. Section 302.102 allows dilution in a mixing zone before application of the water quality standards.

The Board does not construe Section 406.104 as in any way limiting dilution after treatment in order to avoid violation of water quality standards. This dilution [*6] may take place prior to discharge to waters of the State, so long as it does not interfere with contaminant removal efficiency (I-62, 67). If effluent concentrations are measured beyond the dilution point, concentrations would have to be corrected.

Section 406.105 has been renumbered to 406.202: the water quality rule and special TDS procedure will be placed together in a separate Subpart.

Section 406.106 Effluent Standards

An effluent standard of 2.0 mg/l manganese has been added to the table. Manganese is frequently regulated as an effluent parameter, and its omission from the revised mine waste rules may have been an oversight caused by the ambiguity as to whether the effluent standards table of old Chapter 4 supplemented or superseded the effluent standards of old Chapter 3 (I-55). The Board regulates manganese in effluents other than mine waste at 1.0 mg/l (Section 304.124). Federal regulations impose a limitation of 2.0 mg/l on mining activities, including, for example, the acid mine drainage category (40 CFR 434.32(a)).

Treatment for manganese is similar to iron, involving addition of alkali to cause precipitation, followed by sufficient detention to allow settling. [*7] Unlike iron, manganese may be too soluble at pH 9 to precipitate sufficiently to meet the 2.0 mg/l standard. Effluents will be allowed to go to pH 10 if necessary to meet the manganese standard (I-36). (For related discussion, see Section 304.125; R76-21, Opinion of September 24, 1981, 43 PCB 367, 6 Ill. Reg. 563).

The Board regulates manganese as a water quality standard at 1.0 mg/l (Section 302.208). The standard was based on fish toxicity (R71-14, 3 PCB 755, 4 PCB 3, March 7, 1972). In her study of several streams impacted by mine discharges, which is discussed below, Dr. Allison Brigham found that manganese was found to account for the greatest amount of variance of species diversity and richness of several variables studied (II-31).

The manganese effluent standard will not apply to mine discharges which are associated with areas where no mining activities have taken place since May 13, 1976. This date is taken from Federal regulations regulating manganese discharges from coal mining (I-36, 54; II-10, 12).

Section 406.202 Violation of Water Quality Standards

This Section has been moved from Section 406.105. Subpart A of Part 406 will deal only with effluent rules, [*8] while Subpart B will deal with water

quality rules. The TDS procedure of the next Section will thus appear next to the Section which it modifies.

Section 406.203 Water Quality-based TDS Permit Conditions

TDS includes all material dissolved in water, as opposed to total suspended solids. In Illinois coal mine discharges TDS consists mostly of chloride and sulfate (I-49). Underground mines often have high chloride levels from saline water encountered in mining. Surface mines often produce sulfuric acid from the action of air and water on sulfur minerals exposed in mining. Neutralization of the acid produces sulfate salts, and further increases the TDS because of the dissolved solids in the alkali which must be added.

The problems with treating for TDS have been adequately addressed in prior Board Opinions. The Board repealed the TDS effluent standard in R76-21, supra, finding that the only treatment technologies involved large amounts of energy consumption, and produced concentrated brines which still required ultimate disposal. Regulation of TDS discharges was left to enforcement of water quality standards of Section 302.208:

Chloride	500 mg/l
Sulfate	500 mg/l
TDS	1000 mg/l

[*9]

In R76-20, 77-10, the Board recognized that coal mines faced a special problem with TDS in that they produced high TDS discharges, but were often forced to locate upland, away from major rivers with dilution adequate to avoid violation of water quality standards. In response, the Board adopted the temporary exception procedure now found at Section 406.201 (Opinion and Order of July 24, 1980, 39 PCB 196, 260).

The permanent TDS rule follows the temporary exemption in some respects: the applicant is required to demonstrate that he is utilizing "good mining practices", and that there will be no impact on public water supplies (I-30). However, under the permanent rule, the permittee, rather than the Agency, will be required to demonstrate no impact on the receiving stream.

The TDS procedure creates a presumption of no adverse impact on the stream if discharge levels are less than 3500 mg/l sulfate and 1000 mg/l chloride (I-30). If levels are higher, the permittee will have to prove no adverse impact. This will involve actual stream studies to be done by the permittee, involving a demonstration of the effect of the existing or proposed discharge levels on the stream, not a showing [*10] of compliance with water quality standards (I-31, 46,61).

If the 1000 and 3500 mg/l numbers are met, it is assumed that there is no adverse impact on the receiving stream. This is a presumption which could be rebutted by other evidence introduced into the record in the permit proceeding before the Agency.

If the water quality-based TDS condition is granted, the discharge will not be subject to the water quality standards for sulfate, chloride and total dissolved solids. The permit will contain conditions requiring monitoring for these parameters and limiting discharge concentrations (I-47, II-17).

The proposal would have allowed exemption from the water quality standards for iron and manganese, as well as the TDS related contaminants. The Board has dropped this from the proposal. The logical relationship between the presumptive sulfate and chloride levels and the iron and manganese levels is tenuous at best. Furthermore, there exists a simple, relatively inexpensive way to treat for iron and manganese. As noted above, manganese concentration was

found to be adversely affecting stream conditions in sites affected by mine discharges. These discharges will have to avoid causing [*11] water quality violations:

	Effluent Std.	General Use Water Quality Stds.
Iron	3.5 mg/l	1.0 mg/l
Manganese	2.0 mg/l	1.0 mg/l

The presumptive levels refer to concentration of sulfate and chloride, with no TDS level specified. As a matter of experience, TDS is mostly these two ions (I-49). Sulfate and chloride concentrations generally correlate better with environmental impacts than TDS (I-33; Ex. E, p. 29, II-32). Monitoring of TDS will continue to provide a check for the possible presence of large concentrations of some other material (I-47, II-17).

Exhibit E is a study entitled "Acute Toxicity of Chlorides, Sulfates, and Total Dissolved Solids to Some Fishes in Illinois" by Paula Reed and Ralph Evans of the State Water Survey. They studied effects of TDS and constituents on channel catfish fingerlings, large mouth bass fingerlings and blue gill fingerlings. They found the following 96-hour median tolerance limits (I-33, Ex. E, p. 29):

Sulfate	11,000 to 13,000 mg/l
Chloride	8,000 to 8,500 mg/l
TDS (sulfate)	14,000 to 17,500 mg/l
TDS (chloride)	13,000 to 15,000 mg/l

The presumptive values for sulfate are set at about one-third of the 96-hour [*12] median tolerance limit; those for chloride at about one-eighth (I-33). This is less stringent than the general practice of setting water quality standards at one-tenth the median tolerance limit (Section 302.210); however, this departure is justified for these contaminants, which are highly soluble, not toxic in the usual sense and not expected to accumulate or have any chronic effect.

The presumptive levels are also well below the levels considered safe for livestock watering (I-34).

If the discharge is above the presumptive levels, the operator could elect to treat the effluent, or to obtain a source of fresh water to dilute it to below the presumptive levels (I-61, 67). However, the thrust of the proposal is to allow permittees to adopt operating practices designed to reduce TDS production, rather than to require end-of-pipe treatment.

The Agency is to approve the water quality-based TDS condition only if the permittee proves that it is utilizing "good mining practices" designed to minimize TDS production. The Agency may promulgate a code of good operating practices, in which case compliance with the code would be prima facie proof of use of good mining practices. A "final" [*13] draft of the code has been filed as Exhibit H. The Board has proposed Sections 406.204 through 406.208 as a definition of "good mining practices". These are taken from Exhibit H.

Section 406.204 defines "good mining practices." The Agency is to consider whether the operator is utilizing the following practices:

1. Practices which may stop or minimize water from coming into contact with disturbed areas.

2. Retention and control within the site of waters exposed to disturbed materials.

3. Control and treatment of waters discharged from the site.

4. Unconventional practices.

These practices are each further defined in Sections 406.205 through 406.208.

These Sections are not intended to require that each of these practices be carried out at each site; indeed, some of the practices would exclude the use of others. What the Board intends is that the Agency review each of these practices to determine if the operator is doing all that is economically reasonable at the site to prevent the production of TDS discharges or to minimize their impact.

The proposal is in practice a modification to the Illinois NPDES program, since all mines with point source surface discharges [*14] are presently required to have NPDES permits. Section 302(b) of the Clean Water Act allows the State to establish procedures whereby dischargers can avoid application of water quality standards where the discharger demonstrates at a public hearing that "there is no reasonable relationship between the economic and social costs and benefits to be obtained." The procedures of Section 406.203 will arise in the context of NPDES permit modification. Hearings required by the Clean Water Act will be provided pursuant to Section 406.203(a).

Based on the record before it, the Board has determined that, for coal mine discharges taken as a class, which have levels of chloride and sulfate less than the presumptive levels, which are not upstream of public water supplies and which are engaged in good mining practices, the cost of treatment outweighs the value of any improvement in stream quality by many orders of magnitude. Furthermore, the societal costs associated with the effective prohibition of mining in much of Illinois would be enormous (R 50, 64). The proposed procedures allow the Agency to confirm this conclusion in particular cases, with an opportunity for a public hearing. In the [*15] case of discharges which exceed the presumptive level, the Agency will make a case-by-case determination pursuant to permit application including actual stream studies conducted by the applicant (Proposed Section 406.203(c)(4).

In June, 1983 there were 45 active coal mines in Illinois, 19 surface and 26 underground. Of these, 31 are operating under the current exemption of Section 406.201, 14 surface and 17 underground (Agency comment of August 3, 1983 in R83-6B). The remaining 14 are assumed to be able to meet the current water quality standards and are not impacted at all by the permanent TDS procedure.

The 31 mines operating under the temporary exemption should be able to easily demonstrate that they are using good mining practices and that they are not adversely impacting public water supplies, since these requirements are not altered. The mines with less than 1000 mg/l chloride and 3500 mg/l sulfate will qualify under the permanent procedure automatically. The main difference will be the mines which are above the presumptive levels. They will be required to demonstrate no adverse impact on the receiving stream. This could cost quite a lot of money. If they are unable [*16] to make the showing, expensive treatment may be required for continued operation.

As noted, the 31 potentially affected mines include 14 surface and 17 underground mines. Sulfate should be the limiting factor for surface, chloride

for underground mines. It appears that at the time Exhibit C was prepared, no surface mines exceeded the 3500 mg/l sulfate level, but that four underground mines exceeded the 1000 mg/l chloride level (II-52). Thus a maximum of four underground mines are expected to have to make stream studies. These are likely to cost in excess of $ 10,000 each.

The cost of complying with the Part 302 water quality standards through application of end-of-pipe treatment technology was discussed at 39 PCB 251. Updating these costs to the fourth quarter of 1982 infers construction costs of $ 195 million and annual operating costs of $ 52.8 million (II-56). However, the number of mines in the State has decreased, possibly reducing the aggregate estimates. Any costs associated with compliance with the exemption procedure must be judged as savings with respect to the cost of current regulations.

Costs of various good mining practices are estimated in Exhibit C, although [*17] it is difficult to summarize these concisely. These costs are less than the cost of treatment by orders of magnitude. The initial costs have already been met under the temporary rule, although there may be continuing costs associated with some practices.

The proposal creates a special TDS water quality rule for a category of dischargers. The Board has proposed to treat these dischargers differently for several reasons unique to this industry group. Section 28 of the Act allows the Board to make "different provisions as required by circumstances for different contaminant sources and for different geographical areas".

At the outset, the Board notes that coal mines represent an easily defined category of dischargers. It is the only industry group with high TDS discharges which has made itself known to the Board by filing a general proposal. The Board would consider granting special rules by industry category to any group should that group propose rules to it (Section 28 of the Act and 35 Ill. Adm. Code 102.120).

Having defined a category of TDS dischargers, it is possible to be more specific as to the identity of the TDS constituents: it is either primarily chloride or sulfate, [*18] and not often both. This allows the use of chloride and sulfate toxicity data, which is better defined than for TDS in general.

Since there is no economically reasonable treatment available for TDS discharges, compliance with the water quality standards depends on process changes and location close to large rivers with adequate dilution. Existing facilities have the variance and site-specific rulemaking procedures to ease any difficulties. However, it has proven possible to propose a general regulation for mines, both new and existing.

The most unique feature of coal mines is their relative inability to locate close to major rivers; instead, they must locate where coal deposits are located. Thus choice of location is largely eliminated for this category of dischargers.

Restricting consideration to a single industry group allows the Board to adopt meaningful regulations taking account of the processes which produce the TDS. It would not be feasible to address such a problem for industry in general.

Conclusion

In a separate Order the Board proposes to adopt the amendments to 35 Ill. Adm. Code 405 and 406 discussed above. The record will remain open for comment for a period [*19] of 45 days after publication in the Illinois Register.

This Proposed Opinion supports the Board's Proposed Order of this date.

Exhibit C

Omitted Page

"Storm Water Monitoring Map
(Surface Effects Area)"

Exhibit D

Oversized page

"Little Vermillion River
Drainage Area
West of Unnamed Tributary

9208.95 Acres

Exhibit E

IEPA EXHIBIT
No. 000072

Illinois Nature Preserves Commission

[redacted]

September 1, 2000

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

Re: NPDES permit # IL0074802, Notice # 1592c/jkb
Black Beauty Coal Company, Vermilion County

Dear Madam or Sir:

This letter is in regard to the application by Black Beauty Coal Company to create a new underground coal mine that will result in the discharge of acid mine drainage into outfall 003, an unnamed tributary that flows into the Little Vermilion River. The Illinois Nature Preserves Commission is concerned about potential negative impacts of this project on the Little Vermilion River and Carl Fliermans' River Nature Preserve.

The Little Vermilion River has been ranked as a Class "B" stream, a highly valued aquatic resource, (Biological Stream Characterization, Illinois Environmental Protection Agency, 1996) in the vicinity where the River will receive discharge from the mine area via an unnamed tributary to the Little Vermilion River. Downstream of the unnamed tributary and the Georgetown dam, the Little Vermilion River has received the highest biological aquatic characterization as a Class "A" stream, an unique aquatic resource.

The Little Vermilion River upstream, downstream, and in the vicinity of the proposed coal mine is recognized as a high-quality stream by the Illinois Natural Areas Inventory (INAI). In addition to the INAI designation and Class "A" and "B" rankings, The Nature Conservancy (TNC) has categorized the Little Vermilion watershed as one of the 327 watersheds nationwide (15% of all U.S. watersheds), as "critical" for maintaining freshwater biodiversity. The Little Vermilion River is one of only four watersheds in Illinois categorized as such. The Nature Conservancy's categorization of this stream in a nationwide comprehensive study emphasizes the national significance of preserving the Little Vermilion River.

This unique River also provides habitat for several State endangered species: Indiana bat (*Myotis sodalis*), Bigeye Shiner (*Notropis boops*), Bigeye Chub (*Notropis amblops*), Rainbow mussel (*Villosa iris*), Little Spectaclecase Mussel (*Villosa lienosa*), and Slippershell Mussel (*Alasmidonta viridis*).

The Carl Fliermans' River Nature Preserve, an area dedicated as a State nature preserve under the Illinois Natural Areas Preservation Act (525 ILCS 30), is located on the Little Vermilion River approximately 2 miles downstream of the location where water from the unnamed tributary flows into the Little Vermilion River. This Nature Preserve protects a high-quality 1.2 mile segment of the Little Vermilion River and its associated riparian corridor. In addition to protecting a Class "A" stream that is a unique aquatic resource, this Nature Preserve also supports populations of Illinois threatened and endangered species including the Bigeye Shiner *(Notropis boops)*, Little Spectaclecase Mussel (*Villosa lienosa*), and Slippershell Mussel (*Alasmidonta viridis*).

Carl Fliermans' River Nature Preserve was dedicated as an Illinois Nature Preserve by the Illinois Nature Preserves Commission to ensure its permanent protection and the perpetuation of the area in as nearly a natural condition as possible. Areas dedicated as State nature preserves are to be put to their highest and best use and are held in trust for the benefit of the people of the State of Illinois. The Commission is charged with implementing the Illinois Natural Areas Preservation Act (525 ILCS 30), which states it is ". . . public policy of the State of Illinois to secure for the people . . . the benefits of an enduring resource of natural areas . . . by establishing a system of nature preserves, protecting nature preserves and . . . otherwise encouraging and assisting in the preservation of natural areas and features."

The development of a new coal mining surface facility in such close proximity to the Little Vermilion River is of significant concern to the Illinois Nature Preserves Commission. The Commission is concerned about potential negative impacts of the proposed coal mine on the Little Vermilion River, including the Carl Fliermans' River Nature Preserve. The Little Vermilion River is an important stream with unusually high fish and wildlife value. This natural resource should receive protection from any source that could degrade its natural integrity.

After reviewing the permit application, it is our understanding that the sediment basin will result in a discharge of sediment control effluent after the 24-hour, 10-year storm event. This standard may be inadequate to prevent water quality degradation to one of Illinois' most valuable resources. Considering the frequency of the 10-year event, we believe more stringent measures need to be taken. Increased storage capacity for the settling basins would ensure that water is contained during greater storm events before it is released into a tributary of the Little Vermilion River.

In 1999, IEPA issued a NPDES permit to DynaChem, Inc. of Georgetown, Illinois that permitted stormwater discharge of contact water into a tributary of the Little Vermilion River. At this facility, the stormwater retention basin was designed to contain the runoff from the 100-year storm event. The applicant originally proposed that the retention basin contain the 25-year storm event. After IEPA review and public comment, the NPDES permit stipulated that the retention basin be increased in size to contain the 100-year storm event. IEPA should request that the Black Beauty Coal Mine sediment control basin be increased in size, just as the DynaChem basin was increased in size. If this is not done, please explain why it is not deemed necessary.

According to an IEPA memo dated Aug. 2, 2000 from Scott Twait to Larry Crispin regarding the proposed coal mine "dissolved and suspended minerals (manganese, iron, sulfates, and chlorides) will be present in the settled water discharged during storm events . . ." (Page 2, 3rd par. attached). The memo goes on to state that the dissolved and suspended minerals present in the settled water that is discharged "will be limited in the permit at levels that will be protective of aquatic life, including threatened and endangered species." What is the factual basis for this conclusion? Have the effects of the specific minerals contained in the proposed discharge water been studied on the threatened and endangered species found in the Little Vermilion River? Please provide citations or references to reports, studies, publications, etc. that support the conclusion that the dissolved and suspended minerals (manganese, iron, sulfates, and chlorides) that will be present in the settled water discharged during storm events will be at levels that will be protective of aquatic life, including threatened and endangered species.

The permit proposes to regulate acid mine discharge using effluent limits prescribed by the standards for mining discharges. Are these effluent standards adequate to 1) protect the public water supply of Georgetown, which is taken from Georgetown Lake, located about 1 mile downstream of the unnamed tributary confluence and 2) assure that no ecological alteration of the Little Vermilion River will occur? For example, the public notice states that discharge can contain sulfates with a daily maximum concentration limit of 3,500 mg/l. However, general use water quality standards for sulfates are 500 mg/l. Given the close proximity of the mine to Georgetown's public water supply and the high natural quality of the Littler Vermilion River, higher standards for water quality should be considered.

Have ambient levels of sulfates, chlorides, iron, total suspended solids, manganese, pH, acidity/alkalinity and settleable solids been determined for the Little Vermilion River? How do the proposed permitted levels of these minerals and substances compare to ambient levels? Does the permit allow higher levels of certain pollutants than are currently in the river?

Alternatives should be seriously considered. For instance, could coal be extracted from a portal at the present Riola Mine instead of creating a new surface facility? Has an analysis of alternatives been done?

A social or economic need for this project has not been demonstrated adequately. How many jobs will be created by this project? Will new workers be hired in addition to those already present at the Riola Mine? Will Illinois residents have first priority for employment?

On behalf of the Illinois Nature Preserve Commission, I respectfully request that a public hearing be held regarding this permit application due to the high level of public concern expressed to the Commission about this project, possible negative impacts on the Little Vermilion River, including the Carl Fliermans' River Nature Preserve, and possible negative impacts on aquatic life found within the river, including State threatened and endangered animals.

Please contact me at 217/785-8686 if I can provide further information or assistance. Thank you for the opportunity to comment on this important matter. I look forward to your response.

Sincerely,

Carolyn T. Grosboll

Carolyn Taft Grosboll
Director, Illinois Nature Preserves Commission

cc: Director Brent Manning, IDNR
Rene Cipriano, Office of the Governor
INPC Commissioners
Tom Flattery, IDNR, Office of Realty and Environmental Planning
Deanna Glosser, IDNR, Division of Resource Review and Coordination
Kim Underwood, IDNR, Office of Mines and Minerals

Exhibit F

Illinois
Department of
Natural Resources
524 South Second Street, Springfield, Illinois 62707-1787
http://dnr.state.il.us
George H. Ryan, Governor • Brent Manning, Director

EXHIBIT
1
9/13/00
mgg

September 13, 2000

Hearing Officer Bill Seltzer #21
Water Pollution Control, Permit Section # 15
1021 North Grand Avenue East
Post Office Box 19276
Springfield, IL 62794-9276

RE: **NPDES Permit No.** IL0074802, **Notice No.** 1592c/jkb
Discharger: Black Beauty Coal Company
Facility Location: Vermilion Grove Mine
Receiving Waters: Unnamed tributary to the Little Vermilion River
Vermilion County: T17N R12W Sections 13
IDNR # 0005819

Dear Mr. Seltzer:

The following comments are provided in response to the Illinois Environmental Protection Agency (IEPA) request for comments on the NPDES non-degradation evaluation prepared 8/2/00 for the above permit. These comments are also generated from the review of the NPDES draft Permit No. IL0074802, Notice No. 1592c/jkb in accordance with the Illinois Endangered Species Protection Act [520 ILCS 10/11], the Illinois Natural Areas Preservation Act [525 ILCS 30/17], Title 17 Illinois Administrative Code Part 1075.

The draft NPDES permit identifies the location of the proposed outfall 003 as the discharge point for a series of three settling basins for the coal preparation site of the Black Beauty Coal Company in Vermilion Grove. The discharge will enter an unnamed tributary of the Little Vermilion River (LVR). This unnamed tributary is approximately 0.5 mile upstream of the (LVR) and is recorded as having a zero $_7Q_{10}$ flow. The IEPA non-degradation evaluation utilized the Biologically Significant Illinois Streams publication (Page et al. 1992) to document that the receiving stream does not have any listed resources.

The LVR receives the water from the receiving tributary and is listed as a biologically significant stream supporting several threatened and endangered species. The Natural Heritage Database and biological reports for the area confirms that the state endangered Bigeye shiner (*Notropis boops*), River chub (*Nocomis micropogon*), Slippershell mussel (*Alasmidonta viridis*), and the Little spectacle case mussel (*Villosa lienosa*) occupy the waters of the LVR upstream and downstream of the confluence of the discharge tributary. The LVR is also identified as an Illinois Natural Areas Inventory (INAI) site due to these sensitive resources and the presence of the State dedicated Carl Flierman's River Nature Preserve just south of Georgetown in Section 5 of Township 17 North, Range12 West.

In addition to the LRV being a significant biological resource the Georgetown Reservoir has been

identified as a public water supply. The Municipal Code [65ILCS 5/11-125-2] grants a city or a village the authority to extend its jurisdiction to up to 20 miles beyond its corporate limits in order to "prevent or punish any pollution or injury to the stream or source of water, or to the waterworks". The concerns of any municipality whose jurisdiction would include the location of the expanded coal processing activities planned by the Black Beauty Coal Company should be addressed and incorporated into the permit before it is issued.

A detailed description as to what portions of the LVR are considered to be part of the Georgetown Reservoir has not been provided. This is significant because of the close proximity of the proposed outfall to the upper reaches of the Georgetown Reservoir, which is on the 1998 303(d) List for Illinois. The proposed discharge point for outfall 003 is an unnamed tributary with a zero-Q_{10} flow, so it could be considered a direct discharge to the upper reaches of Georgetown Reservoir during those times of the year when the tributary is dry.

The effluent limits for any substance identified as a cause of pollution on the 303(d) list cannot be revised for discharges to any 303(d) listed waters whose permit contains limits for those substances [Sections 303(d)(4)(A) and 401(a)(1) of the Clean Water Act]. How have these public water supply issues been addressed in the proposed NPDES permit?

The Department was requested by IEPA to review the above proposal under the revised IPCB non-degradation Standard - 35Il. Adm. Code 302.105. This revised standard is the proposed new anti-degradation standard and its purpose is "*to **maintain** high quality waters and to **prevent** unnecessary deterioration of waters of the state.*" Under this new anti-degradation standard, existing uses must be maintained and protected. Degradation of existing uses includes but is not limited to "*an action that would result in the deterioration of the existing aquatic community, such as a shift from a community of predominantly pollutant-sensitive species to pollutant-tolerant species or a loss of species diversity or an action which would result in a loss of a resident of indigenous species whose presence is necessary to sustain commercial or recreational activities*". The non-degradation evaluation which was completed to satisfy this anti-degradation standard has deficiencies which need to be revisited by IEPA.

According to the Section 354.103 of the proposed Anti-degradation Policy, "*the permit application must include "a). Identification and characterization of the waters affected by the proposed load increase or proposed activity and their exiting uses. Characterization must address physical , biological, and chemical conditions of the waters.*"

- The characterization of the existing uses and physical, biological and chemical conditions of the water provided in the non-degradation evaluation appears deficient in determining the extent of the existing uses. The public water supply and the threatened and endangered species are the only two uses mentioned. The data which substantiates the non-degradation decision is not sufficiently demonstrated. There is no data.

- Based on the criteria outlined in Section 302.105 some additional existing uses should be addressed. Sport fishing/recreational use, habitats for a diverse macro-invertebrate community, and the protection of the State's Natural Heritage of the 1.2 mile stretch of the LVR designated as Illinois' first river nature preserve - Carl Flierman's River Nature Preserve should be evaluated for potential degradation. Simply meeting permit limits does not infer non-degradation to all aquatic resources and existing uses.

- According to the Biological Stream Characterization (BSC) (Bertrand, 1996), the LVR is rated as "B"; however, previous biological surveys of the area (Sauer, 1989; Hefley, 1993; Hite and Bertrand, 1989) did have "A" ratings for the LVR. Historically, abandoned coal mines have been known to produce increasing toxic metal loads in adjacent streams and rivers, increases in acidic conditions, and associated pH moderation of the bioavailability of metals (Milam and Farris, 1998). The degradation from an A rating to a B rating in such a short time period could be attributed to the exiting Riola Mine discharge which also meets Mining Discharge Standards. Cumulative and long term impacts need to be investigated before all our unique and high quality waters' biological integrity gradually degrades over time.

- Although the Illinois Natural History Survey does not list the unnamed tributary of the LVR as a biologically significant stream, the habitat in this tributary is such that it could serve as spawning areas for the Bigeye shiner and the River Chub, (Per. Comm. IDNR Fisheries, 2000).

- The review of biological surveys (Sauer, 1989; Hefley, 1992) conducted for the LVR and the BSC (Bertrand et al., 1996) indicate the presence of fish and macro-invertebrate species which are intolerant of water quality degradation. Sampling of benthic macro-invertebrates has been used to collect baseline data to be used as a basis for detecting effects of waste waters and determination of the extent of this impact in both the short-term and longer-term (Humphrey et. al, 1990). These resources should be considered in the non-degradation evaluation as existing uses which could potentially be impacted if the water quality is degraded. The NPDES permit should include monitoring of these resources to quantify and monitor fluctuations in water quality to avoid degradation. The Department requests that a draft Monitoring Plan be prepared by the Applicant for our review and concurrence prior to the plans approval by the IEPA.

- If the concentrations of the ambient conditions in the river today differ significantly from the it is likely to create problems for sensitive or intolerant species. Current baseline data needs to be collected to document the ambient conditions of the LVR which will eventually receive the discharge waters. This baseline data should be used to determine if discharge will modify these current water quality parameters. Acute and chronic whole-effluent toxicity testing and biological monitoring should be required to serve as a check on the predicted effluent dilutions and permit limits, as well as the responses of these discharges on the aquatic community composition and diversity of unionids, macro-invertebrates, and fish.

According to the Section 354.103 of the proposed Anti-degradation Policy, *"the permit application must include "b). Identification and quantification of the proposed load increased for the applicable parameters and of the potential impacts of the proposed activity on the affected waters".*

- The IDNR, Office of Mines and Minerals, Mining Permit Application No. 342 section on Hydrological information (Page 9 Part III) indicated that "there will be increased pollutant loadings for Total Dissolved Solids (TDS), Calcium, Chlorides, Sulfate, iron, manganese, Magnesium, sodium, and pH and the effects of this increased loading will not diminish until after the site is reclaimed. All of these parameters are not addressed in the non-degradation evaluation or the NPDES permit.

- The NPDES permit identifies parameters and limits for total suspended solids (TSS), iron (total), pH, Alkalinity/Acidity, sulfates, chlorides, manganese, and settleable solids. The non-

degradation evaluation discussed the net siltation or suspended solids levels as potentially decreasing since the current agriculture practices do not employ any storm water treatment for runoff. There was also a forested riparian corridor which provided a buffer for the existing agricultural land use practices. If these riparian corridors are to be removed to accommodate for the mining operation, the runoff from the site could actually be compounded as a result of this mining operation.

- Currently, the Riola Mine discharges into the Fayette drainage system which eventually drains into the LVR. This similar operation has sulfate discharges of 500 mg/l or less, yet the current NPDES permit is allowing for 3500 mg/l to be discharged. If current technologies allow the mining operation to meet the 500 mg/l level what are the reasons for the increased load limits and what data validates that these limits will be protective of all aquatic life?

- The evaluation for the remaining parameters simply suggested that limits will be set using the effluent limits prescribed by the standards for mining discharges. Where is the data which substantiates that these mining limits do not degrade the receiving waters of the coal mine discharge.

- The non-degradation evaluation indicates the storm water ponds will not include any mine plumage from the mining operation and there will be no dry weather discharge. The construction permit for the site indicates the discharge for Outfall 003 will be classified as Acid Mine Drainage from coal refuse piles. Air-born coal dust is also an avenue for which pollutants can reach the Little Vermilion River regardless of the surface water containment for the operation. Therefore, regardless of the intent to contain and limit the coal mining operation runoff, there is always the potential for untreated acid mine drainage to enter the LVR and negatively impact the sensitive resources it supports.

- Historically, abandoned coal mines have been known to produce increasing toxic metal loads in adjacent streams and rivers, increases in acidic conditions, and associated pH moderation of the bioavailability of metals (Milam and Farris, 1998). Mine effluent has also been shown to be toxic to zooplankton exposed to an undiluted effluent with metal concentrations approaching the daily maximum limitations set in the NPDES permit (Masnado, et. al. 1995). Masnado et. al also demonstrated that depending on the hardness (calcium) of the dilution waters, the permitted metals mixture was sometimes toxic to the freshwater mussel *Anodonta imbecilis*. The non-degradation evaluation and the NPDES permit fails to address the issues of metals and the potential for bio-accumulation of these parameters associated with coal mines.

- Larval mussels are known to have low tolerance to low pH which can decrease their viability. This decrease in viability is a possible explanation for the disappearance of mussels from acid-contaminated waters (per. com. INHS 2000). In Ohio, the discovery of an endangered mussel species prompted further validation of a lowest observable effect concentration for the discharge as it was diluted by the Ohio River (Milam and Garris, 1998). We owe our rivers the same respect.

According to the Section 354.103 of the proposed Anti-degradation Policy, *"the permit application must include "c). The purpose and anticipated benefits of the proposed activity."*

- The only discussion of a social need is for the creation of jobs for the community. Alternative discharge locations or a different surface preparation site should not affect the potential for job creation in the area and may in fact require more man power to accomplish some of the additional hauling needs.

According to the Section 354.103 of the proposed Anti-degradation Policy, *"the permit application must include "d). Assessments of alternatives to proposed increases in pollutant loading ...that result in less of a load increase, no load increase or minimal environmental degradation."*

- IEPA should require the Applicant to prepare an Alternatives Analysis pertaining to the purpose and need for the proposed location of the mine's surface facilities.

- IEPA should summarize the alternatives for the storm water discharge. The three settling basins proposed will provide a 24 hour retention for a 10 year storm event. Due the frequency of 10 year storm events and larger storm events, a larger storage capacity or a no discharge facility should be investigated by the applicant.

- If additional sediment basin effluent treatment is required, the mining permit application indicates that the treatment options would include: ammonia, soda ash, caustic soda, hydrated lime, quick lime, limestone, potassium permanganate, hydrogen peroxide, coagulants ans flocculent. These parameters are not addressed in the NPDES permit or the non-degradation evaluation.

- The non-degradation evaluation mentions the additional dilution of the discharge due to the relocation of the proposed Outfall 003 further upstream on the unnamed tributary. The stream has a zero $_7Q_{10}$ flow and discharges will only occur under wet conditions; therefore, the only dilution will occur during storm events as a result of other storm water drainage into this tributary. If discharge standards are being met at the discharge point before entering any tributary waters and if these standards are suppose to protect all aquatic life, why would additional dilution be suggested? If there is any insecurity about the negative impacts to the receiving waters, it is best to not discharge at all. The design and implementation of a no-discharge system is recommended by the IDNR as the best available method to maintain the long-term integrity of the LVR ecosystem.

- The close vicinity of the coal preparation site to the LVR should require some sort of conservation easement for the remaining riparian corridor of the LVR to buffer the mining activities from this unique resource.

The Department does not feel the information presented in the non-degradation evaluation dated 8/2/00 meets the requirements of 35 Il. Adm. Code 302.105 Anti-degradation due to the deficiencies mentioned above. The issuance of the current NPDES draft permit will allow for degradation of the Little Vermilion River and its unique resources.

If you need additional information or have questions, please do not hesitate to contact me at 217-785-5500.

Sincerely,

Deanna Glosser, Ph.D.
OREP/Division of Natural Resource Review & Coordination

cc: Brian Anderson, IDNR/INHS
Larry Crislip, IEPA Mine Pollution Control Program
Kirby Cottrell, IDNR/ORC
Kevin Cummings, IDNR/INHS
Tom Flattery, IDNR/OREP
Scott Fowler, IDNR/OMM
Gary Lutterbie, IDNR/OREP
Patrick Malone, IDNR/OREP
Tom McSwiggin, IEPA/BOW
Robert Mosher, IEPA/Planning
Lawrence Page, IDNR/INHS
Robert Szafoni, IDNR/OREP
Kim Underwood, IDNR/OMM
MaryJo Woodruff, IDNR/OREP

References:

*Bertrand, W. A., R. L. Hite, and D.M. Day, eds. 1996. Biological Stream Characterization (BSC): Biological Assessment of Illinois Stream Quality through 1993. IEPA/BOW/96-058. 40pp.

*Hefley, J. E., 1993. State of Illinois, Environmental Protection Agency Division of Water Pollution Control, Planning Section; An Intensive Survey of the Little Vermilion River as Effected by Seasonal Variation. IEPA/WPC/93-139. 47 pp.

*Hite, R. L. and W. A. Bertrand. 1989. Biological Stream Characterization (BSC): A Biological Assessment of Illinois Stream Quality. Spec. Rep. No. 13 of the Illinios State Water Plan Task Force. IEPA/AC/89-275. 42pp.

*Humphrey, C.L., K.A. Bishop, and V.M. Brown. 1990. Use of biological monitoring in the assessment of effects of mining wastes on aquatic ecosystems of the Alligator Rivers region, tropical northern Australia. Environmental Monitoring and Assessment 14(2-3):139-181.

*Masnado, R.G., S.W. Geis, and W.C. Sonzogni. 1995. Comparative acute toxicity of a synthetic mine effluent to *Ceriodaphnia dubia*, larval fathead minnow and the freshwater mussel *Anodonta imbecilis*. Environmental Toxicology and Chemistry 14(11):1913-1920.

*Milam, C.D., and J.L. Farris 1998 Risk identification associated with iron-dominated mine discharges and their effect upon freshwater bivalves. Environmental Toxicology and Chemistry 17(8):1611-1619.

*Page, L.M.,et. al., Illinois Natural History Survey, Center for Biodiversity Tech. Rep. 1992(1). Biologically Significant Illinois Streams, An Evaluation of the Streams of Illinois Based on Aquatic Biodiversity. 485pp.

*Sauer, R. 1989. Illinois Department of Conservation. Division of Fisheries Stream Program. Biological survey of the Little Vermilion River.

Exhibit G

Exhibit H

Illinois
Environmental
Protection Agency

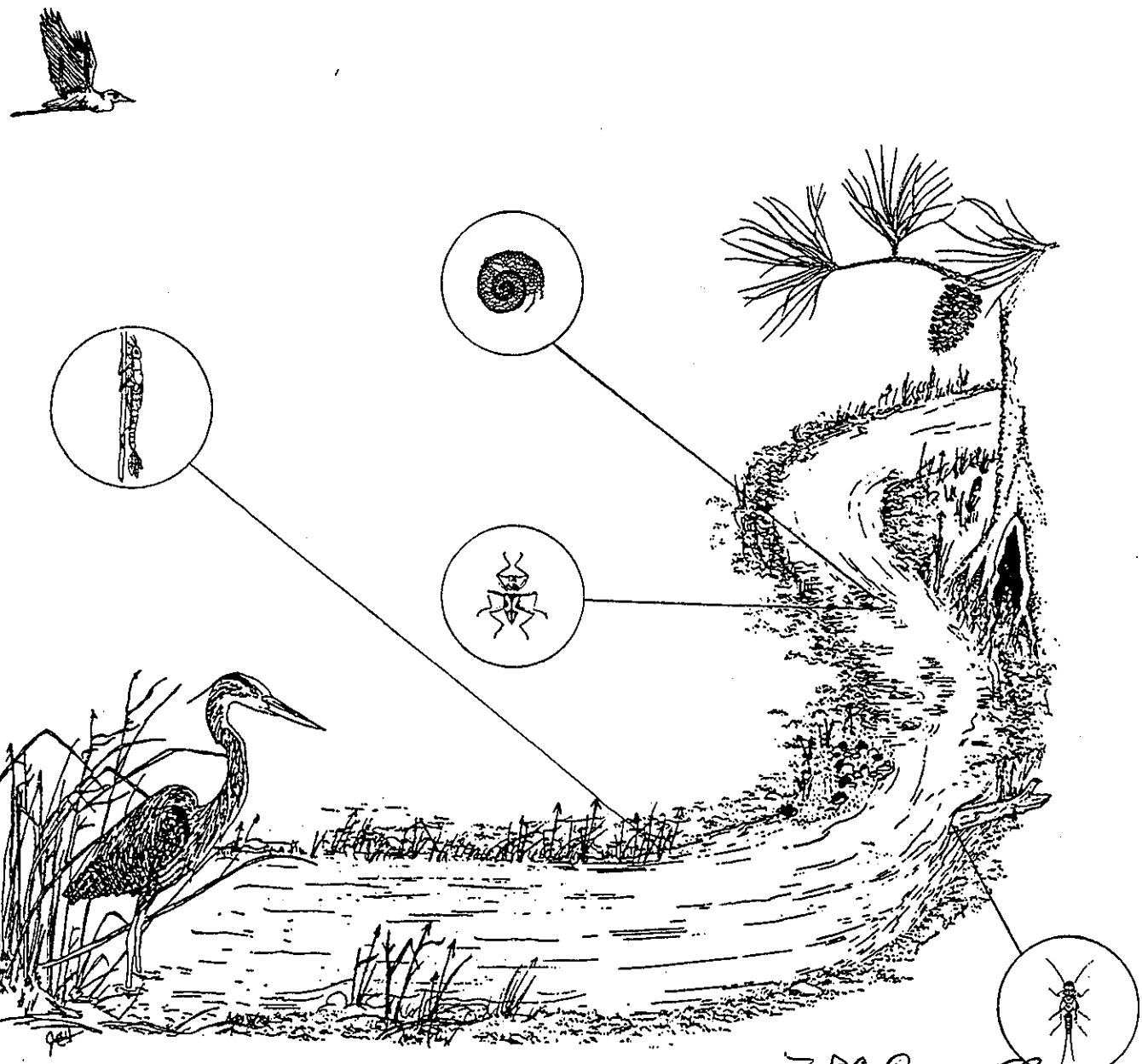
Bureau of Water
2200 Churchill Road
Springfield, IL 62794-9276

August 1993

IEPA/WPC/93-139

An Intensive Survey of the Little Vermilion River As Affected By Seasonal Variation

1992



Printed on Recycled Paper

BEC@ 59

AN INTENSIVE SURVEY OF THE LITTLE VERMILION RIVER AS AFFECTED BY SEASONAL VARIATION

1992

BY

J. E. HEFLEY

Central Monitoring Unit
4500 South Sixth Street
Springfield, Illinois 62706

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF WATER POLLUTION CONTROL
PLANNING SECTION

MARCH 1993

CONTENTS

LIST OF FIGURES

FIGURE **PAGE**

LIST OF TABLES

APPENDIX

SECTION I. EXECUTIVE SUMMARY

In 1992, the Illinois Environmental Protection Agency conducted a seasonal intensive survey of the Little Vermilion River near Georgetown, Illinois. This study looked at macroinvertebrate communities, fish populations, instream habitat, and water and sediment chemistry as tools to document the biological and chemical status of the Little Vermilion River.

The Little Vermilion survey was also designed as a program to observe biotic and abiotic fluctuations within lotic environments due to seasonal variation.

STREAM HABITAT

Habitat data were recorded at seven sites on the Little Vermilion during a period of low stream discharge in early September. During this time, the Little Vermilion River, a fourth order stream, had an average discharge of 8.1 cubic feet per second (cfs). The average water width and depth was 46 feet and 0.9 foot respectively. Bottom substrate on the upper end of the basin, upstream of the Georgetown reservoir, contained a high percent of sand while the majority of the basin's substrate was coarse, composed predominantly of gravel and cobble.

Predicted Index of Biotic Integrity (PIBI) values generated from habitat metrics at the seven Little Vermilion sites had an average value of 45 with only slight deviation between sites. PIBI values indicated that every segment sampled exhibited the potential of a Highly Valued or Class B resource.

WATER QUALITY

Water quality samples were collected from seven Little Vermilion main stem sites during four sampling periods in 1992. The water quality at all sites was considered very good, showing no apparent seasonal fluctuation. There were no violations of general use water quality standards throughout this study.

SEDIMENT CHEMISTRY

A total of seven sieved sediment samples were collected from the Little Vermilion basin for analysis. Nutrient and metal parameters examined were found to be non-elevated within the surficial sediment deposits with the exception of chromium, iron, zinc, and phosphorus.

MACROINVERTEBRATES

A total of 99 taxa were collected from seven sites on the Little Vermilion during four sampling runs in 1992. Taxa richness for the sudy revealed seasonal totals of 38 (March), 49 (May), 63 (September), and 48 (December), representing normal fluctuations for an undisturbed environment. Calculated MBI values remained consistent throughout the survey with seasonal averages for the study area of 5.4 (March), 5.2 (May), 5.0 (September), and 4.5 (December).

On the basis of macroinvertebrate community metrics including MBI, taxa richness and presence of intolerant species, the Little Vermilion River was ranked as having good to excellent stream conditions.

FISH POPULATIONS

To facilitate an assessment of biotic integrity, fish populations were sampled by electrofishing at seven sites on September 21-23, 1992. A total of 6,950 fish represented by 50 species were collected. Five species including the white sucker, northern hogsucker, golden redhorse, bluegill and longear sunfish were ubiquitous at all sites. The sample included one specimen of the bigeyed chub (*Hybopsis amblops*), an Illinois endangered species which is not known to have been collected in Illinois since 1961.

The biotic integrity of main stem fish communities was considered excellent based on Index of Biotic Integrity (IBI) values which ranged from 44 to 56. The entire Little Vermilion main stem was rated class A except for a reach south of Indianola which received a class B rating.

BIOLOGICAL STREAM CHARACTERIZATION

On the basis of Index of Biotic Integrity values ranging from 44 to 56, with an average of 52, the Little Vermilion Basin was rated as a Class A stream or Unique Aquatic Resource.

SECTION II. INTRODUCTION

BACKGROUND AND RATIONALE

Since 1981, the Illinois Environmental Protection Agency (IEPA) has used the intensive basin survey as a means of generating baseline data for the review of Illinois' water quality standards and more recently as a means of evaluating stream use support. The degree to which the streams of a particular basin support designated uses is determined by a combination of biotic and abiotic data, intensive survey field observations, and professional judgement (Ettinger, 1989).

Between March and December of 1992, the Illinois Environmental Protection Agency (IEPA) conducted an
intensive survey on the Little Vermilion River basin. This included a cooperative fish sampling effort with Illinois Department of Conservation (IDOC) in September of the same year. From data collected, environmental quality was summarized utilizing various indicies including macroinvertebrates (MBI), fish (IBI) and habitat (PIBI), as well as, water and sediment chemistry.

In 1988 Kruse and Ebinger, private consultants and instructors at Eastern Illinois University, conducted a biological survey of a 400 acre area to be inundated by a proposed Little Vermilion Lake near Georgetown, Illinois. This included a reach of the Little Vermilion River south of Georgetown at the IL Route 1 bridge to the projected dam site, east of Georgetown near the Humrick Road bridge. Their species list included two Illinois endangered mussels, slippershell *(Alismidonta viridis)* and little spectacle case (*Villosa lienosa*), as well as, the big-eyed shiner (*Notropis boops*), an Illinois threatened fish. They concluded that although unique small stream species could potentially survive downstream, they would be eliminated from the proposed area to be inundated.

A 1989 IDOC survey was conducted on the Little Vermilion River to determine the overall biotic integrity of the stream while verifying the distribution of several state "threatened" and "endangered" species. This survey was in response to the City of Georgetown's proposal to impound over three miles of the river as a water supply reservoir. The results reported this reach as a unique aquatic resource and that any impoundment would cause permanent and unmitigable loss to this resource (Sauer, 1989).

The United States Department of Agriculture has an ongoing project developing an educational and technical assistance program that will ultimately improve water quality in the Little Vermilion River and Georgetown Reservoir. Watershed background information and project results are published in an annual report.

SURVEY OBJECTIVES

Objectives of the 1992 Little Vermilion Intensive Survey were to:

1. Evaluate biotic integrity using aquatic macroinvertebrate and fish communities;
2. Observe seasonal water quality fluctuations and document specific constituents contributing to water quality degradation;
3. Observe seasonal fluctuations in macroinvertebrate communities;
4. Determine biotic potential for each stream segment through assessment of available aquatic habitat;
5. Evaluate sediment chemistry characteristics at selected stream sites and document constituents present at abnormal levels;

BASIN DESCRIPTION

According to Healy (1979), the Little Vermilion basin consists of a 244 square mile total drainage area. One hundred and ninety-six square miles of the basin are located in Illinois and include parts of Champaign, Edgar, and Vermilion counties. The river continues for twenty miles into Indiana to its confluence with the Wabash River near Newport (Figure 1).

The Little Vermilion River originates (at river mile 58.5) on the east side of Champaign County and runs nearly due east with tributary drainages located on either side of the main stem in a simple leaf pattern. This orientation of the tributaries causes lower peak flows, and more sustained low flows. Approximately 28 miles from its origin, the stream enters Georgetown Lake, a water supply reservoir located on the southwest edge of Georgetown. It impounds approximately a 1.5 mile reach of the stream at river mile 30.

Elevation in the watershed ranges from about 600 feet above sea level along the floodplain near Georgetown, to over 720 feet on the uplands formed by the Ridge Farm moraine which is located along the southern boundary of Vermilion County. Local relief is generally less than 25 feet, but does reach as much as 60 feet along the Little Vermilion River (U.S. Dept. of Agriculture, 1991).

The slope of the stream is moderate, equaling about 3.6 feet per mile in the lower third of the basin, and approximately 2.0 feet per mile in the upper two-thirds of the stream length. There is much more surface relief in the lower part of the basin, east of Sidell, and in the upper portion, the mild land slopes move right up to the stream bank.

Physiographic Divisions and Natural Divisions

The topography of the Little Vermilion is the result of recent modification of glacial activity during the Wisconsinan and Illinoian glacial periods.

The Little Vermilion basin is within the Bloomington Ridge Plain and is described by Wangsness (1983) as depositional plains of low relief underlain by thick till and modified only slightly by postglacial stream erosion. The plains are nearly flat to gently rolling and are crossed by several low and poorly developed end moraines. The flatness of the plains is broken by low eskers, esker troughs, and meltwater drainways that trend southeast.

Natural divisions of the State are characterized by bedrock, glacial history, topography, soils, and the distribution of plants and animals (Schwegman, 1973). A small portion of the basin, upstream of Sidell, is located in the Grand Prairie Division while the remaining basin and all monitoring sites fall into the Wabash Border Division. This division includes bottomlands along the Wabash River, loess covered uplands and lowland oak forests. Several tree and fish species are unique to only this division.

Geology (from Wangsness, 1983)

The uppermost bedrock in this basin is primarily Pennsylvanian. The bedrock is covered by glacial deposits from the Kansan, Illinoian and Wisconsinan glaciers. Deposits associated with the Kansan advance are buried under deposits of subsequent glacial advances. Illinoian deposits were in turn obscured by the Wisconsin advance. The Wisconsin drift is the uppermost deposit in this area. Thickness of the drift ranges from about 50-400 feet. Wisconsin loess covers the entire Little Vermilion River basin. A thickness of four feet is common on the Illinois side of the basin, but may be as thick as eight feet in areas near the Wabash River.

Soils (from U.S Dept. of Agriculture, 1991)

Soils of the Little Vermilion River basin developed from glacial tills, loess, and recent alluvial deposits. Because of varying parent material and topography, these soils vary widely in color, texture, and physical characteristics.

There are three soil associations of major importance in the Little Vermilion basin.
-Drummer-Flanagan association occurs on broad upland areas of the watershed and includes the majority of soil found in the area. These dark colored soils form on three to four feet of silty loess over a silty glacial till. The association is intensively cropped and very productive.
-Fincastle-Russel association is found on nearly level to moderately sloping areas parallel to major rivers and streams. The light colored soils make up 1.5 to 3 feet of

silty loess over silty glacial till. They are somewhat poor to moderately well drained. The main use is cropland, but also includes pasture and timber.
-Lawson-Strawn association occurs on moderate to steep slopes on both sides of nearly level bottomland along the Little Vermilion River. The dark colored, nearly level, bottomland soils formed on silt loam sediments. The light colored sloping soils formed on silty glacial till. These soils are used as a combination of cropland, pasture and woodland.

Land Use

Land use in the watershed is approximately 90 percent in rowcrop agriculture, with areas of woodland and grassland being equally divided and occurring mostly on the floodplain along major drainage ways. Land ownership is mostly private, and about half of the farms are owned by absentee landlords (U.S. Dept. of Agriculture, 1991).

Major Basin Discharges

Discharges located within the Little Vermilion River basin include permitted outfalls for Allerton and Georgetown public water supplies, as well as, outfalls from municipal wastewater treatment facilities in Georgetown and Ridge Farm, Illinois.

Georgetown is a community of approximately 3,678 residents. Their wastewater treatment facility consists of a trickling filter and aerated lagoon with tertiary rapid sand filtration and sedimentation. Georgetown was granted a year-round chlorine disinfection exemption. The plant has a design average flow of 0.6 mgd with an actual average flow in 1990 of 0.69 mgd. The point of discharge is located on an unnamed tributary of the Little Vermilion River.

Ridge Farm is a community of approximately 936 residents. Their wastewater treatment facility consists of an Imhoff tank, slow sand filtration, and trickling filtration followed by tertiary slow sand filtration and chlorine disinfection. It has a design average flow of 0.2 mgd with an actual average flow in 1990 of 0.2 mgd. The point of discharge is located on an unnamed tributary of the Little Vermilion River (Figure 1).

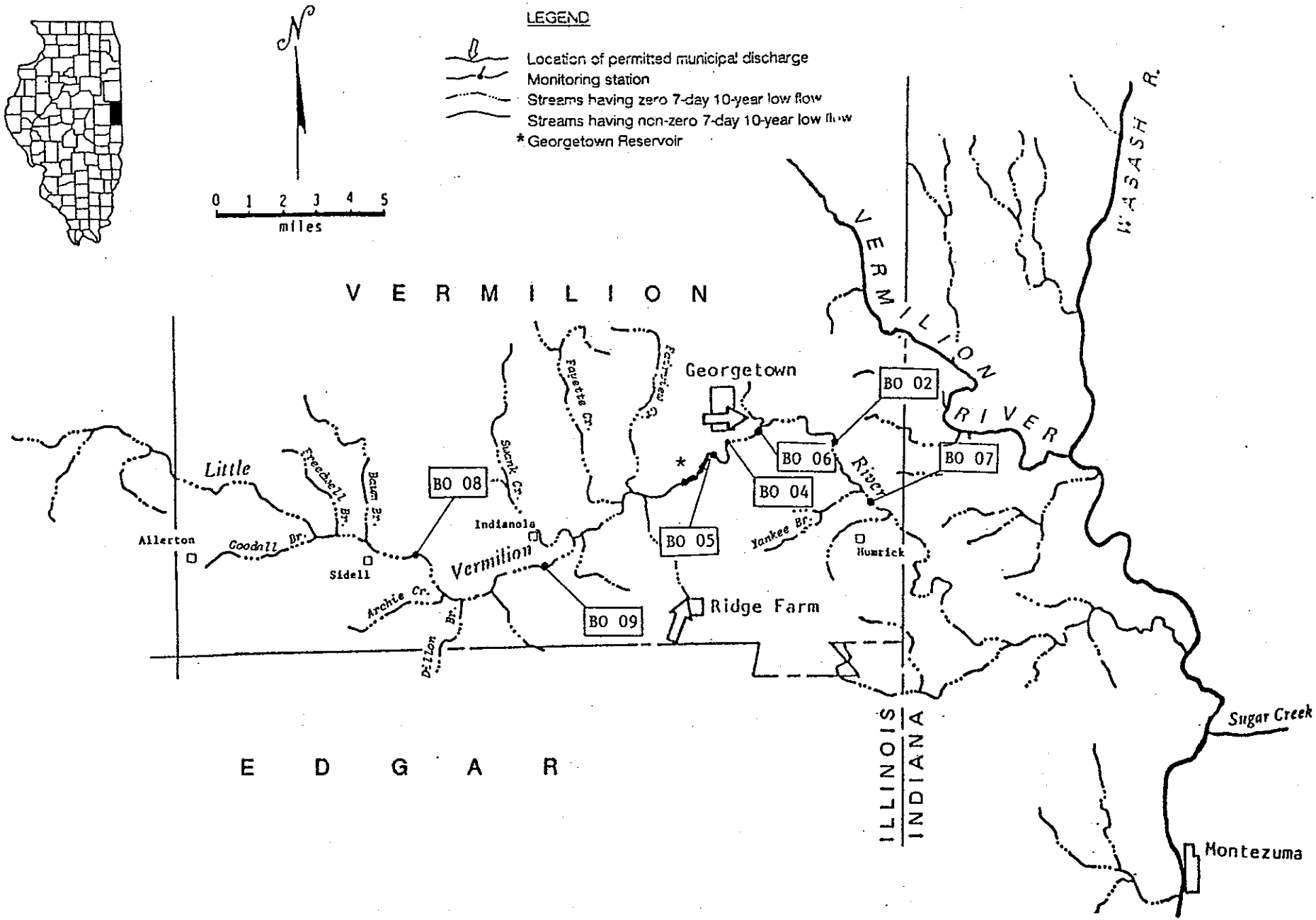


Figure 1. Locations of intensive sites monitored during the Little Vermilion River survey, 1992. Seven-day ten-year low flow designations were taken from Singh et al. (1988).

SECTION III. HABITAT

INTRODUCTION

Rationale

The composition of aquatic communities and the distribution and abundance of individual species in lotic systems are largely governed by geographically related physicochemical variables. Although fish are found almost everywhere, each species occurs in natural settings that are its habitat (Pflieger, 1975). A local assemblage of organisms results from passage of all the world's organisms "through a series of ever finer zoogeographic, climatic, physiological and ecological screens...the local fauna represent the sum of the autecologies of the constituent species" (Haedrick, 1975).

Stream quality is a function of two major components: chemical and physical. Both suitable chemical water quality and desirable physical habitat (e.g., flow, current velocity, bottom substrate composition, cover, etc.) must exist to meet specific individual species requirements. While both major habitat components are largely determined by a mix of naturally occurring geographic, climatic and physiographic conditions, man's activities can alter these components.

Biotic Potential

With respect to aquatic life (i.e., biotic integrity), the Illinois Environmental Protection Agency's mandate is to ensure that man's activities do not deleteriously affect the chemical habitat component. When assessing aquatic environments where the biota are impacted, it is frequently necessary to determine whether the impact is attributable to man induced changes in the physical and/or chemical component. To accomplish this, it is necessary to evaluate both water quality and stream habitat.

In streams where fish populations are impacted from water quality degradation, (i.e., water quality limitations), a stream habitat assessment provides an indication of the community that could be present. The fish community that would theoretically be present in the absence of water quality limitations is defined as biotic potential.

METHODS

Field Procedures

A method modified from Gorman and Karr (1978) was used to assess stream habitat at all sampling stations in the Little Vermilion River. A total of 17 habitat metrics were recorded in accordance with guidelines established in the Agency Field Methods Manual (IEPA, 1987). Habitat parameters including depth, velocity and substrate were recorded along eleven transects in a 100 yard stream segment for all fish collection stations. Other

habitat metrics including percent shade, instream cover and pool were estimated for the study reach. Stream discharge measurements were made in accordance with U.S. Geological Survey methods (USGS, 1976).

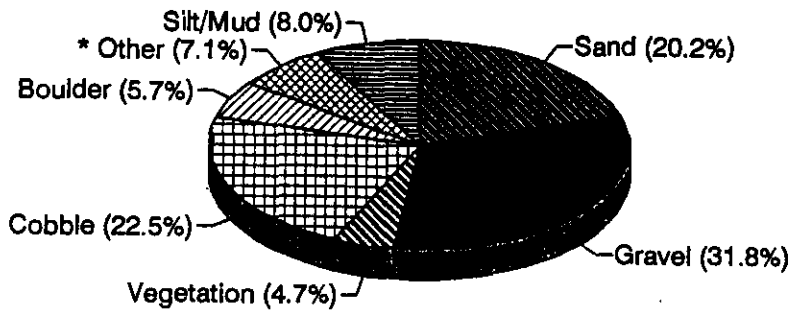
Data Analysis

Stream habitat metrics and substrate composition data were used to assess the biotic potential of each station. The biotic potential is determined using specific habitat variables identified through a stepwise multiple regression analysis (IEPA, 1986). This regression equation allows the biotic potential to be predicted in terms of an Index of Biotic Integrity (PIBI). While the IBI measures actual fish populations, the predicted IBI measures the potential for fish populations. Comparisons of PIBI values should only be made between streams of the same order.

RESULTS AND DISCUSSION

Habitat data were collected on September 1-3, 1992, a period when the basin was experiencing low-flow conditions (Appendix Table B). The typical Little Vermilion River habitat site reflected these low-flow conditions with a water width range of 29-61 feet, a water depth range of 0.6-1.4 feet, and a discharge range of 4.3-11.1 cubic feet per second (cfs) for the project area. The mean percentages of pool and riffle in the study area were 49.4 and 10.6 respectively. Average instream cover was 7.4 percent with estimated shading being dense throughout most of the area, ranging from 0-84 percent. Gravel (31.8 percent), cobble (22.5 percent), and sand (20.2 percent) were the predominant substrate types, reflecting a minimal impact from agricultural practices and erosion. These were followed by silt\mud (8.0 percent), vegetation (4.7 percent), plant detritus (3.4 percent) and lesser amounts of bedrock, claypan, and submerged logs (Figure 2). The Little Vermilion was a fourth order stream at each sampling site and had an average PIBI (Predicted Index of Biotic Integrity) value of 45. Calculated values for individual stations ranges from 42 to 47, indicating this basin had a biotic potential of a highly valued aquatic resource.

Figure 2. Substrate composition of a typical Little Vermilion River site, 1992.



* Includes bedrock (1.1%), claypan (1.1%), submerged logs (1.3%) and plant detritus (3.4%).

CHARACTERIZATION BY STUDY SITE

Station BO-08 was the farthest upstream site, located adjacent to county road #23 at the Union Pacific RR bridge 0.75 mile NE of Sidell. The mean stream width and depth were 29 feet and 0.6 foot respectively with a discharge of 4.3 cfs. The substrate consisted of sand (46 percent), gravel (20 percent), vegetation (24 percent) and lesser amounts of silt/mud and cobble. Instream vegetation was dominated by colonies of the green algae *Cladophora sp.* in late spring and later overgrown with dense patches of the macrophyte water star-grass (*Heteranthera dubia).* The stream banks were established with non-woody vegetation, primarily grasses. Canary reed grass *(Phalaris arrundinacea)* dominated areas adjacent to the stream. Shading was limited to a small area below the RR bridge. A county road paralleled this reach to the north and cultivated fields existed to the south.

Station BO-09 was located 0.75 mile SE of Indianola at the county road #16 bridge. The mean stream width and depth were 34 and 1.4 feet respectively with a discharge of 5.7 cfs. The Little Vermilion in this area was mostly pooled with a small run. The substrate consisted of sand (44 percent), gravel (16.9 percent), plant detritus (10.2 percent), cobble/boulder (11 percent) and lesser amounts of silt/mud, claypan, vegetation, and submerged logs. Instream vegetation was restricted to sparse patches of water willow *(Dianthera americana)* in a shallow area near the bridge. This reach was characterized by steep banks and a full canopy. Surrounding land was under cultivation with riparian woods to the north and south. A residence was located to the northeast with a pasture bordering the stream.

Station BO-05 was the first site downstream of the Georgetown Reservoir. It was located south of Georgetown above the IL Route 150 bridge. The mean stream width and depth were 48 feet and 1.1 feet respectively with a discharge of 7.6 cfs. This was a large pooled area with riffles located below the bridge. The substrate consisted of gravel (45 percent), cobble (27 percent) boulder (14.3 percent) and lesser amounts of silt/mud, sand, plant detritus, and submerged logs. This reach was characterized by steep banks and a dense canopy. Surrounding land to the south was under cultivation with riparian trees and wooded to the north with an occasional residence.

Station BO-04 was located at a ford in Flierman's Nature Preserve on the southeast corner of Georgetown. The mean stream width and depth were 43 feet and 0.8 foot respectively with a discharge during this sampling period of 9.7 cfs. Most of this site was a combination of pools and runs with a riffle area at the ford crossing. The substrate consisted of silt/mud (10 percent), gravel (26 percent), cobble (38 percent) and lesser amounts of sand, claypan, boulder, bedrock, and sparse patches of water willow growing among gravel bars and within the ford crossing. This reach was moderately shaded by riparian wooded areas.

Station BO-06 was located a half mile east of Georgetown at the Humrick Road bridge. The bridge at this site was under construction throughout most of the survey, limiting access and sampling during the March round. The mean stream width and depth were 49 feet and 1 foot respectively with a discharge of 8.5 cfs. This site was a combination of pooled areas and slow moving runs. Substrate consisted of gravel (25 percent), cobble (35 percent), sand (17.2 percent) and lesser amounts of silt/mud, boulders, plant detritus, and submerged logs. A wooded floodplain to the east and riparian woods to the west provided a full canopy for this reach of the stream.

Station BO-02 was located three miles ESE of Georgetown at the end of a township road. Peabody Coal owned the land adjacent to the river in this area with evidence of past mining activity. This was an IDOC fish site and was only sampled during the September round. The mean stream width and depth were 6.1 feet and 1.1 feet respectively with a discharge of 11.1 cfs. This was a very slow moving section and almost all pooled. Substrate consisted of gravel (45 percent), sand (16.3 percent), silt/mud (13.5 percent), cobble (12.5 percent) and lesser amounts of boulder, claypan, and plant detritus. This reach was located in a wooded floodplain which provided a full stream canopy.

Station BO-07 was located at a steel bridge 1.5 miles north of Humrick and was the farthest downstream site. The mean stream width and depth were 59 feet and 0.7 foot respectively with a discharge of 9.5 cfs. This reach differed from upstream sites in having a large percent of riffle and run areas with an occasional pool. Substrate consisted of gravel (45 percent), cobble (31 percent), sand (8.8 percent) and lesser amounts of silt/mud, boulder, submerged logs, and vegetation which consisted of abundant patches of water willow. A riparian border of trees provided moderate canopy along this reach. The surrounding land was primarily in cultivation with a residence located on the northeast corner.

SECTION IV. WATER QUALITY

INTRODUCTION

The single most important feature of a lake or river system is water (Reid, 1961); the quantity and quality of that water regulate aquatic ecosystems and ultimately, beneficial uses to man. The quantity of water available on the land, or surface water, is largely a function of the hydrologic cycle (Leopold, 1974), a natural phenomenon governed by geography and climate. Following precipitation, many other variables affect hydrologic regimes some of which include vegetative cover, gradient, soil type and infiltration rate.

Water quality refers to the chemical and physical properties of water which are the result of complex interactions between physicochemical and environmental constituents and biological factors. Data used in the determination of water quality are obtained by the chemical analyses of water samples in the laboratory or on-site sensing of chemical properties in the field (Hem, 1970).

As the chemical composition of natural waters is controlled by many interrelated processes, it follows that some understanding of these processes and water quality constituents are needed before one can understand water quality and the manner in which such constituents affect aquatic life and other designated beneficial uses. To supplement biological monitoring, an acceptable water quality constituent data base should include (but not necessarily be limited to) an assessment of the following parameters:

1. Nutrients, physical and chemical factors that may limit, inhibit, or stimulate plant growth;
2. Constituents which affect water transparency and thus, primary production and higher trophic levels; and
3. Potentially toxic contaminants such as ammonia, heavy metals and organochlorine compounds.

METHODS

To characterize water quality within the Little Vermilion River, stream water samples were collected in accordance with quality assurance procedures outlined in the IEPA Field Methods Manual (IEPA, 1987). Hand held bottles or weighted bottle holders were used to collect vertically integrated samples representative of the water column. Samples were cooled with ice in the field and shipped to the Champaign IEPA laboratory for analysis (Table 1). A Surveyor II Hydrolab was used for on-site measurements of pH, temperature, dissolved oxygen, and specific conductance.

RESULTS AND DISCUSSION

A total of 24 water samples from 7 sites were collected at various stream stages during March, May, September, and December in 1992 (Appendix Table C & D). Due to inclement weather and inaccessability, station BO-04 was not sampled during the March round. Station BO-02 was an IDOC fish site and was only sampled for water quality during the September round.

There were no recorded water quality violations for the basin during any of the sampling rounds. All sampled parameters were within State General Use Water Quality Standards (Table 1). Outside of water temperature, there was no discernable seasonal pattern to the water chemistry for any of the stations sampled.

Table 1. Water quality techniques (IEPA, 1982) and applicable General Use Standards (IPCB, 1990).

Parameter	Sample Container	Preservation	Method of Analysis	Units of Measure	Detection Limits	Lab Performing Analysis	General Use Standard
Water Temperature			In situ measurement using SRVR2 Hydrolab	degrees C	nearest 0.1o C	Field measurement	Apr-Nov 32oC Dec-Mar 18oC
Dissolved Oxygen			In situ measurement using SRVR2 Hydrolab	mg/l O2	0.1 mg/l	Field measurement	not less than 5 mg/l
Conductivity			In situ measurement using SRVR2 Hydrolab	umhos/cm 1 umhos/cm	nearest	Field measurement	
pH			In situ measurement using SRVR2 Hydrolab	units 0.1 units	nearest	Field measurement	In range 6.5 to 9.0
Fecal Coliform	6 oz sterile glass	0.15 ml-10% thiosulfate 4oC	Membrane filtration-24hr incubation at 44.5oC + 0.2oC	N/100 ml		Field analysis	200/100 ml
Total Suspended Solids (TSS)	quart polyethylene	refrigeration at 4oC	Filtration on glass fiber filter, determination of increase in weight upon drying at 103-105oC	mg/l TSS	1 mg/l	Champaign IEPA lab	
Nitrate+nitrite nitrogen (NO3+NO2-N)	4 oz. polyethylene	10 ml - 20% H2SO4/l at 4oC	Cadmium reduction method with Flow Injection Analyzer	mg/l N	Low level at 0.02 mg/l high level at 0.05 mg/l	Champaign IEPA lab	
Ammonia-N	4 oz. polyethylene	10 ml - 20% H2SO4/l at 4oC	Phenate method on technicon Auto-Analyzer II	mg/l N	Low level at 0.01 mg/l, high level at 0.05 mg/l	Champaign IEPA lab	Un-ionized NH3-N 0.04 mg/l
Unionized Ammonia			Calculated based on Total ammonia-N, pH and temperature	mg/l	0.001 mg/l	Calculated	0.04 mg/l
Total Phosphorus	4 oz. polyethylene	10 ml - 20% H2SO4/l at 4oC	Digestion to convert all phosphorus forms to orthophosphate followed by determination using ascorbic acid reduction method using technicon Autoanalyzer II	mg/l P	Low level at 0.001 mg/l, mid level at 0.01 mg/l, high level at 0.1 mg/l	Champaign IEPA lab	
Total ICP: (Pb, Cu, Fe, MN, Cd, Cr, Mg, Zn, K, Ba, Be, Co, Ni, Sr, Ca, Na, Al, B, Ag, V)	8 oz. polyethylene	20 ml- 50% HNO3/l	Inductively Coupled Plasma (ICP) Atomic Emission Spectrometric Method	ug/l elemental metal	5 ug/l Pb 5 ug/l Cu 50 ug/l Fe, 5 ug/l Mn 5 ug/l Cd, 50 mg/l 5 mg/l Cr	Champaign IEPA lab	a3.9-188 ug/l Cu a0.4-14 ug/l Cd a,c15-100 ug/l Pb 1000 ug/l Mn, Zn

Table 1. (cont.) Water quality techniques (IEPA, 1982) and applicable General Use Standards (IPCB, 1990).

Sulfate (SO4)	quart polyethylene	refrigeration at 4oC	Automated Methylthymol Blue Method, Technicon Autoanalyzer II	mg/l SO4	Low level at 0.5 mg/l, high level at 5.0 mg/l	Champaign IEPA lab	500 mg/l
Total Dissolved Solids (TDS)	quart polyethylene	refrigeration at 4oC	Residue on Evaporation (ROE) Filterable Residue, Gravimetric at 180oC Micro Method	mg/l	40-2500 mg/l	Champaign IEPA lab	1000 mg/l
Chemical Oxygen Demand (COD)	8 oz. polyethylene	10 ml - 20% H2SO4/l at 4oC	Dichromate Reflux Titrimetric Method	mg/l	Low level at 1 mg/l high level at 85 mg/l	Champaign IEPA lab	
Cyanide	4 oz. polyethylene	5 ml - 5N NaOH	Automated Pyridine-Barbituric Acid Method using Technicon Autoanalyzer II	mg/l	0.002 mg/l	Champaign IEPA lab	b5.2 mg/l
Chloride	quart polyethylene	refrigeration at 4oC	Automated Ferricyanide Method using Technicon Autoanalyzer II	mg/l	Low level at 0.5 mg/l high level at 5 mg/l	Champaign IEPA lab	500 mg/l
Total Alkalinity	quart polyethylene	refrigeration at 4oC	Automated Methyl Orange Method usin Technicon Autoanalyzer II	mg/l as CaCO3	5 mg/l	Champaign IEPA lab	
Total Mercury (Hg)	2 oz. glass	20ml-2.5% K2Cr2O7 in 50% HNO3/l	Automated Cold Vapor Technique with Atomic Absorbtion	ug/l	0.005 ug/l	Champaign IEPA lab	0.5 ug/l
Total Hardness	quart polyethylene	refrigeration at 4oC	Automated Calmagite Method using Technicon Autoanalyzer II	mg/l as CaCO3	5 mg/l	Champaign IEPA lab	
Total Kjeldahl Nitrogen (TKN)	4 oz. polyethylene	10 ml - 20% H2SO4/l, refrigeration at 4oC	Block Digestion, Automated Phenatic Method for Ammonia	mg/l	0.1 mg/l	Champaign IEPA lab	
Arsenic	8 oz. polyethylene	20 ml - 50% HNO3/l	Manual Digestion/Oxidation, Automated Hydride Generation, Atomic Absorbtion Spectroscopy	mg/l	0.0005 mg/l	Champaign IEPA lab	b190 ug/l
Flouride	quart polyethylene	refrigeration at 4oC	Automated Complexone Method using Technicon Autoanalyzer II	mg/l	0.04 mg/l	Champaign IEPA lab	1.4 mg/l
Phenol	8 oz. glass	10 ml - CuSO4 + H3PO4/l, refrigeration at 4oC	Automated 4-Aminoantipyrine method using manual distillation and Technicon Autoanalyzer II	ug/l	2 ug/l	Champaign IEPA lab	0.1 mg/l
Oil and Grease	quart glass	4 ml - 50% H2SO4 refrigeration at 4oC	Partition with Freon-Gravimetric Method	mg/l	1 mg/l	Champaign IEPA lab	

a Standard dependent upon hardness
b Chronic standard
c Acute standard

SECTION V. SEDIMENT CHEMISTRY

INTRODUCTION

Many water-borne contaminants sorb to particulate materials, i.e., suspended and settleable solids, or sediment. Heavy metals, nutrients, and oxygen-demanding materials occur naturally in stream sediments, generally in low to moderate concentrations. Most elevated levels of sediment constituents are caused by point-source wastewater dischargers and/or non-point runoff from urban, industrial, or agricultural areas. Harmful or toxic levels of contaminants could, in many cases, be prevented through control at the source.

Sediment has the advantage of being available and collectable with a minimum of sampling gear in most streams. Collection and chemical analysis of stream sediment is a useful monitoring tool for locating sources of potentially harmful contaminants, targeting areas where further monitoring is appropriate, and identifying areas where remedial action may be necessary.

METHODS

Field Collection

Stream sediments were collected in accordance with guidelines established in the Division of Water Pollution Control Field Methods Manual (IEPA, 1987). All sampling equipment was cleaned with detergent, rinsed with deionized water, acetone rinsed, and rinsed in the ambient water prior to use.

Sediment samples were collected by scraping the uppermost layer of recently deposited sediment with a stainless steel spoon. After compositing samples from several deposits in a stainless steel pan, sediment was wet sieved through a U.S. Standard No. 230 (63-micron) stainless steel sieve. Sieving allows the collection of a known particle size and decreases variability between samples. Sediment samples were then placed in glass quart jars and allowed to settle. The supernatent was decanted and sieved sediment transferred to 8 ounce plastic bottles for metals and 8 oz. glass bottles for organics. The samples were frozen and shipped to the appropriate IEPA laboratory for analysis.

Data Interpretation

Currently, there are no standards for sediment concentrations. To evaluate Little Vermilion sediment chemistry, nutrient and metal constituent concentrations were compared to a stream sediment classification derived from analysis of over 800 sediment samples at 556 stream sites throughout Illinois from 1974 to 1980 (Kelly and Hite, 1984; Appendix Table E). For the purpose of this study, all sediment data were interpreted using this sediment classification.

RESULTS AND DISCUSSION

A total of seven sieved surficial samples were collected from 7 sites during the Little Vermilion survey in 1992 (Appendix Table F).

Metals and Arsenic

Sediment samples were analyzed for arsenic, mercury, potassium, barium, cadmium, chromium, copper, iron, lead, manganese, nickle, silver, and zinc. The majority of the samples contained non-elevated levels of these constituents with the following exceptions:

1. Chromium was slightly elevated in 6 samples and highly elevated in one sample;
2. Iron was slightly elevated in 3 samples and elevated in two samples; and
3. Zinc was slightly elevated in 2 samples.

The elevated chromium level was from a sample collected at station BO-09. Elevated levels of this metal are generally associated with areas of high fossil fuel usage, industrial influences, or waters which receive wastewater discharge or runoff. The area in question is very rural with a past history of only sporatic mining. Since this site was unique in having bordering pastures, the confined elevation of chromium to this site may be runoff related.

Iron is a widespread and plentiful constituent of rock and soil which may fluctuate from site to site based on geology. High levels are also typical downstream from urban areas. The elevated levels in this case were collected from stations BO-04 and BO-06, which were located immediately downstream from the city of Georgetown.

Nutrients

In general, low concentrations of COD, phosphorus, Kjeldahl nitrogen, and volatile solids were recorded from the Little Vermilion sediment samples. All parameters were non-elevated at each site except for a slight elevation of volatile solids at one site and slightly elevated phosphorus throughout the survey area.

SECTION VI. MACROINVERTEBRATES

INTRODUCTION

The use of aquatic organisms to evaluate water quality is well established. The rationale is that good water quality supports a diverse biotic community with pollution-intolerant forms (Wilhm, 1975). Macroinvertebrates are well suited for bio-monitoring purposes since they are easily collected and indicative of the quality of their environment. They are dependent on lower trophic levels for their energy supply while higher trophic levels are dependent on them for their energy sources. Each species is dependent on specific ranges of environmental conditions throughout its lifespan. Each macroinvertebrate community reflects the sum of these conditions for numerous species over time (i.e., weeks or month preceding collection).

METHODS

Field Methods

Qualitative sampling of macroinvertebrates in the Little Vermilion River was conducted in accordance with Agency guidelines (IEPA, 1987). Macroinvertebrates were sampled from all available habitats with emphasis on riffles or runs. Organisms were collected with forceps, U.S. Standard 30-mesh sieve, and/or D-net. A uniform sampling effort was made at each site. This method yields a sample representing relative abundance of each taxon in the aquatic community. All organisms were preserved in 95 percent ethyl alcohol and returned to the Springfield Regional Office for identification, enumeration, and calculation of MBI values.

Data Handling

Macroinvertebrate data are interpreted by analysis of community structure and applicable biotic indices. Several methods are used to summarize macroinvertebrate data in a concise and consistent manner for easy understanding by decision makers and others who may not have the expertise and/or time to evaluate detailed macroinvertebrate data. One method presently used by IEPA is the Macroinvertebrate Biotic Index or MBI.

The Macroinvertebrate Biotic Index (MBI) used by IEPA is a modification of the Hilsenhoff method (1982). IEPA personnel are, based on available literature and field experience, assigning a pollution tolerance rating to each taxon. Pollution tolerance ratings range from 0 to 11; a rating of zero is assigned to taxa found only in unaltered streams of high water quality, and a rating of 11 is assigned to taxa known to occur in severely polluted or disturbed streams. Intermediate ratings are assigned based on an organism's relative degree of tolerance or intolerance to pollution. The MBI is the mean tolerance rating for the sample and is computed as $MBI = \Sigma(n_i t_i)/N$, where n_i is the number of individuals in each taxon, t_i is the tolerance rating assigned to that taxon and N

is the total number of individuals in the sample. A high MBI value, therefore, usually denotes a community of low species richness with few if any intolerant (sensitive) species present and poor water quality. Good water quality is indicated by a low MBI value which results from a higher proportion of sensitive organisms.

Based on present assessment methods, the breakdown of MBI values to reflect water quality is as follows (IEPA, 1988):

<5.0	Excellent
5.0 - 6.0	Very Good
6.1 - 7.5	Good/Fair
7.6 - 10.0	Poor
>10.0	Very Poor

RESULTS AND DISCUSSION

A total of 2,665 organisms representing 99 macroinvertebrate taxa were collected from seven sampling locations on the Little Vermilion River. Data were collected in March, May, September, and December in 1992 to document seasonal variation in the biotic community (Appendix Table G).

Due to station inaccessibility, macroinvertebrates were not collected at sites BO-04 and BO-06 during the March round. Station BO-02 was an IDOC fish site and was only sampled for macroinvertebrates during the September round. For this reason, stations BO-05 and BO-07 were picked as representative Little Vermilion sites to observe changes in the macroinvertebrate community during all four sampling periods. Table 2 represents a summary of data collected at each station.

Figure 3 shows total organisms at their lowest during late winter, gradually increasing through spring and reaching their peak in late summer and fall. According to Hynes (1972), this cycle represents normal fluctuations for macroinvertebrate communities within undisturbed streams. The increase in total organisms during spring and dramatic rise through summer and fall represent a period of active breeding and growth, while the decrease in total organisms collected during December and March represents a period when many taxa are present at an uncollectible stage of their life cycle and other taxa are reduced from winter die-off. By comparing these data with taxa richness results (Figure 4), a seasonal correlation is evident. This comparison shows the richness of the community fluctuating as total numbers fluctuate rather than one or two dominant organisms controlling the curve.

Figure 3. Seasonal trend of total organisms from stations BO-05 and BO-07, 1992.

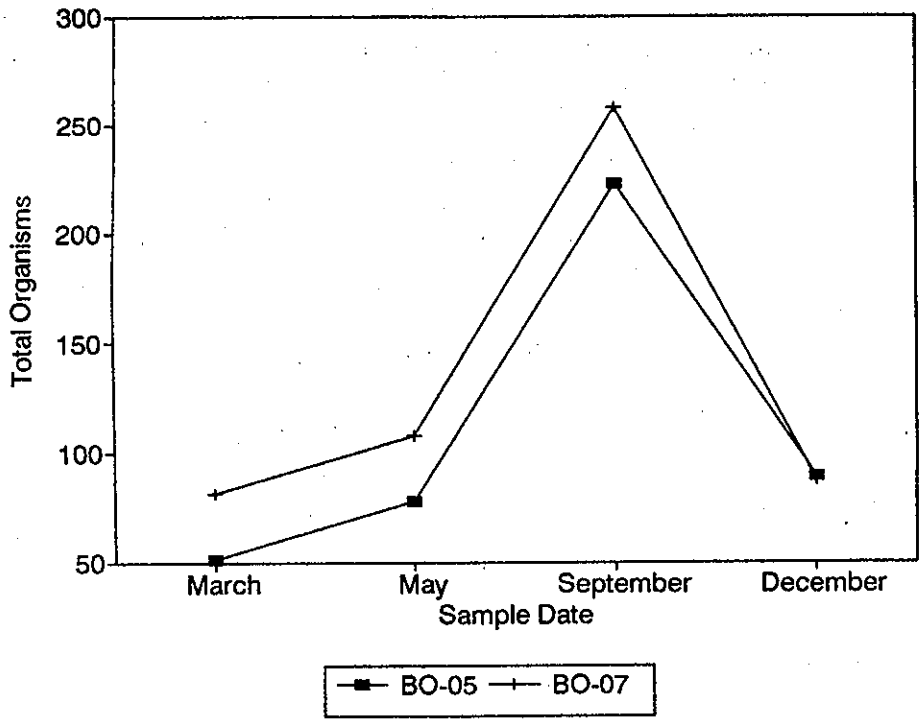
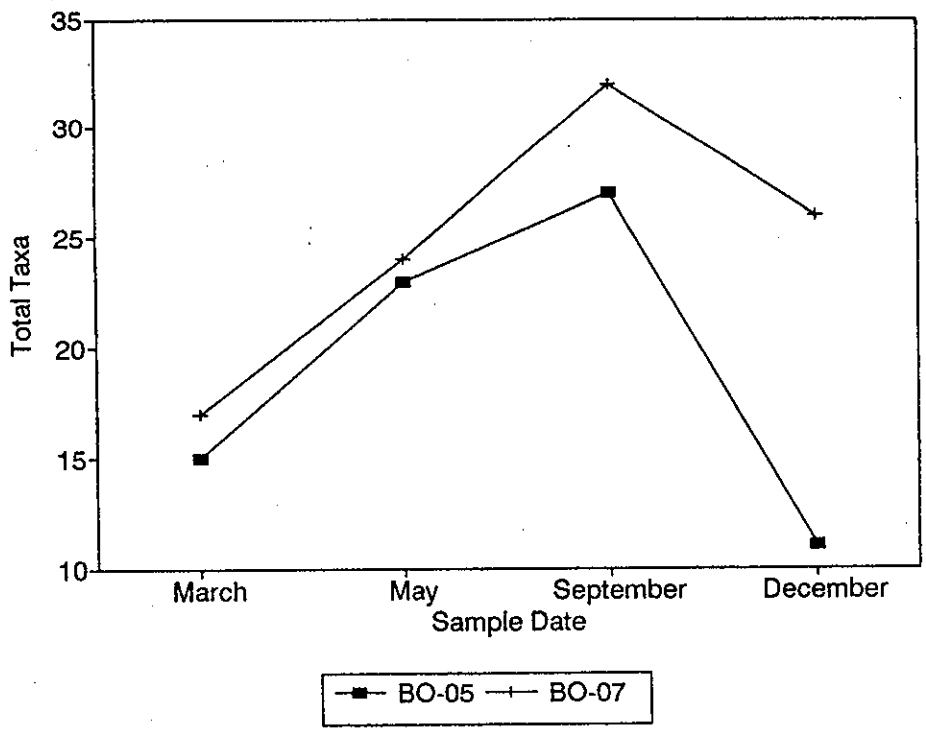


Figure 4. Seasonal trend of total taxa from stations BO-05 and BO-07, 1992.



Data from four sampling periods gives a general picture of seasonal variation within the macroinvertebrate community as a whole. It is possible that an increased number of sampling periods would show smaller peaks occurring at different times of the year representing individual or smaller groups of taxa with fast seasonal cycles in which growth is rapid after a long egg diapause. Given a healthy environment, this would explain the occurrence of organisms unique to only one sampling period, such as stoneflies. *Allocapnia vivipara* and *Taeniopteryx nivalis* were well represented in December but failed to appear at any other sampling period.

Other organisms were present during each sampling period, and seemed to exhibit non-seasonal trends. These trends seemed characteristic of several different taxanomic groups, those which require more than one year to complete their life cycle (e.g. *Corydalus cornutus*) and those with a series of overlapping generations (e.g. Gastropoda and certain Crustacea).

Intolerant or sensitive organisms represented a high percentage of samples throughout the survey. Their abundance is indicative of low organic enrichment and a balaned aquatic environment.

In general, calculated MBI values remained very consistent, with only slight deviations from site to site and season to season (Table 2). During the March round, MBI values ranged from 4.6 to 6.3 with an average of 5.4, indicating very good water quality. In May, MBI values ranged from 4.9 to 6.2 with an average of 5.2, indicating very good aquatic conditions. September MBI values ranged from 4.5 to 5.5 with an average of 5.0, indicating excellent stream quality. During the final December round, MBI values ranged from 3.8 to 6.1 with an average of 4.5, indicating excellent aquatic conditions.

Figure 3. Seasonal trend of total organisms from stations BO-05 and BO-07, 1992.

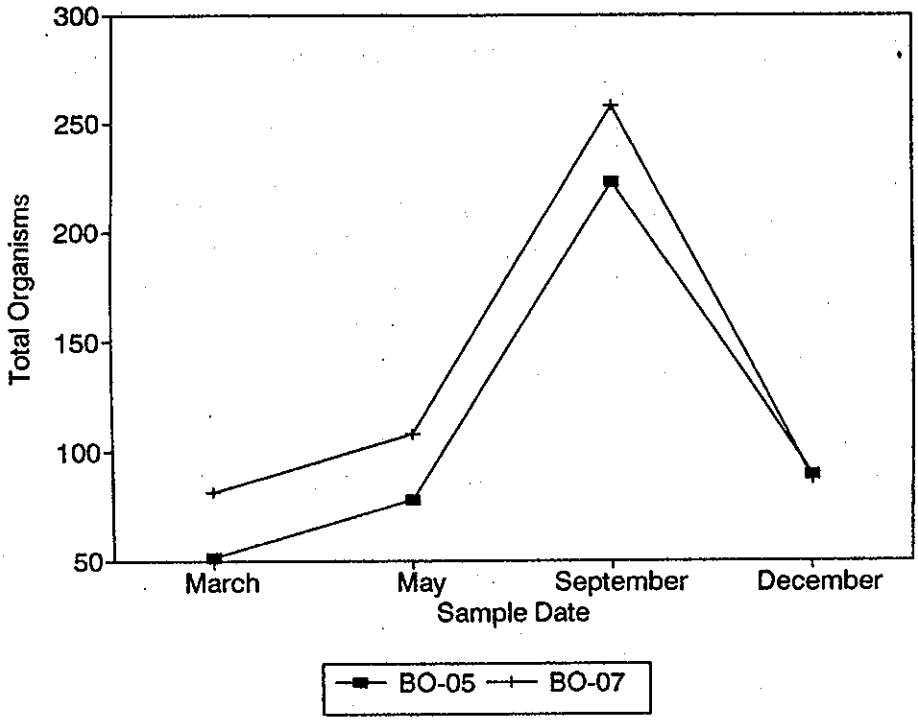
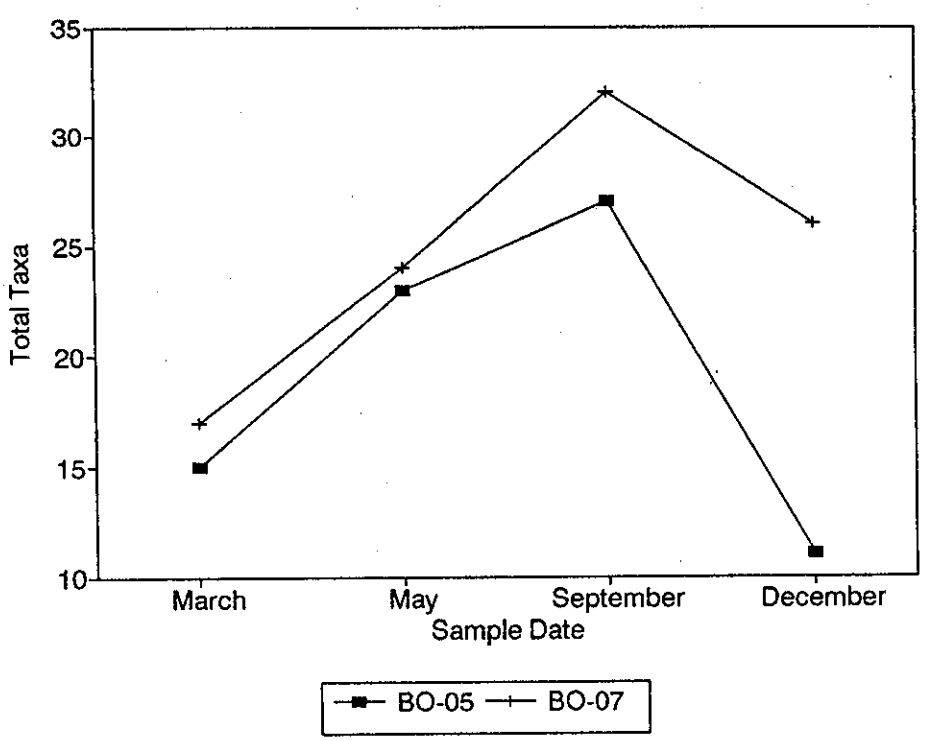


Figure 4. Seasonal trend of total taxa from stations BO-05 and BO-07, 1992.



Data from four sampling periods gives a general picture of seasonal variation within the macroinvertebrate community as a whole. It is possible that an increased number of sampling periods would show smaller peaks occurring at different times of the year representing individual or smaller groups of taxa with fast seasonal cycles in which growth is rapid after a long egg diapause. Given a healthy environment, this would explain the occurrence of organisms unique to only one sampling period, such as stoneflies. *Allocapnia vivipara* and *Taeniopteryx nivalis* were well represented in December but failed to appear at any other sampling period.

Other organisms were present during each sampling period, and seemed to exhibit non-seasonal trends. These trends seemed characteristic of several different taxanomic groups, those which require more than one year to complete their life cycle (e.g. *Corydalus cornutus*) and those with a series of overlapping generations (e.g. Gastropoda and certain Crustacea).

Intolerant or sensitive organisms represented a high percentage of samples throughout the survey. Their abundance is indicative of low organic enrichment and a balaned aquatic environment.

In general, calculated MBI values remained very consistent, with only slight deviations from site to site and season to season (Table 2). During the March round, MBI values ranged from 4.6 to 6.3 with an average of 5.4, indicating very good water quality. In May, MBI values ranged from 4.9 to 6.2 with an average of 5.2, indicating very good aquatic conditions. September MBI values ranged from 4.5 to 5.5 with an average of 5.0, indicating excellent stream quality. During the final December round, MBI values ranged from 3.8 to 6.1 with an average of 4.5, indicating excellent aquatic conditions.

Table 2. Summary of macroinvertebrate community characteristics in the Little Vermilion River, March - December, 1992.

Community Metric	**Site	BO-08	BO-09	BO-05	BO-04	BO-06	BO-02	BO-07	Season Total	Season Ave.
Total Organisms										
March		93.0	48.0	51.0	NS	NS	NS	81.0	273.0	68.3
May		64.0	142.0	78.0	124.0	78.0	NS	108.0	594.0	99.0
September		201.0	122.0	223.0	212.0	156.0	171.0	258.0	1343.0	191.9
December		91.0	56.0	89.0	81.0	51.0	NS	87.0	455.0	75.8
mean		112.3	92.0	110.3	139.0	95.0	171.0	133.5		
Taxa Richness										
March		16.0	15.0	15.0	NS	NS	NS	17.0	*38.0	15.8
May		18.0	21.0	23.0	28.0	19.0	NS	24.0	*49.0	22.2
September		24.0	22.0	27.0	33.0	25.0	30.0	32.0	*63.0	27.6
December		20.0	14.0	11.0	22.0	15.0	NS	26.0	*48.0	18.0
mean		19.5	18.0	19.0	27.7	19.7	30.0	24.8		
# Intolerant Organisms (MBI<=5.0)										
March		50.0	37.0	29.0	NS	NS	NS	14.0	130.0	32.5
May		35.0	97.0	46.0	77.0	25.0	NS	81.0	361.0	60.2
September		127.0	98.0	110.0	148.0	108.0	131.0	203.0	925.0	132.1
December		41.0	39.0	45.0	40.0	32.0	NS	69.0	266.0	44.3
mean		63.3	67.8	57.5	88.3	55.0	131.0	91.8		
% Intolerant Organisms										
March		54.0	77.0	57.0	NS	NS	NS	17.0	48.0	51.3
May		55.0	68.0	59.0	62.0	32.0	NS	75.0	61.0	58.5
September		63.0	80.0	49.0	70.0	69.0	77.0	79.0	69.0	69.6
December		45.0	70.0	51.0	49.0	63.0	NS	79.0	58.0	59.5
mean		54.3	73.8	54.0	60.3	54.7	77.0	62.5		
# Intolerant Taxa (MBI<=5.0)										
March		4.0	10.0	9.0	NS	NS	NS	8.0	18.0	7.8
May		9.0	14.0	13.0	18.0	11.0	NS	14.0	31.0	13.2
September		13.0	14.0	16.0	21.0	15.0	21.0	18.0	40.0	16.9
December		9.0	9.0	7.0	12.0	10.0	NS	18.0	28.0	10.8
mean		8.8	11.8	11.3	17.0	12.0	21.0	14.5		
% Intolerant Taxa										
March		25.0	67.0	60.0	NS	NS	NS	47.0	47.0	49.8
May		50.0	67.0	57.0	64.0	58.0	NS	58.0	63.0	59.0
September		54.0	64.0	59.0	64.0	60.0	70.0	56.0	63.0	61.0
December		45.0	64.0	64.0	55.0	67.0	NS	69.0	58.0	60.7
mean		43.5	65.5	60.0	61.0	61.7	70.0	57.5		
Biotic Index (MBI)										
March		6.3	4.6	5.0	NS	NS	NS	5.9		5.5
May		5.4	5.1	5.0	4.9	6.2	NS	4.6		5.2
September		5.5	4.8	5.0	5.0	5.0	4.8	4.5		4.9
December		6.1	4.5	4.1	4.6	4.1	NS	3.8		4.5
mean		5.8	4.8	4.8	4.8	5.1	4.8	4.7		

* Calculated from seasonal totals, not compilation of station totals
** sampling station are listed in upstream to downstream order
NS station was not sampled

SECTION VII. FISH POPULATIONS

INTRODUCTION

(Matson and Hite, 1987; modified from Weber, 1973 and Karr, 1981)
Fish occupy upper levels of aquatic food chains and are directly and indirectly affected by chemical and physical changes in the environment. Water quality conditions that significantly affect lower levels of the food chain will also affect the abundance, species composition, and condition of the fish community. While use of aquatic macroinvertebrates and water chemistry are integral components in the assessment of water quality and documentation of constituents causing impairment, the condition of the fishery is currently the most meaningful index of water quality to the general public.

Passage of the Clean Water Act of 1977 (PL 95-217) and more recently, the Water Quality Act of 1987 (PL 100-4) has emphasized protection and assessment of biotic integrity in aquatic environments. Use of fish to assess biotic integrity of water resources has also received increased emphasis in recent years (Karr, 1981; Hocutt, 1981, Stauffer et al., 1976, Karr et al., 1986).

Karr (1981) listed several advantages for using fish as indicator organisms in monitoring programs:

1. Life-history information is extensive for most species;

2. Fish communities generally include a range of species that represent a variety of trophic levels;

3. Fish are relatively easy to identify;

4. Both acute toxicity and stress affects can be evaluated;

5. Fish are typically present, even in the smallest streams and in all but the most polluted waters; and

6. Results of fish studies can be directly related to the fishable waters mandate of the Congress.

In recent years the Illinois Environmental Protection Agency has also placed greater emphasis on fish communities as indicators of stream quality and as the primary biotic metric of the IEPA and Illinois Department of Conservation inter-agency Biological Stream Characterization (BSC) process (See Section VIII: Biological Stream Characterization). To facilitate an assessment of biotic integrity and development of BSC ratings for the Little Vermilion River, fish populations were sampled at seven sites from September 1-3, 1992.

METHODS

Field Collections

Fish were collected using a 30 ft. A.C. electric seine powered by a single phase, 1600 W generator. A crew of six people were required, with three netters dipping stunned fish as the seine was hauled upstream. Block nets were used to define a sampling reach and to prevent fish from leaving or entering the sample area. Stunned fish collected in the downstream block net were also added to the sample. Fish were identified to species, weighed, measured, and released on site. Smaller specimens were preserved in 10% formalin for later identification. An attempt was made to maintain a standard sampling time of 30 minutes; however, the variability of physical conditions at each site often dictated the amount of sampling time required to obtain an adequate fish population sample.

Data Analysis

Fisheries data were evaluated by assessment of community structure with the Index of Biotic Integrity (IBI). Twelve IBI metrics in three categories were used to assess fish communities (Table 3). IBI calculations were made on an interactive program written in BASIC for use on the IBM-PC (Bickers et al. 1988).

Table 3. Metrics used to assess midwest fish communities (Karr et all., 1986).

Category	Metric
Species Richness and Composition	Total number of fish species
	Number and identity of darter species
	Number and identity of sunfish species
	Number and identity of sucker species
	Number and identity of intolerant species
	Proportion of individuals as green sunfish
Trophic Composition	Proportion of individuals as omnivores
	Proportion of individuals as insectivorous cyprinids
	Proportion of individuals as piscivores (top carnivores)
Fish Abundance and Condition	Number of individuals in sample
	Proportion of individuals as hybrids
	Proportion of individuals with disease, tumors, fin damage, and skeletal anomalies

RESULTS AND DISCUSSION

A total of 6950 fish from 50 species were collected at the seven Little Vermilion River sites on September 1-3, 1992 (Appendix table H). Five of these species, white sucker, northern hogsucker, golden redhorse, bluegill and longear sunfish were found at all stations. The bluntnose minnow was the most abundant fish, making up 30% of the total collection, followed by the longear sunfish and spotfin shiner. The sample included one bigeyed chub (*Hybopsis amblops*), an Illinois endangered species which has not been collected in the state since 1961. The bigeyed shiner (*Notropis boops*), an Illinois threatened species, was collected at all five sites below the Georgetown reservoir.

Biotic integrity of Little Vermilion fish communities was considered good to excellent based on Index of Biotic Integrity (IBI) values which ranged from 44 at station BO-09 (south of Indianola) to 56 at station BO-04 (the Fleirman preserve in Georgetown) (Table 4). The mean biotic integrity for the Little Vermilion River was 52, indicating excellent stream quality and classifying it as a unique aquatic resource.

Table 4. Summary of fish community characteristics in the Little Vermilion River, 1992.

Community Metric	*Site:	BO-08	BO-09	BO-05	BO-04	BO-06	BO-02	BO-07
Species Richness/Composition								
Total Species		25	16	29	33	28	38	30
Sucker Species		4	4	6	6	6	9	5
Sunfish Species		4	4	5	5	3	5	3
Darter Species		4	0	5	4	5	5	6
Intollerant Species		8	4	13	13	11	18	15
Trophic Composotion (%)								
Green sunfish		3.1	2.1	0.8	0.7	0.3	0.7	0.0
Omnivores		36.6	1.0	11.5	16.7	36.7	35.4	0.0
Insectivorus Cyprinids		37.0	18.6	4.4	37.5	20.4	30.2	27.7
Carnivores		0.9	13.4	2.6	3.3	1.4	2.6	1.3
Fish Abundance/ condition								
Proportion of hybrids		0	0	0	0	0	0	0
Proportion Diseased		0	0	0	0	0	0	0
Total no. individuals		3205	97	495	736	651	1072	694
Index of Biotic Integrity (IBI)		52	44	52	56	52	54	52
Stream Quality Assessment		Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent
Stream Classification (BSC)		A	B	A	A	A	A	A

* Sampling stations are listed in upstream to downstream order

SECTION VIII. BIOLOGICAL STREAM CHARACTERIZATION

INTRODUCTION

(From Hite and Bertrand, 1989)

Management or protection of any natural resource, either biotic or abiotic, requires that environmental managers have a detailed knowledge of the resource to be managed and an awareness of where that resource exists. The understanding of any resource is typically aquired through an environmental inventory process known as monitoring. Ultimately, judicious management of a resource usually requires some type of classification system. In Illinois, the Illinois Environmental Protection Agency and the Illinois Department of Conservation have developed programs to monitor and assess the quality of the state's rivers and streams.

Stream Classification

Stream quality varies spatially as a function of physiography, geology, climate, and anthropogenic features such as land use and wastewater disposal. In Illinois, some streams are little more than highly turbid, nutrient-laden, channelized ditches conveying runoff from agricultural fields. Other streams, such as the Middle Fork Vermilion River in east-central Illinois, and certain streams in the Shawnee National Forest (e.g.,Big and Lusk Creeks) in southern Illinois are impressive aquatic resources characterized by pleasing aesthetic surroundings, clear flowing waters, and diverse aquatic biota. Indeed, selected reaches of these streams have been designated or nominated for inclusion in the National Wild and Scenic Rivers System or designated wilderness areas.

The tremendous range in stream types and biotic quality evident in Illinois streams indicated a need to group or classify these streams to ensure adequate protection and management. A stream classification system was desirable as a vehicle to place the vast array of information gained from IEPA/IDOC cooperative basin surveys in a comprehensible format and to provide both fishery and water quality managers an overall perspective of the state's stream resources. Classification of Illinois stream resources was needed to:

1. Facilitate planning and prudent allocation of state resources;

2. Inventory streams exhibiting a potential for fisheries management or restoration activities;

3. Identify stream segments of exceptional quality which warrant special consideration for protection;

4. Allocate pollution control resources for attainment of Clean Water Act goals;

5. Focus greater emphasis on the importance of valuable stream resources and awareness of where these resources exist; and

6. Establish a common vehicle for the interpretation, and communication of aquatic resource values.

In May 1984, IEPA and IDOC biologists agreed to pursue a mutually acceptable classification system to be developed by a Biological Stream Characterization (BSC) committee or work group. IEPA biologists proposed a stream classification based on the type and condition of the fishery and macroinvertebrate community. IDOC Streams Program personnel had been testing the Index of Biotic Integrity (Karr, 1981) on stream fisheries data since 1982 and promoted incorporation of the IBI into the BSC methodology.

METHODS

The Biological Stream Characterization Work Group developed a provisional five-tiered stream classification in 1984 utilizing two types of biotic data: fish and macroinvertebrates. However, BSC criteria for the classification of Illinois streams are based largely on attributes of lotic fish communities with the Index of Biotic Integrity (IBI) the priority BSC metric. In the absence of suitable fishery data for IBI calculation, narrative fishery criteria and finally, macroinvertebrate data may be used to derive selected BSC ratings. If a valid IBI value can be determined for a fish sample, that stream reach is characterized as one of five stream classes in which IBI values range from about 20 to 60. Values of 51-60 place a stream in the Unique Aquatic Resource or A category; 41-50 in the Highly-Valued or B category; 31-40 in the Moderate or C category; 21-30 in the Limited or D category; and values of 20 or less place a stream in the Restricted or E category (Table 5).

RESULTS AND DISCUSSION

The Little Vermilion River was rated on the basis of fish data evaluated by the Index of Biotic Integrity. Fish population samples at seven Little Vermilion sites in 1992 yielded IBI values ranging from 44 to 56.

Except for a reach south of Indianola, all sites on the Little Vermilion produced IBI values over 50 with an average value of 52 for the entire basin. Based on the BSC methodology (Hite and Bertrand, 1989), the stream was classified as a unique aquatic resource or class A stream. The class A designation is appropriate as a year-round characterization; however, periodic perturbations, e.g., non-point, or agricultural run-off events, may cause temporary disruptions of aquatic life uses in some reaches and could affect BSC ratings.

The lack of impact due to pollution and geographic location of this basin has resulted in a stream of unique physical and biological quality that ranks as one of the best in the state.

Table 5. Biological Stream Characterization (BSC) summary.

Stream Class	BSC Category	AIBI Range	MBI Range	Biotic Resource Quality Description
A	Unique Aquatic Resource	51-60	N/A	**EXCELLENT.** Comparable to the best situations without human disturbance.
B	Highly Valued Aquatic Resource	41-50	N/A	**GOOD.** Good fishery for important gamefish species; species richness may be somewhat below expectations for stream size or geographic area.
C	Moderate Aquatic Resource	31-40	N/A	**FAIR.** Fishery consists predominantly of bullheads (Ictalurus spp.); sunfish (Lepomis spp.), and carp (Cyprinus carpio). Species diversity and number of intolerant fish reduced. Trophic structure skewed with increased frequency of omnivores, green sunfish or other tolerant species.
D	Limited Aquatic Resource	21-30	7.5-10.0	**POOR.** Fishery predominantly carp; fish community dominated by omnivores and tolerant forms. Intolerant macroinvertebrates rare or absent; moderate, faculative and tolerant organisms dominate benthic community. Species richness may be notably lower than expected for geographic area, stream size or available habitat.
E	Restricted Aquatic Resource	< 20	> 10.0	**VERY POOR.** Few fish of any species present; no sport fishery exists. Intolerant macroinvertebrates absent; benthic community consists of essentially tolerant forms, or no aquatic life may be present. Species richness may be restricted to a few oligochaete or chironomid taxa.

SECTION IX. AQUATIC LIFE USE SUPPORT

INTRODUCTION

The stated objective of the Clean Water Act (CWA) of 1987 (PL100-4) is to "restore and maintain the chemical, physical, and ecological integrity of the nation's water". To accomplish this objective, an array of legislation, policies, and comprehensive programs for water pollution control have been established at both federal and state levels. One such provision of the federal CWA (Section 305(b)) requires each state to submit a biennial report to the U.S. Environmental Protection Agency detailing "the extent to which all navigable waters of such state provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allow recreational activities in and on the water". The extent to which pollution control programs are successful in meeting CWA goals and the extent to which designated uses are met in Illinois waters are assessed in part through an evaluation of aquatic life use support. Aquatic life use support in streams is determined through an assessment of the biotic integrity and composition of fish and macroinvertebrate communities.

METHODS

Four levels of aquatic life use support were assessed for the Little Vermilion River using both biotic and abiotic data along with field observations and professional judgement. The four use support categories included: 1) full support, 2) partial support/minor impairment, 3) partial support/moderate impairment, and 4) nonsupport. Fishery data were evaluated utilizing the Index of Biotic Integrity (IBI) (Table 6). Physical habitat metrics were used to predict biotic potential (PIBI) in the form of IBI values generated from a regression equation. Stream sites were usually considered attaining full use support where the IBI value was near the PIBI value and water quality did not appear limiting. A partial/minor impairment designation generally was made when the IBI value was below the habitat assessment value and/or water quality was limiting. Partial support/moderate impairment was designated where the IBI value was significantly below the habitat assessment value and/or water quality was limiting. A stream site was considered to be in the nonsupport category if its IBI value was substantially less than the habitat assessment value and/or water quality was extremely limiting (IEPA 1990b).

RESULTS AND DISCUSSION

Physical, chemical, and/or biological attributes were assessed at 7 Little Vermilion River sites in 1992 with use support criteria developed for the CWA 305(b) report. All 7 sites displayed full support (Table 7).

Table 6. Summary of use support assessment criteria for Illinois streams (IEPA, 1990).

USE PA		FULL SUPPORT		PARTIAL SUPPORT MINOR	PARTIAL SUPPORT MODERATE	NON-SUPPORT
GENERAL STREAM/WATER QUALITY CONDITIONS		Excellent	Very Good	Fair-Good	Poor	Very Poor
IEPA/IDOC BIOLOGICAL STREAM CHARACTERIZATION (BSC)		Unique Aquatic Resource	Highly Valued Resource	Moderate Aquatic Resource	Limited Aquatic Resource	Restricted Aquatic Resource
FISH	Index of Biotic Integrity (IBI/AIBI)	51-60	41-50	31-40	21-30	<20
BENTHOS	Macroinvertebrate Biotic Index (MBI)	<5.0	5.0-6.0	6.0-7.5	7.5-10.0	>10.0
WATER CHEMISTRY	STORET Water Quality Index (WQI)	0-10	10-30	30-50	50-70	>70
WATER CHEMISTRY	Total Suspended Solids (TSS/mg/l)	<10	10-25	25-80	80-400	>400
STREAM HABITAT	Potential Index of Biotic Integrity	51-60	41-50	31-40	<31	
STREAM SEDIMENT	IEPA Stream Sediment Classification	Nonelevated	Nonelevated -Slightly Elevated	Slightly Elevated	Elevated -Highly Elevated	Extreme

Table 7. Assessment of use support for the Little Vermilion River basin, 1992.

Station Code	Waterbody Name	Reach Index	Length	Degree of Use Support	WQI	MBI	AIBI	PIBI
BO-07	Little Vermilion River	05120108-023/on	19.74	Full	19.2	4.5	52	44
BO-02	Little Vermilion River	05120108-023/on	2.35	Full		4.8	54	47
BO-06	Little Vermilion River	05120108-023/on	1.84	Full		5.0	52	45
BO-04	Little Vermilion River	05120108-023/on	0.94	Full		5.0	56	45
BO-05	Little Vermilion River	05120108-023/on	3.54	Full		5.0	52	47
BO-09	Little Vermilion River	05120108-023/on	5.34	Full		4.8	44	45
BO-08	Little Vermilion River	05120108-023/on	16.24	Full		5.5	52	42

SECTION X. LITERATURE CITED

Bickers, C.A., M.H. Kelly, J.M. Levesque, and R.L. Hite. 1988. IBI-AIBI Version 2.01 a BASIC Program for Computing the Index of Biotic Integrity With the IBM-PC. Illinois Environmental Protection Agency, Staff Report. Marion, Illinois.

Brigham, A.R., W.U. Bringham, and A. Gnilka, eds. 1982. Aquatic Insects and Oligochaetes of North and South Carolina. Midwest Aquatic Enterprises. Mahomet, Illinois. 837pp.

Burks, B.D. 1953. The Mayflies, or Ephemeroptera, of Illinois. Illinois Natural History Survey, Bulletin 26-1. Urbana, Illinois. 216pp.

Ettinger, W.H. 1989. An Intensive Survey of the Embarras River Basin, 1987. Illinois Environmental Protection Agency. Division of Water Pollution Control. Central Monitoring. Springfield, Illinois.

Frison, T.H. 1942. Studies of North American Plecoptera With Special Reference to the Fauna of Illinois. Illinois Natural History Survey. Bulletin 23-1. Urbana, Illinois. 355pp.

Gorman, O.T. and J.R. Karr. 1978. Habitat Structure and Stream Fish Communities. Ecology 59:507-515.

Haedrick, R.L. 1975. Diversity and Overlap as Measures of Environmental Quality. Water Research 9: 945-952.

Healy, R.W. 1979. River Mileages and Drainage Areas for Illinois streams - Volume 1, Illinois Except Illinois River Basin. United States Geological Survey. Water Resources Division. Champaign, Illinois.

Hem, J.D. 1970. Study and Interpretation of the Chemical characteristics of water. U.S. Geological Survey Water Supply Paper 1473. Washington, D.C.

Hilsenhoff, W.L. 1982. Using a Biotic Index to Evaluate Water Quality in Streams, Wisconsin Dept. of Natural Resources, Technical Bulletin No. 132, Madison, Wi.

Hite, R.L. and B.A. Bertrand. 1989. Biological Stream Characterization (BSC): a Biological Assessment of Illinois Stream Quality. Special Report No. 13 of the Illinois State Water Plan Task Force. Printed by Illinois Environmental Protection Agency. Springfield, Illinois.

Hite, R.L., M.R. Matson, C.A. Bickers, and M.M. King. 1991. An Intensive Survey of the Big Muddy Main Stem from Rend Lake to the Mississippi River, 1988. Illinois Environmental Protection Agency. Division of Water Pollution Control. Southern Monitoring. Marion, Il.

Hynes, H.B.N. 1970. The Ecology of Running Waters. University of Toronto Press. 555pp.

Illinois Environmental Protection Agency. 1982. Manual of Laboratory Methods, volume 1. Division of Laboratories. Springfield, Illinois.

Illinois Environmental Protection Agency. 1987. Quality Assurance and Field Methods Manual: 1987 Revision. Division of Water Pollution Control. Springfield, Illinois.

Illinois Pollution Control Board. 1990. Title 35: Environmental Protection, Subtitle C: Water Pollution, Chapter 1, Rules and Regulations. Illinois Environmental Protection Agency. Springfield, Illinois.

Karr, J.R. 1981. Assessment of Biotic Integrity Using Fish Communities. Fisheries 6(6):21-27.

Karr, J.R., K.D. Faush, P.L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing Biological Integrity in Running Waters, a Method and its Rationale. Illinois Natural History Survey Special Publication No. 5. Champaign, Illinois.

Kelly, M.H. and R.L. Hite. 1984. Evaluation of Illinois Stream Sediment Data, 1974-1980. IEPA/WPC/84-004. Illinois Environmental Protection Agency.

Kruse, K.C. and J.E. Ebinger. 1988. A biological assessment of the proposed Little Vermilion Lake at Georgetown, Ill. Unpublished report. Charlestown, Ill. 51pp.

Leopold, L.B. 1974. Water: A primer. W.H. Freeman and Company. San Francisco, California.

Matson, M.R. and R.L. Hite. 1987. An intensive survey of the Eagle Creek Basin in Saline and Gallatin Counties, Illinois. Illinois Environmental Protection Agency. Southern Monitoring. Marion, Illinois.

Pflieger, W.L. 1975. The Fishes of Missouri. Missouri Department of Conservation. Jefferson City, Missouri. Reid, G.K. 1961. Ecology of Inland Waters and Estuaries. Van Nostrand Reinhold Company. New York.

Ross, Herbert H. 1944. The Caddisflies, or Trichoptera, of Illinois. Illinois Natural History Survey. Bulletin 23-1. Urbana, Illinois. 326pp.

Schwegman, J.E. 1987. Natural Divisions. pp. 28-31 in Neely, R.D. and C.G. Heister comps. The Natural Resources of Illinos, Introduction and Guide. Illinois Natural History Survey. Spec. Publ. 6.

Simpson, Karl W. and Robert W. Bode. 1979. Common Larvae of Chironomidae (Diptera) from New York State Streams and Rivers. New York State Education Department. Albany, New York. 105pp.

Singh, K.P., G.S. Ramamurthy, and I.W. Seo. 1988. Seven-day, Ten-year Low Flows of Streams in the Kankakee, Sangamon, Embarras, Little Wabash, and Southern Regions. Illinios State Water Survey. Champaign, Ill.

United States Department of Agriculture. 1991. Little Vermilion River Agricultural Nonpoint Source Hydrologic Unit Area. Champaign, Edgar, and Vermilion Counties, Illinois.

United States Geological Survey. 1976. Discharge Measurements at Gaging Stations. Book 3, Chapter 8. Arlington, Virginia.

Wangsness, D.J. and others. 1983. Hydrology of Area 30, Eastern Region Interior Coal Province, Illinois and Indiana. U.S. Geological Survey, Water Resources Investigation 82-1005. Indianapolis, Indiana.

Wiggins, Glenn B. 1977. Larvae of the North American Caddisfly Genera (Trichoptera). University of Toronto Press. Toranto and Buffalo. 401pp.

Wilhm, J.L. 1975. Biological indicators of pollution. Pages 375-402 in B.S. Whitton, editor. River Ecology. University of California Press. Berkley, California.

SECTION XI. APPENDIX

Appendix Table A. Description of 1992 IEPA – IDOC sampling stations on the Little Vermilion River Basin.

All sites were monitored for water and sediment chemistry, macroinvertebrates, fish, and habitat metrics.

IEPA Station Number	Stream	USGS River Mile	Stream Order	County	Latitude	Longitude	T	R	S	Description	Topographic Quad–Map No.
BO–08	Little Vermilion R.	42.1	4	Vermilion	39°55'12"	87°48'16"	17N	13W	NE22	0.75 mi NE Sidell Co. Rd. #23 at RR.	Sidell–151a
BO–09	Little Vermilion R.	36.9	4	Vermilion	39°54'52"	87°43'58"	17N	12W	SE20	0.75 mi SE Indianola Co. Rd. #16 Bridge	Georgetown–150b
BO–05	Little Vermilion R.	29.6	4	Vermilion	39°57'37"	87°38'23"	17N	11W	SE6	0.5 mi SW Georgetown Il Rt. 150 Bridge	Georgetown–150b
BO–04	Little Vermilion R.	28.6	4	Vermilion	39°57'55"	87°37'46"	17N	11W	NW5	SE edge of Georgetown Flierman's Nature Preserve	Georgetown–150b
BO–06	Little Vermilion R.	27.4	4	Vermilion	39°58'11"	87°36'55"	18N	11W	SW33	0.5 mi SE Georgetown Humrick Rd. Bridge	Humrick–150a
BO–02**	Little Vermilion R.	24.3	4	Vermilion	39°57'51"	87°34'22"	17N	11W	NW2	3.0 mi ESE Georgetown end of township Rd.	Humrick–150–a
BO–07*	Little Vermilion R.	21.9	4	Vermilion	30°56'29"	87°33'05"	17N	11W	SE12	Steel bridge 1.5 mi. north of Humrick	Humrick–150a

* I.E.P.A. Ambient Water Quality Monitoring Network Site
** Only sampled during fish round in September

Appendix Table B. Summary of habitat characteristics in the Little Vermilion River, September, 1992.

	STATION							
Habitat Parameter	BO-08	BO-09	BO-05	BO-04	BO-06	BO 02	BO-07	Mean
Hydrolic Features								
Stream Order	4	4	4	4	4	4	4	
Mean Width (ft)	29.0	34.0	48.0	43.0	49.0	61.0	59.0	46.1
Mean Depth (ft)	0.6	1.4	1.1	0.8	1.0	1.1	0.7	0.9
Mean Velocity (ft/s)	0.3	0.1	0.2	0.3	0.2	0.1	0.4	0.2
Discharge (cfs)	4.3	5.7	7.6	9.7	8.5	11.1	9.5	8.1
Channel Width (ft)	81.0	53.0	67.0	53.0	70.0	73.0	59.0	65.1
Pool (%)	0.0	81.0	67.5	54.0	43.0	76.0	24.5	49.4
Riffle (%)	1.0	0.0	25.0	10.0	4.0	2.0	32.0	10.6
Run (%)	99.0	19.0	7.5	36.0	53.0	22.0	43.5	40.0
Substrate								
Silt/Mud (%)	6.1	6.8	3.0	10.0	9.8	13.5	6.6	8.0
Sand (%)	45.5	44.1	7.1	2.7	17.2	16.3	8.8	20.2
Fine Gravel (%)	10.1	5.9	7.1	6.7	7.5	19.5	4.4	8.7
Medium Gravel (%)	10.1	5.9	12.5	9.3	4.6	15.3	14.6	10.3
Coarse Gravel (%)	0.0	5.1	25.6	10.0	12.6	10.2	26.3	12.8
Small Cobble (%)	2.0	5.1	8.3	17.3	16.1	6.5	19.0	10.6
Large Cobble (%)	1.0	5.1	18.5	20.7	19.5	6.0	12.4	11.9
Boulder (%)	1.0	0.8	14.3	6.0	9.2	6.0	2.9	5.7
Bedrock (%)	0.0	0.0	0.0	8.0	0.0	0.0	0.0	1.1
Claypan (%)	0.0	4.2	0.0	2.7	0.0	0.9	0.0	1.1
Plant Detritus (%)	0.0	10.2	2.4	2.7	2.9	4.7	0.7	3.4
Vegetation (%)	24.2	0.8	0.0	4.0	0.0	0.0	3.6	4.7
Submerged Logs (%)	0.0	5.9	1.2	0.0	0.6	0.5	0.7	1.3
Other (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% Gravel*	20.2	16.9	45.2	26.0	24.7	45.0	45.3	31.9
% Cobble/Boulder/Bedrock	4.0	11.0	41.1	44.0	44.8	18.5	34.3	28.2
% Course Substrate**	20.6	27.9	86.3	70.0	69.5	63.5	79.6	59.6
Other								
Instream Cover (% est.)	10.2	5.2	8.6	15.4	3.5	2.3	6.4	7.4
Shading (% est.)	0.0	84.0	70.9	31.5	84.2	76.7	36.0	54.8
No. of Transects	11	11	11	11	11	11	11	11.0
PIBI	42	45	47	45	45	47	44	45
Biotic Potential Category	B	B	B	B	B	B	B	B

* Gravel = fine, medium, and course gravel

** Course substrate = all gravel, cobble, boulder, and bedrock

Appendix Table C. Seasonal water chemistry data from the Little Vermilion River, March-December, 1992.

Parameter	General use Standard	Station BO-08				Station BO-09				Station BO-05			
		03/24	05/19	09/03	12/21	03/24	05/19	09/03	12/21	03/24	05/18	09/01	12/21
Field Water Temp., Deg. C.		8.7	23.3	23.8	4.6	8.5	18.7	21.8	3.7	7.7	20.7	22.0	3.2
Field pH, units	6.5-9.0	8.3	8.3	8.1	8.1	8.2	7.9	7.8	8.1	8.3	8.0	7.9	8.2
Field Dissolved Oxygen, mg/l	5.0 min	15.4	13.9	12.8	13.2	13.2	7.8	7.2	12.7	13.2	8.4	7.0	13.3
Field Conductivity, umhos/cm		622	606	542	624	620	607	536	624	616	620	665	622
Ammonia Nitrogen, mg/l	1.5/15b	0.02	0.02	0.07	<0.01	<0.01	<0.01	0.17	<0.01	<0.01	0.09	0.07	<0.01
+ Unionized Ammonia, mg/l	0.04 max	0.001	0.002	0.005	0.000	0.000	0.000	0.005	0.000	0.000	0.004	0.003	0.000
Nitrate + Nitrite, mg/l		13.0	12.0	2.2	11.0	13.0	12.0	1.7	10.0	11.0	11.0	3.7	9.5
Total Phosphorus, mg/l		<0.01	0.03	0.03	0.01	<0.01	0.02	0.04	0.01	<0.01	0.07	0.07	0.03
COD, mg/l		9	10	8	7	10	6	10	4	8	10	8	3
Total Susp. Solids, mg/l		1	3	9	2	1	3	4	1	3	25	19	3
T. Mercury, ug/l	0.5 ug/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
T. Calcium, mg/l		79	68	62	80	79	67	55	79	78	69	74	80
T. Magnesium, mg/l		34	33	36	33	33	32	34	32	33	33	36	33
T. Sodium, mg/l		6.7	5.1	8.0	4.6	6.5	5.1	8.1	4.6	7.5	5.8	7.8	5.4
T. Potassium, mg/l		<1.0	<1.0	1.4	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	1.1	<1.0
T. Aluminum, ug/l		<150	<150	440	<150	<150	<150	270	<150	<150	320	480	<150
T. Barium, ug/l	5000 ug/l	37	36	180	45	37	40	55	45	38	43	67	47
T. Boron, ug/l	1000 ug/l	26	<5	72	<5	32	<5	51	<5	26	10	48	<5
T. Beryllium, ug/l		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
T. Cadmium, ug/l	*=*=*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Chromium, ug/l	*=*=*	<5	<5	6	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Copper, ug/l	*=*=*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Cobalt, ug/l		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Iron, ug/l		62	220	150	58	91	150	390	120	160	560	600	110
T. Lead (furnace), ug/l	*=*=*	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Manganese, ug/l	1000 ug/l	<15	22	30	<15	30	37	52	19	40	72	78	24
T. Nickel, ug/l	1000 ug/l	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
T. Silver,ug/l	5.0 ug/l	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Strontium, ug/l		120	110	120	120	120	110	120	110	120	110	120	110
T. Vanadium, ug/l		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Zinc, ug/l	1000 ug/l	66	<50	<50	63	54	<50	<50	110	66	<50	54	89
+ Hardness, mg/l		334	306	301	334	333	299	277	329	332	304	331	335

+ calculated value

* State Water Quality Standard Violation

(b) Ammonia nitrogen shall not exceed 15.0 mg/L; if it is less than 15.0 mg/L but greater than 1.5 mg/L, then unionized ammonia shall not exceed 0.04 mg/L.

==* Standards are hardness dependent, see appendix table D.

Appendix Table C. (cont.) Seasonal water chemistry data from the Little Vermilion River, March - December 1992.

Parameter	General use Standard		Station BO-04 03/25	05/18	09/02	12/22	Station BO-06 03/25	05/18	09/01	12/21	Station BO-02 09/02	Station BO-07 03/25	05/19	09/02	12/22
Field Water Temp., Deg. C.			21.6	21.4	3.0	8.4	22.3	21.2	3.2	20.7	7.3	19.2	21.2	2.5
Field pH, units	6.5-9.0		8.2	7.7	8.2	8.3	8.2	7.9	8.2	7.9	8.1	8.0	8.0	8.1
Field Dissolved Oxygen, mg/l	5.0 min		9.1	6.4	13.3	13.2	9.4	7.7	13.8	8.0	11.4	7.7	9.4	13.8
Field Conductivity, umhos/cm		N	617	617	623	607	616	617	621	631	620	620	623	625
Ammonia Nitrogen, mg/l	1.5/15b	O	0.04	0.07	<0.01	<0.01	0.03	0.04	<0.01	0.07	0.03	<0.01	0.04	<0.01
+ Unionized Ammonia, mg/l	0.04 max	T	0.003	0.002	0.000	0.000	0.002	0.001	0.000	0.002	0.001	0.000	0.002	0.000
Nitrate + Nitrite, mg/l			11.0	3.6	9.5	11.0	11.0	3.9	9.4	4.0	10.0	11.0	3.8	9.3
Total Phosphorus, mg/l			0.05	0.06	0.02	0.02	0.05	0.05	0.03	0.14	0.02	0.09	0.10	0.03
COD, mg/l		S	9	9	5	9	10	7	5	8	10	8	7	6
Total Susp. Solids, mg/l		A	27	11	1	4	28	2	4	6	4	20	6	3
		M												
T. Mercury, ug/l	0.5 ug/l	P	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	<0.05	<0.05	<0.05
T. Calcium, mg/l		L	69	74	80	76	69	74	82	75	78	70	73	81
T. Magnesium, mg/l		E	32	36	33	34	32	36	33	37	34	33	36	34
T. Sodium, mg/l		D	5.8	8.0	5.4	7.6	5.8	7.7	5.6	11.0	8.1	6.6	10.0	6.0
T. Potassium, mg/l			<1.0	1.3	<1.0	<1.0	<1.0	1.0	<1.0	1.9	<1.0	<1.0	1.7	<1
T. Aluminum, ug/l			210	320	<150	200	170	170	510	<150	<150	230	180	<150
T. Barium, ug/l	5000 ug/l		42	63	46	40	41	59	200	55	41	46	55	46
T. Boron, ug/l	1000 ug/l		8	51	7	35	<5	51	33	78	34	13	71	16
T. Beryllium, ug/l			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
T. Cadmium, ug/l	*=*=*		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Chromium, ug/l	*=*=*		<5	<5	<5	<5	<5	<5	6	<5	7	<5	<5	<5
T. Copper, ug/l	*=*=*		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Cobalt, ug/l			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Iron, ug/l			420	380	94	330	370	220	140	120	190	480	180	130
T. Lead (furnace), ug/l	*=*=*		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Manganese, ug/l	1000 ug/l		53	49	23	56	47	30	33	18	44	62	25	24
T. Nickel, ug/l	1000 ug/l		<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
T. Silver,ug/l	5.0 ug/l		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Strontium, ug/l			110	120	110	120	110	120	110	120	120	110	120	110
T. Vanadium, ug/l			<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
T. Zinc, ug/l	1000 ug/l		<50	<50	84	79	<50	62	140	54	110	<50	<50	<50
+ Hardness, mg/l			302	333	335	327	306	334	339	336	328	299	331	341

+ calculated value

* State Water Quality Standard Violation

(b) Ammonia nitrogen shall not exceed 15.0 mg/L; if it is less than 15.0 mg/L but greater than 1.5 mg/L, then unionized ammonia shall not exceed 0.04 mg/L.

==* Standards are hardness dependent, see appendix table D.

Appendix Table D. Hardness-dependent General Use water quality standards for samples collected from the Little Vermilion River Survey, March - December, 1992.

All standards, acute (AS) and chronic (CS), are in u/gl, total (including suspended and dissolved).

		Station BO-08				Station BO-09				Station BO-05			
Date:		03/24	05/19	09/03	12/21	03/24	05/19	09/03	12/21	03/24	05/18	09/01	12/21
Hardness (mg/l)		334	306	301	334	333	299	277	329	332	304	331	335
Cadmium	AS	38.0	34.4	33.8	38.0	37.8	33.5	30.8	37.3	37.7	34.2	37.6	38.1
Cadmium	CS	2.9	2.7	2.7	2.9	2.9	2.7	2.5	2.9	2.9	2.7	2.9	2.9
Chromium, trivalent	AS	4663	4340	4282	4663	4651	4258	4000	4605	4640	4317	4628	4674
Chromium, trivalent	CS	556	517	510	556	554	508	477	549	553	515	552	557
Copper	AS	55.2	50.8	50.1	55.2	55.1	49.7	46.3	54.4	54.9	50.5	54.7	55.4
Copper	CS	33.1	30.7	30.3	33.1	33.1	30.1	28.2	32.7	33.0	30.6	32.9	33.2
Lead	AS	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Lead	CS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix Table D. (cont.) Hardness-dependent General Use water quality standards for samples collected from the Little Vermilion River Survey, March - December, 1992.

All standards, acute (AS) and chronic (CS), are in u/gl, total (including suspended and dissolved).

		Station BO-04				Station BO-06				Station BO-02	Station BO-07			
Date:		03/25	05/18	09/02	12/22	03/25	05/18	09/01	12/21	09/02	03/25	05/19	09/02	12/22
Hardness (mg/l)		N O T S A M P L E D	302	333	335	327	306	334	339	336	328	299	331	341
Cadmium	AS		33.9	37.8	38.1	37.1	34.4	38.0	38.6	38.2	37.2	33.5	37.6	38.9
Cadmium	CS		2.7	2.9	2.9	2.9	2.7	2.9	3.0	2.9	2.9	2.7	2.9	3.0
Chromium, trivalent	AS		4293	4651	4674	4582	4340	4663	4720	4685.4	4594	4258	4628	4742
Chromium, trivalent	CS		512	554	557	546	517	556	563	558.5	548	508	552	565
Copper	AS		50.2	55.1	55.4	54.1	50.8	55.2	56.0	55.5	54.3	49.7	54.7	56.3
Copper	CS		30.4	33.1	33.2	32.5	30.7	33.1	33.6	33.3	32.6	30.1	32.9	33.7
Lead	AS		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Lead	CS		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix Table E. Classification of Illinois stream sediments(Kelly and Hite, 1984).

NUTRIENTS AND HEAVY METALS: Ranges of concentrations displayed and resultant groupings are based on one, two, four and eight standard deviations from the background mean. Unless otherwise noted, concentrations are in mg/kg sediment dry weight.

	NON-ELEVATED	SLIGHTLY ELEVATED	ELEVATED	HIGHLY ELEVATED	EXTREME
COD	<90,000	>90,000	>132,000	>215,000	>380,000
Total Kjeldahl Nitrogen	<2,300	>2,300	>3,200	>5,100	>8,800
Total Volatile Solids (%)	<6.5	>6.5	>8.8	>13	>22
Total Phosphorus	<80	>80	>1,100	>1,700	>3,000
Arsenic	<8.0	>8.0	>11	>17	>28
Chromium	<16	>16	>23	>38	>60
Copper	<38	>38	>60	>100	>200
Iron	<18,000	>18,000	>23,000	>32,000	>50,000
Lead	<28	>28	>38	>60	>100
Manganese	<1,300	>1,300	>1,800	>2,800	>5,000
Zinc	<80	>80	>100	>170	>300
Cadmium	<0.5	>0.5	>1.0	>2.0	>20.0

Appendix Table F. Concentrations of volatile solids, nutrients and metals in sieved bottom sediment samples collected from the Little Vermilion River, September 1992.

All units are mg/kg(ppm) unless otherwise noted.

PARAMETER	BO-08	BO-09	BO-05	BO-04	BO-06	BO-02	BO-07
A. Non-Metals							
COD	51550	43700	46800	52650	37900	36000	39850
Phosphorus-P	515	440	512	613	494	510	606
Kjeldahl-N	2150	1460	1790	1800	1320	1310	1360
Solids,Vol	5.9	5.5	5.7	7.1	5.1	4.9	5.4
B. Metals & Arsenic							
Arsenic	4.3	4.4	4.8	5.5	5.7	4.9	5.6
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Potassium	1000	1100	1200	1400	1200	1100	1100
Barium	88	92	102	116	109	89	91
Cadmium	<1	<1	<1	<1	<1	<1	<1
Chromium	27	46	22	20	18	16	18
Copper	12	13	15	17	16	16	15
Iron	14000	17000	22000	26000	24000	20000	20000
Lead	12	14	17	19	21	15	15
Manganese	749	928	848	1100	990	761	765
Nickel	22	31	22	24	23	19	19
Silver	<1	<1	<1	<1	<1	<1	<1
Zinc	57	60	72	83	88	70	67

Appendix Table G. Macroinvertebrate data collected from the Little Vermilion River intensive survey, March - December, 1992.

Taxon	Tol Rating	Station BO-08 03/24	05/19	09/03	12/21
TURBELLARIA	8	1	3	2	
OLIGOCHAETA	10	7	1		
ISOPODA					
Asellidae	8				
Caecidotea sp.	6				
Lirceus sp.	4		1		1
AMPHIPODA	4				
Hyalellidae					
Hyalella azteca	5	45	7	36	28
DECAPODA					
Cambaridae	5				
Orconectes virilus	5				
EPHEMEROPTERA	3				
Oligoneuriidae	3				
Isonychia sp.	3				2
Baetidae	4				
Baetis sp.	4				
B. intercalaris	7		2	44	
B. pygmaeus	4			9	
Callibaetis sp.	4			13	1
Heterocloeon curiosum	4				
Pseudocloeon sp.	4		2	1	
Heptageniidae	3.5				
Heptagenia sp.	3				
H. maculipennis	3				
Stenacron interpunctatum	4			3	2
Stenonema sp.	4				
S. exiguum	5				
S. femoratum	7			1	1
S. mediopunctatum	2				
S. terminatum	4				
S. vicarium	3				
Dannella lita	2				
Tricorythidae	5.5				
Tricorythodes sp.	5			52	
Caenidae	5.5				
Caenis sp.	6	1	6	5	1
Potamanthidae					
Potamanthus sp.	4				
Ephemeridae					
Ephemera simulans	3				
Hexagenia limbata	5				
ODONATA					
Gomphidae					
Gomphus sp.	7				
Ophiogomphus sp.	2				
Aeshnidae					
Anax junius	5				1
Boyeria vinosa	3		1	1	
Macromiidae					
Macromia sp.	3				
M. taeniolata	3				
Cordulidae					
Epicordulia princeps	2				
Calopterygidae	3.5				
Calopteryx maculata	4			1	
Hetaerina americana	3			1	
Coenagrionidae	5.5				
Argia sp.	5	1			
A. apicalis	5				
A. tibialis	5		2		
A. translata	5				
Enallagma sp.	6	6	7	9	15
PLECOPTERA	1.5				
Taeniopterygidae					
Taeniopteryx nivalis	2				2
Capniidae					
Allocapnia vivipara	2				
Perlidae					
Perlesta placida	4		15		
Perlodidae					
Isoperla sp.	2	2			
MEGALOPTERA					
Sialidae					
Sialis sp.	4				
Corydalidae					
Corydalus cornutus	3				

Taxon	Tol Rating	Station BO-08 (cont.) 03/24	05/19	09/03	12/21
TRICOPTERA	3.5				
Hydropsychidae	5.5				
Cheumatopsyche sp.	6				3
Hydropsyche cuanis	5				
H. frisoni	5				
H. orris	4				
H. bronta	4				
Polycentropidae					
Polycentropus remotus	3				
Rhyacophilidae					
Rhyacophila lobifera	1				1
Limnephilidae					
Pycnopsyche sp.	3				2
P. guttifer	3				
Helicopsychidae					
Helicopsyche borealis	2			5	
Leptoceridae					
Nectopsyche candida	3				
N. diarina	3				
N. pavida	3		1		
COLEOPTERA					
Dryopidae (adult & larvae)	1.5				
Helichus sp.	4			1	
Elmidae (adult & larvae)	5				
Ancyronyx variegatus	2				
Dubiraphia sp.	5		3	3	
Macronychus glabratus	2				
Stenelmis sp.	7	6	3		2
DIPTERA	10				
Tipulidae	4				
Culicidae	8				
Anopheles sp.	8			4	
Simuliidae	6				
Simulium sp.	6		1		1
Chironomidae	6				
Tanypodinae	6			1	
Clinotanupus pinguis	6		1		
Thienemannimyia group	6	1			3
Orthocladiinae	6				
Brillia sp.	6				
Cricotopus sp.	6	2			1
C. bicinctus	10				
C. trifasciata	6				
Eukiefferiella bavarica	4				
Nanocladius sp.	3			1	
Orthocladius sp.	4	2			
Psectrocladius sp.	5				
Chironominae	11			2	2
Chironomus sp.	11				
Dicrotendipes neomodestu	6				3
Polypedilum sp.	6			1	
P. convictum	6				
P. illinoense	5				
Tribelos sp.	5				
Tanytarsini					
Tanytarsus sp.	7			2	
Tabanidae	7				
GASTROPODA	6				
Viviparidae					
Campeloma sp.	7				
Pleuroceridae					
Goniobasis sp.	5				
Physidae	9				
Physella sp.	9	13	5	3	18
Lymnaeidae	7				
Fossaria sp.	7	2			
Stagnicola sp.	7	2			
Planorbidae	6.5				
Helisoma sp.	7	1			
Menetus sp.	7	1			
Ancylidae					
Ferrissia sp.	7				
PELECYPODA					
Corbiculidae					
Corbicula sp.	4		3		
Total Organisms		93	64	201	91
Total Taxa		16	18	24	20
MBI		6.3	5.4	5.5	6.1

Appendix Table G. (cont.) Macroinvertebrate data collected from the Little Vermilion River Intensive survey, March - December, 1992.

Taxon	Tol Rating	Station BO-05 03/24	05/18	09/01	12/21
TURBELLARIA	6		6	4	
OLIGOCHAETA	10	3	2		
ISOPODA					
Asellidae	6				
Caecidotea sp.	6		9	1	2
Lirceus sp.	4				
AMPHIPODA	4				
Hyalellidae					
Hyalella azteca	5			13	
DECAPODA					
Cambaridae	5				
Orconectes virilus	5		1	1	
EPHEMEROPTERA	3				
Oligoneuriidae	3				
Isonychia sp.	3			45	
Baetidae	4				
Baetis sp.	4				
B. intercalaris	7		1	4	
B. pygmaeus	4			1	
Callibaetis sp.	4	1			
Heterocloeon curiosum	4				
Pseudocloeon sp.	4		23		
Heptageniidae	3.5				
Heptagenia sp.	3				1
H. maculipennis	3				
Stenacron interpunctatum	4	11	5	17	1
Stenonema sp.	4				
S. exiguum	5			6	
S. femoratum	7	4	2		2
S. mediopunctatum	2				
S. terminatum	4				
S. vicarium	3				
Dannella lita	2				
Tricorythidae	5.5				
Tricorythodes sp.	5			3	
Caenidae	5.5				
Caenis sp.	6	1	1	2	
Potamanthidae					
Potamanthus sp.	4				
Ephemeridae					
Ephemera simulans	3				
Hexagenia limbata	5				
ODONATA					
Gomphidae					
Gomphus sp.	7				
Ophiogomphus sp.	2				
Aeshnidae					
Anax junius	5				
Boyeria vinosa	3				
Macromiidae					
Macromia sp.	3				
M. taeniolata	3				
Cordulliidae					
Epicordulia princeps	2				
Calopterygidae	3.5				
Calopteryx maculata	4		1		
Hetaerina americana	3				
Coenagrionidae	5.5				
Argia sp.	5	1			
A. apicalis	5				
A. tibialis	5	1			
A. translata	5				
Enallagma sp.	6		1	4	
PLECOPTERA	1.5				
Taeniopterygidae					
Taeniopteryx nivalis	2				24
Capniidae					
Allocapnia vivipara	2				15
Perlidae					
Perlesta placida	4		6		
Perlodidae					
Isoperla sp.	2	3			
MEGALOPTERA					
Sialidae					
Sialis sp.	4				
Corydalidae					
Corydalus cornutus	3		3	2	

Taxon	Tol Rating	Station BO-05 (cont.) 03/24	05/18	09/01	12/21
TRICHOPTERA	3.5				
Hydropsychidae	5.5				
Cheumatopsyche sp.	6			79	15
Hydropsyche cuanis	5				
H. frisoni	5			6	
H. orris	4			1	
H. bronta	4				
Polycentropidae					
Polycentropus remotus	3				
Rhyacophilidae					
Rhyacophila lobifera	1	4			1
Limnephilidae					
Pycnopsyche sp.	3	1			
P. guttifer	3				
Helicopsychidae					
Helicopsyche borealis	2			1	
Leptoceridae					
Nectopsyche candida	3				
N. diarina	3				
N. pavida	3				
COLEOPTERA					
Dryopidae (adult & larvae)	1.5				
Helichus sp.	4		1	3	
Elmidae (adult & larvae)	5				
Ancyronyx variegatus	2			1	
Dubiraphia sp.	5		1	9	
Macronychus glabratus	2		1		
Stenelmis sp.	7		7	5	
DIPTERA	10				
Tipulidae	4		1		1
Culicidae	8				
Anopheles sp.	8			3	
Simuliidae	6				
Simulium sp.	6	11	2		25
Chironomidae	6			2	
Tanypodinae	6				
Clinotanupus pinguis	6				
Thienemannimyia group	6				
Orthocladiinae	6				
Brillia sp.	6				
Cricotopus sp.	8				
C. bicinctus	10				
C. trifasciata	6				
Eukiefferiella bavarica	4				
Nanocladius sp.	3				
Orthocladius sp.	4	6	1		
Psectrocladius sp.	5				
Chironominae	11			2	
Chironomus sp.	11				
Dicrotendipes neomodestu	6				
Polypedilum sp.	6			1	
P. convictum	6				
P. illinoense	5			2	
Tribelos sp.	5				
Tanytarsini					
Tanytarsus sp.	7				
Tabanidae	7		1		
GASTROPODA	6				
Viviparidae					
Campeloma sp.	7				
Pleuroceridae					
Goniobasis sp.	5	1	1	5	2
Physidae	9				
Physella sp.	9	2			
Lymnaeidae	7				
Fossaria sp.	7				
Stagnicola sp.	7	1			
Planorbidae	8.5				
Helisoma sp.	7				
Menetus sp.	7				
Ancylidae					
Ferrissia sp.	7				
PELECYPODA					
Corbiculidae					
Corbicula sp.	4		1		
Total Organisms		51	78	223	89
Total Taxa		15	23	27	11
MBI		5	5	5	4.1

Appendix Table G. (cont.) Macroinvertebrate data collected from the Little Vermilion River intensive survey, March - December, 1992.

Taxon	Tol Rating	Station BO-09 03/24	05/19	09/03	12/21
TURBELLARIA	6				
OLIGOCHAETA	10		2		1
ISOPODA					
Asellidae	6				
Caecidotea sp.	6				
Lirceus sp.	4				
AMPHIPODA	4				
Hyalellidae					
Hyalella azteca	5	8	9	41	7
DECAPODA					
Cambaridae	5				
Orconectes virilus	5		1	1	
EPHEMEROPTERA	3				
Oligoneuriidae	3				
Isonychia sp.	3			11	1
Baetidae	4				
Baetis sp.	4				
B. intercalaris	7		24	3	2
B. pygmaeus	4			2	
Callibaetis sp.	4			1	2
Heterocloeon curiosum	4				
Psuedocloeon sp.	4		32		
Heptageniidae	3.5				
Heptagenia sp.	3				
H. maculipennis	3				
Stenacron interpunctatum	4	12	8	15	15
Stenonema sp.	4				
S. exiguum	5				2
S. femoratum	7			2	
S. mediopunctatum	2				
S. terminatum	4			2	
S. vicarium	3				
Dannella lita	2				
Tricorythidae	5.5				
Tricorythodes sp.	5			3	
Caenidae	5.5				
Caenis sp.	6		2	1	
Potamanthidae					
Potamanthus sp.	4		2		1
Ephemeridae					
Ephemera simulans	3				
Hexagenia limbata	5		3		
ODONATA					
Gomphidae					
Gomphus sp.	7				
Ophiogomphus sp.	2				
Aeshnidae					
Anax junius	5				
Boyeria vinosa	3				
Macromiidae					
Macromia sp.	3				
M. taeniolata	3				
Corduliidae					
Epicordulia princeps	2				
Calopterygidae	3.5				
Calopteryx maculata	4				
Hetaerina americana	3				
Coenagrionidae	5.5				
Argia sp.	5				
A. apicalis	5	1	1		
A. tibialis	5		7	9	
A. translata	5				
Enallagma sp.	6		9	3	
PLECOPTERA	1.5				
Taeniopterygidae					
Taeniopteryx nivalis	2				6
Capniidae					
Allocapnia vivipara	2				4
Perlidae					
Perlesta placida	4		24		
Perlodidae					
Isoperla sp.	2	3			
MEGALOPTERA					
Sialidae					
Sialis sp.	4			1	
Corydalidae					
Corydalus cornutus	3			1	

Taxon	Tol Rating	Station BO-09 (cont.) 03/24	05/19	09/03	12/21
TRICHOPTERA	3.5				
Hydropsychidae	5.5				
Cheumatopsyche sp.	6	1		6	6
Hydropsyche cuanis	5				
H. frisoni	5				
H. orris	4				
H. bronta	4			3	
Polycentropidae					
Polycentropus remotus	3		2		
Rhyacophilidae					
Rhyacophila lobifera	1	2			
Limnephilidae					
Pycnopsyche sp.	3				
P. guttifer	3				
Helicopsychidae					
Helicopsyche borealis	2				
Leptoceridae					
Nectopsyche candida	3				
N. diarina	3				
N. pavida	3				
COLEOPTERA					
Dryopidae (adult & larvae)	1.5				
Helichus sp.	4		1		
Elmidae (adult & larvae)	5				
Ancyronyx variegatus	2				
Dubiraphia sp.	5	2	1	7	
Macronychus glabratus	2	1	4	1	
Stenelmis sp.	7	3	2	1	
DIPTERA	10				
Tipulidae	4				
Culicidae	8				
Anopheles sp.	8				
Simuliidae	6				
Simulium sp.	6	5			7
Chironomidae	6				
Tanypodinae	6				
Clinotanupus pinguis	6	1			
Thienemannimyia group	6			1	1
Orthocladiinae	6				
Brillia sp.	6				
Cricotopus sp.	8				
C. bicinctus	10				
C. trifasciata	6				
Eukiefferiella bavarica	4				
Nanocladius sp.	3				
Orthocladius sp.	4	6			1
Psectrocladius sp.	5	1			
Chironominae	11				
Chironomus sp.	11				
Dicrotendipes neomodestu	6				
Polypedilum sp.	6				
P. convictum	6			5	
P. illinoense	5				
Tribelos sp.	5	1			
Tanytarsini					
Tanytarsus sp.	7				
Tabanidae	7		1		
GASTROPODA	6				
Viviparidae					
Campeloma sp.	7				
Pleuroceridae					
Goniobasis sp.	5				
Physidae	9				
Physella sp.	9	1	5		
Lymnaeidae	7				
Fossaria sp.	7				
Stagnicola sp.	7				
Planorbidae	6.5				
Helisoma sp.	7				
Menetus sp.	7				
Ancylidae					
Ferrissia sp.	7				
PELECYPODA					
Corbiculidae					
Corbicula sp.	4		2		
Total Organisms		48	142	122	58
Total Taxa		15	21	22	14
MBI		4.6	5.1	4.8	4.5

Appendix Table G. (cont.) Macroinvertebrate data collected from the Little Vermilion River intensive survey, March - December, 1992.

Taxon	Tol Rating	Station BO-04 03/25	05/18	09/01	12/22
TURBELLARIA	6		2	3	4
OLIGOCHAETA	10	N	3		
ISOPODA		O			
Asellidae	6	T			
Caecidotea sp.	6		19	2	8
Lirceus sp.	4	S			
AMPHIPODA	4	A			
Hyalellidae		M			
Hyalella azteca	5	P	2	9	
DECAPODA		L			
Cambaridae	5	E			
Orconectes virilus	5	D	2		1
EPHEMEROPTERA	3				
Oligoneuriidae	3				
Isonychia sp.	3		1	20	
Baetidae	4				
Baetis sp.	4		2		
B. intercalaris	7			5	
B. pygmaeus	4			2	
Callibaetis sp.	4				
Heterocloeon curiosum	4			1	
Pseudocloeon sp.	4		13		
Heptageniidae	3.5				
Heptagenia sp.	3				
H. maculipennis	3			1	
Stenacron interpunctatum	4		2	2	1
Stenonema sp.	4			1	
S. exiguum	5				1
S. femoratum	7			3	4
S. mediopunctatum	2				1
S. terminatum	4				
S. vicarium	3				
Dannella lita	2		1		
Tricorythidae	5.5				
Tricorythodes sp.	5			18	
Caenidae	5.5				
Caenis sp.	6		3	2	
Potamanthidae					
Potamanthus sp.	4				
Ephemeridae					
Ephemera simulans	3				
Hexagenia limbata	5		2		
ODONATA					
Gomphidae					
Gomphus sp.	7				
Ophiogomphus sp.	2			1	
Aeshnidae					
Anax junius	5				
Boyeria vinosa	3		4	1	
Macromiidae					
Macromia sp.	3				
M. taeniolata	3		1	1	
Corduliidae					
Epicordulia princeps	2				
Calopterygidae	3.5				
Calopteryx maculata	4			4	
Hetaerina americana	3				
Coenagrionidae	5.5				
Argia sp.	5				
A. apicalis	5				
A. tibialis	5			1	
A. translata	5				
Enallagma sp.	6		6	2	
PLECOPTERA	1.5				
Taeniopterygidae					
Taeniopteryx nivalis	2				22
Capniidae					
Allocapnia vivipara	2				1
Perlidae					
Perlesta placida	4		20		
Perlodidae					
Isoperla sp.	2				
MEGALOPTERA					
Sialidae					
Sialis sp.	4				
Corydalidae					
Corydalus cornutus	3		1		

Taxon	Tol Rating	Station BO-04 (cont.) 03/25	05/18	09/01	12/22
TRICHOPTERA	3.5				
Hydropsychidae	5.5				
Cheumatopsyche sp.	6			30	13
Hydropsyche cuanis	5				3
H. frisoni	5			2	
H. orris	4				
H. bronta	4			1	
Polycentropidae					
Polycentropus remotus	3				
Rhyacophilidae					
Rhyacophila lobifera	1				
Limnephilidae					
Pycnopsyche sp.	3				
P. guttifer	3				
Helicopsychidae					
Helicopsyche borealis	2		6	2	3
Leptoceridae					
Nectopsyche candida	3				
N. diarina	3				
N. pavida	3				
COLEOPTERA					
Dryopidae (adult & larvae)	1.5				
Helichus sp.	4		1	5	1
Elmidae (adult & larvae)	5				
Ancyronyx variegatus	2				
Dubiraphia sp.	5		3	55	
Macronychus glabratus	2		5	6	
Stenelmis sp.	7		5	10	1
DIPTERA	10				
Tipulidae	4				
Culicidae	8				
Anopheles sp.	8				
Simuliidae	6				
Simulium sp.	6		1		6
Chironomidae	6		1	2	
Tanypodinae	6				
Clinotanupus pinguis	6				
Thienemannimyia group	6			2	
Orthocladiinae	6			2	1
Brillia sp.	6				1
Cricotopus sp.	8				2
C. bicinctus	10				
C. trifasciata	6				
Eukiefferiella bavarica	4				
Nanocladius sp.	3				
Orthocladius sp.	4	N			2
Psectrocladius sp.	5	O			
Chironominae	11	T			
Chironomus sp.	11				
Dicrotendipes neomodestu	6	S			
Polypedilum sp.	6	A			
P. convictum	6	M			
P. illinoense	5	P			
Tribelos sp.	5	L			
Tanytarsini		E			
Tanytarsus sp.	7	D			
Tabanidae	7				
GASTROPODA	6				
Viviparidae					
Campeloma sp.	7		1		
Pleuroceridae					
Goniobasis sp.	5		8	13	3
Physidae	8				
Physella sp.	8		4	1	1
Lymnaeidae	7				
Fossaria sp.	7				
Stagnicola sp.	7				
Planorbidae	6.5				
Helisoma sp.	7				
Menetus sp.	7				
Ancylidae					
Ferrissia sp.	7				
PELECYPODA					
Corbiculidae					
Corbicula sp.	4		3	2	1
Total Organisms			124	212	81
Total Taxa			26	33	22
MBI			4.9	5	4.8

Appendix Table G. (cont.) Macroinvertebrate data collected from the Little Vermilion River Intensive survey, March - December, 1992.

Taxon	Tol Rating	Station BO-06 03/25	05/18	09/01	12/21
TURBELLARIA	6				2
OLIGOCHAETA	10	N	7		
ISOPODA		O			
Asellidae	6	T			
Caecidotea sp.	6		14	3	12
Lirceus sp.	4	S			
AMPHIPODA	4	A			
Hyalellidae		M			
Hyalella azteca	5	P	4	22	1
DECAPODA		L			
Cambaridae	5	E			
Orconectes virilus	5	D	3	2	
EPHEMEROPTERA	3				
Oligoneuriidae	3				
Isonychia sp.	3			6	
Baetidae	4				
Baetis sp.	4				
B. intercalaris	7			5	
B. pygmaeus	4				
Callibaetis sp.	4			1	
Heterocloeon curiosum	4				
Psuedocloeon sp.	4				
Heptageniidae	3.5				
Heptagenia sp.	3				
H. maculipennis	3				
Stenacron interpunctatum	4		2	30	4
Stenonema sp.	4				
S. exiguum	5				1
S. femoratum	7		2	4	
S. mediopunctatum	2				1
S. terminatum	4				
S. vicarium	3				
Dannella lita	2				
Tricorythidae	5.5				
Tricorythodes sp.	5			10	
Caenidae	5.5				
Caenis sp.	6		13	2	1
Potamanthidae					
Potamanthus sp.	4				
Ephemeridae					
Ephemera simulans	3				
Hexagenia limbata	5		1		
ODONATA					
Gomphidae					
Gomphus sp.	7			1	
Ophiogomphus sp.	2				
Aeshnidae					
Anax junius	5				
Boyeria vinosa	3				
Macromiidae					
Macromia sp.	3				
M. taeniolata	3			1	
Cordulidae					
Epicordulia princeps	2				
Calopterygidae	3.5				
Calopteryx maculata	4		1		
Hetaerina americana	3				
Coenagrionidae	5.5				
Argia sp.	5				
A. apicalis	5		1	4	
A. tibialis	5		2	2	
A. translata	5				
Enallagma sp.	6		8	6	
PLECOPTERA	1.5				
Taeniopterygidae					
Taeniopteryx nivalis	2				3
Capniidae					
Allocapnia vivipara	2				9
Perlidae					
Perlesta placida	4		6		
Perlodidae					
Isoperla sp.	2				
MEGALOPTERA					
Sialidae					
Sialis sp.	4				
Corydalidae					
Corydalus cornutus	3				

Taxon	Tol Rating	Station BO-06 (cont.) 03/25	05/18	09/01	12/21
TRICHOPTERA	3.5				
Hydropsychidae	5.5				
Cheumatopsyche sp.	6			22	2
Hydropsyche cuanis	5				
H. frisoni	5				
H. orris	4				
H. bronta	4				
Polycentropidae					
Polycentropus remotus	3				
Rhyacophilidae					
Rhyacophila lobifera	1				
Limnephilidae					
Pycnopsyche sp.	3				
P. guttifer	3				1
Helicopsychidae					
Helicopsyche borealis	2			3	7
Leptoceridae					
Nectopsyche candida	3				
N. diarina	3				
N. pavida	3				
COLEOPTERA					
Dryopidae (adult & larvae)	1.5				
Helichus sp.	4			4	
Elmidae (adult & larvae)	5				
Ancyronyx variegatus	2				
Dubiraphia sp.	5			15	
Macronychus glabratus	2		1	1	
Stenelmis sp.	7		2	3	
DIPTERA	10				
Tipulidae	4				
Culicidae	8				
Anopheles sp.	8				
Simuliidae	6				
Simulium sp.	6			1	
Chironomidae	6				
Tanypodinae	8				
Clinotanupus pinguis	6				
Thienemannimyia group	6				
Orthocladiinae	6				
Brillia sp.	6				
Cricotopus sp.	8				
C. bicinctus	10				
C. trifasciata	6				
Eukiefferiella bavarica	4				
Nanocladius sp.	3				
Orthocladius sp.	4	N			
Psectrocladius sp.	5	O			
Chironominae	11	T			
Chironomus sp.	11				
Dicrotendipes neomodestu	6	S			
Polypedilum sp.	6	A			
P. convictum	6	M			
P. illinoense	5	P			
Tribelos sp.	5	L			
Tanytarsini		E			
Tanytarsus sp.	7	D			
Tabanidae	7				
GASTROPODA	6				
Viviparidae					
Campeloma sp.	7				
Pleuroceridae					
Goniobasis sp.	5		2	4	4
Physidae	9				
Physella sp.	9		8	1	
Lymnaeidae	7				
Fossaria sp.	7				
Stagnicola sp.	7				
Planorbidae	6.5				
Helisoma sp.	7		1		
Menetus sp.	7				
Ancylidae					
Ferrissia sp.	7				2
PELECYPODA					
Corbiculidae					
Corbicula sp.	4		2	3	1
Total Organisms			78	158	51
Total Taxa			19	25	15
MBI			6.2	5	4.1

Appendix Table G. (cont.) Macroinvertebrate data collected from the Little Vermilion River intensive survey, March - December, 1992.

Taxon	Tol Rating	Station BO-02 09/02
TURBELLARIA	6	1
OLIGOCHAETA	10	
ISOPODA		
Asellidae	6	
Caecidotea sp.	6	5
Lirceus sp.	4	
AMPHIPODA	4	
Hyalellidae		
Hyalella azteca	5	10
DECAPODA		
Cambaridae	5	
Orconectes virilus	5	3
EPHEMEROPTERA	3	
Oligoneuriidae	3	
Isonychia sp.	3	5
Baetidae	4	
Baetis sp.	4	
B. intercalaris	7	
B. pygmaeus	4	
Callibaetis sp.	4	5
Heterocloeon curiosum	4	
Pseudocloeon sp.	4	1
Heptageniidae	3.5	
Heptagenia sp.	3	
H. maculipennis	3	
Stenacron interpunctatum	4	32
Stenonema sp.	4	3
S. exiguum	5	
S. femoratum	7	3
S. mediopunctatum	2	
S. terminatum	4	
S. vicarium	3	
Dannella lita	2	
Tricorythidae	5.5	
Tricorythodes sp.	5	10
Caenidae	5.5	
Caenis sp.	6	2
Potamanthidae		
Potamanthus sp.	4	
Ephemeridae		
Ephemera simulans	3	
Hexagenia limbata	5	
ODONATA		
Gomphidae		
Gomphus sp.	7	
Ophiogomphus sp.	2	2
Aeshnidae		
Anax junius	5	
Boyeria vinosa	3	1
Macromiidae		
Macromia sp.	3	
M. taeniolata	3	
Corduliidae		
Epicordulia princeps	2	
Calopterygidae	3.5	
Calopteryx maculata	4	5
Hetaerina americana	3	
Coenagrionidae	5.5	
Argia sp.	5	
A. apicalis	5	
A. tibialis	5	2
A. translata	5	2
Enallagma sp.	6	3
PLECOPTERA	1.5	
Taeniopterygidae		
Taeniopteryx nivalis	2	
Capniidae		
Allocapnia vivipara	2	
Perlidae		
Perlesta placida	4	
Perlodidae		
Isoperla sp.	2	
MEGALOPTERA		
Sialidae		
Sialis sp.	4	1
Corydalidae		
Corydalus cornutus	3	2

Taxon	Tol Rating	Station BO-02 (cont.) 09/02
TRICHOPTERA	3.5	
Hydropsychidae	5.5	
Cheumatopsyche sp.	6	9
Hydropsyche cuanis	5	
H. frisoni	5	
H. orris	4	
H. bronta	4	
Polycentropidae		
Polycentropus remotus	3	
Rhyacophilidae		
Rhyacophila lobifera	1	
Limnephilidae		
Pycnopsyche sp.	3	
P. guttifer	3	
Helicopsychidae		
Helicopsyche borealis	2	
Leptoceridae		
Nectopsyche candida	3	1
N. diarina	3	1
N. pavida	3	
COLEOPTERA		
Dryopidae (adult & larvae)	1.5	
Helichus sp.	4	7
Elmidae (adult & larvae)	5	
Ancyronyx variegatus	2	1
Dubiraphia sp.	5	10
Macronychus glabratus	2	
Stenelmis sp.	7	7
DIPTERA	10	
Tipulidae	4	
Culicidae	8	
Anopheles sp.	8	
Simuliidae	6	
Simulium sp.	6	
Chironomidae	6	
Tanypodinae	6	
Clinotanupus pinguis	6	
Thienemannimyia group	6	
Orthocladiinae	6	10
Brillia sp.	6	
Cricotopus sp.	6	
C. bicinctus	10	
C. trifasciata	6	
Eukiefferiella bavarica	4	
Nanocladius sp.	3	
Orthocladius sp.	4	
Psectrocladius sp.	5	
Chironominae	11	
Chironomus sp.	11	
Dicrotendipes neomodestu	8	
Polypedilum sp.	6	
P. convictum	6	
P. illinoense	5	
Tribelos sp.	5	
Tanytarsini		
Tanytarsus sp.	7	
Tabanidae	7	
GASTROPODA	6	
Viviparidae		
Campeloma sp.	7	
Pleuroceridae		
Goniobasis sp.	5	21
Physidae	9	
Physella sp.	9	
Lymnaeidae	7	
Fossaria sp.	7	
Stagnicola sp.	7	
Planorbidae	6.5	
Helisoma sp.	7	
Menetus sp.	7	
Ancylidae		
Ferrissia sp.	7	
PELECYPODA		
Corbiculidae		
Corbicula sp.	4	6
Total Organisms		171
Total Taxa		30
MBI		4.8

Appendix Table G. (cont.) Macroinvertebrate data collected from the Little Vermilion River intensive survey, March - December, 1992.

Taxon	Tol Rating	Station BO-07 03/25	05/19	09/02	12/22
TURBELLARIA	6				
OLIGOCHAETA	10				
ISOPODA					
Asellidae	8				
Caecidotea sp.	6	2	1	4	3
Lirceus sp.	4				
AMPHIPODA	4				
Hyalellidae					
Hyalella azteca	5		3	37	
DECAPODA					
Cambaridae	5				
Orconectes virilus	5				1
EPHEMEROPTERA	3				
Oligoneuriidae	3				
Isonychia sp.	3			64	1
Baetidae	4				
Baetis sp.	4			1	
B. intercalaris	7			6	
B. pygmaeus	4				
Callibaetis sp.	4		3		
Heterocloeon curiosum	4				
Psuedocloeon sp.	4				
Heptageniidae	3.5				
Heptagenia sp.	3				
H. maculipennis	3				
Stenacron interpunctatum	4	4	43		2
Stenonema sp.	4		1	2	
S. exiguum	5			2	9
S. femoratum	7	1	1		2
S. mediopunctatum	2				5
S. terminatum	4				
S. vicarium	3				1
Dannella lita	2				
Tricorythidae	5.5				
Tricorythodes sp.	5		2	5	
Caenidae	5.5				
Caenis sp.	6		2	2	1
Potamanthidae					
Potamanthus sp.	4		1		1
Ephemeridae					
Ephemera simulans	3				1
Hexagenia limbata	5		1		
ODONATA					
Gomphidae					
Gomphus sp.	7				
Ophiogomphus sp.	2				
Aeshnidae					
Anax junius	5				
Boyeria vinosa	3				
Macromiidae					
Macromia sp.	3				
M. taeniolata	3				
Cordulidae					
Epicordulia princeps	2			1	
Calopterygidae	3.5				
Calopteryx maculata	4	1			
Hetaerina americana	3				
Coenagrionidae	5.5				
Argia sp.	5				
A. apicalis	5		1		
A. tibialis	5				
A. translata	5			1	2
Enallagma sp.	6		13	8	
PLECOPTERA	1.5				
Taeniopterygidae					
Taeniopteryx nivalis	2				25
Capniidae					
Allocapnia vivipara	2				5
Perlidae					
Perlesta placida	4		8		
Perlodidae					
Isoperla sp.	2				
MEGALOPTERA					
Sialidae					
Sialis sp.	4				
Corydalidae					
Corydalus cornutus	3	2		3	1

Taxon	Tol Rating	Station BO-07 (cont.) 03/25	05/19	09/02	12/22
TRICHOPTERA	3.5				
Hydropsychidae	5.5				
Cheumatopsyche sp.	6	1		12	5
Hydropsyche cuanis	5				2
H. frisoni	5			1	
H. orris	4				
H. bronta	4			63	7
Polycentropidae					
Polycentropus remotus	3				
Rhyacophilidae					
Rhyacophila lobifera	1	1			2
Limnephilidae					
Pycnopsyche sp.	3				
P. guttifer	3				
Helicopsychidae					
Helicopsyche borealis	2		8	2	
Leptoceridae					
Nectopsyche candida	3		1		
N. diarina	3				
N. pavida	3				
COLEOPTERA					
Dryopidae (adult & larvae)	1.5				
Helichus sp.	4	1		1	
Elmidae (adult & larvae)	5				
Ancyronyx variegatus	2			3	
Dubiraphia sp.	5		1	2	
Macronychus glabratus	2				
Stenelmis sp.	7		2	1	1
DIPTERA	10				
Tipulidae	4	1		1	
Culicidae	8				
Anopheles sp.	8			3	
Simuliidae	6				
Simulium sp.	6	49	3	6	3
Chironomidae	6	4		6	
Tanypodinae	6				
Clinotanupus pinguis	6				
Thienemannimyia group	6		1		
Orthocladiinae	6				
Brillia sp.	6				
Cricotopus sp.	8	6	2		
C. bicinctus	10			1	
C. trifasciata	8			2	
Eukiefferiella bavarica	4				1
Nanocladius sp.	3				
Orthocladius sp.	4	2	1		
Psectrocladius sp.	5				
Chironominae	11			1	1
Chironomus sp.	11	1			
Dicrotendipes neomodestu	6	1			
Polypedilum sp.	6				
P. convictum	6				
P. illinoense	5				
Tribelos sp.	5				
Tanytarsini					
Tanytarsus sp.	7				
Tabanidae	7				2
GASTROPODA	6				
Viviparidae					
Campeloma sp.	7				
Pleuroceridae					
Goniobasis sp.	5	2	7	13	2
Physidae	9				
Physella sp.	9		1	2	
Lymnaeidae	7				
Fossaria sp.	7				
Stagnicola sp.	7	2			
Planorbidae	6.5				
Helisoma sp.	7		1	1	
Menetus sp.	7				
Ancylidae					
Ferrissia sp.	7				
PELECYPODA					
Corbiculidae					
Corbicula sp.	4			1	1
Total Organisms		81	108	258	87
Total Taxa		17	24	32	26
MBI		5.9	4.6	4.5	3.8

Appendix Table H. Fish community sampling results from Little Vermilion River, September 1992.

Common name	Scientific Name	STATION BO-08	BO-09	BO-05	BO-04	BO-06	BO-02	BO-07
grass pickerel	*Esox americanus*	16	1					
carp	*Cyprinus carpio*		1					
gizzard shad	*Dorosoma cepedianum*			11	8	9	39	22
common stoneroller	*Campostoma anomalum*	230		60	72	86	61	145
silverjaw minnow	*Ericymba buccata*	378	1		1	16	51	
silvery minnow	*Hybognathus nuchalis*							1
bigeye chub	*Hybopsis amblops*						1	
river chub	*Nocomis micropogan*						1	2
golden shiner	*Notemigonus crysoleucas*	1		1				
bigeye shiner	*Notropis boops*			4	6	1	6	6
striped shiner	*N. chrysocephalus*			9	28	49	12	22
ribbon shiner	*N. fumeus*				1			
rosyface shiner	*N. rubellus*						1	
spotfin shiner	*N. spilopterus*	289	15		192		130	92
sand shiner	*N. stramineus*	231		1		15	65	2
redfin shiner	*N. umbratilis*	185			17	16	22	18
suckermouth minnow	*Phenacobius mirabilis*			8	6	14	26	10
bluntnose minnow	*Pimephales notatus*	1173		45	115	228	336	170
creek chub	*Semotilus atromaculatus*	104	2		26	22	9	8
river carpsucker	*Carpiodes carpio*					2	3	
quillback	*C. cyprinus*						1	
white sucker	*Catostomus commersoni*	3	7	1	2	6	2	1
creek chubsucker	*Erimyzon oblongus*	40						
northern hogsucker	*Hypentelium nigricans*	24	2	29	16	13	16	27
spotted sucker	*Minytrema melanops*		4	6	4	2	5	
silver redhorse	*Moxostoma anisurum*					3	7	
black redhorse	*M. duquesnei*			26	42		12	7
golden redhorse	*M. erythrurum*	54	29	47	6	16	95	26
shorthead redhorse	*M. macrolepidotum*			3	7		3	1
yellow bullhead	*Ictalurus natalis*	9	3		1			
channel catfish	*I. punctatus*				1		1	
stonecat	*Noturus flavus*			3	6	3	4	17
brindled madtom	*N. miurus*	10	1	1	1	8	1	
blackstripe topminnow	*Fundulus notatus*	18						1
rock bass	*Ambloplites rupestris*	1		3	9		6	3
green sunfish	*Lepomis cyanellus*	1	2	4	5	2	7	
orangespotted sunfish	*L. humilis*			1				
bluegill	*L. macrochirus*	2	2	14	11	1	2	1
longear sunfish	*L. megalotis*	363	15	178	105	104	69	42
smallmouth bass	*Micropteris dolomieui*			3	5	4	4	4
spotted bass	*M. punctulatus*			4	5	5	15	2
largemouth bass	*M. salmoides*	11	3	3	3			
white crappie	*Pomoxis annularis*		9		1		2	
greenside darter	*Etheostoma blennioides*	24		8	14	15	40	29
rainbow darter	*E. caeruleum*			9	10	1	8	18
fantail darter	*E. flabellare*	1		4	9	6	1	1
johnny darter	*E. nigrum*	31			1	3		1
orangethroat darter	*E. spectabile*	6						
logperch	*Percina caprodes*			3			1	1
dusky darter	*P. sciera*			6		1	7	14
Total Abundance		3205	97	495	736	651	1072	694
Total No. of Species		25	16	29	33	28	38	30
Index of Biotic Integrity (IBI)		52	44	52	56	52	54	52

COOPERATIVE IEPA-IDOC INTENSIVE BASIN SURVEY REPORTS: 1981-1993

Year	Report Title	IEPA Report No.
1982	An intensive survey of the Fox River basin from the Wisconsin State line to Ottawa, Illinois	IEPA/WPC/88-003
1982-83	An intensive survey of the Kaskaskia River basin	IEPA/WPC/89-105
1983	An intensive survey of the Kiswaukee River and its tributaries	IEPA/WPC/88-009
1983	An intensive survey of the DuPage River basin	IEPA/WPC/88-010
1983	An intensive survey of the DesPlaines River basin from the Wisconsin State line to Joliet, Illinois	IEPA/WPC/88-014
1984	An intensive survey of the American Bottoms basin	IEPA/WPC/89-211
1984-85	An intensive survey of the Kyte River basin	IEPA/WPC/88-013
1984-85	An intensive survey of the Pecatonica River basin	IEPA/WPC/88-012
1985	An intensive survey of Rock River tributaries	IEPA/WPC/88-011
1985	An intensive survey of the Elkhorn Creek basin	IEPA/WPC/88-017
1985-86	An intensive survey of the Vermilion River basin	IEPA/WPC/89-262
1986-87	An intensive survey of Shawnee National Forest Region streams of Southern Illinois	IEPA/WPC/90-171
1987	Biological and water quality survey of the Carol Creek watershed, Carol County, Illinois	IEPA/WPC/89-163
1987	An intensive survey of the Embarras River basin	IEPA/WPC/89-212
1987	An intensive survey of the Mackinaw River basin	IEPA/WPC/88-034
1988	An intensive survey of the La LaMoine River basin	IEPA/WPC/89-117
1988	An intensive survey of the Big Muddy River main stem from Rend Lake to the Mississippi River	IEPA/WPC/91-56
1989-90	An intensive survey of the Little Wabash River basin	IEPA/WPC/92-053
1990	An intensive survey of the Big Bureau Creek watershed	IEPA/WPC/92-002
1990	An intensive survey of the Vermilion River basin Illinois River drainage	IEPA/WPC/93/142
1992	An intensive survey of the Little Vermilion River as affected by seasonal variation	IEPA/WPC/93/-139

OTHER IEPA SPECIAL STREAM AND INTENSIVE BASIN REPORTS: 1980-1993

Year	Report Title	IEPA Report No.
1977-80	Re-establishment of aquatic macroinvertebrate communities after drought in Solomon Creek, an intermittent stream	N/A
1980	Investigation of six intermittent streams, April-Sept 1980	N/A
1980	An intensive survey of the Apple River from the Illinois/Wisconsin state line to Hanover, Illinois	N/A
1974-80	Evaluation of Illinois stream sediment from 1974-1980	IEPA/WPC/84-004
1986	An intensive survey of the Sugar Creek Basin, Crawford County, Illinois	IEPA/WPC/88-030
1986-87	An intensive survey of the Eagle Creek basin, Saline and Gallatin Counties, Illinois	IEPA/WPC/88-019
1987	An intensive survey of the Embarras River Basin	IEPA/WPC/89-212
1988	User's guide to IBI-AIBI Version 2.01: a BASIC program for computing the Index of Biotic Integrity with the IBM-PC	IEPA/WPC/89-007
1988	Low flow water quality characteristics of the Mississippi River in the vicinity of St. Louis, July 1988	N/A
1989	Biological Stream Characterization (BSC): A biological assessment of Illinois stream quality. Special Report # 13 of the Illinois State Water Plan Task Force.	IEPA/WPC/89-275
1989	Biological and water quality survey of three tributaries to River: South Fork basin, Mosquito Creek, and Long Point Slough	IEPA/WPC/93/-143
1992	Effects of livestock wastes on small Illinois streams: lower Kaskaskia and upper little Wabash River Basins, 1991	IEPA/WPC/92-114
1993	A biological and water quality survey of Sugar Creek and tributaries, Crawford County, Illinois	IEPA/WPC/93-063

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. IEPA/WPC/93-139	2.	3. Recipient's Accession No.

4. Title and Subtitle
An Intensive Survey of the Little Vermilion River As Affected By Seasonal Variation

5. Report Date 8/93

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Illinois Environmental Protection Agency
Division of Water Pollution Control
P. O. Box 19276
2200 Churchill Road
Springfield, Illinois 62794-9276

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
Illinois Environmental Protection Agency
Division of Water Pollution Control
P. O. Box 19276
2200 Churchill Road
Springfield, Illinois 62794-9276

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

In 1992, the Illinois Environmental Protection Agency conducted a seasonal intensive survey of the Little Vermilion River near Georgetown, Illinois. This study looked at macroinvertebrate communities, fish populations, instream habitat, and water and sediment chemistry as tools to document the biological and chemical status of the Little Vermilion River.

The Little Vermilion survey was also designed as a program to observe biotic and abiotic fluctuations within lotic environments due to seasonal variation.

17. Document Analysis a. Descriptors

Water Quality
Aquatic Biology
Biotic Integrity
Stream Pollution
Fish Populations
Aquatic Macroinvertebrates
Stream Classification
Sediment Chemistry
Use Support
Habitat Quality

b. Identifiers/Open-Ended Terms

Little Vermilion River Basin
Illinois

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages 47
	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce