Attachment A
Appendix A: IEPA Documents

ILLINOIS POLLUTION CONTROL BOARD
November 8, 1973

IN THE MATTER OF WATER QUALITY STANDARDS REVISIONS	)	R72-4

OPINION OF THE BOARD (by Mr. Dumelle):

This Opinion of the Board is in support of amendments to Chapter 3 of the Pollution Control Board's Water Pollution Regulations adopted on June 28, 1973. These amendments were consolidated from revisions proposed by the Board, the Environmental Protection Agency (Agency), Granite City Steel, The Metropolitan Sanitary District of Greater Chicago (MSDGC), and Commonwealth Edison Company. After reviewing the record produced in ten hearings, the Board adopted the amendments as published in the Newsletter #65, May 17, 1973, with two revisions that were published in Newsletter #69, July 16, 1973. The Amendments were first published in Newsletter #50, July 14, 1972. Hearings were held in six cities throughout Illinois.

1. The first group of amendments were proposed by the Board. An amendment to Sec. 406 Nitrogen was proposed and adopted to control industrial dischargers of more than 100 lbs. of ammonia as N, whose wasteload cannot be computed on a population equivalent (PE) basis. Such industrial dischargers who discharge into the Illinois River, Chicago River System or Calumet River System will be subject to an ammonia effluent standard of 3.0 mg/l as N after December 31, 1974. The Board found that present technology is capable of meeting this limit and should result in the removal of much ammonia nitrification oxygen demand (NOD) from these stressed waterways. Ammonia removal from such industrial wastes, when compared with removal from domestic wastes is rather easily applied (R. 25, September 13, 1972).

The definition of "water" in Section 104 Definitions was amended by the Board to add a clause that allows the use of in-stream aeration under Agency permit.

Another Board proposal would have allowed the Agency to require bonds as a condition to obtain an Agency permit. After considering their revision, the Board declined to adopt the proposed new Section 926.

2. Another group of amendments which were proposed by the Agency, were received on April 7, 1972. The first of the Agency proposals was to amend Section 103 Repeals to repeal SWB-2 and SWB-17, and to replace SWB-2 with a new Part XII: Treatment Plant Operation Certification. SWB-2 and SWB-17 were adopted by the Illinois Sanitary Water Board and continued in effect by Section 49(c) of the Environmental Protection Act "until repealed, amended, or superseded by regulations under this Act." SWB-2 set rigid regulations that governed the certification of treatment plant operators by the Agency. The Agency desired this amendment to permit them a greater flexibility to change certification requirements with technological developments. As a result of discussion concerning this amendment the Agency proposed an addition to Part XII to insure that an applicant could appeal his certification denial to the Board. The Board adopted the repeal of SWB-2 and the addition of Part XII in order to allow the Agency to cope with various problems such as how to certify the 400 MSDGC plant operators. The Agency sought the repeal of SWB-17 because of language that might be construed to conflict with the act which gives the Agency exclusive control of the administration of Federal grant monies. The Board agreed and amended Section 103 to repeal SWB-17 which had set out rules for establishing priorities for awarding Federal monies in order to avoid any conflict with the Act.

The next portion of the Agency proposal dealt with a relatively minor group of amendments to correct or supply missing STORET NUMBERS in the following Sections: 203(f), 204(b), 206(c), and 408(a). The Agency proposed a correction of a typographical error in the placement of the phrase "for excess energy" within Section 104 Definitions "Industrial Wastes". A correction of misspelled words in Section 501, 502 and 912 was also proposed. The Board adopted these changes as published in Newsletter #65, May 17, 1973.

The Agency proposed to amend Section 302 Restricted Use Waters by adding a clause to require that the Board hold hearings in 1973 and every 5 years thereafter to determine whether any Restricted Use Water should be reclassified as a General Use Water. This amendment is in response to the Federal Environmental Protection Agency (U.S. EPA) policy not to approve restricted use status as a permanent status for any water (R. 11, September 13, 1972 and Ex. #4). In addition to the Federal objection, the revision would give notice to those who are currently discharging into Restricted Use Waters that they are not permanently guaranteed such use (R. 12, September 14, 1972). The Board agreed with the Agency's reasoning and adopted its amendment to reflect a limitation on the Restricted Use designation.

The Agency proposed a change in Section 404(f)(ii)B to substitute "the levels set by the applicable water quality standard" for the previously specified numerical DO level. The Board approved this clarification and adopted the amendment.

The Agency proposed amending Section 405 Bacteria by addition of "governed by this part" to clarify the wording which requires disinfection of combined overflows by July 31, 1972. The deletion of the language referring to SWB-7 through SWB-15 was also proposed. The Agency also proposed establishing a later deadline of December 31, 1973 for discharges into the Ohio and Mississippi Rivers. Regulations passed by the Board in 1971 (R. 70-3 and 71-3) required disinfection of combined overflows discharging into the Ohio and Mississippi Rivers by December 31, 1973. When the Board amended this regulation in R70-7, 71-14 and 71-20 it unintentionally accelerated the deadline for Ohio and Mississippi River discharges. The Board adopted this amendment to correct a previous error.

The Agency proposed that Section 406 Nitrogen be amended to include the Des Plaines downstream of its confluence with the Chicago River System in those waters which have an effluent limitation on ammonia. The Board approved this amendment because it conforms to the Board's original intent when it placed ammonia effluents on the other waterways listed in this Section.

The Agency proposed a specific standard of 0.025 mg/l as a limit for discharges of cyanide into a public sewer system. Section 702(a) Cyanide previously had read "detectable levels of cyanide". The Board adopted this as a parallel to the Water Quality Standard of 0.025 mg/l found in Section 203.

The Agency proposed the deletion of "by the Agency" in Section 942 Permit Revocation to conform to the Board's desire that all permit revocations take place only as a result of a complaint and action brought before the Board. The Board amended Section 942 to conform with this policy.

3. Granite City Steel Company proposed an amendment to reclassify Horseshoe Lake from Public and Food Processing Water Supply to General Use (Section 303). The Board received the proposal on July 6, 1972. The basis for their request was that Horseshoe Lake had never and would never be used for a public or food processing water supply and thus should not be classified as such. Various company officials so testified in support of their proposal (R. 32, 84, and 111, September 22, 1972). Granite City Steel's Engineering Consultant, Mr. John Huston, testified that the Lake did not meet the drinking water standards required as a source of public waters. The Agency testified that in their view an amendment of the rules regarding Horseshoe Lake is not needed at the present time (R. 10, September 22, 1972). The Board finds that there is no need to reclassify Horseshoe Lake as a general use water (Section 301) and to take it out of Section 303 Public and Food Processing Water Supply

because of the extreme unlikelihood that the Lake will ever be used as a public water supply and thus such standards may never become operative.

4. The MSDGC proposed an amendment to Section 404(e) Deoxygenating Wastes to change the effluent limits to 10 mg/1 BOD_5 and 12 mg/1 suspended solids (SS) from 4 mg/1 BOD_5 and 5 mg/1 SS. The Board received the proposal on April 25, 1972. At the hearing, the Agency stated that they did not oppose the amendment (R. 17, 9/13/72). The original purpose of requiring the MSDGC to meet a 4 mg/1 BOD_5 and 5 mg/1 SS was to remove deoxygenating wastes from their effluent and thus allow the DO in the downstream waterways to reach the level prescribed by the existing standard. During periods of low flow up to 99% of the flow in the sanitary district's controlled waterways is made of MSDGC effluent.

Evidence presented by Mr. Ralph Evans, Illinois Water Quality Survey, tends to show that, even with the MSDGC meeting the 4-5 effluent standard, the Illinois River at Marseilles and Starved Rock will not meet the DO standard of 6 and will be in fact less than 4 mg/1 DO (R. 114, 10/19/72). Even if the oxygen demand exerted by nitrofication of ammonia (NOD) was zero, the model predicts that a DO level of 6 is not obtainable (R. 124, 10/19/72). Modeling conducted by the MSDGC also predicts that both 4 mg/1 BOD_5 and 5 mg/1 SS and 10 mg/1 BOD_5 and 12 mg/1 SS will not achieve a DO level of 6 mg/1 (R. 283, 10/19/72).

The MSDGC proposed to amend the standard to require them to meet 10-12 instead of 4-5. They propose to carry out instream-aeration to raise the DO level to 6.0 mg/1. MSDGC presented modeling evidence that showed an effluent of 4-5 would result in an instream BOD_5 level of 2.4 mg/1 with a DO level of 4.4 mg/1; while an effluent of 10-12 would result in an instream BOD_5 level of 2.6 mg/1 with a DO level of 4.2 mg/1 (R. 17, 10/20/72). Evidence shows the predicted cost of meeting the 4-5 standards is $236.7 million dollars with an operational cost of $26 million dollars. The cost of 10-12 with instream aeration is $138.8 million dollars with an operating cost of $16 million dollars per year (R. 19, 10/20/72).

Two eminent professionals, Clair Sawyer and General Whipple, both testified that the most economic way for the MSDGC to meet the required DO levels is by 10-12 and instream aeration (R. 223, 235, 10/20/72). Dr. Sawyer testified the downstream DO problems should be eliminated once the MSDGC begins to remove the NOD by nitrification (R. 248, 10/20/72). Every pound of NOD is equal to 4.57 pounds of BOD_5 (R. 254, 10/20/72). Dr. Sawyer testified that the NOD (ammonia oxygen demand) could be easily reduced below 2.5 mg/1 (R. 257, 10/20/72).

The Board decided to delete Section 404(b) instead of amending it as proposed by the MSDGC. By deleting the requirement, the intention of the Board (reading both Section 404(c) and (f) together) was to require the MSDGC to meet 4 mg/l of BOD_5 and 5 mg/l of SS by December 13, 1977 unless it can show through Section 404(f)(ii) that such an effluent standard is not required. In the event that MSDGC can meet the burden required in Section 404 (f)(ii) it is subject to an effluent standard of 10 mg/l of BOD_5 and 12 mg/l of SS. (See pages 14-16, of the Board's Opinion accompanying R70-8, 71-14 and 71-20, for the reasoning supporting the creation of a conditional exemption from the 4 mg/l BOD_5 and 5 mg/l SS limit). The Board based its decision upon the modeling evidence presented and by the testimony which showed that DO standard would be met by 10 mg/l, BOD_5 and 12 mg/l of SS, in-stream aeration and nitrification.

5. Commonwealth Edison proposed an amendment in the alternative on March 30, 1972, to loosen the temperature standard on the Des Plaines River below the Interstate 55 bridge to its confluence with the Kankakee River (hereinafter cited as "5 mile stretch"). The first alternative would have amended Section 302(i) Restrictive Use Waters to delete the phrase "to the Interstate 55 bridge" and replace it with the phrase "to its confluence with the Kankakee River." Edison's second alternative would have amended Section 203(i)(4) by adding "Des Plaines River from the Interstate 55 bridge to its confluence with the Kankakee River. Temperature in this segment of the Des Plaines River shall not exceed 92°F more than five percent of the time, by more than 5°F." In response to a request from Hearing Officer Parker to tighten up its proposal to reflect the minimum temperatures possible, Edison withdrew its original amendments on November 29, and substituted an amendment to Section 203(i)(4) which proposed individual monthly temperature limits, corresponding to historical data, for the "5 mile stretch". This final amendment also contained a 5% excursion up to 5°F maximum from the monthly limits.

Commonwealth Edison's Joliet Plant is located on the Des Plaines River 7.3 miles upstream of the I-55 bridge. Heated water from both the old and new portions of the plant is discharged to the river through once-through cooling systems. After the heated water is discharged it mixes with the River water and gradually cools as heat dissipates to the atmosphere. The river water temperature, gradually decreases with distance downstream from the power plant. Edison presented evidence that the water does not cool sufficiently by the time it reaches the I-55 bridge to meet the general use temperature limits during July and August. The temperature at the I-55 bridge would be the highest in the "5 mile stretch" (Ex. #3, Edison Ex. 25, page 5).

The final proposed amendment dropped the alternative to amend Section 302(i) and proposed individual monthly temperature limits for the five mile stretch from I-55 bridge to the confluence with the Kankakee River. The Board adopted the final Edison amendment as published with some exceptions. It set 90°F as the maximum temperature standard for the months of July and August and reduced the excursion to four percent of the previous twelve month period. The Board also set an automatic termination date of July 1, 1978 at which time the general use temperature standard will again apply.

Edison desired to amend the temperature limit to avoid the necessity of providing cooling for its Joliet Power Plant which consists of two parts located on either side of the Des Plaines River some 7.3 miles upstream from the I-55 bridge. (R. 32, 9/8/72) The Board in a previous decision adopting the revised Water Quality Standards (R. 71-14, March 7, 1972) classified the Des Plaines River from the confluence with the Canal at Lockport to the I-55 bridge as "restricted" use water (Section 302(i). Its temperature limits are 93°F (not to be exceeded more than 5% of the time) or 100°F at any time (Section 205(f). At the I-55 bridge, a discontinuity in temperature limit exists as the river below the bridge is classified as a "General Use" water with the more restrictive water temperature limits contained in Rule 203(i)(4). The basis for the Board's decision to use the I-55 bridge as a boundary for the division of the Des Plaines River into restrictive and general use is that the location of the bridge corresponds to changes in the physical environmental characteristics of the area (R. 71-14 at page 11, March 3, 1972). Above the bridge, the river has been greatly altered by man so that it is not as suited for recreation, (Ex. #3, Edison Ex. 25, page 4) and water quality is such tha at the present time it is not capable of supporting a diverse aquatic life (Ex. #3, Edison Ex. 25, page 4). Edison witnesses expressly excluded the 5 mile stretch below the bridge, from possessing the characteristic that led the Board to classify the upper river as Restrictive Use.

The Board previously decided that the I-55 bridge should be the dividing line between the upstream Restricted Use designations and the downstream General Use designation in R71-14. The Board considered over 800 pages of record and numerous exhibits before reaching its decision on Edison's amendment. Edison's amendment is based upon historical water data it collected during 1966 to 1971 by use of continuous monitors located throughout the lower Des Plaines waterway system. This data was submitted in Edison exhibits 47-62. However, no temperature data was recorded at the I-55 bridge. Edison carried out extrapolations using the temperature data to arrive at a probable water temperature at the I-55 bridge. The two closest recorded locations are 3.3 and 4.3 miles from the bridge.

The maximum water temperatures extrapolated to the I-55 bridge show that 61 occurrences existed above 90°F during the monitored period. (Ex. #3, Edison Ex. 47, Table 1) This data supports the statement made during the hearings that the "summer of 1966 shows some of the warmest water temperature periods recorded in recent decades"

(Ex. #3, Edison Ex. 47, page 2). Thus any standard based upon this historical data should reflect a longer period of time than the five year data period. Edison's data clearly demonstrates that the present Section 203(i) was violated 19 days during July, 1966.

Edison presented testimony concerning in-plant cooling based on the maximum reduction in heat discharge required to lower the observed water temperatures to that required by Rule 203(i). Edison stated that operation at partial load to achieve the required reduction in thermal discharge is not possible because the critical period of water temperatures coincides with the system wide peaks that require maximum power production from the Joliet Power Plant. To meet the general use standard, at the I-55 bridge, Edison estimated it would have to spend $21.9 million dollars to construct cooling towers on the new side if the critical load is less than 75% of capacity (Ex. #3, Edison Ex. 66, page 2).

Dr. Lauer, an Edison witness, testified that Edison's discharge of hot water would have a limited effect on the aquatic life use of the Lower Des Plaines River (Ex. #3, Edison Exs. 17, 37, and 38). He stated in his opinion, the maximum effect of the temperatures allowed by Edison's proposed amendment would be that 785 pounds of fish would move out of the "5 mile stretch" and into cooler water for up to two weeks of the year (Edison Ex. 17 and 38, 10). Edison presented a cost-benefit analyses which concluded, based upon a fish harvest of 100 pounds per acre per year, that the fish would have to be worth $27.91 per pound to warrant cooling towers (Ex. #3, Edison Ex. 26, Page 4). Dr. Upton further testified that based upon a more conservative fish harvest, the fish would "in reality" have to be worth $1,395 per pound (Ex. #3, Edison Ex. 26, Page 6).

Substantial opposition to Edison's proposal was voiced by the Agency, U.S. EPA and by several citizen witnesses. The U.S. EPA objected to any reclassification of a water into the Restricted Use category because of its policy to opposal to such a classification. The U.S. EPA, in conjunction with the Illinois Conservation Department collected fish on May 16, 1972 from five locations within the "five mile stretch" (Ex. #2, Milburn). The total catch consisted of 156 fish: including goldfish, emerald shiners, northern redhorse, white crappie, white suckers, gizzard shad, channel catfish and rock bass. Edison's consultant also conducted a fish survey, Ex. #3, Edison Ex. 44, at one location in the "5 mile stretch" and collected 19 fish; including goldfish, carp and quillback. Although these surveys disclosed that fish species were more diversified in either the Kankakee or Illinois Rivers than in the Lower Des Plaines, the Lower Des Plaines is capable of supporting a desirable aquatic biota (R. 109, 9/14/72). The presence of benthic organisms supports the conclusion that the fish are not just passing through because bottom feeding fish have a source of food (R. 109, 9/14/72).

Evidence of the effects of temperature on various fish species is documented in Exhibit 31, and Ex. #3, Edison Exhibits 38, 41 and 75. In Exhibit 31 the Duluth National Water Quality Laboratory recommends maximum weekly average temperatures for the Illinois Rivers. These values are derived from data of lethal temperatures, maximum temperatures, reproduction and growth and should result in "maintenance of reasonably good populations of most species to be protected". When compared to proposed temperature limits for the "five mile stretch", the recommendations of the Water Quality Laboratory are considerably lower. Edison has presented evidence that diversified fish populations exist in Dresden Lake pools which have water temperatures ranging from 96.8°F to 86°F. This presents evidence that some fish can acclimate to high water temperatures when confined in an elevated temperature body of water (Ex. #3, Edison Ex. 41). But fish in the Des Plaines River are not confined.

The Board finds that the lower "five mile stretch" is capable of providing a source of recreation badly needed in the area (R. 107, 9/14/72), and is supporting a limited desirable aquatic biota.

The Board reduced Edison's proposed 92°F temperature limit during July and August to 90°F in order to give protection to this aquatic life. Dr. Lauer testified that 90°F is recognized as a temperature which will begin to affect some individual species (R. 277, 11/29/72). A maximum temperature limit of 90°F is recognized as necessary to protect fish (R. 219, 11/29/72, Ex. #3, Edison Ex. 39, reference 5, page 57).

The Board reduced the allowable excursion to 4% of the previous year not to exceed 5°F after reviewing Ex. #3, Edison Ex. 47, Table I, Support Table B. An excursion of 4% would allow up to 14.6 days per year. The Board finds that this excursion more closely reflects the historical data. It should be noted that projected excursion temperatures are in fact "projected" values not measured values. Significant problems are present when actually measuring temperatures due to differing temperatures which exist across the width and depth of a body of water. A projection based upon temperature necessarily reflects such problems.

The Board decided to add Section 203(i)(9), which cancels the special temperature limits on July 1, 1978, as middle ground between Edison's proposal and the need to protect aquatic life. Evidence was presented that temperature is not presently the limiting factor which restricts aquatic life in the "5 mile stretch". (Ex. #3, Edison Ex. 7, pages 3-4) However, additional evidence was presented during the hearing that water quality in the Des Plaines will be improved as the MSDGC, which is the major pollution source, further reduced the pollutants contained in its effluent.

The MSDGC is required by Section 404(f) to produce an effluent which shall exceed 4 mg/l BOD_5 or 5 mg/l SS on or before December 31, 1977. They are required by Section 406 to limit their ammonia discharges to 2.5 mg/l during April through October, or 4 mg/l other times, after December 31, 1977. Dr. Sawyer testified that DO problems below Lockport will be resolved by ammonia removal (R. 248, 10/19/72). The MSDGC has stated that they are going to conduct instream-aeration to raise the DO level to 6.0 mg/l (See pages 4 and 5 of this Opinion for discussion of instream aeration plans of MSDGC). They are required to treat or remove combined sewer overflows by December 31, 1977 (Section 602(d)), and work on the proposed "deep tunnel" is underway. All of these projects are designated or required to be completed before July 1978 with the resulting reduction of the pollution load to the Des Plaines River. The Board finds that by July 1978, temperature will be the limiting factor to the attainment of a desirable aquatic biota in the Des Plaines River below the I-55 bridge.

The July 1, 1978, termination date for the specific temperature standard is reasonable in light of the special circumstances presented in this fact situation. It is a Board policy to protect and enhance the quality of the aquatic environment whenever possible. Large discharges of heated water disturb the aquatic environment. The water quality in the Lower Des Plaines River is presently depressed by discharges from upstream sources such as the MSDGC. Such dischargers are currently under orders, or required by Board regulations, to reduce their discharges by 1977 and are planning to implement remedial programs to further enhance water quality. Water quality in the "five-mile stretch", should be the limiting factor to obtain or support a desirable aquatic life by 1978. The termination of thermal standards, which allowed discharges that limit the aquatic biota, is therefore necessary to protect aquatic life in the lower "five-mile stretch".

Edison is required by Sec. 203(i)(5) to conduct a program to monitor the affects of their discharges of heated water from the Joliet Plant and present the results of that program to the Board at a hearing to be held between March, 1977 and March 1978. If, at that time, the Board is convinced that Edison's discharge has not caused, or is not reasonably expected to cause significant ecological damage to the Des Plaines River; the Board would not require Edison to construct cooling facilities. Edison could then either ask the Board to amend its regulation to extend to the termination date to reflect water quality as would then be present in the "five-mile stretch", or seek a variance from the standard. But if the Board is convinced that Edison has caused or is reasonably expected to cause significant ecological damage in the future, then the Board is require by Section 203(i)(5) to order Edison to carry out appropriate measures to correct ecological damage. Edison, because it had relied upon existing Board regulations, would have the variance procedure available to seek time to correct the problem.

The Board notes that cost benefit analyses, as used by Edison, would result in the allowance of large thermal discharges on even small trout streams since it is likely that a lake or artificial stream for fishing purposes could be built for less money than cooling facilities.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify the above Opinion was adopted on the 8th day of November, 1973 by a vote of 5-0.

Christan L. Moffett

Christan L. Moffett, Clerk
Illinois Pollution Control Board

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

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

THOMAS V. SKINNER, DIRECTOR

DATE: July 2, 2001

TO: DISTRIBUTION LIST

FROM: Connie L. Tonsor

RE: MidWest Generation file review/permit questions
Draft Permit No. IL0064254

Procedural Background

On November 8, 2000, the Illinois Environmental Protection Agency ("Illinois EPA") sent draft permit No. IL0064254 to the USEPA for review. On November 30, 2000, the USEPA contacted the Illinois EPA with several concerns. The concerns were: (1) a concern that the effluent might be contributing to violations of the Dissolved Oxygen standard in the general use waters; (2) the applicant should submit a 316(b) of the Clean Water Act study; and (3) monitoring must ensure compliance with the secondary contact temperature standards. The permit should contain a condition showing the combined effect of Generation Unit 6 and the Joliet Station.

On April 30, 2001, the Illinois EPA responded to the USEPA's concerns. USEPA had withdrawn the concern with regard to Dissolved Oxygen. The permit had been amended to request the Section 316(b) report when the federal guidance was finalized. The reporting requirements had been clarified. The permit had been revised to require the permittee utilize the Near-Field Compliance Assessment Model to calculate fully mixed receiving water temperatures on an hourly basis. The Illinois EPA noted that the mixing zone was that portion of the river allowed for mixing in PCB 87-93.

On May 31, 2001, the USEPA requested 90 days to review the permit, 40 CFR 123.44 (a)(1), and additional information concerning whether the permit insured that thermal limits and monitoring conditions are appropriate for the secondary contact waters. The USEPA requested a copy of the thermal demonstration (PCB 87-93/PCB 89-93) and the Near Field Compliance Model.

The following is a review of the various regulatory matters relevant to the Midwest Generation Joliet 29 Station.

Thermal Demonstration

PCB 87-93 (PCB 89-93) did not specify a mixing zone for the secondary contact water or for the general use water at the I-55 Bridge.

Commonwealth Edison (now Midwest Generation) initially filed PCB 87-93. On June 19, 1987, Commonwealth Edison filed an amended petition for a Thermal Demonstration under 35 Ill. Adm. Code 302.211(f). The amended petition replaced the previously submitted petition and the Pollution Control Board renumbered in PCB 89-93. However, the Board has subsequently referred to the determination as PCB 87-93.

In *In the Matter of: Proposed Determination of no Significant Ecological Damage for the Joliet Generating Station,* (PCB87-93, September 17, 1983) Commonwealth Edison sought a determination that the provisions of 35 Ill. Adm. Code 302.211(f) did not apply to it as it discharged into secondary contact water or in the alternative a determination that the discharges from the Joliet Station had not caused and could not reasonably be expected to cause significant ecological damage to the "Five-Mile Stretch"[1] within the meaning of Section 302.211(f). The Five-Mile Stretch is designated a general use water.

Section 302.211(f) provides that:

> "The owner or operator of a source of heated effluent which discharges 150 megawatts (0.5 billions British thermal units per hour) or more shall demonstrate in a hearing before this Pollution Control Board (Board) not less than 5 nor more than 6 years after the effective date of these regulations, or in the case of new sources, after the commencement of operation, that discharges from that source have not caused and cannot be reasonably expected to cause significant ecological damage to the receiving waters. If such proof is not made to the satisfaction of the Board appropriate corrective measures shall be ordered to be taken within a reasonable time as determined by the Board."

The Joliet Station is located on both sides of the Des Plaines River, at a segment that is designated as secondary contact water. The discharge is approximately 7.3 miles upstream of the I-55 Bridge, where for approximately five miles the river is designated as general use water. The Board rejected Commonwealth Edison's argument and held that it must perform a thermal demonstration because of the affect that the discharge could have on the general use water.

On November 15, 1989, the Board found that Commonwealth Edison had successfully made the demonstration. The Board noted that Commonwealth Edison and the (Illinois EPA) agreed that heat was not a factor limiting the quality of the aquatic habitat of the Five-Mile Stretch.[2] The Board further noted: "Edison's desire to proceed at this time

[1] The "five Mile Stretch" is the segment of the lower Des Plaines River between the Interstate 55 Bridge and the head of the Illinois River (the confluence of the Des Plaines River and the Kankakee River).

2Commonwealth Edison had received several variances from the requirements for a demonstration at 35 Ill. Adm. Code 302.211(f), based on the argument that heat was not a limiting factor. See, PCB 78-79, PCB 81-24, and PCB 84-33. The last variance was due to expire in 1989.

appears to be based in part on Edison's belief that it is in compliance with all pertinent thermal water quality standards..."[3]

During the proceeding, the Illinois EPA supported Commonwealth Edison's petition and Commonwealth Edison's conclusion that the discharge complied with both the secondary contact and General use Standards. The Board noted that Agency concluded that as long as the Joliet Station meets all the applicable standards at the point of discharge and in the downstream General use waters, the Agency did not view the Joliet Station's thermal discharges as limiting aquatic diversity in the receiving waters.[4]

A mixing zone as it applied to the secondary contact water was never discussed, as all of the information was that the discharger was in compliance with the temperature limits for the secondary contact water. Note: the record in this proceeding is no longer retrievable. Therefore, I was not able to review the exact testimony presented to the Board.

However as to the General use water, one of Commonwealth Edison's witnesses testified that a complete mixing of the effluent occurred at between two miles of transport (high discharge) and five to six miles of transport (low discharge). No plume existed and Commonwealth Edison was in compliance with the General use water quality standards. The Board found this evidence persuasive.

Peter Howe and the Sierra Club testified that the Commonwealth Edison discharge may be causing early spawning, decrease in viability of gametes, thermal related mortality, cold shock, heat aversion and heat shock. The Board specifically noted that most of the Sierra Club and Mr. Howe's concerns could be raised regarding any waterway that received heated effluent. The concerns are more in the nature of challenges to the Board's water quality standards for temperature. Therefore, the Board found that they were beyond the scope of the proceeding.[5]

The Board noted that should revisions of the water quality regulations with regard to the Des Plaines River occur, Commonwealth Edison would have to comply with the regulations. The Board also noted that its finding[6] did not relieve Commonwealth Edison of its obligation to comply with the secondary contact or general use water quality standards as they then existed or as amended.

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[3]PCB 87-93; PCB 89-93, at p. 3. Therefore, could not argue compliance would constitute arbitrary and unreasonable hardship.

[4]PCB 87-93; 89-93, at p. 9.

[5]Mr. Howe in his letter concerning the instant permit is raising several of the same issues that were raised in PCB 87-93; 89-93.

[6] Commonwealth Edison had demonstrated that the effluent from the Joliet Station had not caused and could not reasonably be expected to cause significant ecological damage to the General use Waters of the Five-Mile Stretch.

As part of this proceeding, Commonwealth Edison committed to implement an operating plan which would limit the megawatt output for the Joliet Station which to ensure that the monthly maximum temperature standard of Section 302.211(e) was not exceeded.[7]

Variance

On November 21, 1991, the Board granted Commonwealth Edison a variance from the requirements of 35 Ill. Adm. Code 302.211(d) and (e) to conduct a study of the Upper Illinois Water Way and the impact of heated effluent discharges to the receiving stream. The study then would become the basis of an adjusted standard/alternate thermal standard, if needed.

Adjusted Standard

On May 16, 1996, Commonwealth Edison filed a petition for alternate thermal standards. (*In the Matter of: Petition of commonwealth Edison Company for Adjusted Standard from 35 Ill. Adm. Code 302.211(d) and (e),* AS 96-10, October 3, 1996; "AS 96-10"). On October 3, 1996, the Board granted the alternate thermal standards utilizing the adjusted standard procedures. The adjusted standard considered the combined discharges of the Joliet, Crawford and Fisk generating stations.

Section 304.141(c) provides the authority for the Board's action:

> "The standards of this chapter shall apply to thermal discharges unless, after public notice and opportunity for hearing, in accordance with Section 316 of the CWA and applicable federal regulations, the Administrator and the Board have determined that different standards shall apply to a particular thermal discharge." (35 Ill. Adm. Code 304.141(c))

Section 316(a) of the Clean Water Act states"

> "With respect to any point source otherwise subject to the provisions of Section 306 of this Act, whenever the owner or operator of any such source, after opportunity for public hearing, can demonstrate to the satisfaction of the Administrator (or, if appropriate, the State) that any effluent limitation proposed for the control of the thermal component of any discharge from any such source will require effluent limitations more stringent than necessary to assure the protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife in and on the body of water into which the discharge is made, the Administrator (or, if appropriate, the State), may impose effluent limitation under such section on such plant, with respect to the thermal component of such discharge (taking into account the interaction of such thermal component with other pollutants), that will assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in and on that body of water."

[7] PCB 87-93 at 21.

33 U.S.C.§1326, Section 316 of the CWA.

Section 125.73 (c) of the Code of Federal Regulations, 40 C.F.R. §125.73(c), provides:

> "Existing dischargers may base their demonstration upon the absence of prior appreciable harm...Any such demonstration shall show: (1) That no appreciable harm has resulted from the normal component of the discharge *(taking into account the interaction of such thermal component with other pollutants and the additional effect of other thermal sources)* [emphasis added] to a balanced, indigenous community of shellfish and wildlife in and on the body of water into which the discharge has been made."

The Board in the alternate thermal standards considered the combined impact of all of the discharges on the Des Plaines and considered the study of the waterway.

The Board concluded that Commonwealth Edison had made the requisite showing for an alternate thermal standard under Section 316(a) of the Clean Water Act and a showing for an adjusted standard from 35 Ill. Adm. Code 302.211(d) and (e) for the Joliet, Will County, Crawford and Fisk generating stations. The Board stated that the following requirements applied at the I-55 Bridge.

January	60°F	February	60°F
March	65°F	April 1-15	73°F
April 16-30	80°F	May 1-15	85°F
May 16-31	90°F	June 1-15	90°F
June 16-30	91°F	July	91°F
August	91°F	September	90°F
October	85°F	November	75°F
December	65°F		

The Board further stated that the standards may be exceeded by no more that 3°F during 2% of the hours in the 12-month period ending December 31, except at no time shall Commonwealth Edison's *plants* cause the water temperature at the I-55 Bridge to exceed 93°F. *"ComEd's plants continue to be subject to the Secondary Contact Standards at the point of discharge."*[8]

The Board considered the combined effect of the discharges of all of the Commonwealth Edison plants in the alternate thermal standards proceeding. It noted operational considerations of each of the generating stations.[9] A review of the documentation in this file shows that the combined effect of all of the plants was considered in the study that

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[8] AS 96-10, at p. 7.

[9] AS 96-10, at p. 3-4. The maximum design temperature rise in the circulating cooling water is approximately 11.1°F for Will County, 12°F for Crawford, and 12.2°F for Fisk.

was presented to the Board. The study specifically mentioned that at high operation the Joliet Stations intake of the river was from 75-100% of flow.[10]

On December 18, 1996, the Illinois EPA sent a copy of the Board's order, the petition, the Exhibits, and the Illinois EPA's recommendation to the USEPA (Joan Karnauskas), pursuant to 40 CFR §131.21. The Illinois EPA has not, to date, received a response from the USEPA.

On March 16, 2000, the Board granted a transfer of AS96-10 to Midwest Generation, as the successor to Commonwealth Edison. The Board did not change any provisions but the name of the owner. I have located a March 23, 2000, letter from Richard Warrington to USEPA pursuant to 40 CFR §131.21. However, it is unsigned and I cannot verify that this documentation was transmitted.

Conclusion:

It appears that the Board in granting the alternate thermal limits at the I-55 Bridge for the general use waters did consider the combined effect of the thermal discharges. It found that the Joliet Station was subject to secondary contact standards. Part of the information before it was the effect of the Crawford and Fisk stations, the cumulative impact of the thermal component of the discharges from the Crawford and Fisk Stations. USEPA's letter seems to suggest another study that may in part be duplicative of the earlier study.

It seems as if the question is whether there is a violation of the secondary contact temperature standards at the Joliet Station.

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[10] Final Report Aquatic Ecological Study of the Upper Illinois Waterway, Vol 2, pp. 10-4.5-10.4-7 (AS96-10, Exhibit 1).

Appendix B

Chemical Probability Plots
Lower Des Plaines River
Use Attainability Analysis

Probability Plots for Barium

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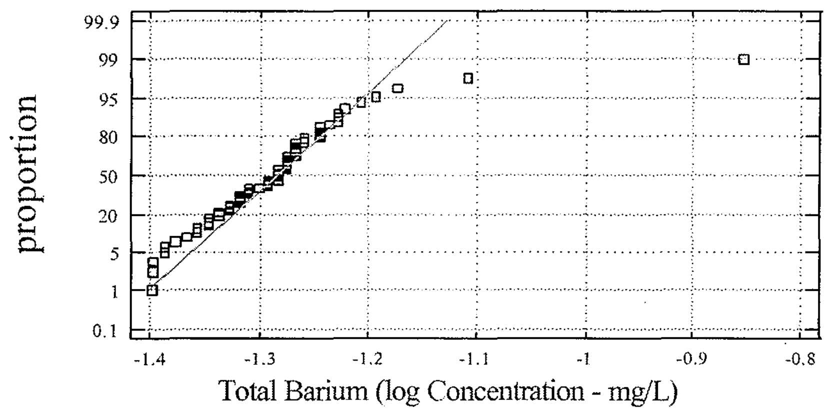

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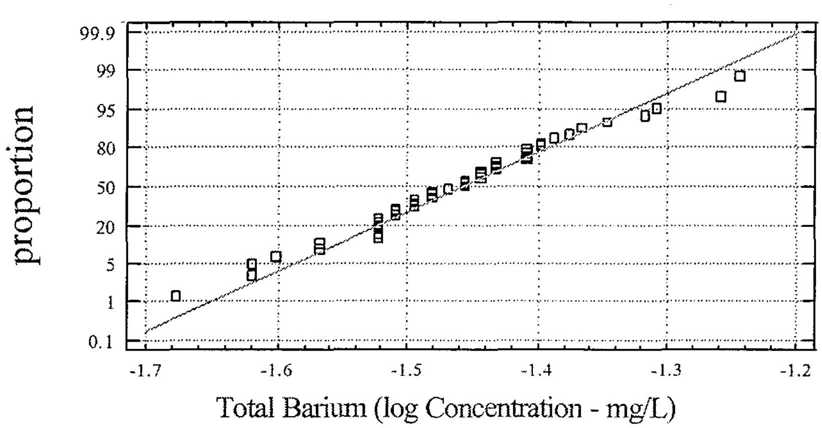

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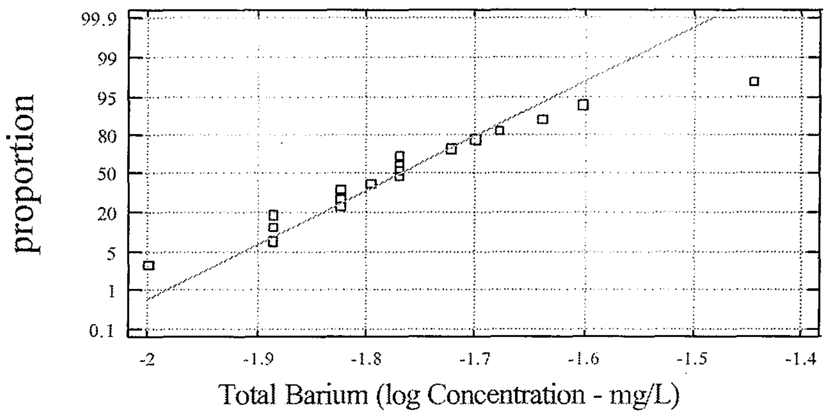

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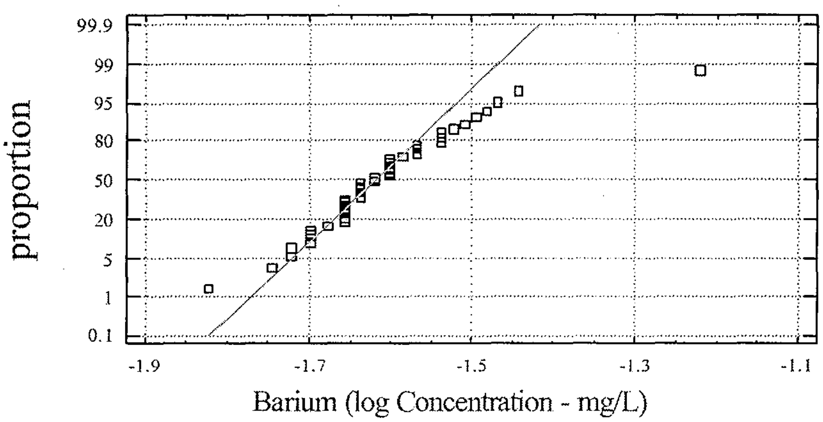

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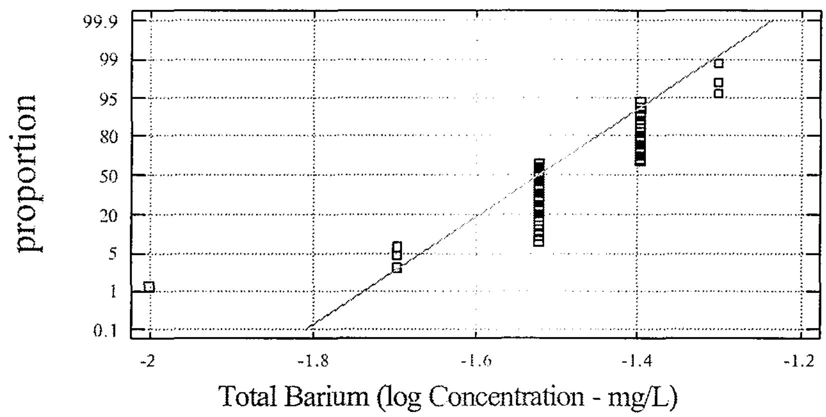

MWRD 92

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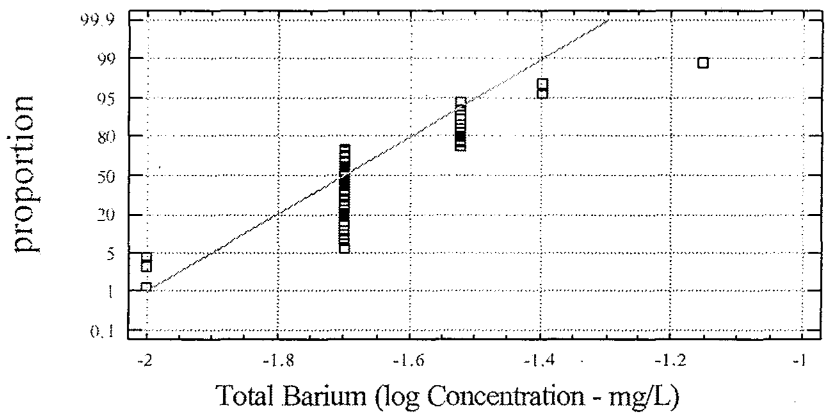

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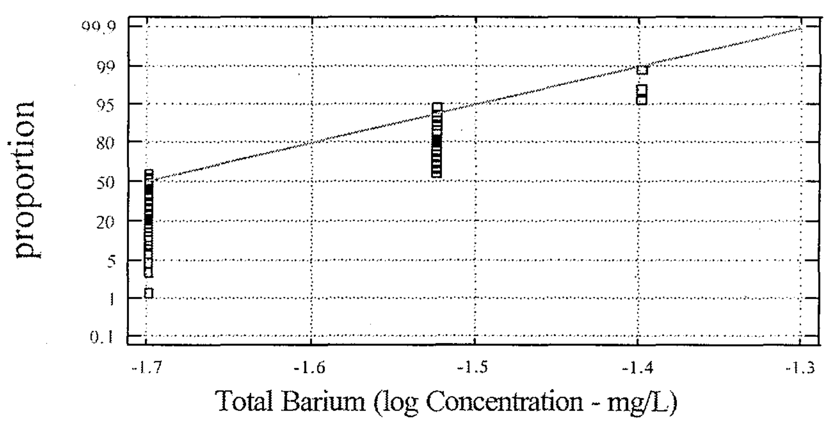

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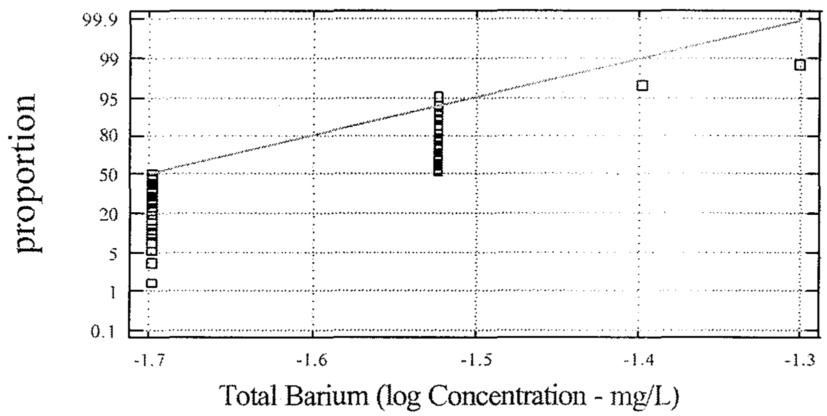

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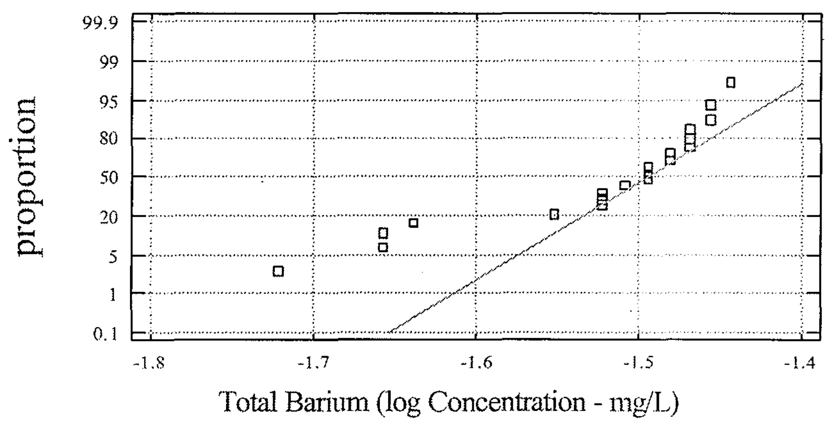
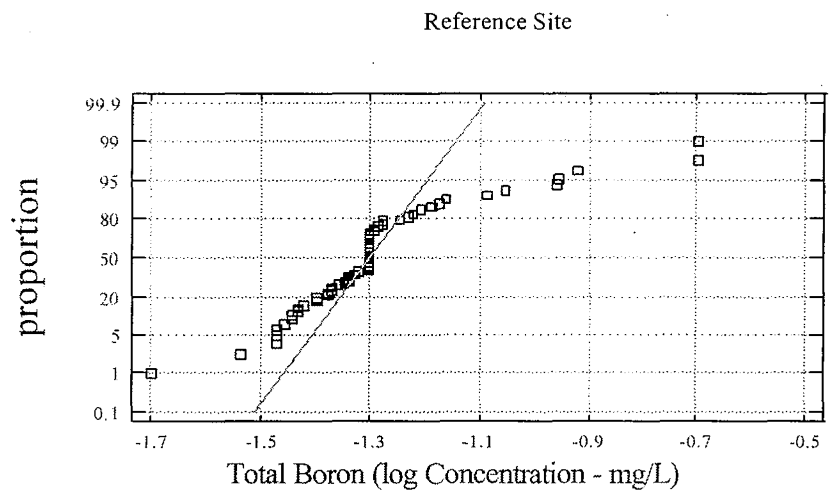
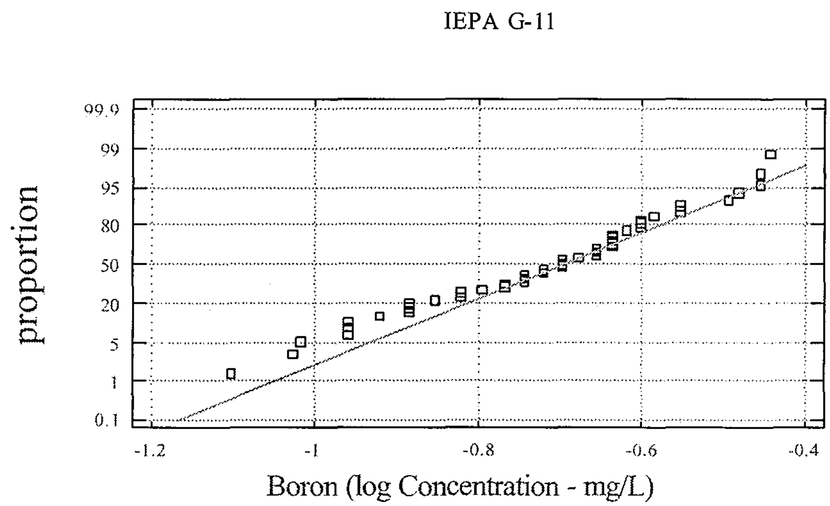


Romeoville (USGS)

Data not available

Probability Plots for Boron





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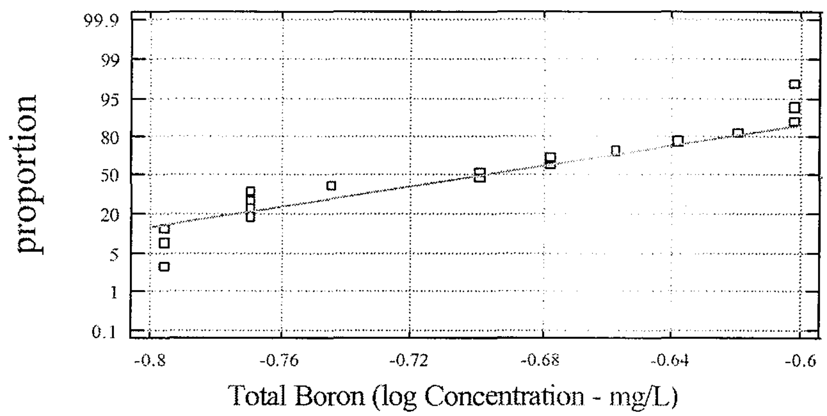

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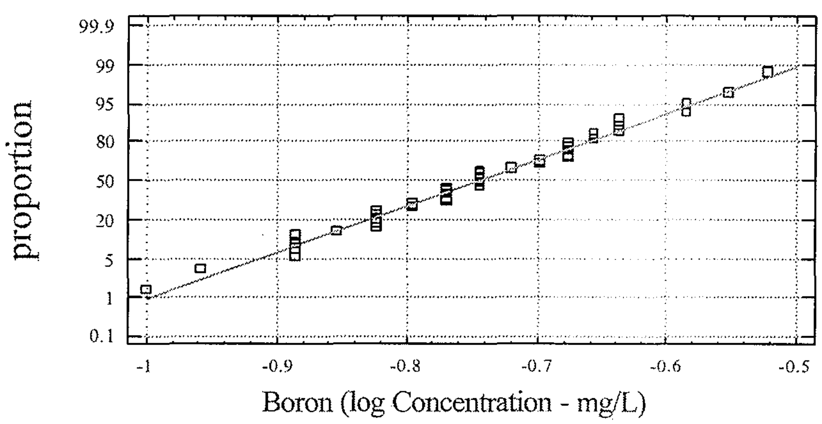

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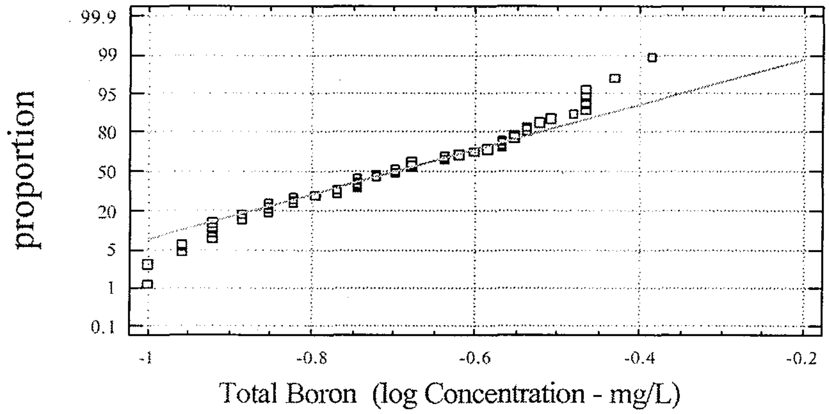

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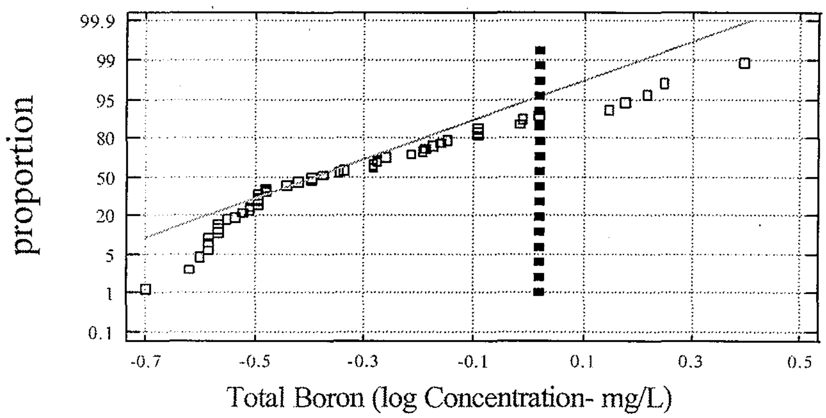

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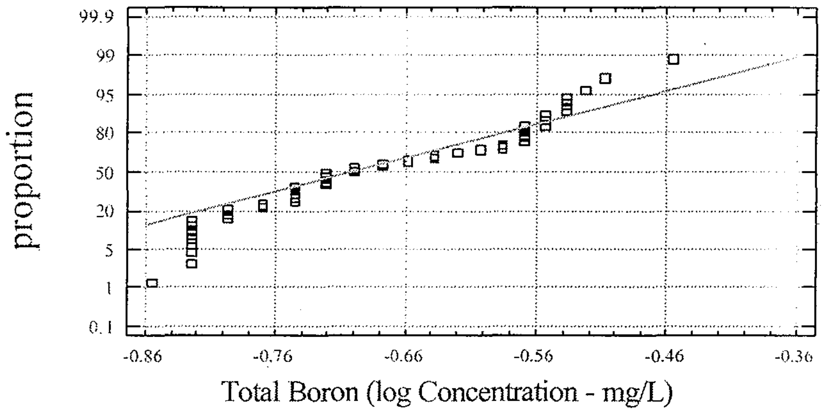

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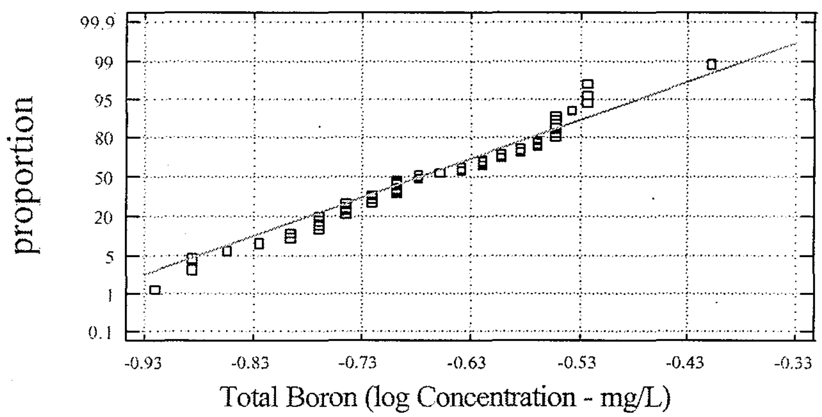

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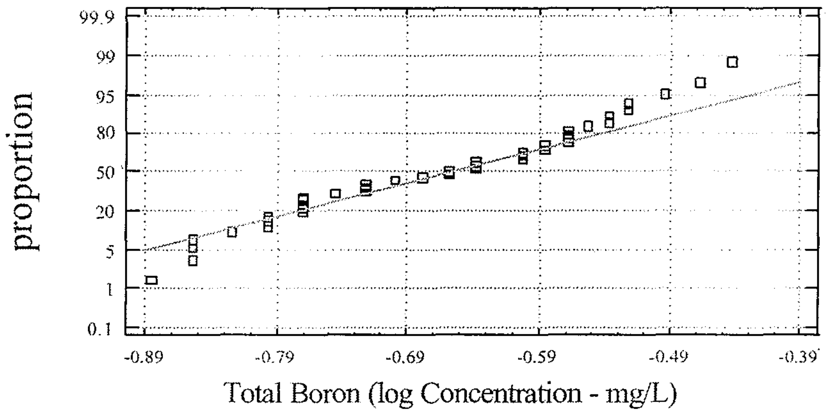

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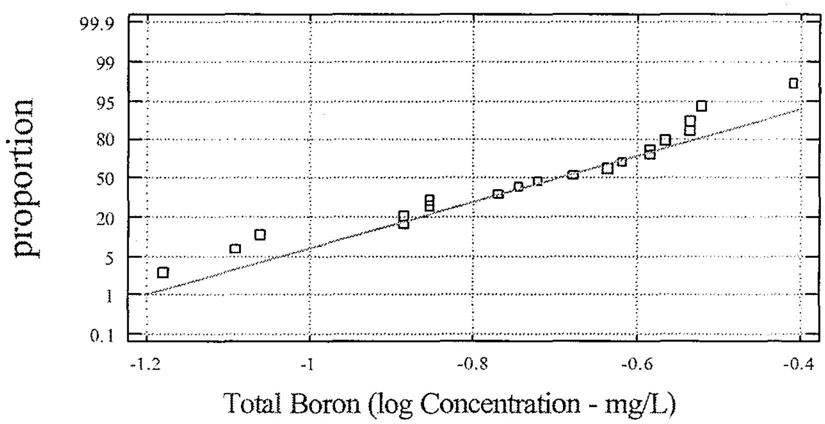
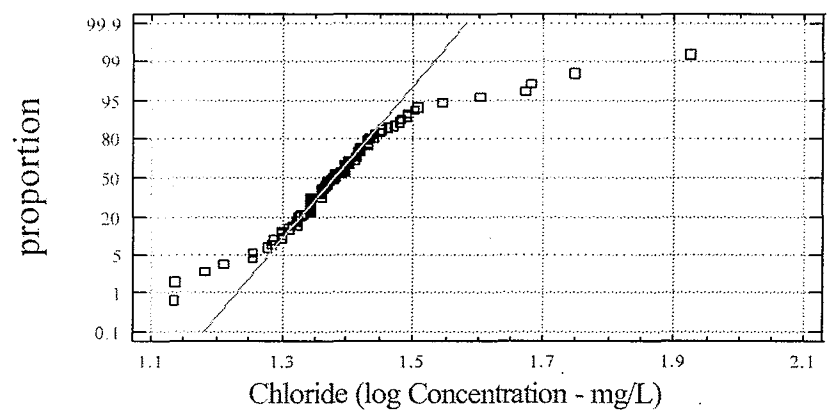


Romeoville (USGS)

Data not available

Probability Plots for Chloride

Reference Site



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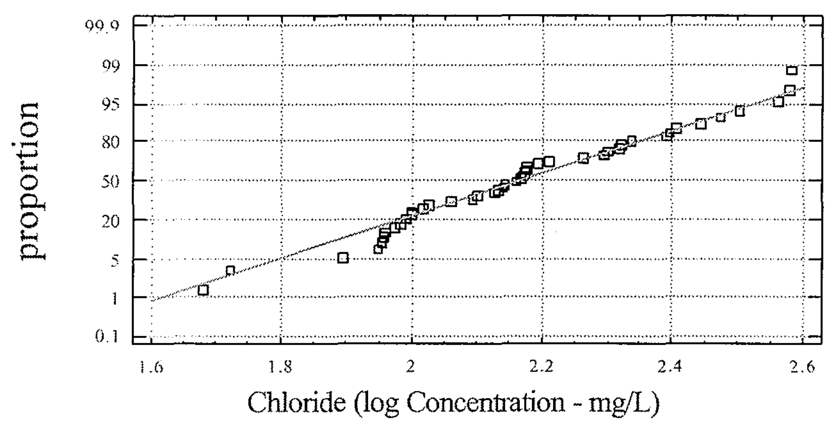

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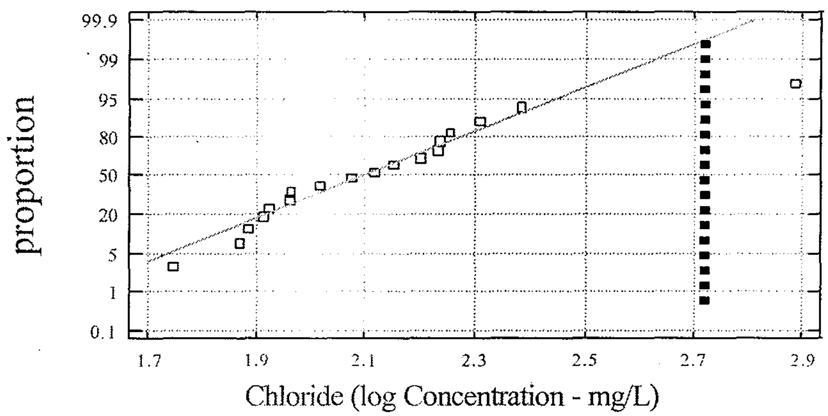

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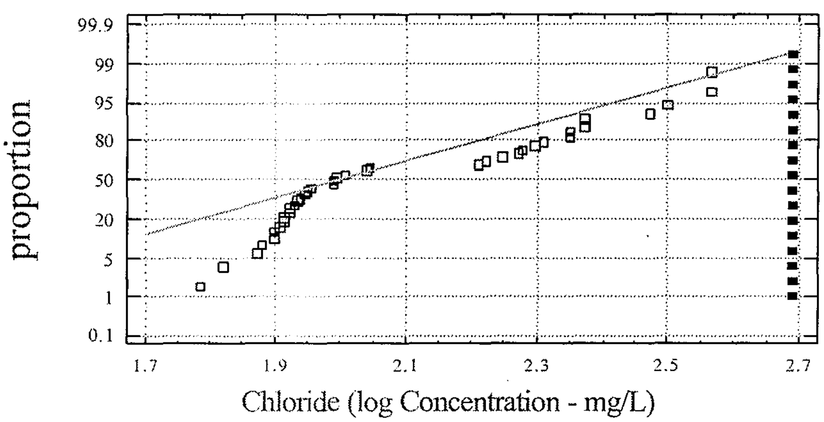

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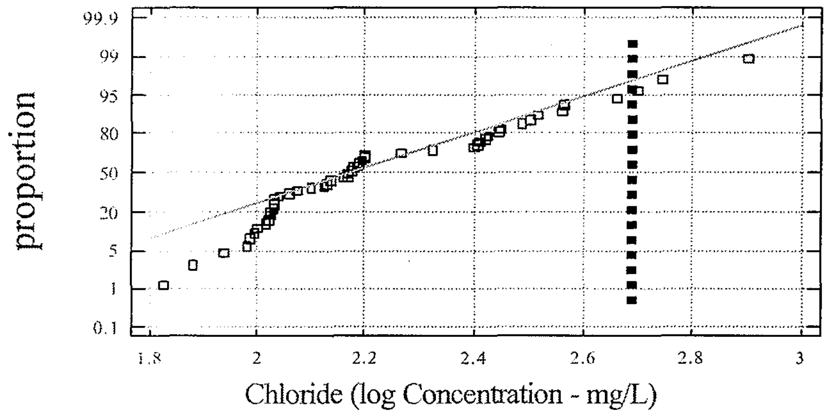

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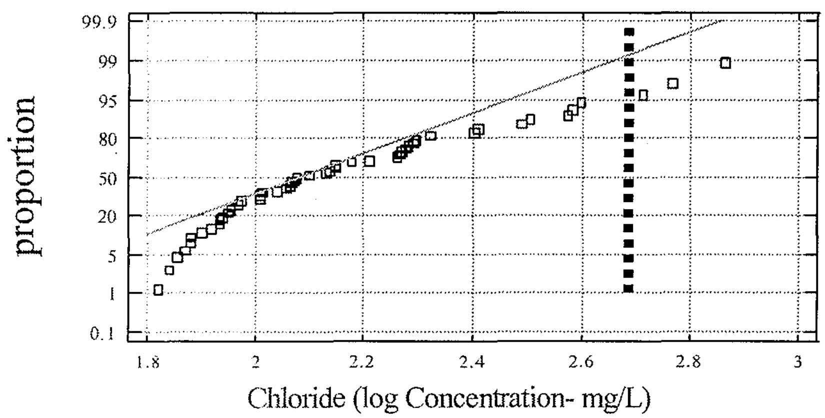

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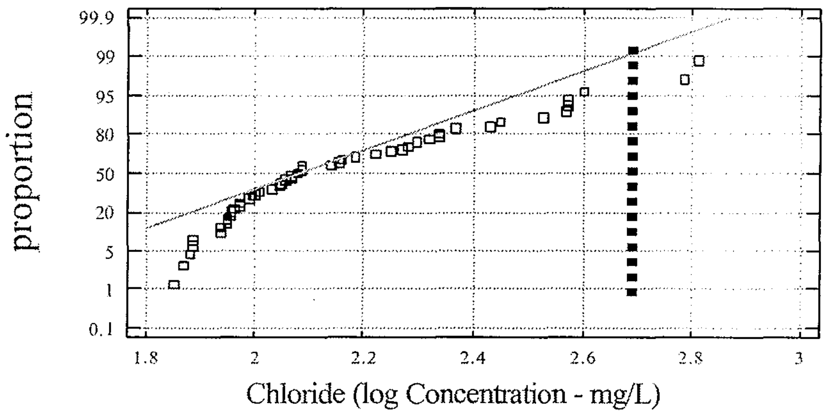

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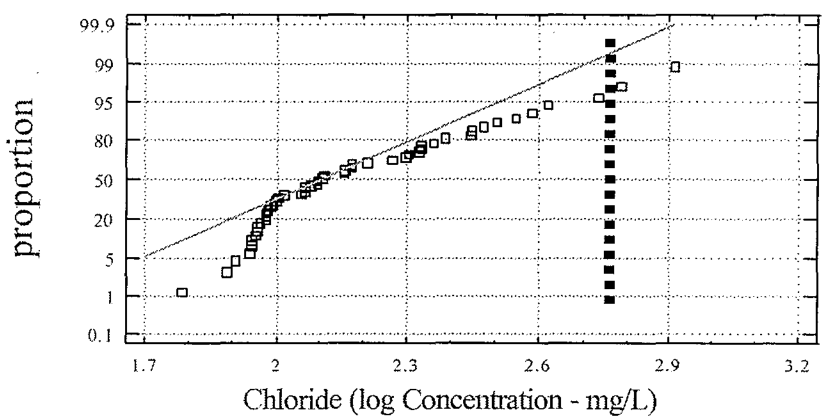

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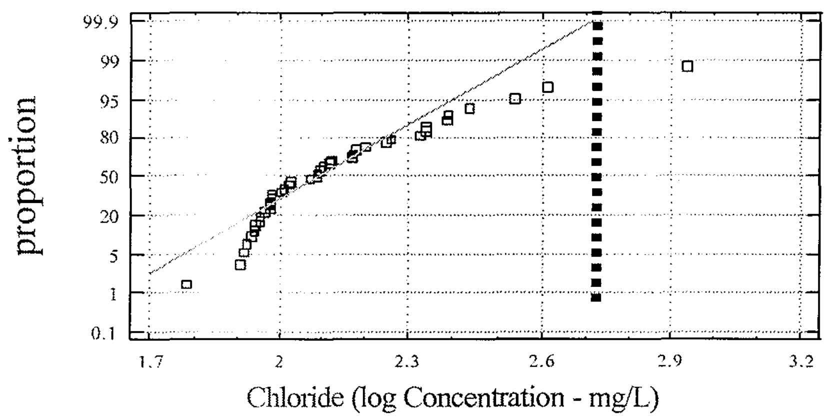

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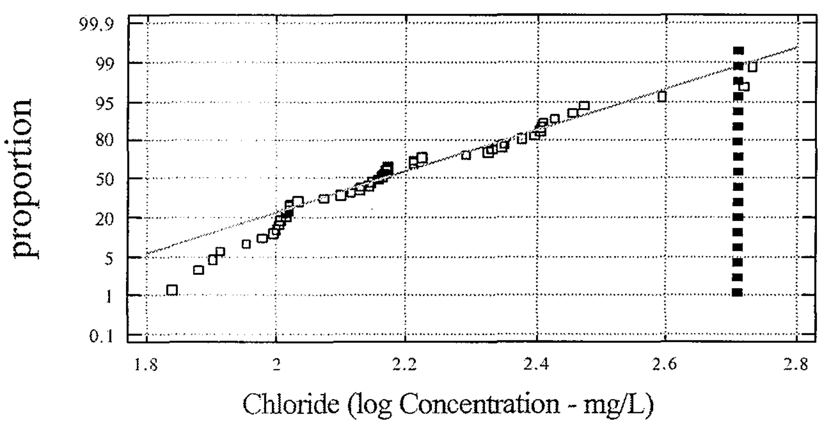

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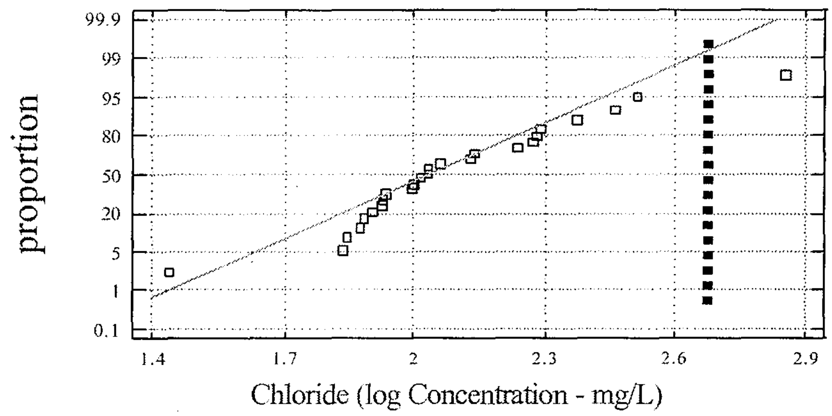

Probability Plots for Copper

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IEPA G-11

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IEPA G-02

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IEPA G-23

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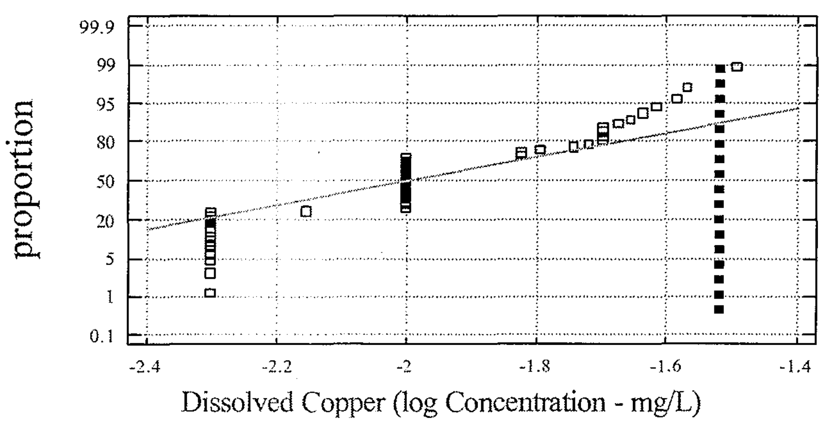

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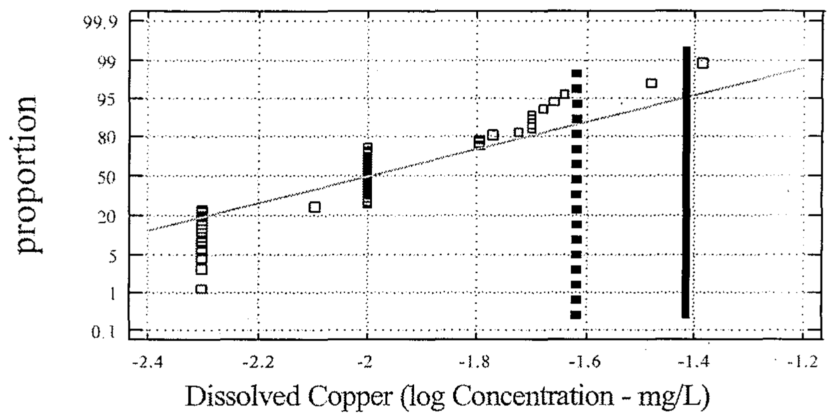

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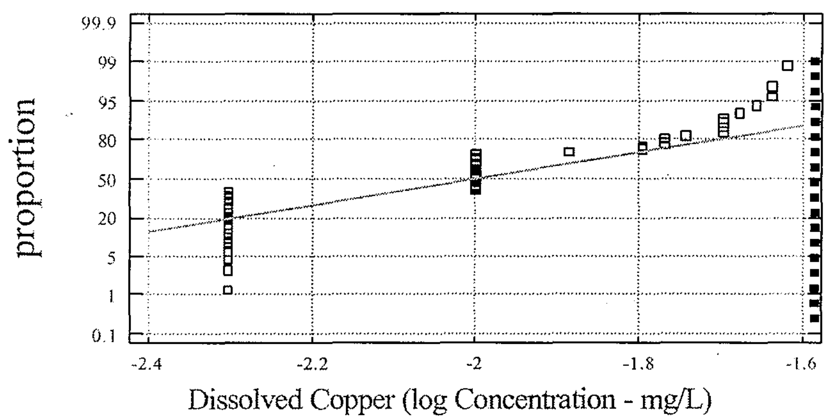

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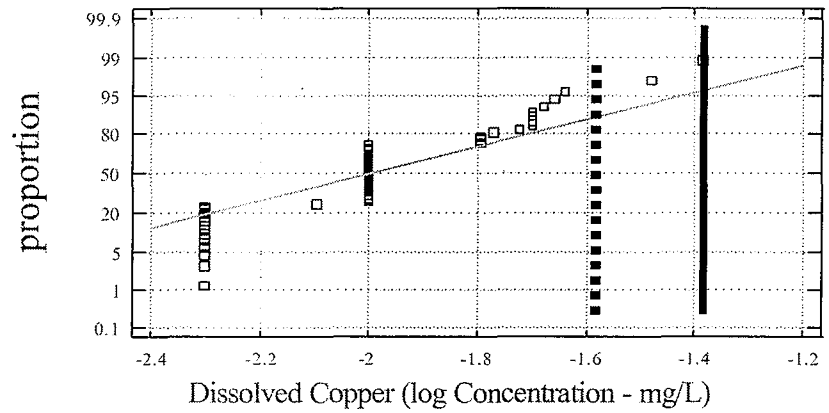

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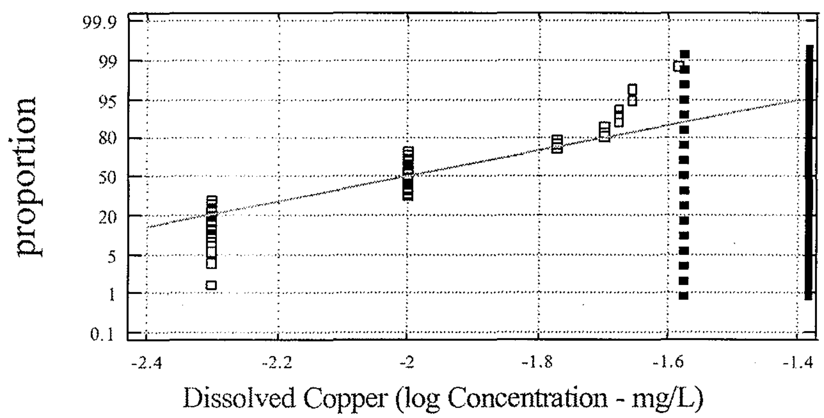

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Romeoville (USGS)

Data not available

Probability Plots for Dissolved Lead

Reference Site

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IEPA G-11

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IEPA G-02

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MWRD 91

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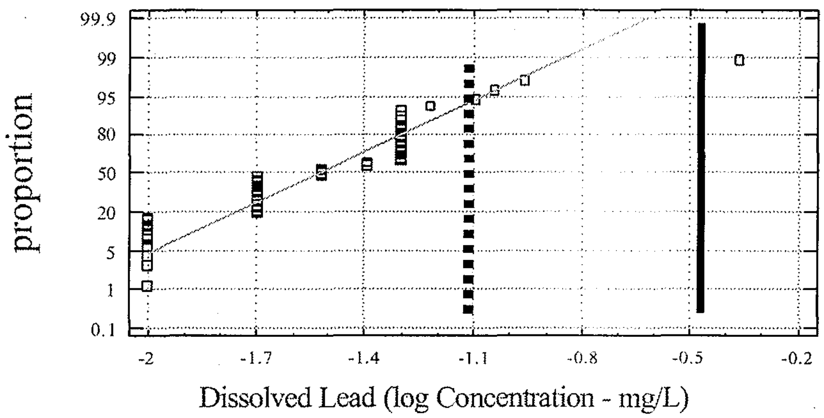

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Probability Plots for Dissolved Oxygen

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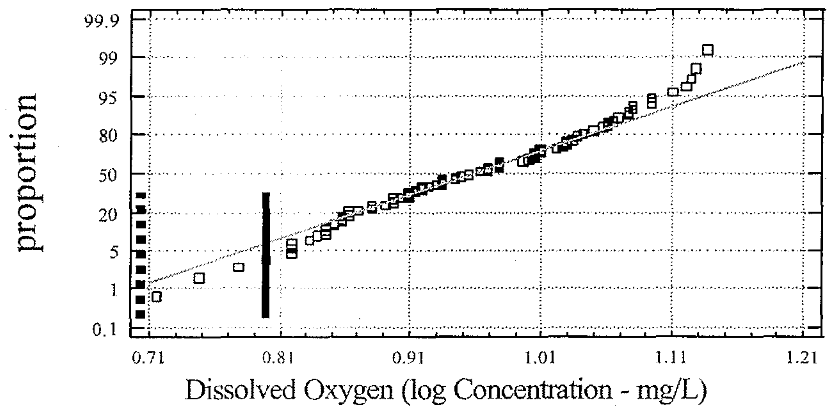

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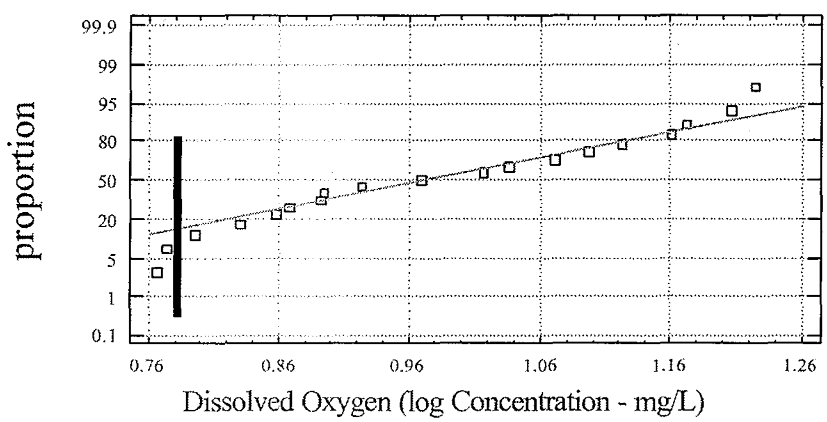

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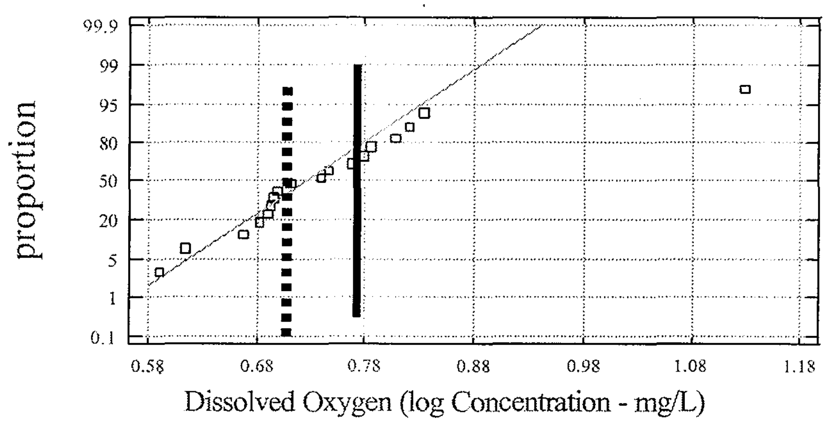

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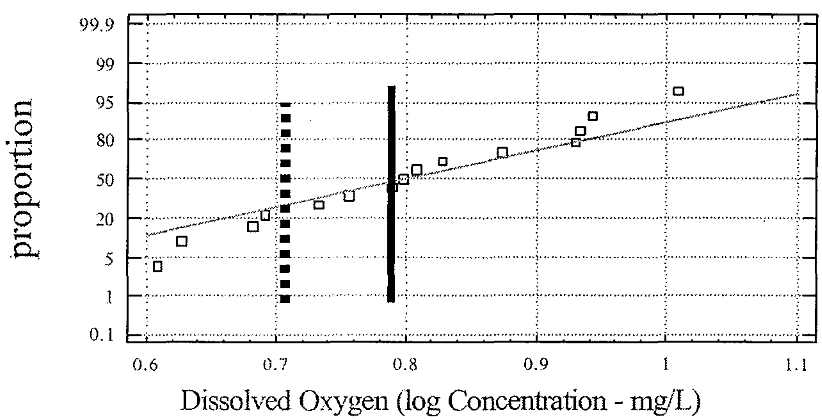

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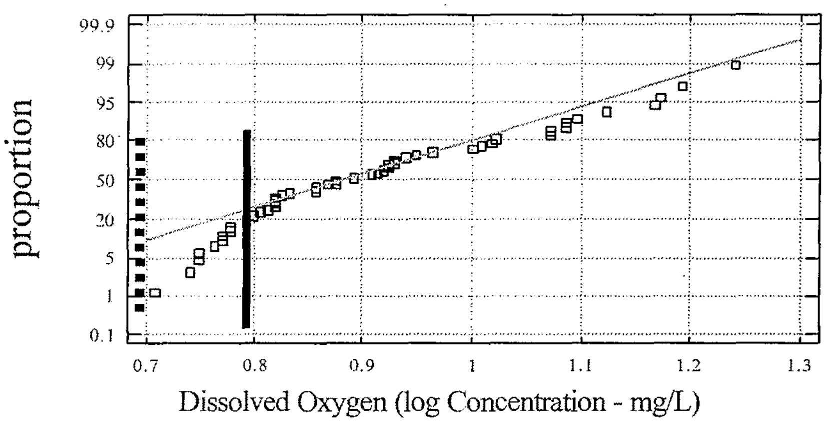

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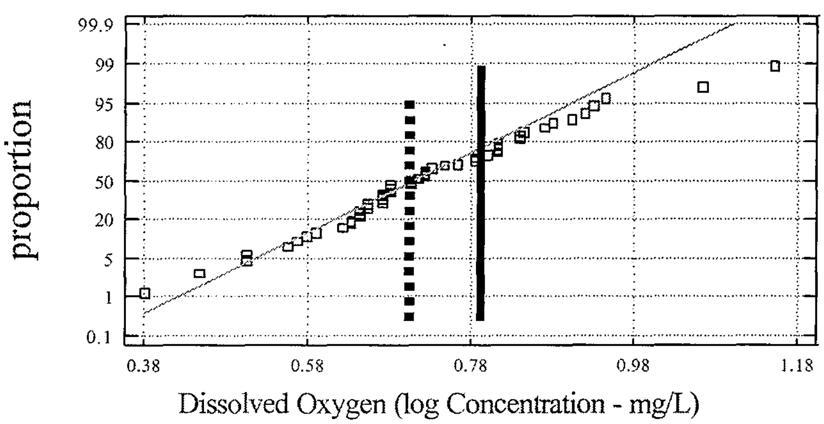

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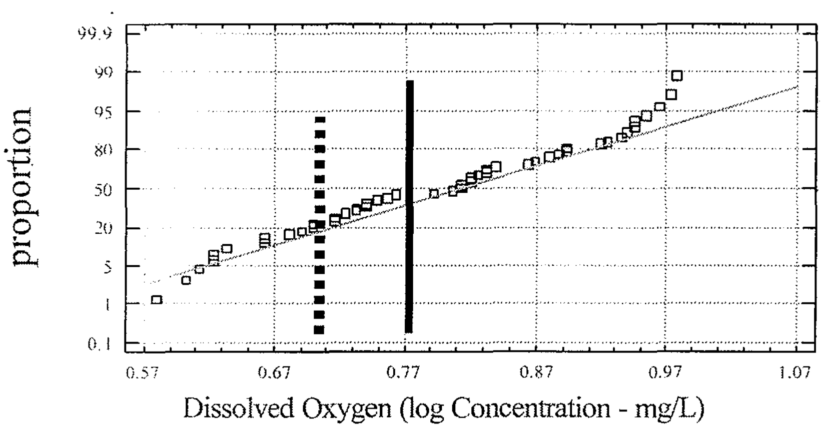

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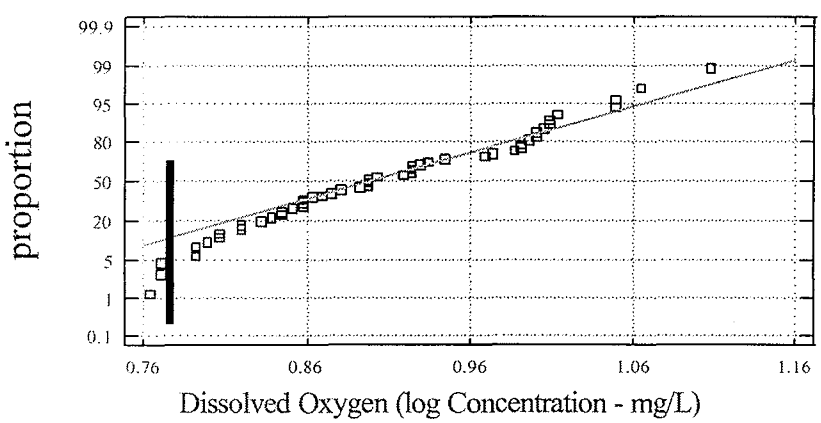

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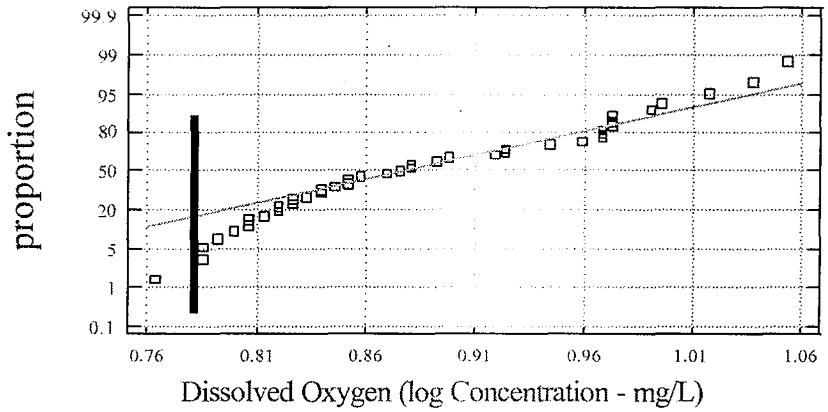

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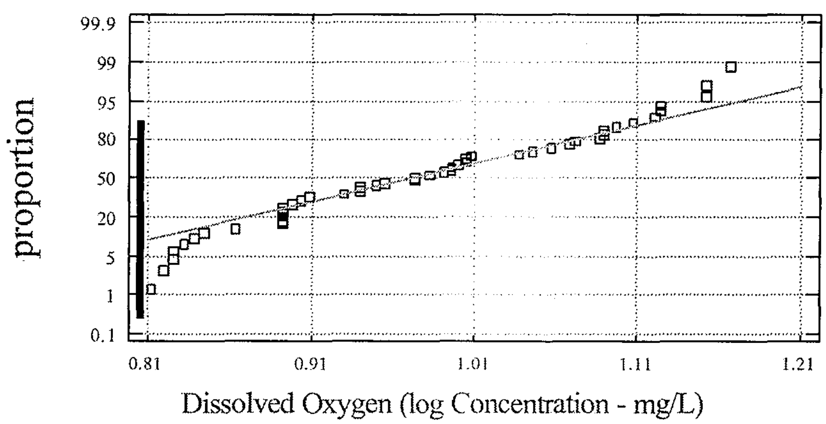

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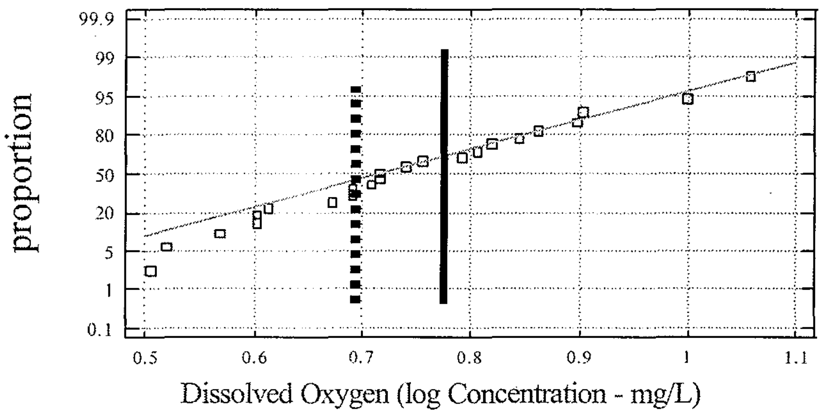
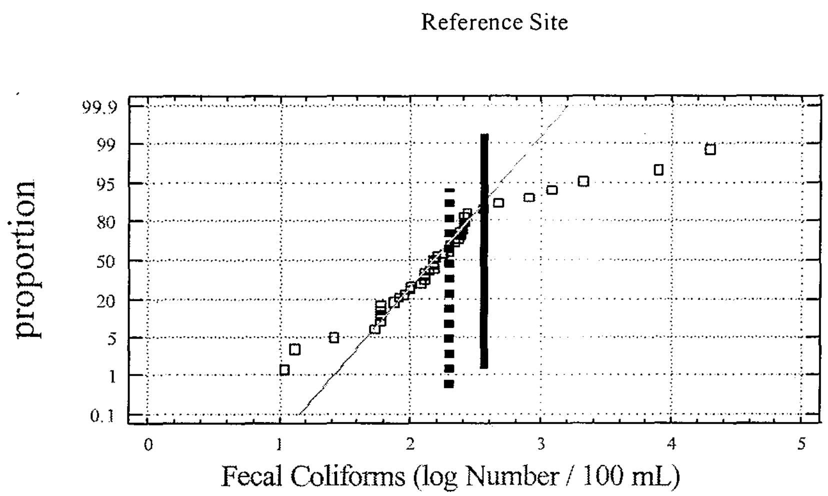
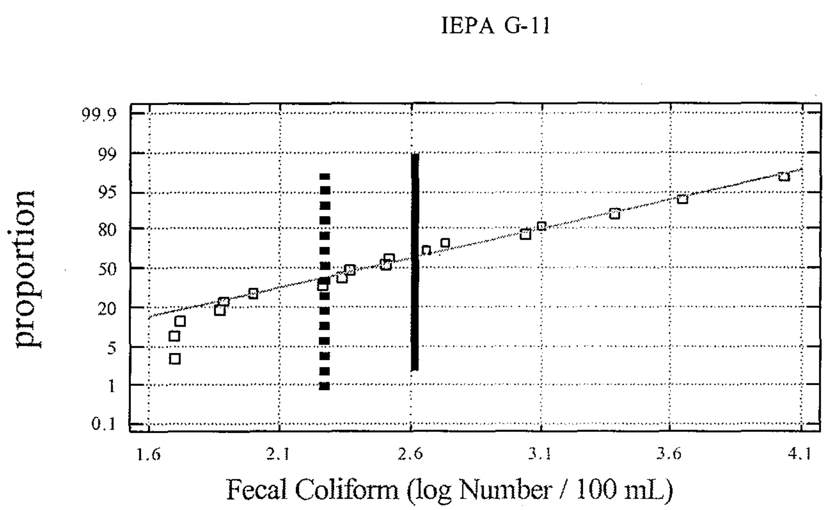


Probability Plots for Fecal Coliforms





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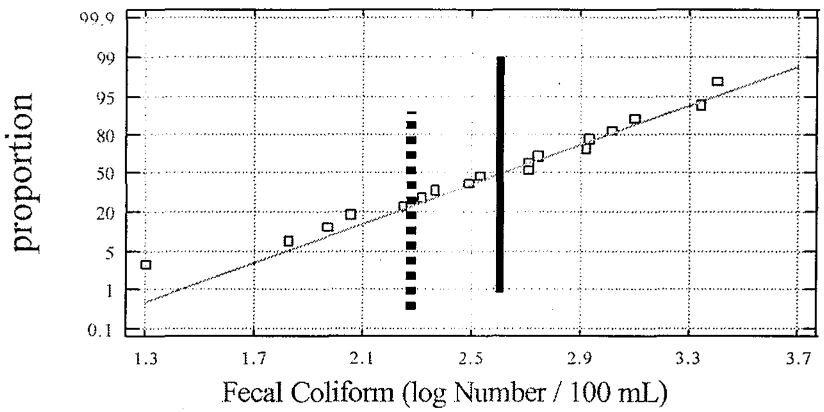

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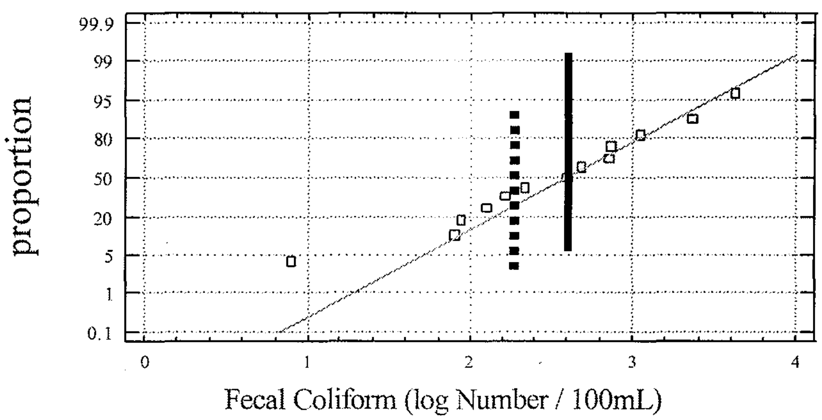

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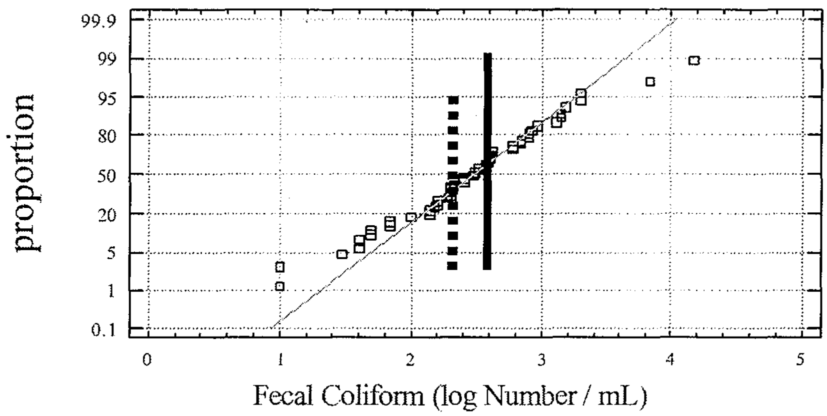

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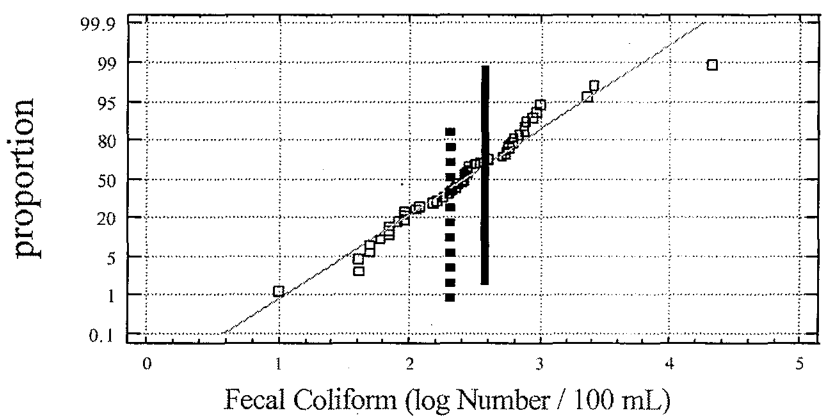

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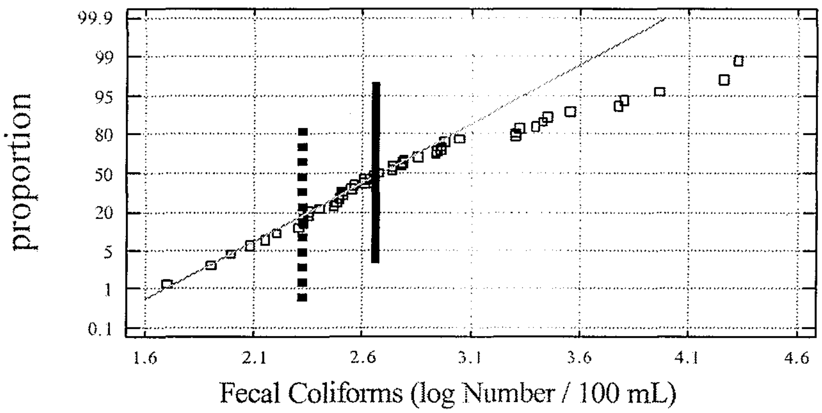

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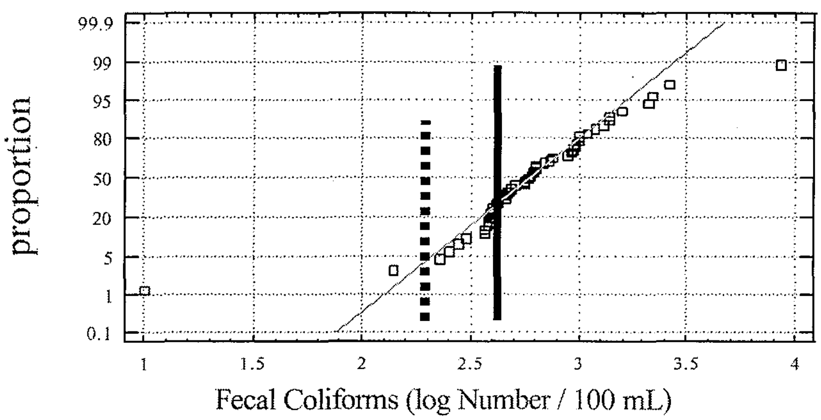

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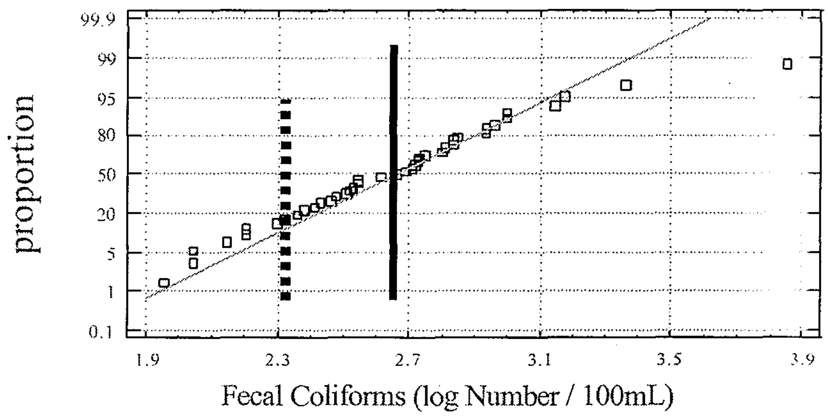
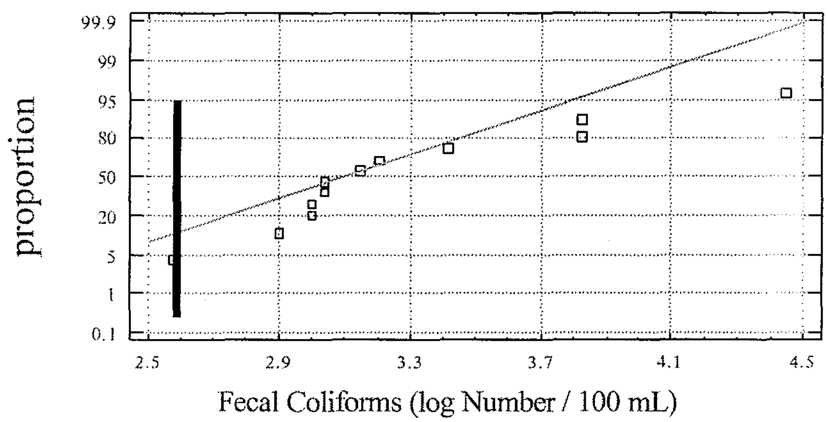


Riverside (USGS)

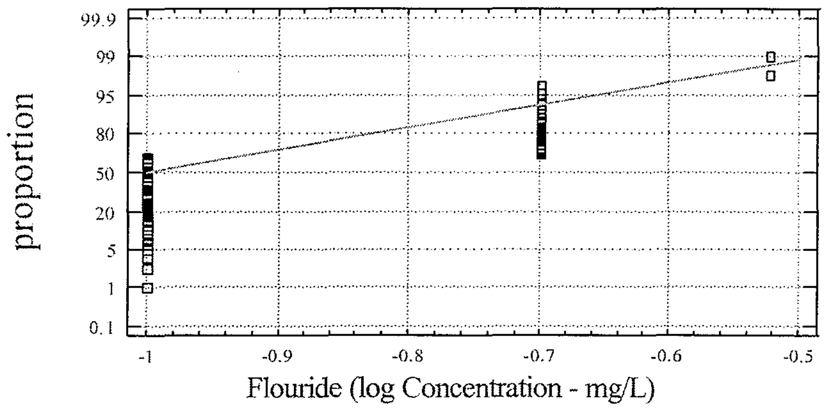


Romeoville (USGS)

Data not available

Probability Plots for Flouride

Reference Site



IEPA G-11

Data not available

IEPA G-02

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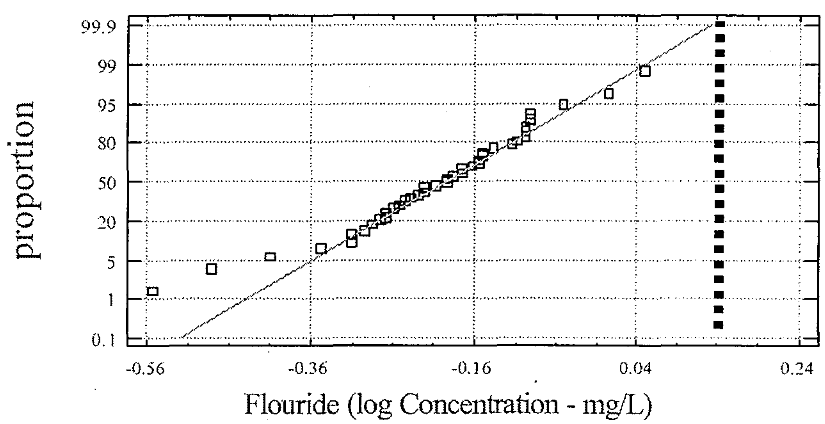
IEPA G-23



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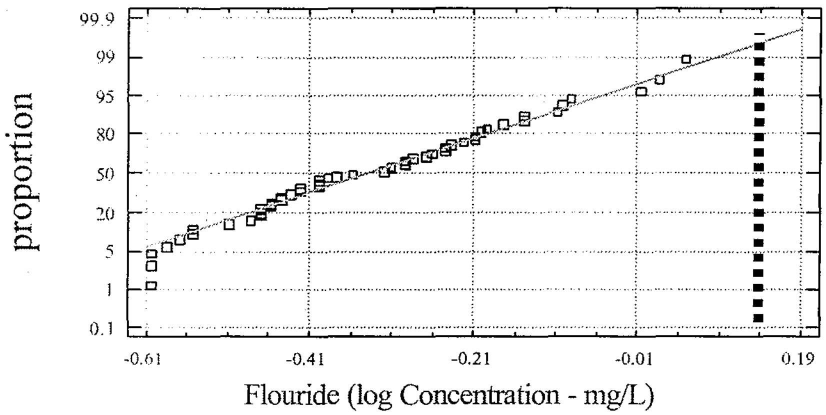

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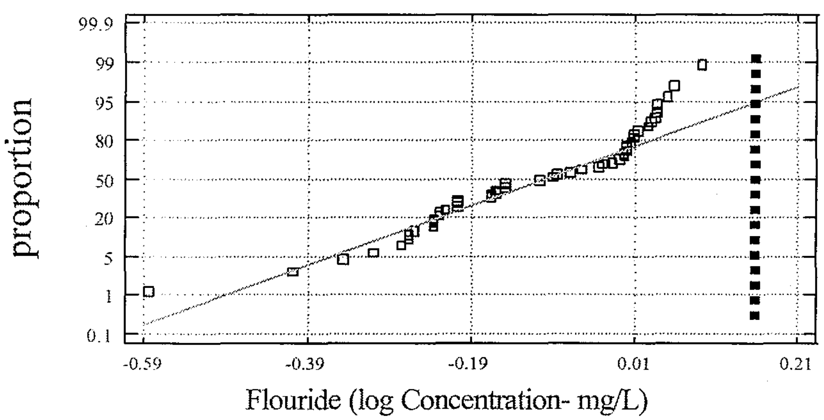
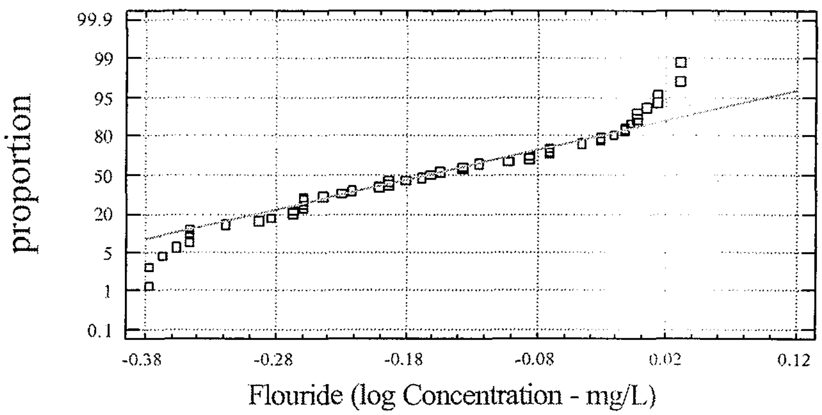
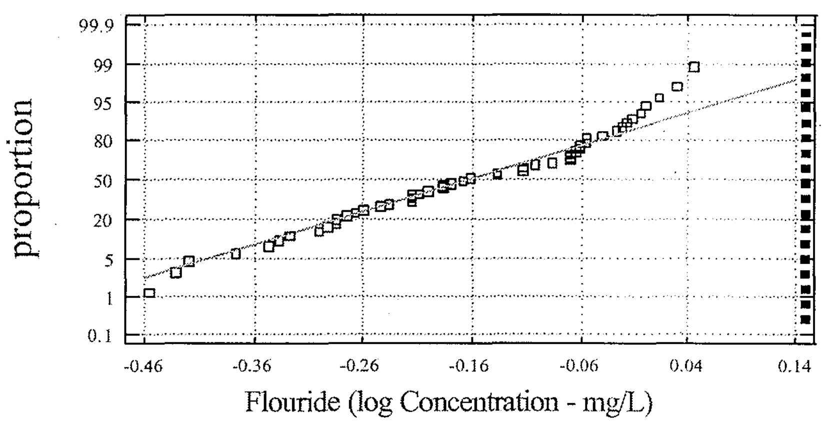


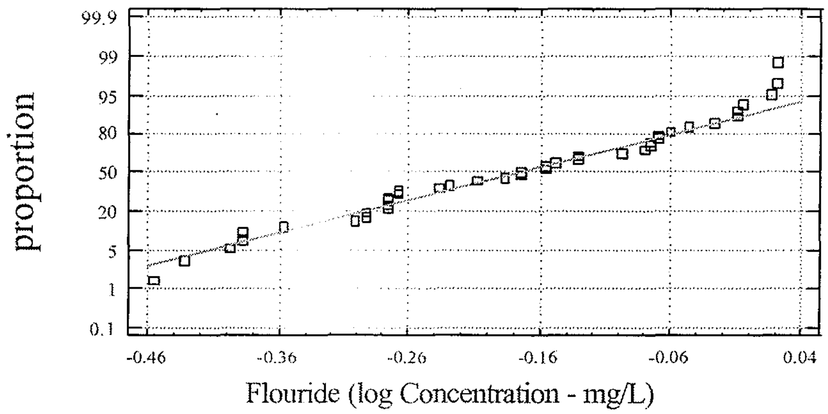
MWRD 93



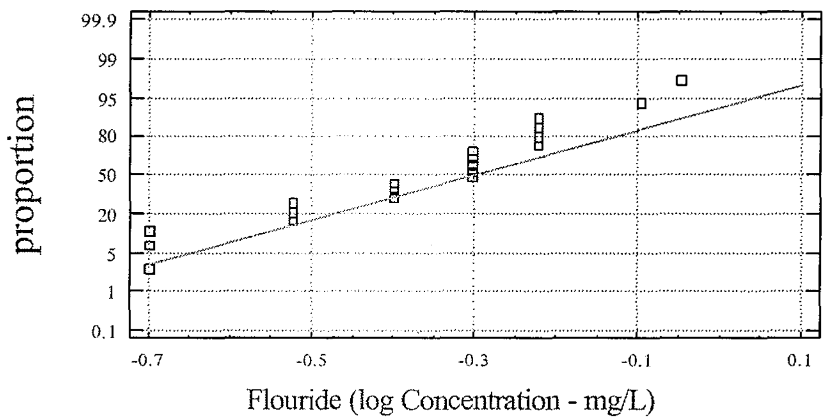
MWRD 94



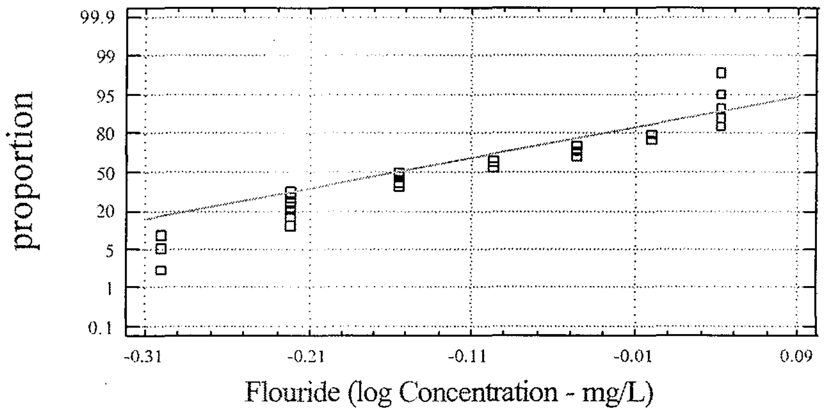
MWRD 95



Riverside (USGS)

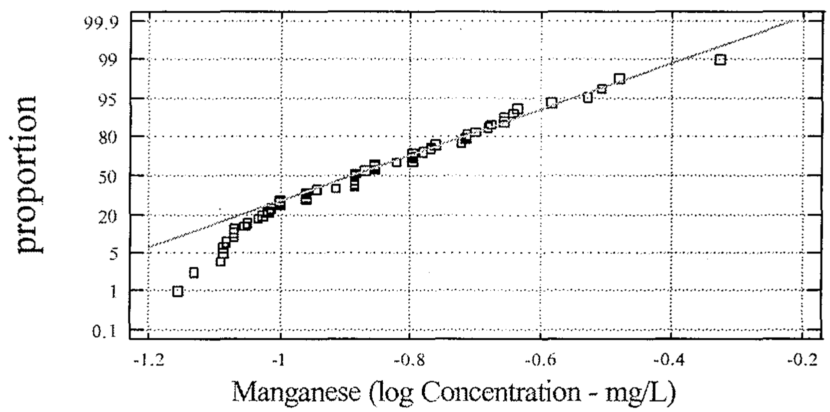


Romeoville (USGS)

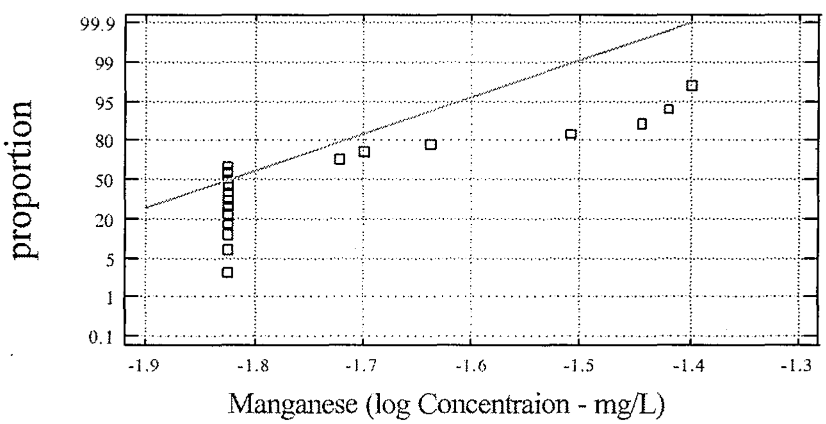


Probability Plots for Manganese

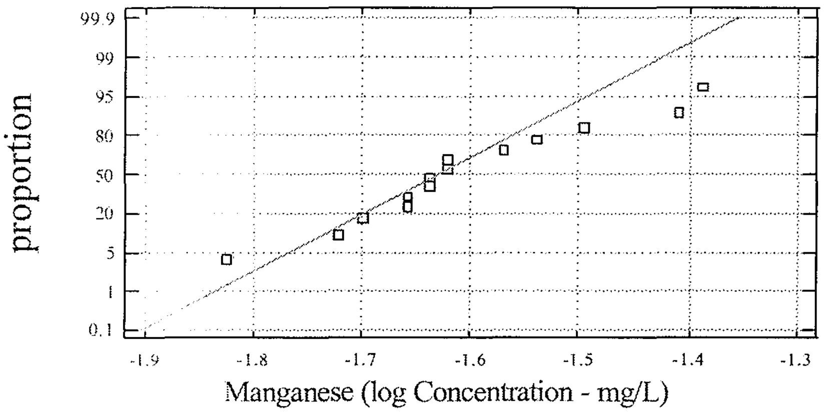
Reference Site



IEPA G-11

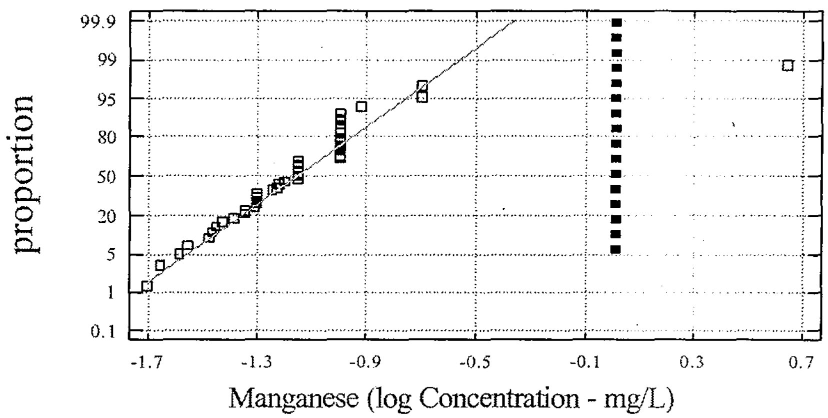


IEPA G-02



IEPA G-23

MWRD 91



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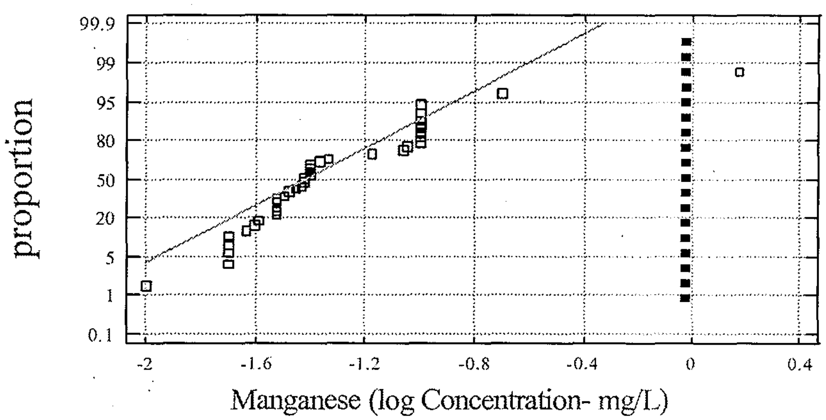

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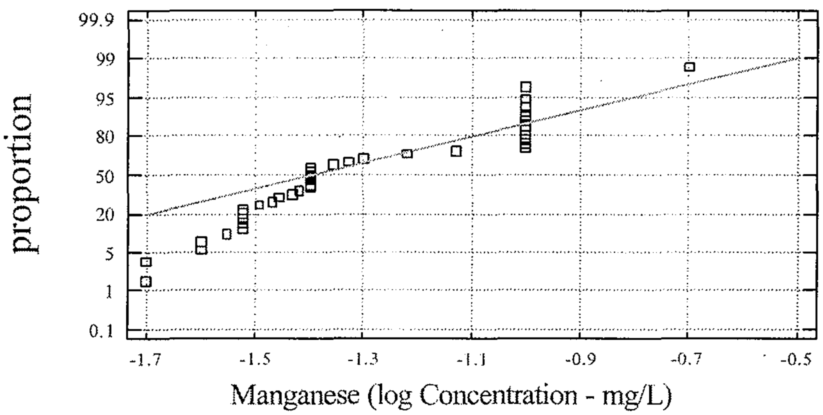

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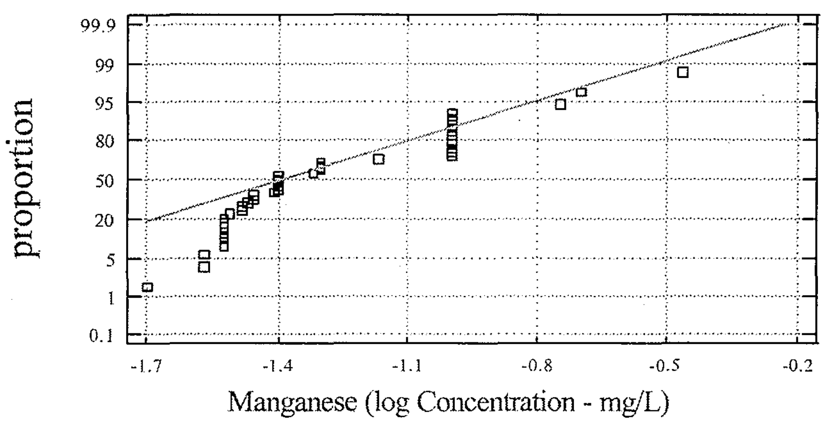
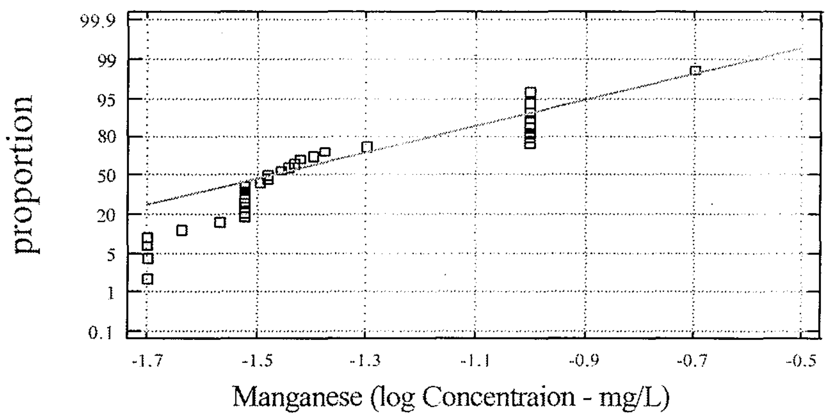
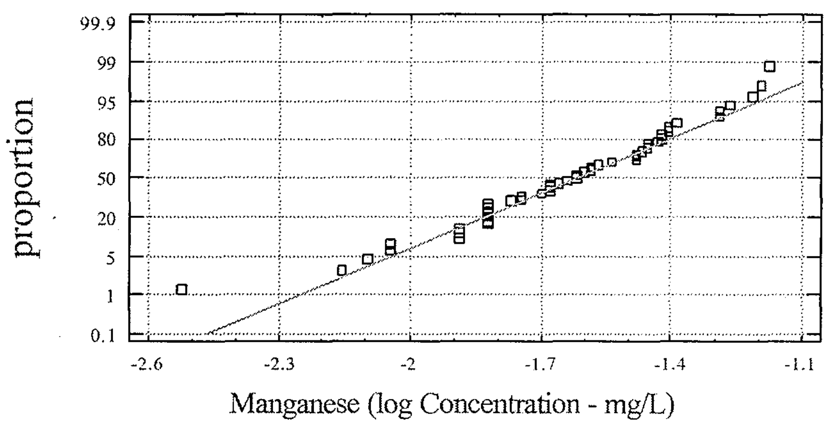


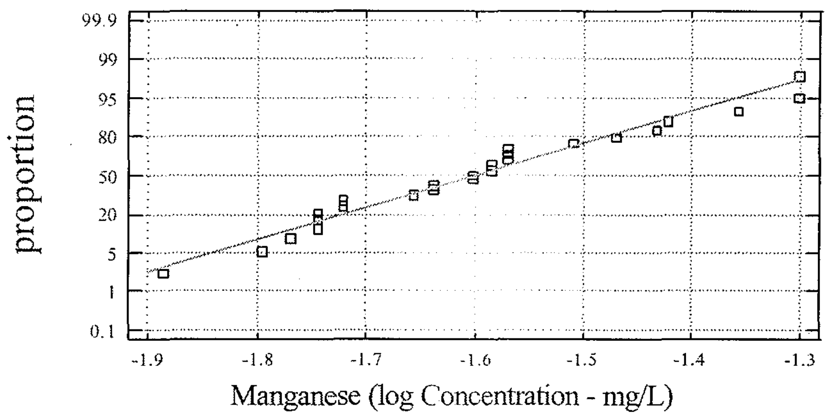
MWRD 95



Riverside (USGS)

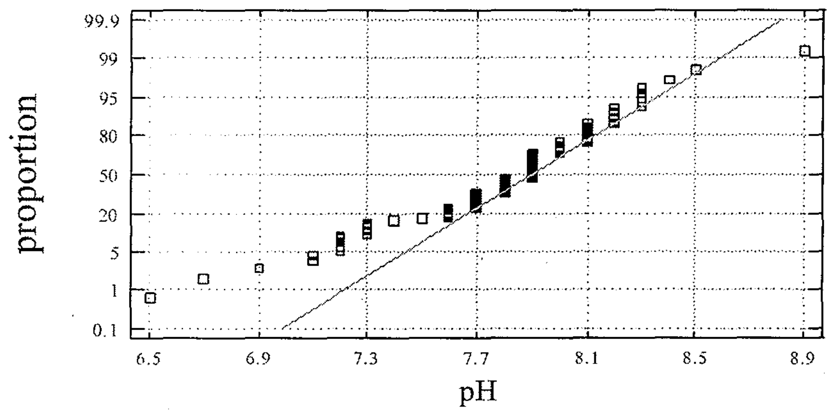


Romeoville (USGS)

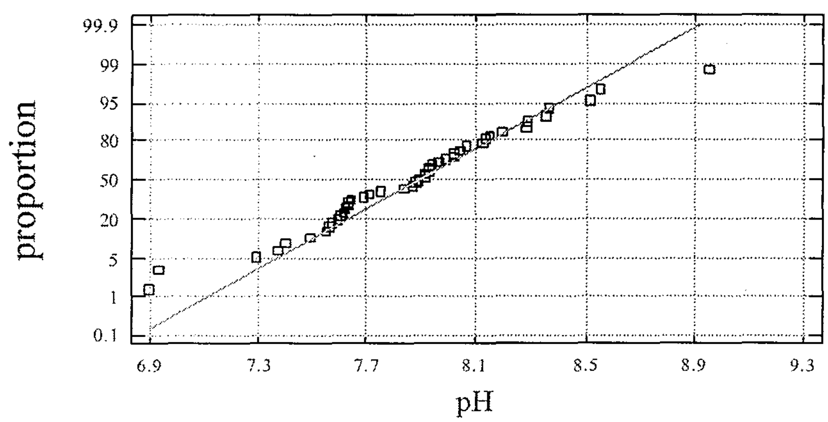


Probability Plots for pH

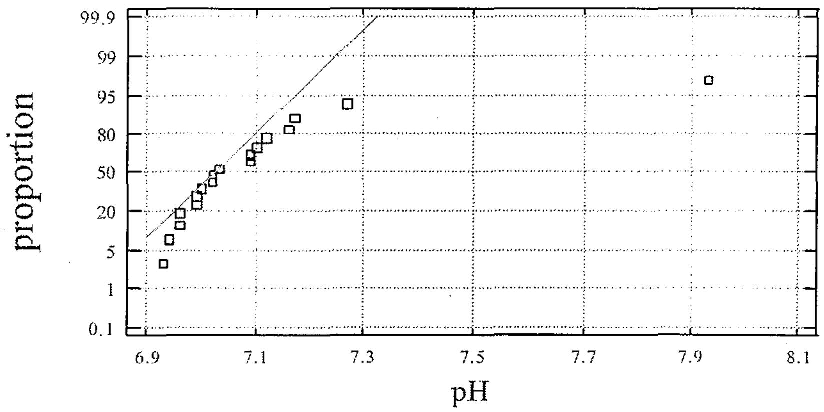
Reference Site



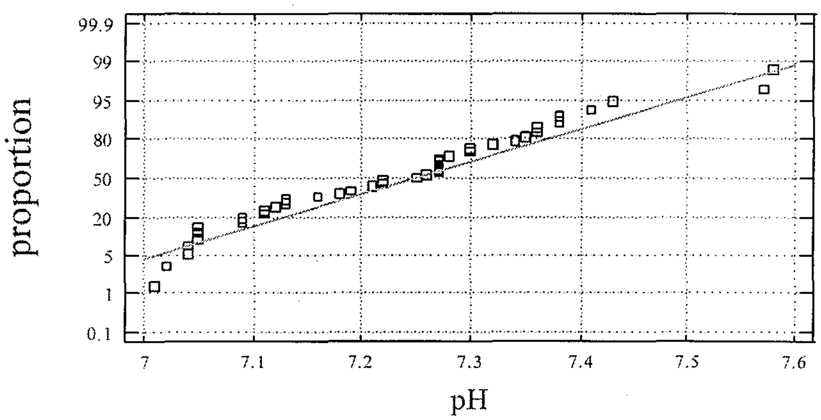
IEPA G-11



IEPA G-02



IEPA G-23



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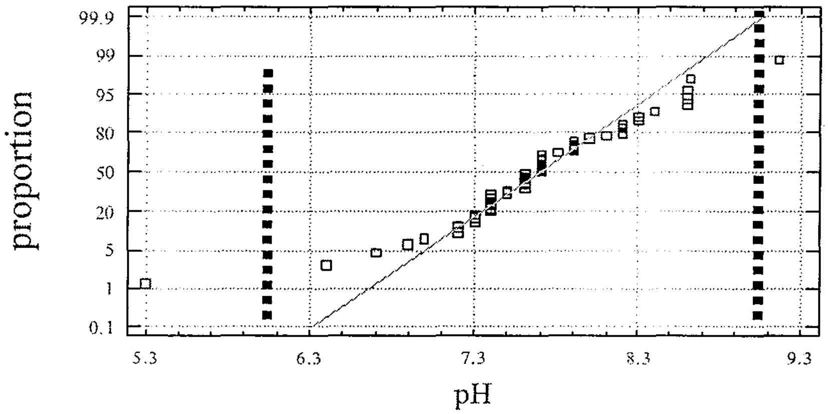
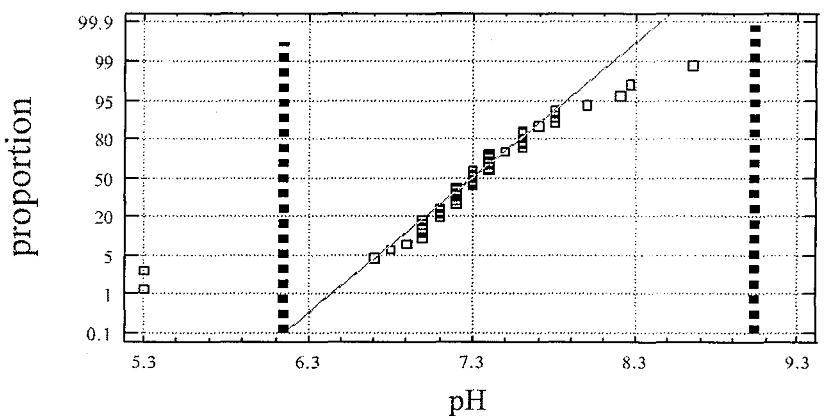
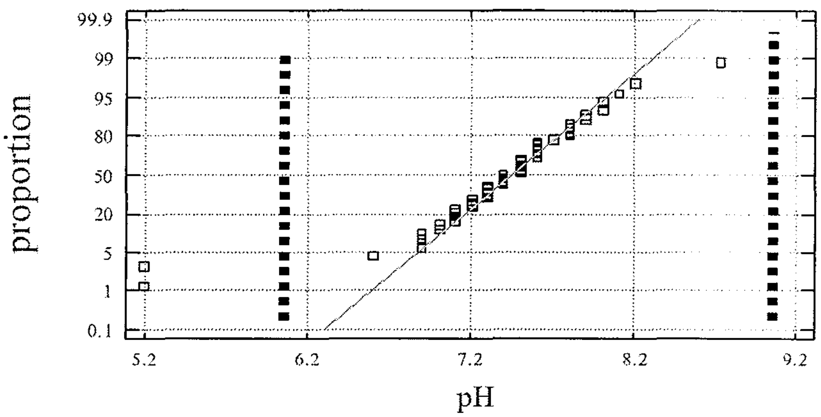


MWRD 92



MWRD 93



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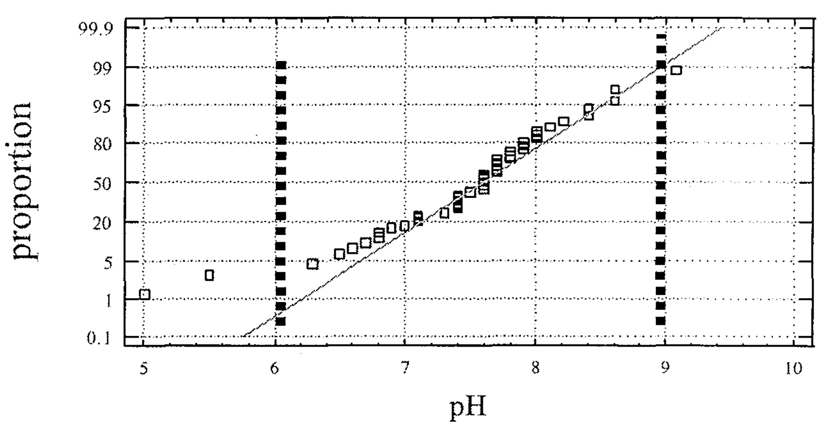
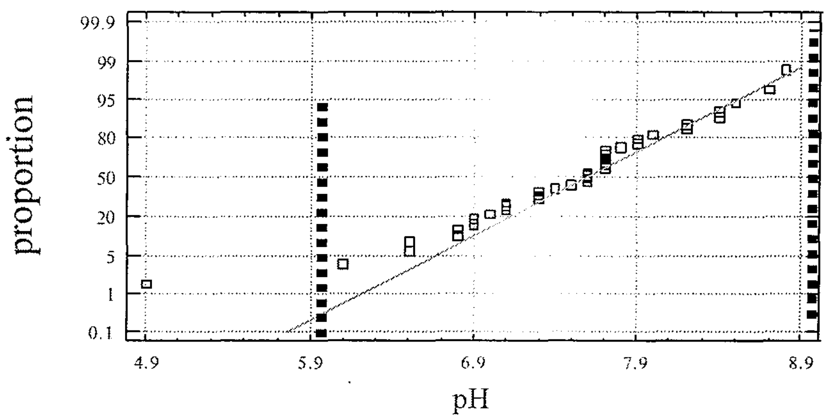


MWRD 95



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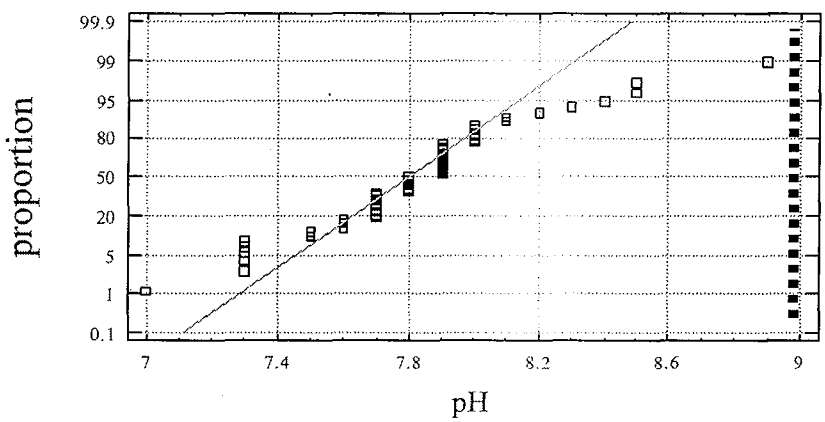
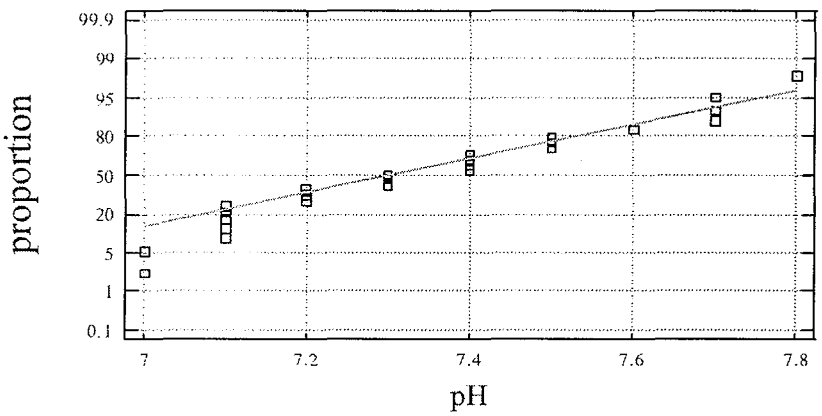


Romeoville (USGS)



Probability Plots for Phenol

Reference Site

Data not available

IEPA G-11

Data not available

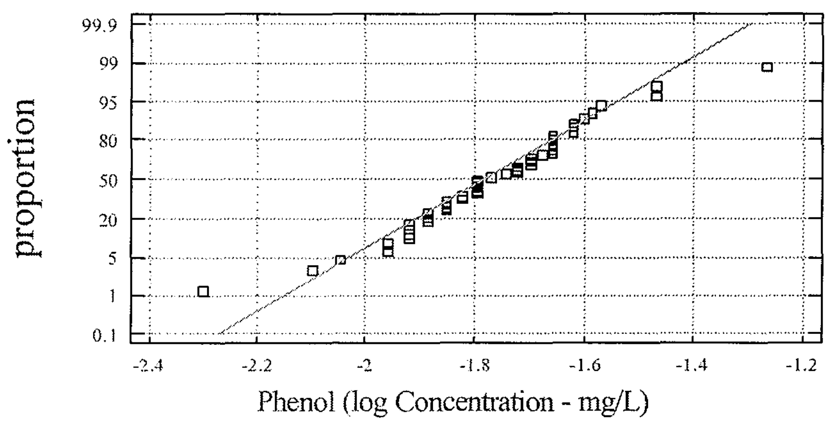
IEPA G-02

Data not available

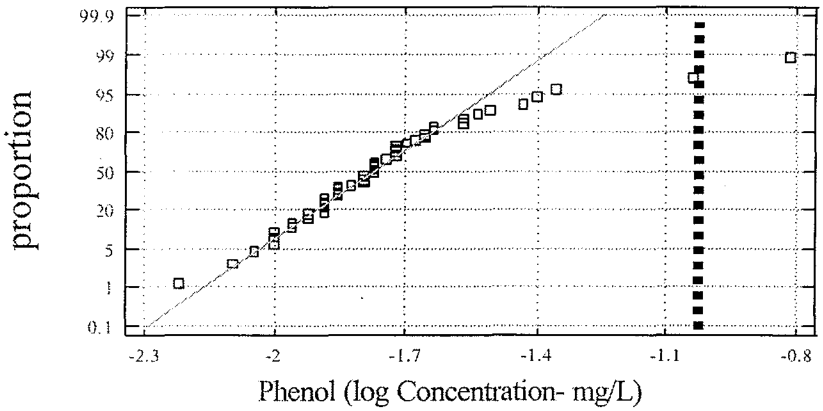
IEPA G-23

Data not available

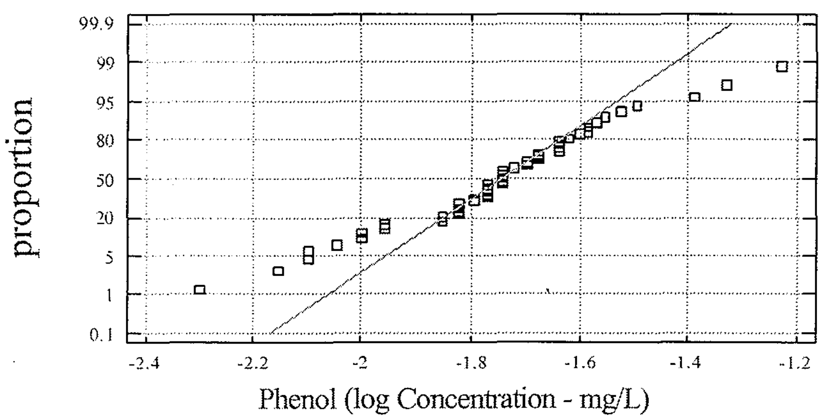
MWRD 91



MWRD 92



MWRD 93



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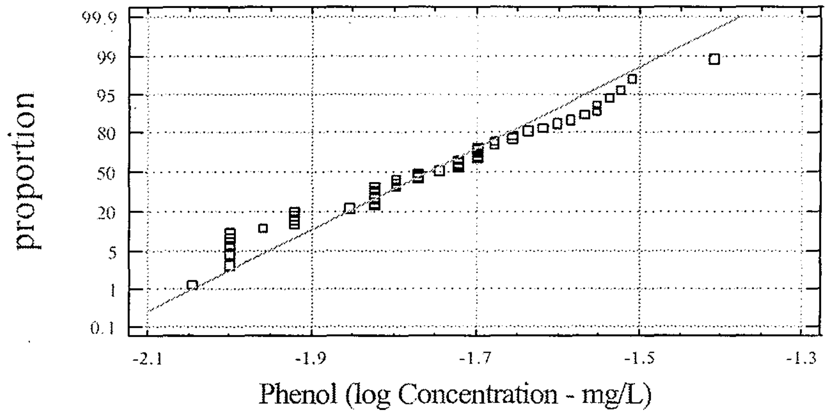

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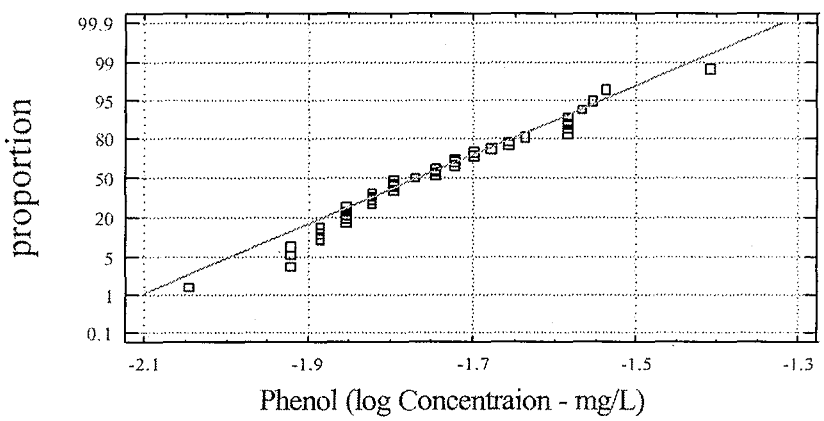


Riverside (USGS)

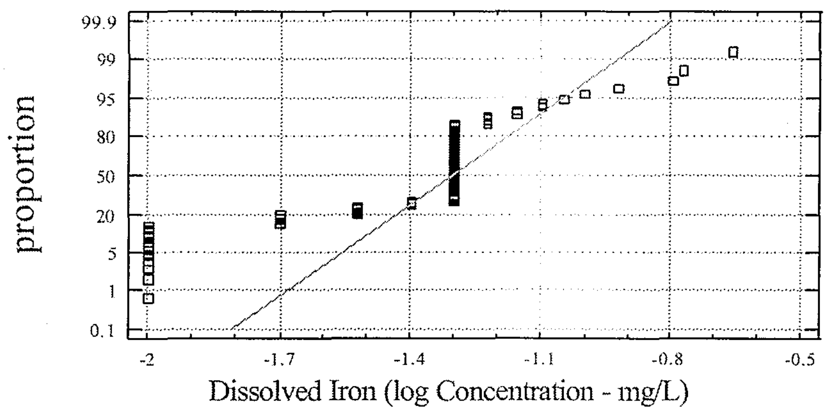
Data not available

Romeoville (USGS)

Data not available

Probability Plots for Dissolved Iron

Reference Site



IEPA G-11

Data Insufficient for probability plot. Within acceptable range.

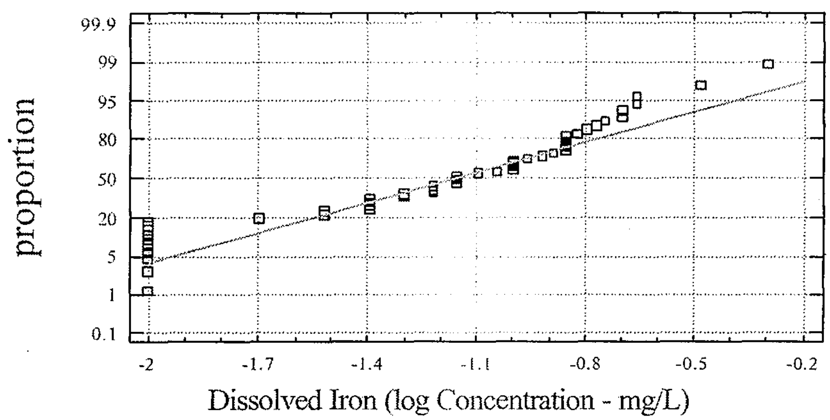
IEPA G-02

Data Insufficient for probability plot. Within acceptable range.

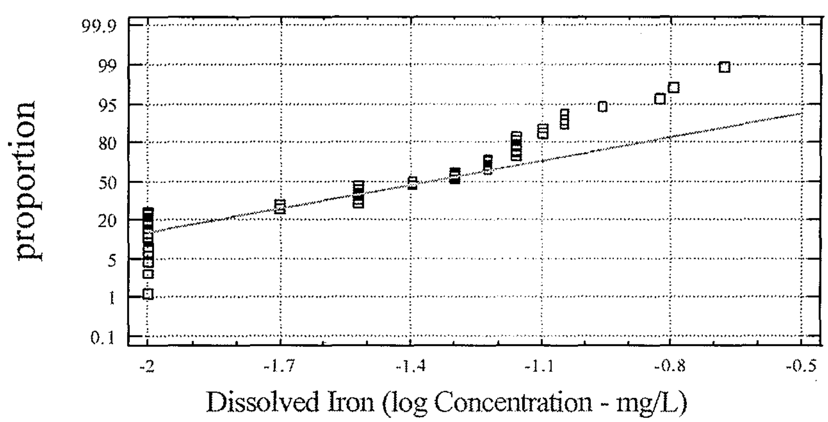
IEPA G-23

Data Insufficient for probability plot. Within acceptable range.

MWRD 91



MWRD 92



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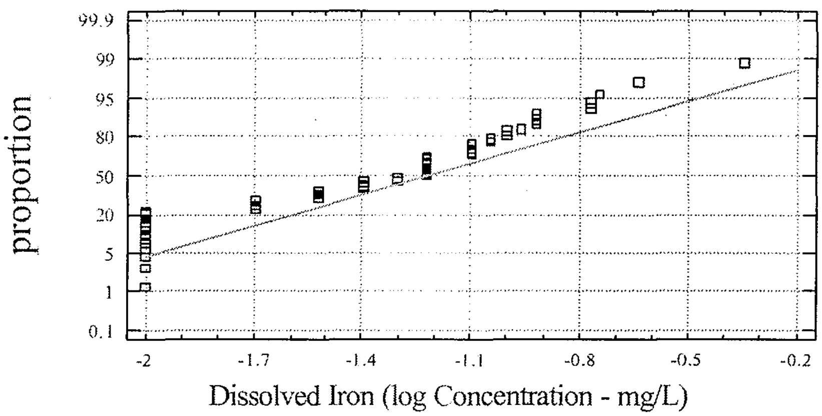

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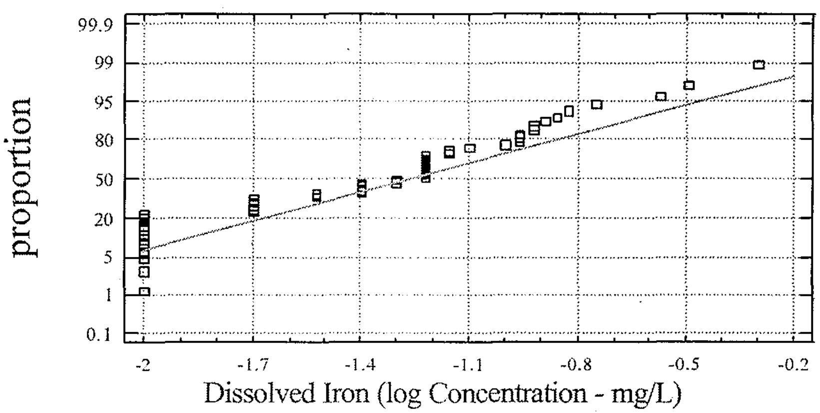
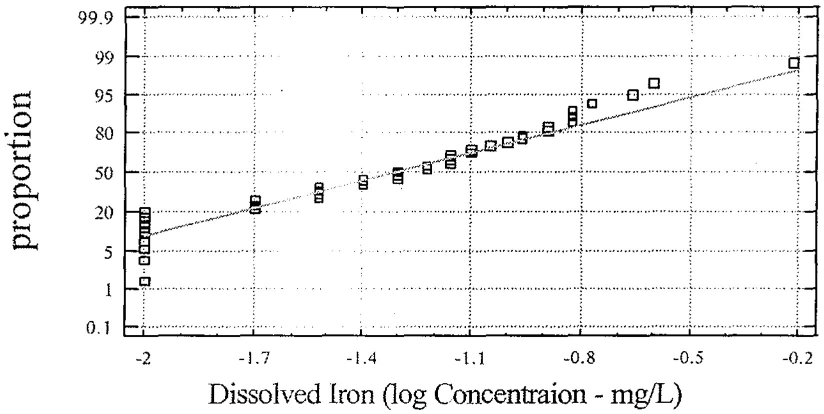
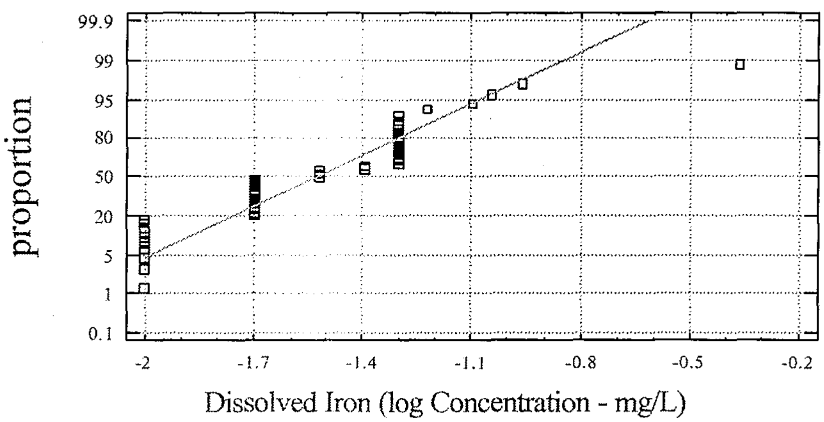
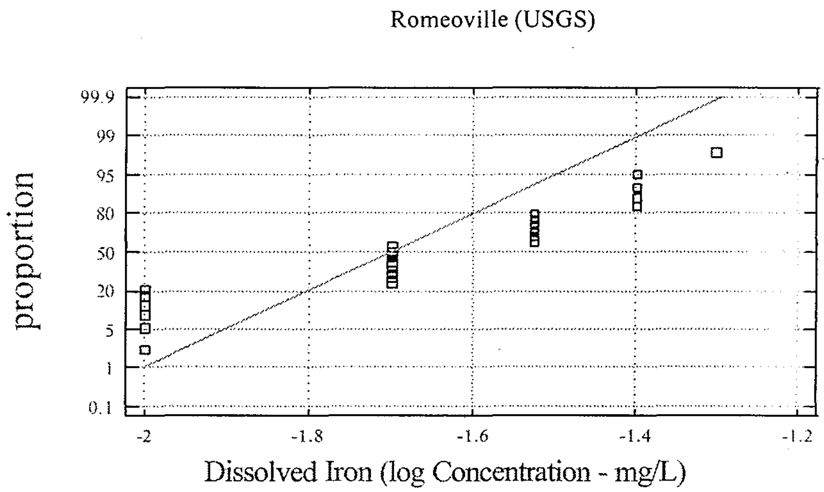


MWRD 95



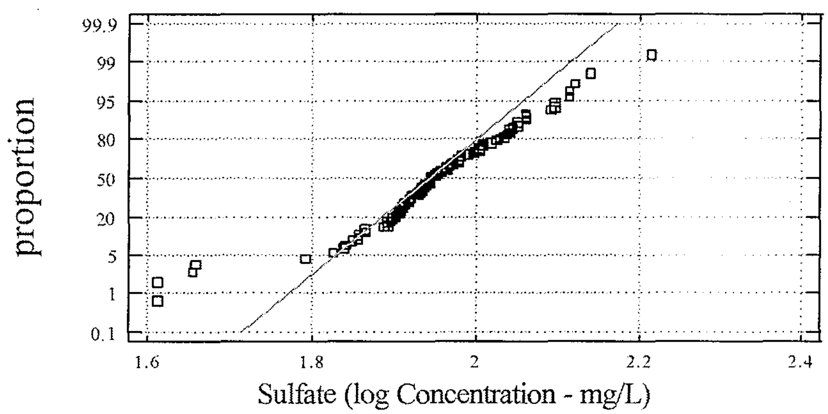
Riverside (USGS)



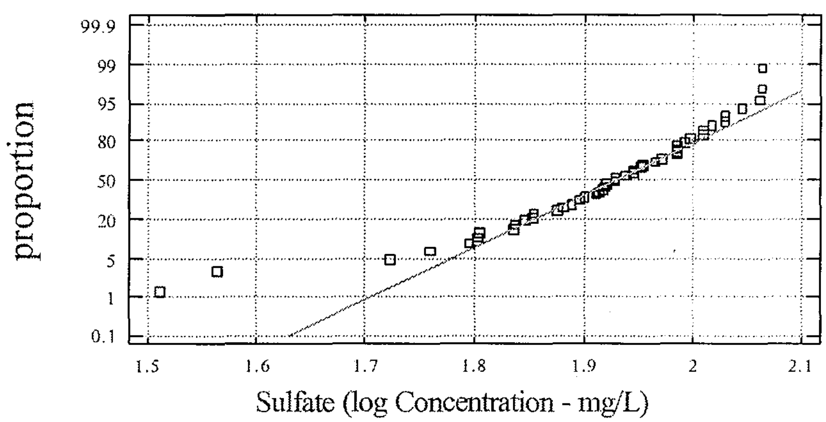

Romeoville (USGS)
proportion
99.9
99
95
80
50
20
5
1
0.1
-2
-1.8
-1.6
-1.4
-1.2
Dissolved Iron (log Concentration - mg/L)

Probability Plots for Sulfate

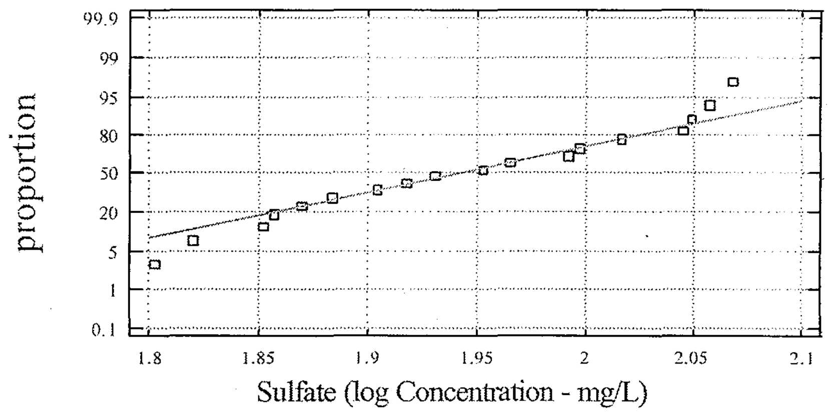
Reference Site



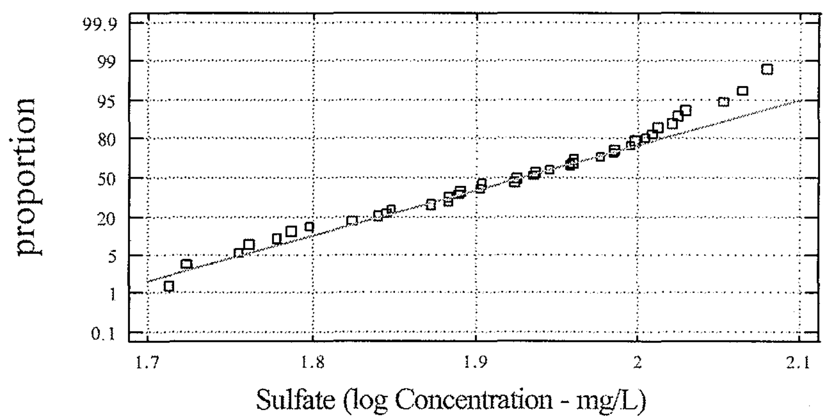
IEPA G-11



IEPA G-02



IEPA G-23



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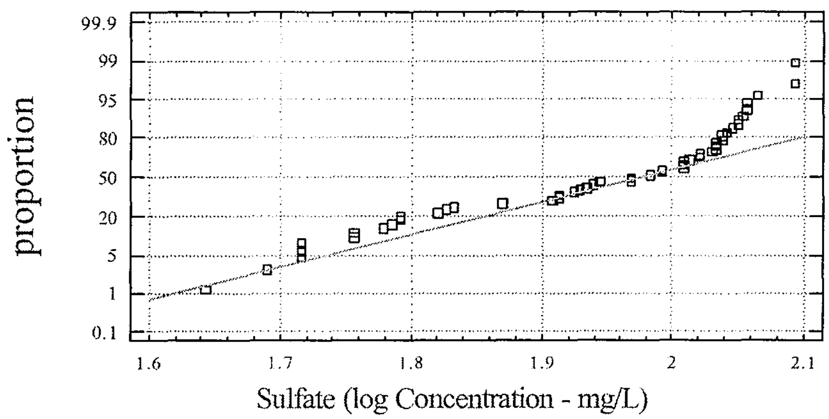

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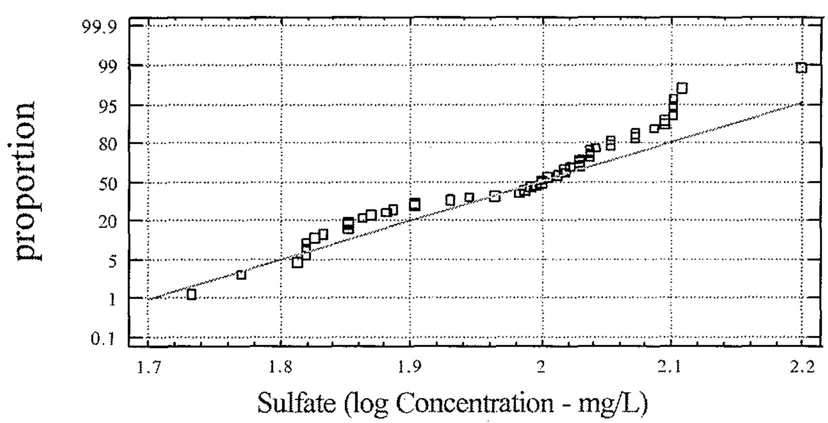

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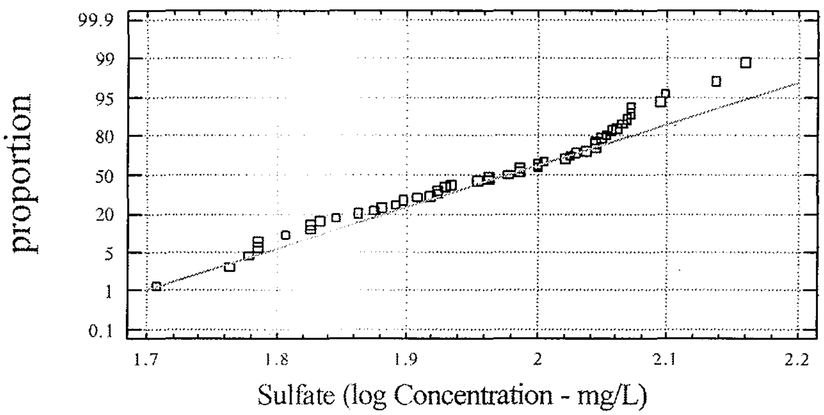

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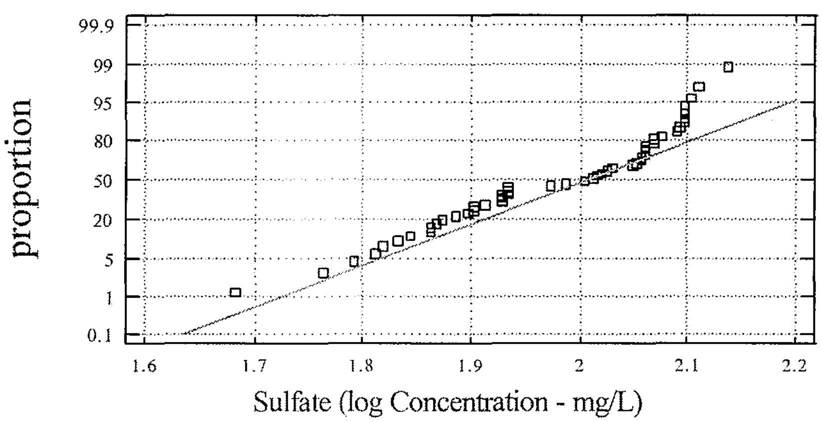
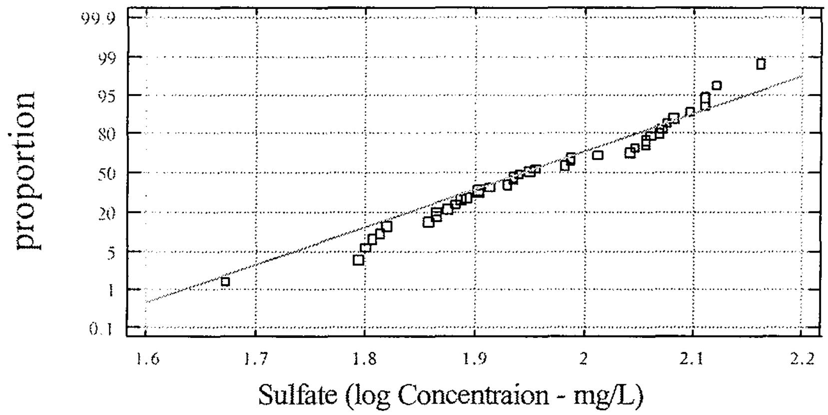
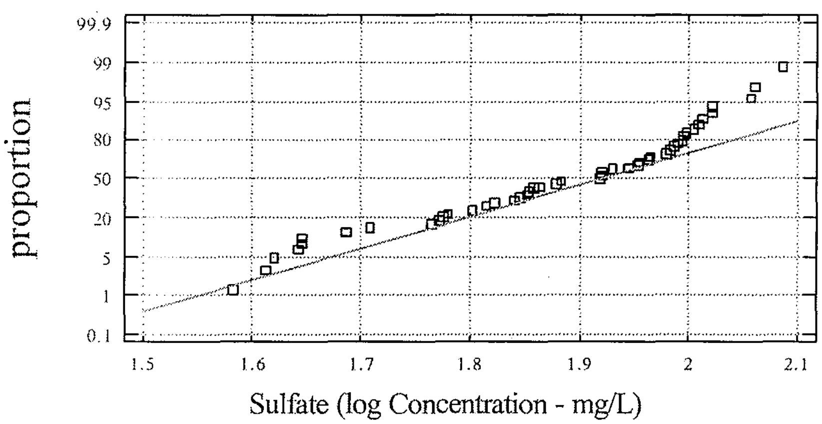


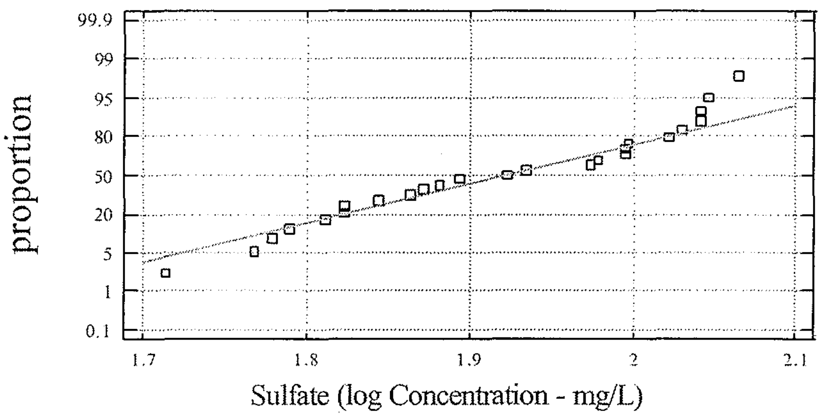
MWRD 95



Riverside (USGS)

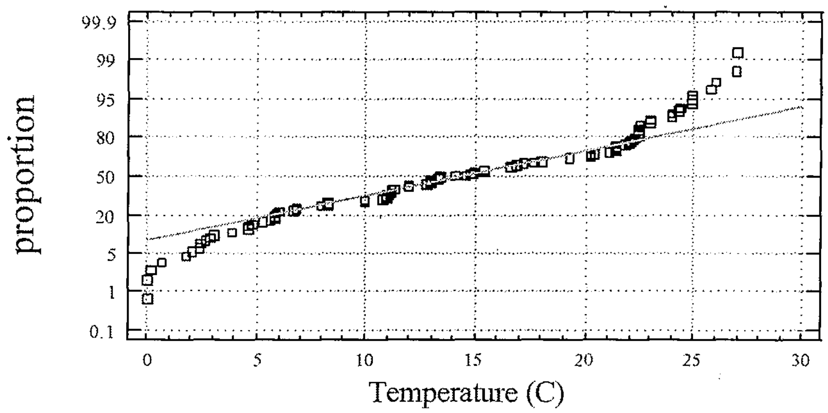


Romeoville (USGS)

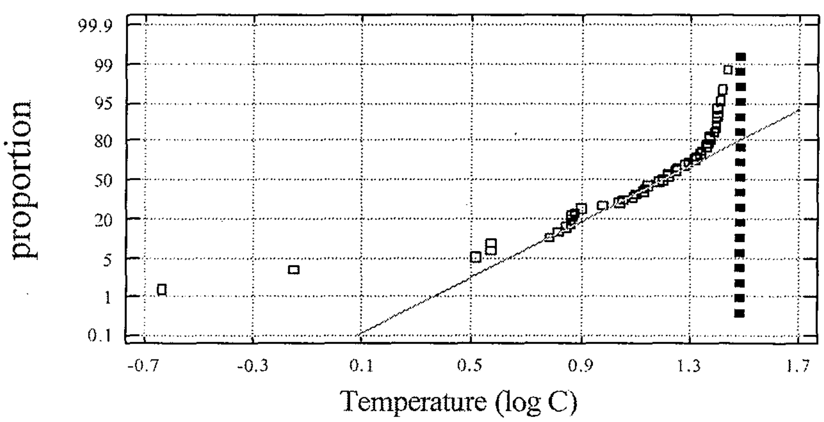


Probability Plots for Temperature

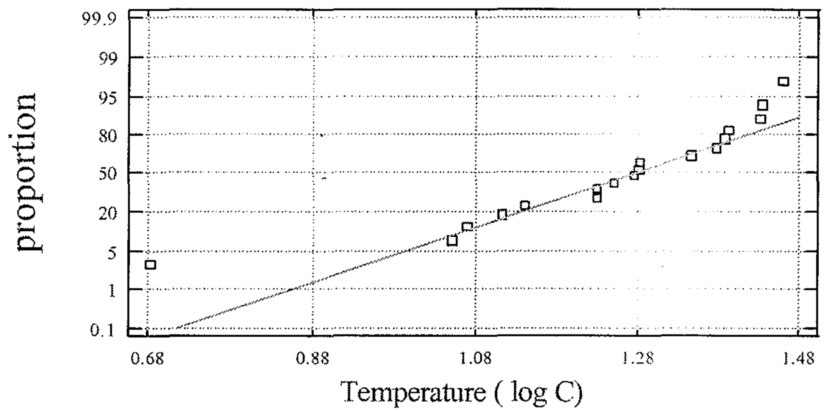
Reference Site



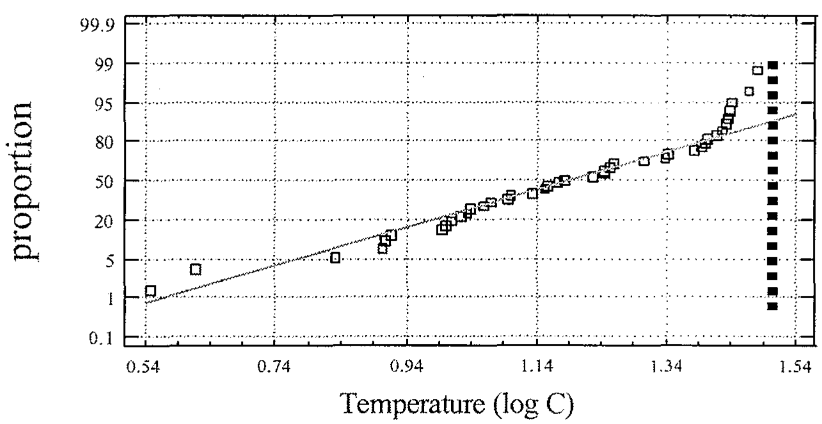
IEPA G-11



IEPA G-02



IEPA G-23



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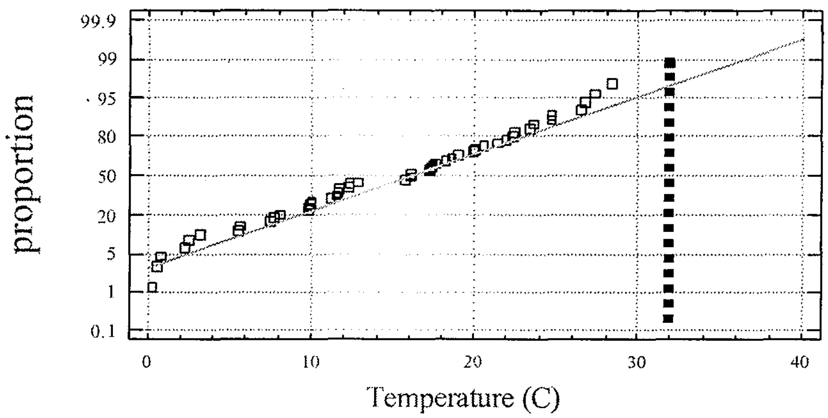

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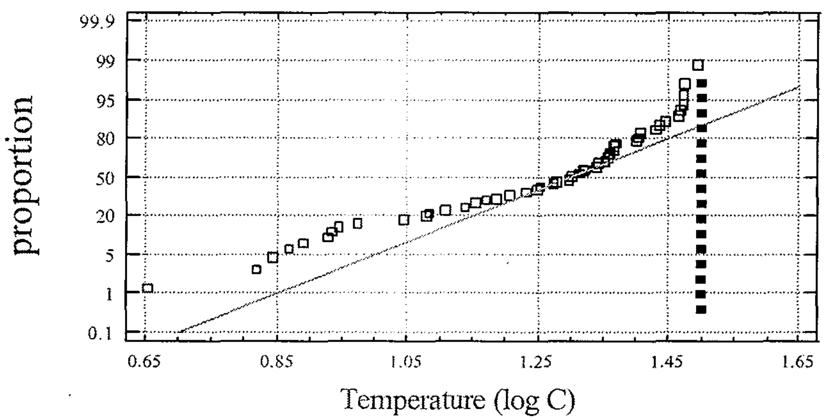

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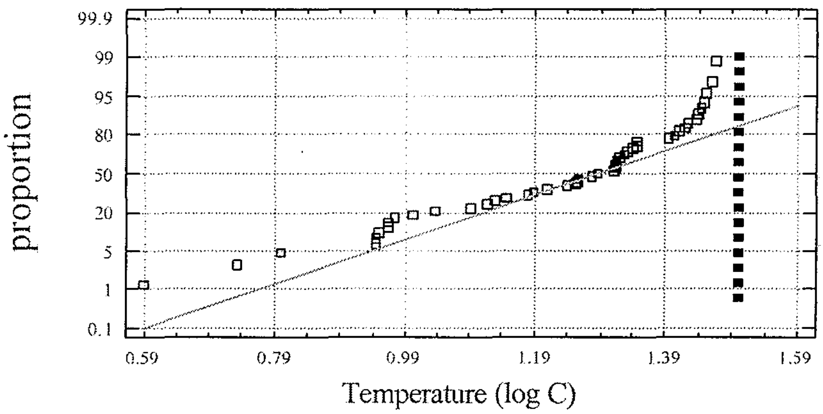

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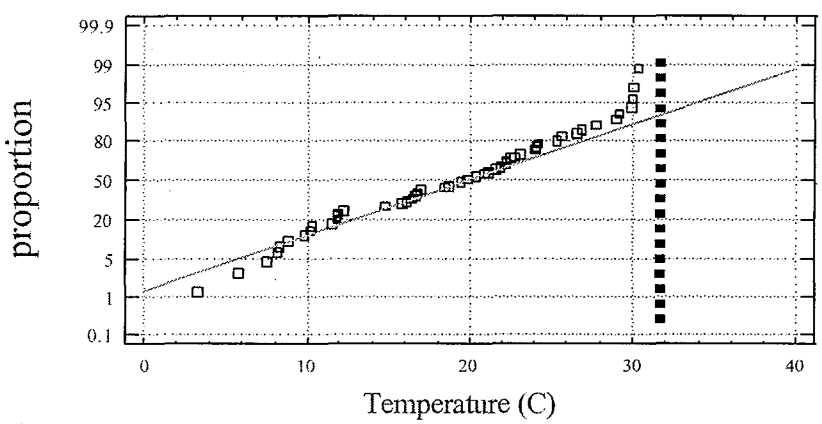
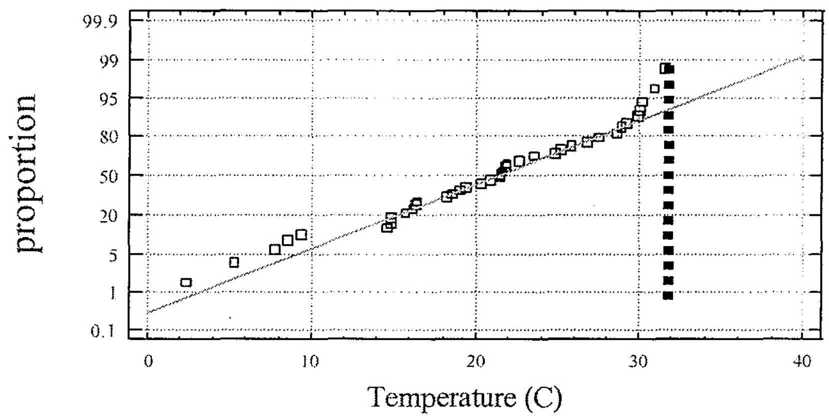
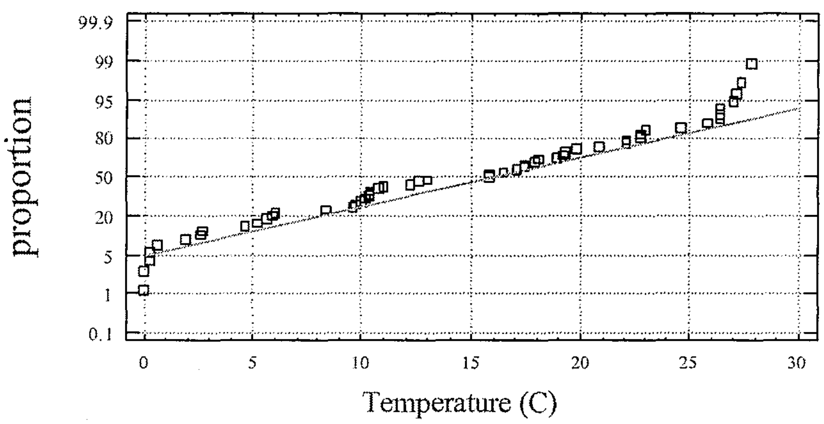


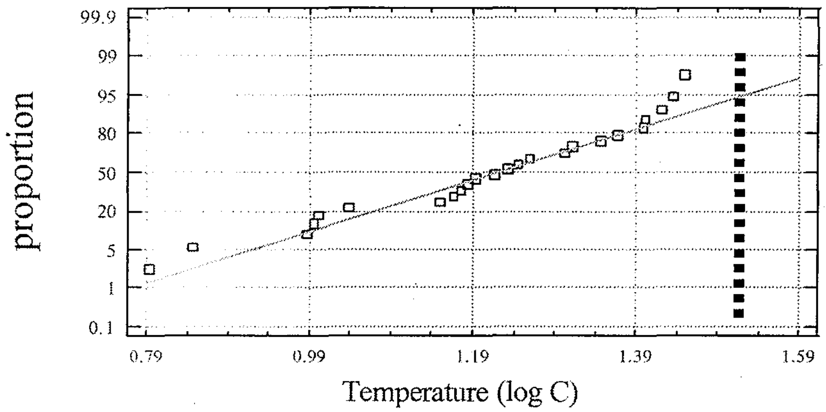
MWRD 95



Riverside (USGS)

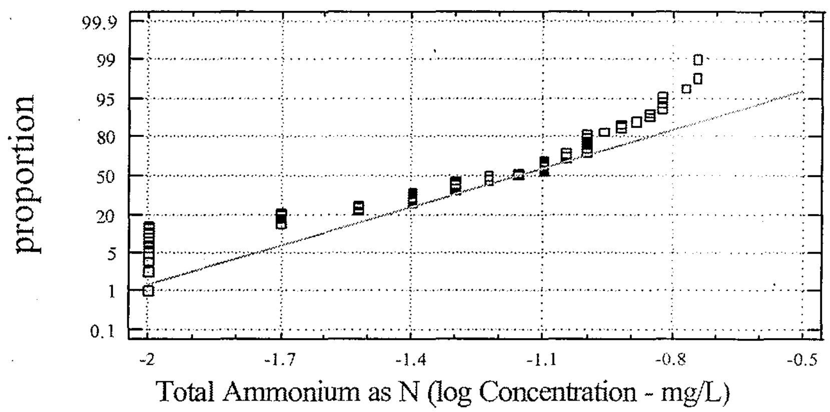


Romeoville (USGS)

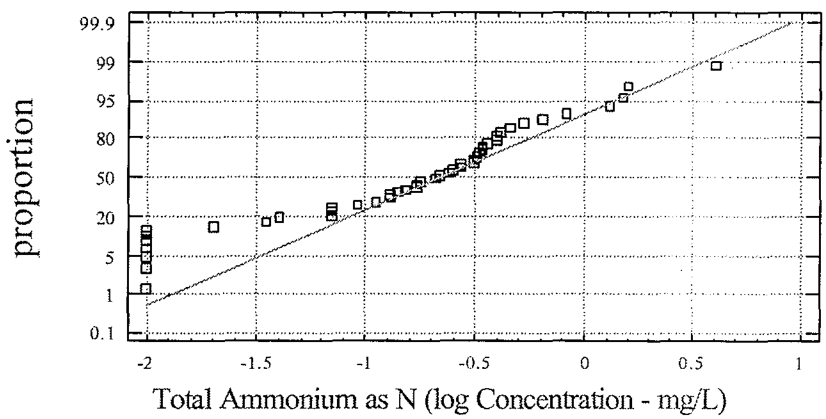


Probability Plots for Total Ammonium as Nitrogen

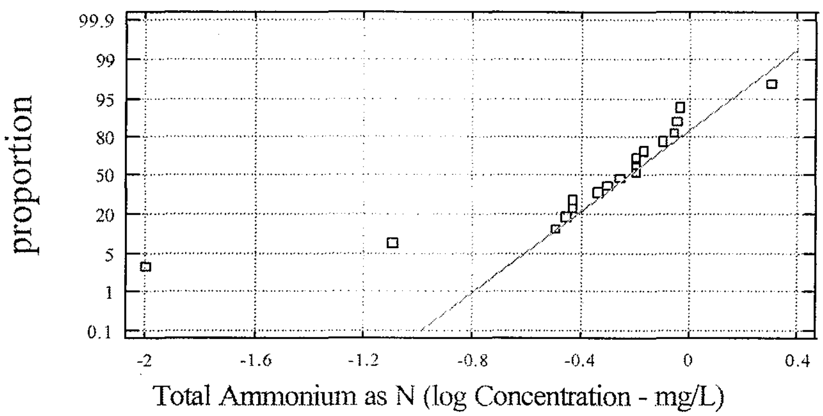
Reference Site



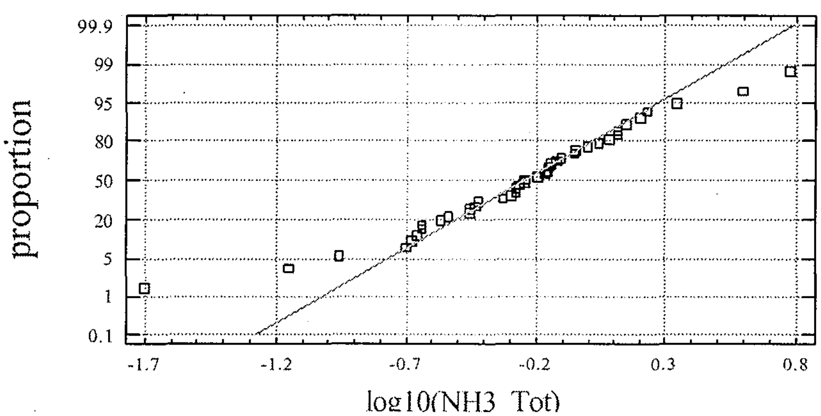
IEPA G-11



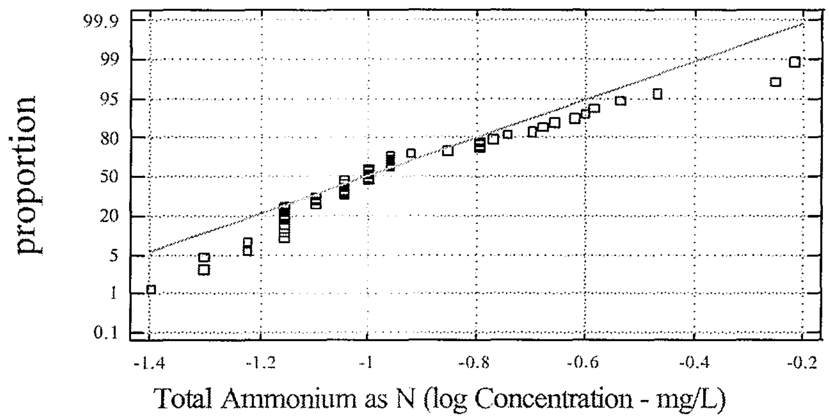
IEPA G-02



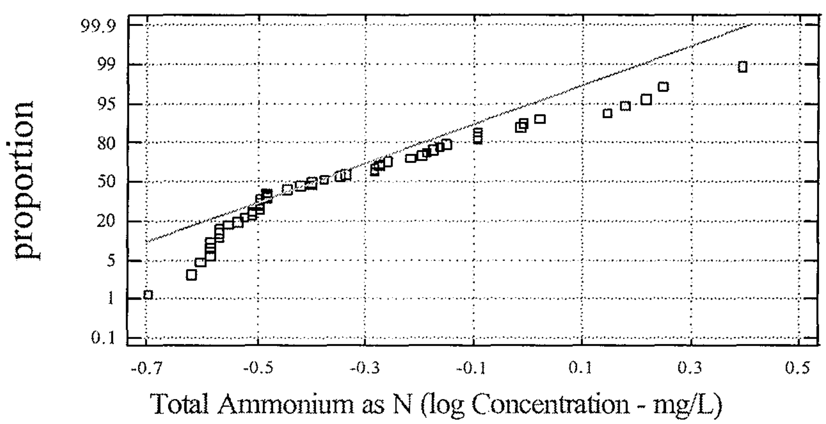
IEPA G-23



MWRD 91



MWRD 92



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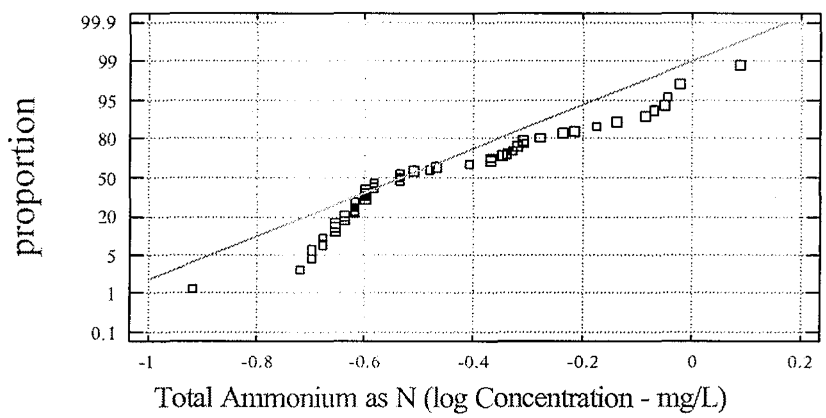
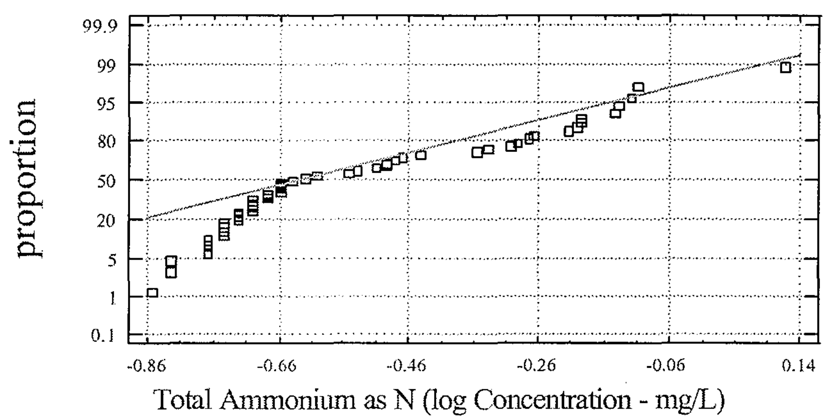
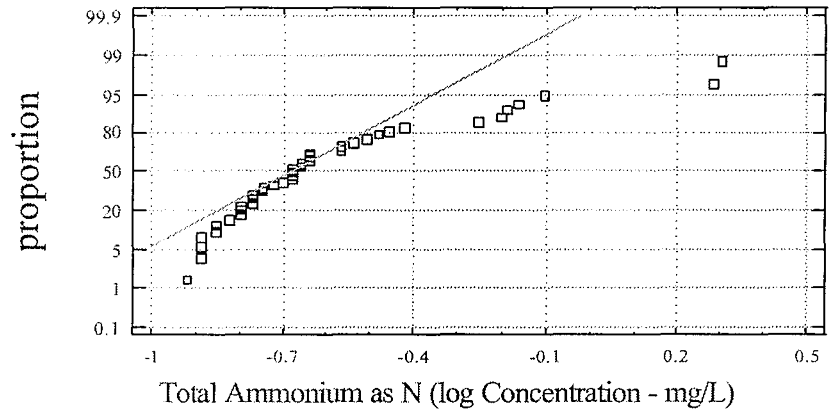


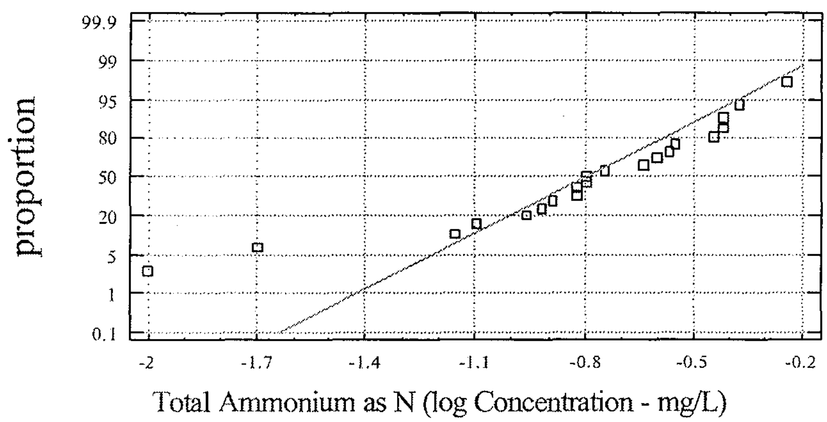
MWRD 94



MWRD 95



Riverside (USGS)

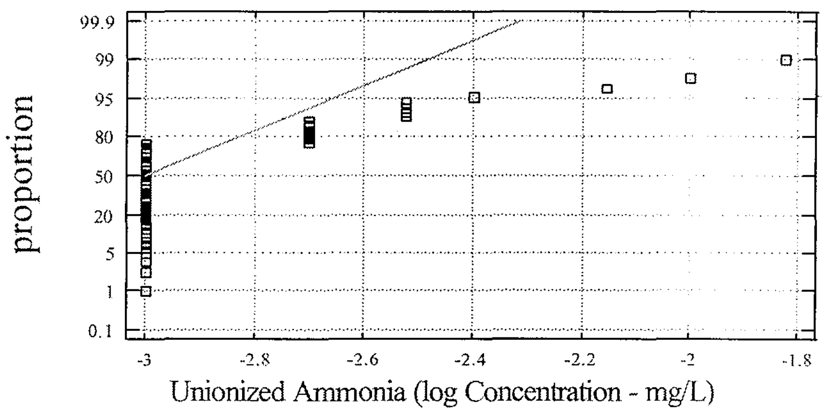


Romeoville (USGS)

Data not available

Probability Plots for Unionized Ammonia

Reference Site



IEPA G-11

Data not available

IEPA G-02

Data not available

IEPA G-23

Data not available

MWRD 91

Data not available

MWRD 92

Data not available

MWRD 93

Data not available

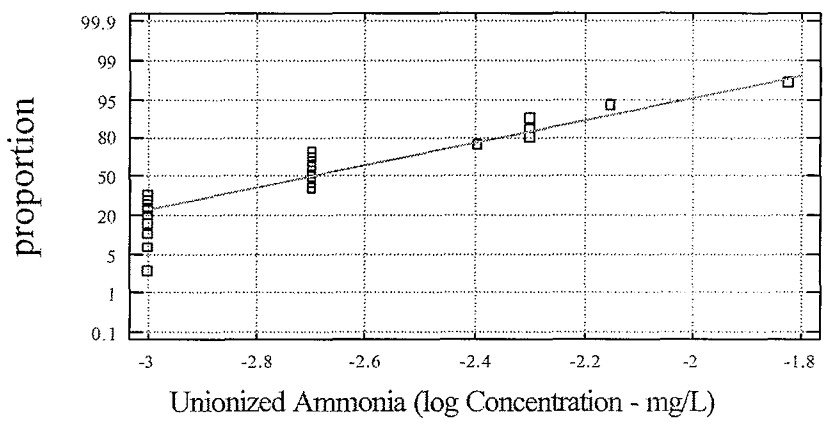
MWRD 94

Data not available

MWRD 95

Data not available

Riverside (USGS)



Romeoville (USGS)

Data not available

Probability Plots for Cyanide(Weak Acid Dissociable)

Reference Site

Data not available

IEPA G-11

Data not available

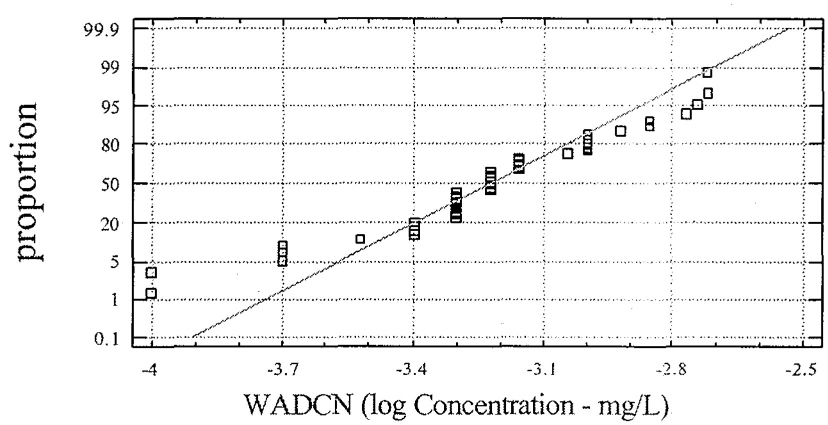
IEPA G-02

Data not available

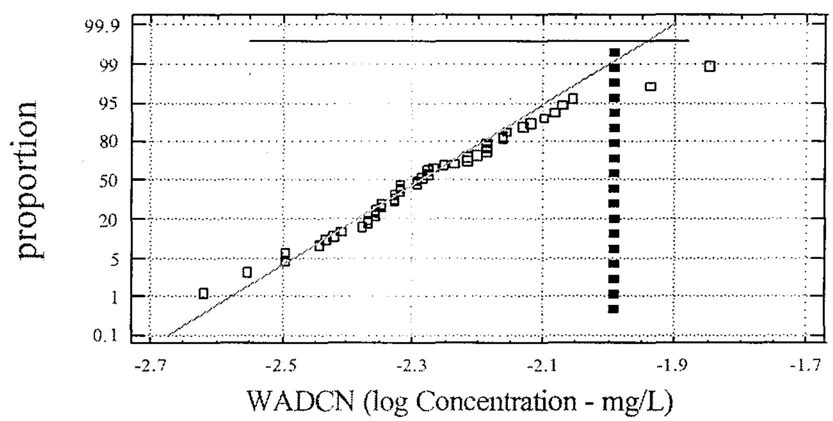
IEPA G-23

Data not available

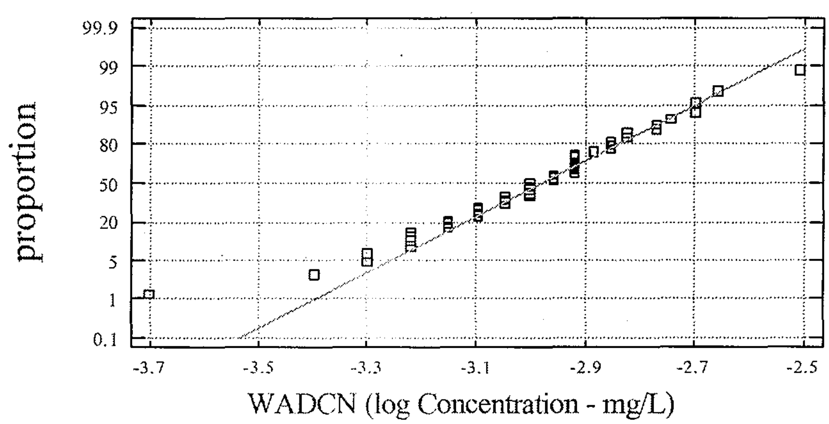
MWRD 91



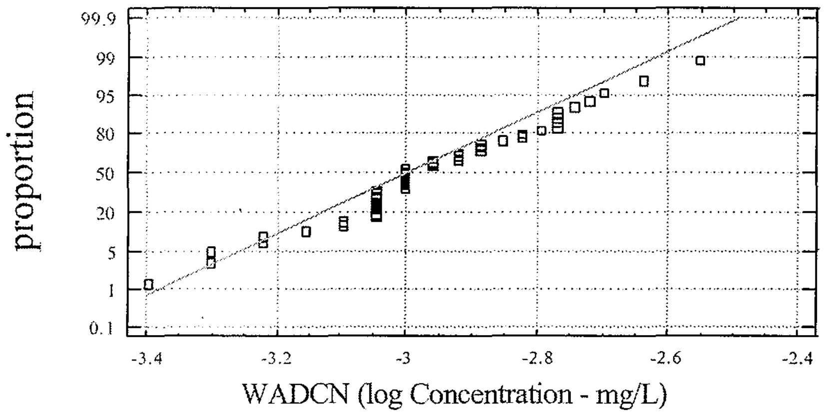
MWRD 92



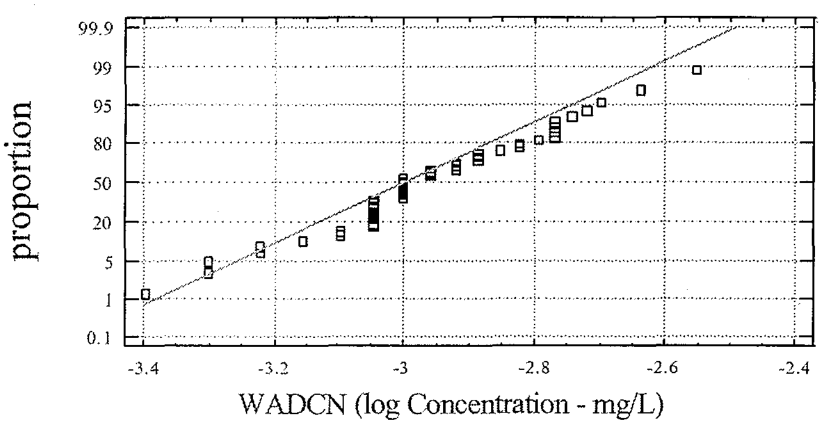
MWRD 93



MWRD 94



MWRD 95



Riverside (USGS)

Data not available

Romeoville (USGS)

Data not available

<u>**Probability Plots for Dissolved Zinc**</u>

Reference Site

Data not available

IEPA G-11

Data not available

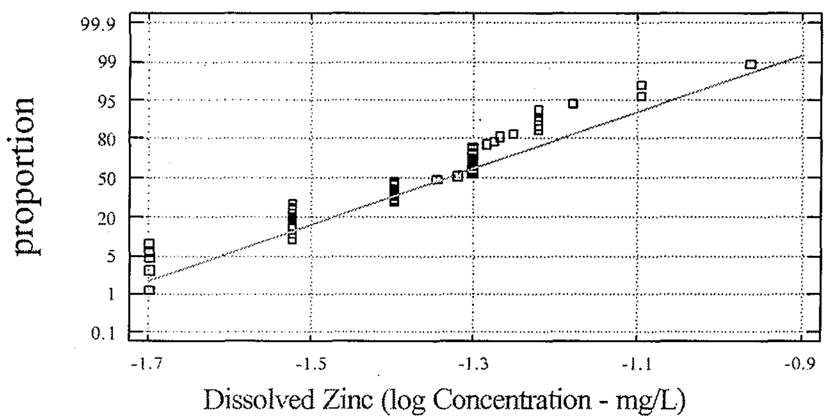
IEPA G-02

Data not available

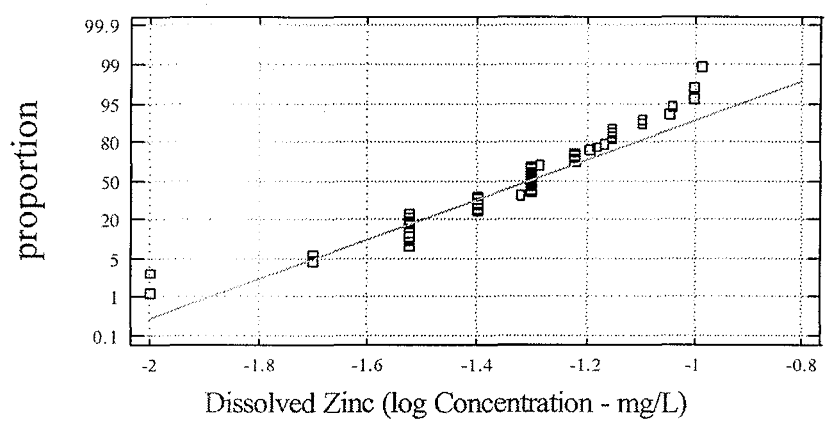
IEPA G-23

Data not available

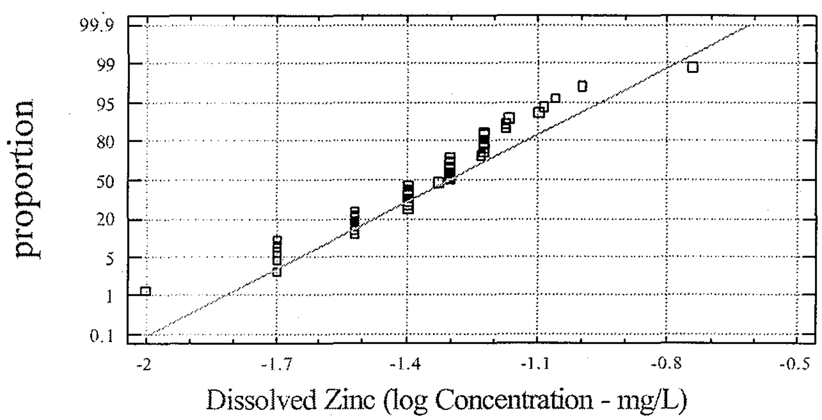
MWRD 91



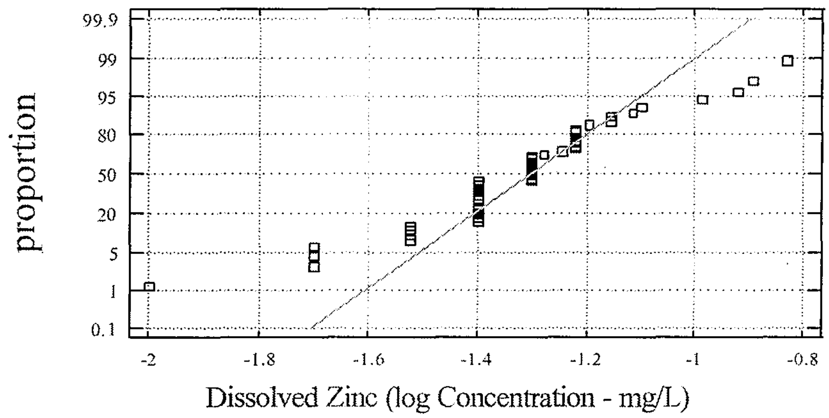
MWRD 92



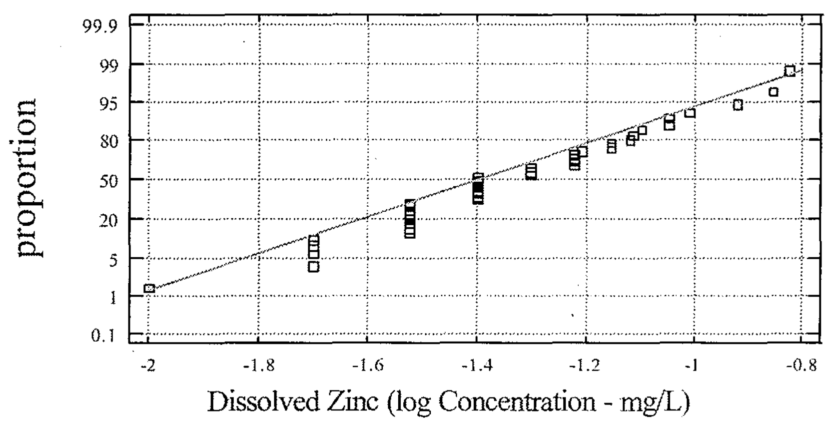
MWRD 93



MWRD 94



MWRD 95



Riverside (USGS)

Data not available

Romeoville (USGS)

Data not available

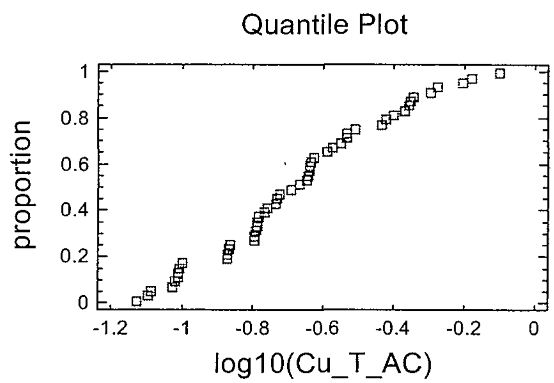
Appendix C

Copper Analysis

One-Variable Analysis - log10(Cu_T_AC) (site=91)

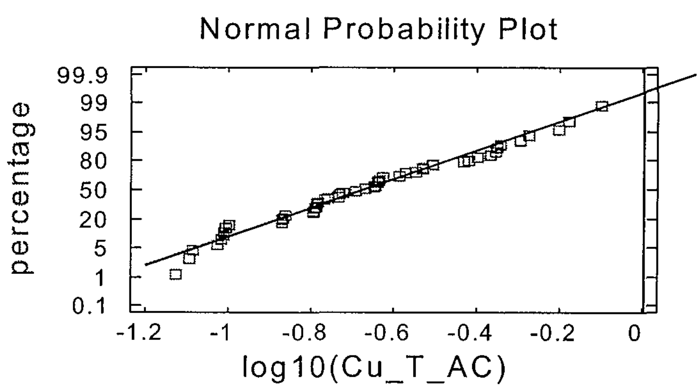
Summary Statistics for log10(Cu_T_AC)

Count = 50
Average = -0.670479
Median = -0.67904
Variance = 0.0678061
Standard deviation = 0.260396
Maximum = -0.0998848



Percentiles for log10(Cu_T_AC)

1.0% = -1.12718
5.0% = -1.0896
10.0% = -1.01673
25.0% = -0.863645
50.0% = -0.67904
75.0% = -0.508458
90.0% = -0.319945
95.0% = -0.20302
99.0% = -0.0998848

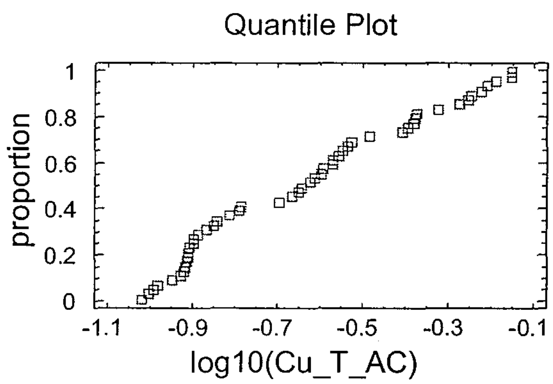


+

One-Variable Analysis - log10(Cu_T_AC) (site=92)

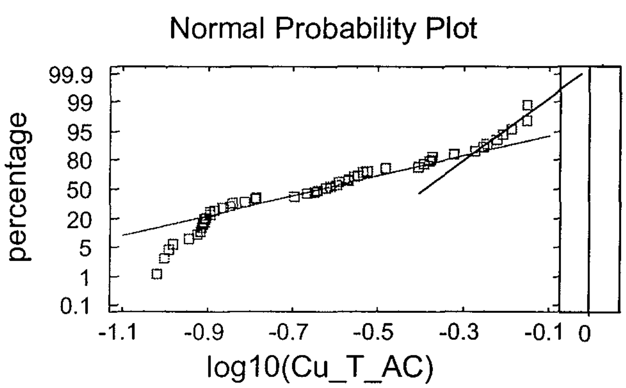
Summary Statistics for log10(Cu_T_AC)

Count = 50
Average = -0.636359
Median = -0.633752
Variance = 0.0719213
Standard deviation = 0.268181
Maximum = -0.15168



Percentiles for log10(Cu_T_AC)

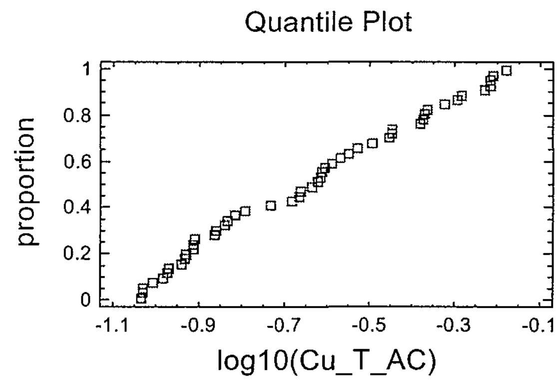
1.0% = -1.02097
5.0% = -0.993685
10.0% = -0.936255
25.0% = -0.898073
50.0% = -0.633752
75.0% = -0.392853
90.0% = -0.235687
95.0% = -0.191161
99.0% = -0.15168



One-Variable Analysis - log10(Cu T AC) (site=93)

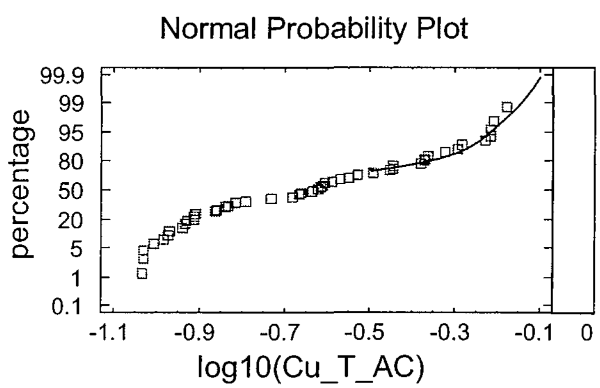
Summary Statistics for log10(Cu_T_AC)

Count = 48
Average = -0.644268
Median = -0.630148
Variance = 0.0717919
Standard deviation = 0.26794
Maximum = -0.179057



Percentiles for log10(Cu_T_AC)

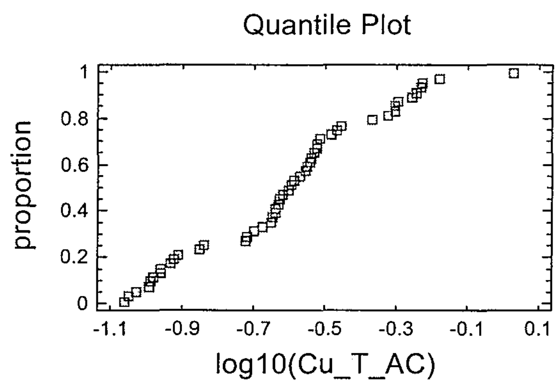
1.0% = -1.03208
5.0% = -1.02915
10.0% = -0.9823
25.0% = -0.910682
50.0% = -0.630148
75.0% = -0.412966
90.0% = -0.231084
95.0% = -0.215847
99.0% = -0.179057



One-Variable Analysis - log10(Cu T AC) (site=94)

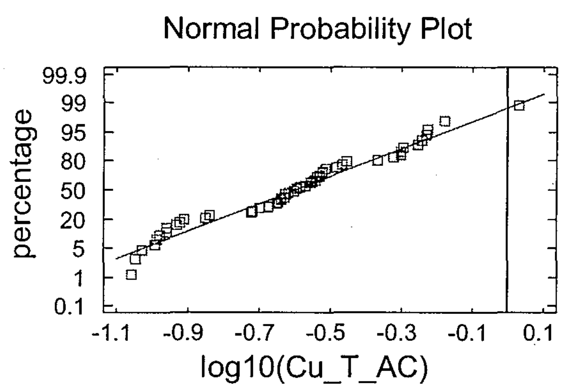
Summary Statistics for log10(Cu_T_AC)

Count = 50
Average = -0.610251
Median = -0.599325
Variance = 0.0686361
Standard deviation = 0.261985
Maximum = 0.0291739



Percentiles for log10(Cu_T_AC)

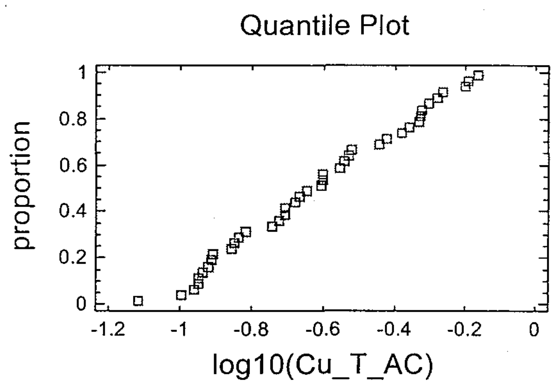
1.0% = -1.05965
5.0% = -1.02846
10.0% = -0.98381
25.0% = -0.838133
50.0% = -0.599325
75.0% = -0.469388
90.0% = -0.249219
95.0% = -0.229886
99.0% = 0.0291739



One-Variable Analysis - log10(Cu_T_AC) (site=95)

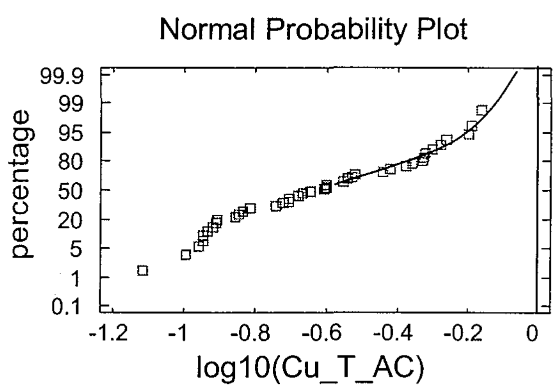
Summary Statistics for log10(Cu_T_AC)

Count = 40
Average = -0.621178
Median = -0.629625
Variance = 0.0691333
Standard deviation = 0.262932
Maximum = -0.162834



Percentiles for log10(Cu_T_AC)

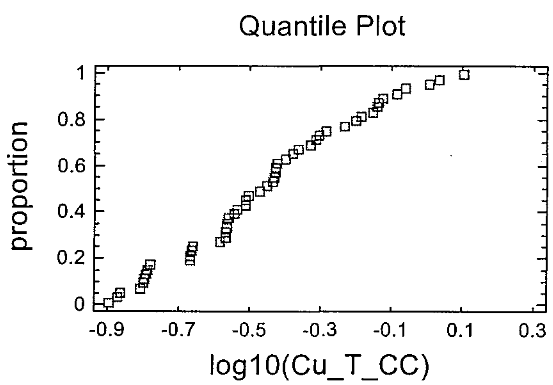
1.0% = -1.11483
5.0% = -0.976653
10.0% = -0.947736
25.0% = -0.850172
50.0% = -0.629625
75.0% = -0.370136
90.0% = -0.273706
95.0% = -0.196403
99.0% = -0.162834



One-Variable Analysis - log10(Cu_T_CC) (site=91)

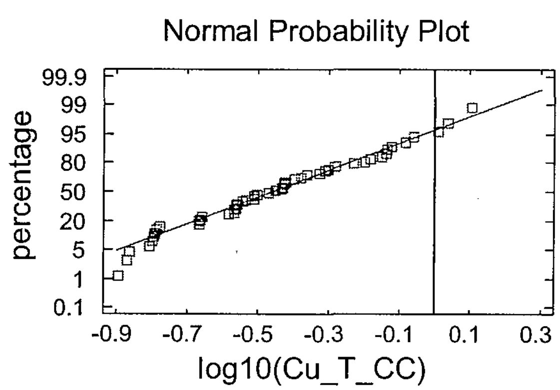
Summary Statistics for log10(Cu_T_CC)

Count = 50
Average = -0.453427
Median = -0.46314
Variance = 0.0664622
Standard deviation = 0.257803
Maximum = 0.102259



Percentiles for log10(Cu_T_CC)

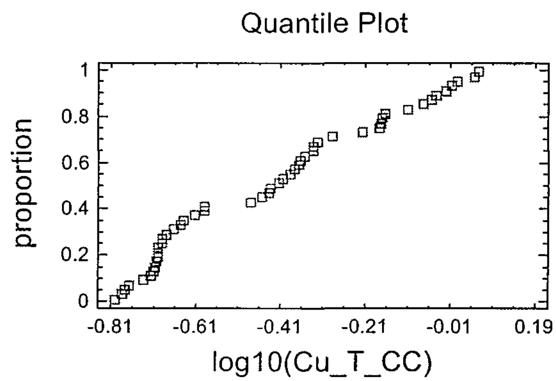
1.0% = -0.897587
5.0% = -0.863502
10.0% = -0.79742
25.0% = -0.658581
50.0% = -0.46314
75.0% = -0.284675
90.0% = -0.104698
95.0% = 0.00719819
99.0% = 0.102259



One-Variable Analysis - log10(Cu T CC) (site=92)

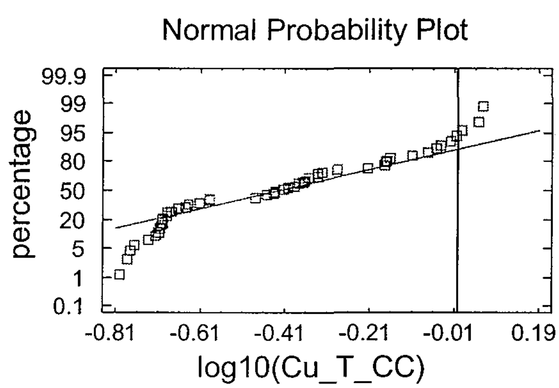
Summary Statistics for log10(Cu_T_CC)

Count = 50
Average = -0.428839
Median = -0.422067
Variance = 0.0705013
Standard deviation = 0.265521
Maximum = 0.0552847



Percentiles for log10(Cu_T_CC)

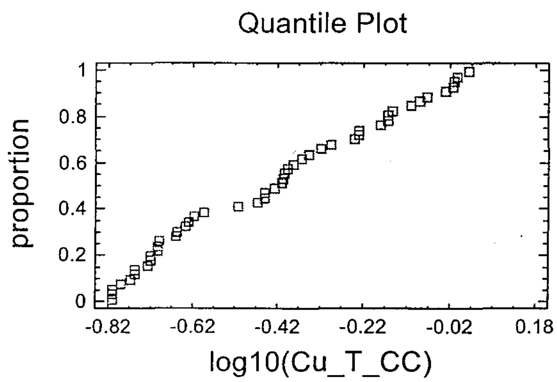
1.0% = -0.801262
5.0% = -0.776518
10.0% = -0.724433
25.0% = -0.689805
50.0% = -0.422067
75.0% = -0.177644
90.0% = -0.0311076
95.0% = 0.00734718
99.0% = 0.0552847



One-Variable Analysis - log10(Cu_T_CC) (site=93)

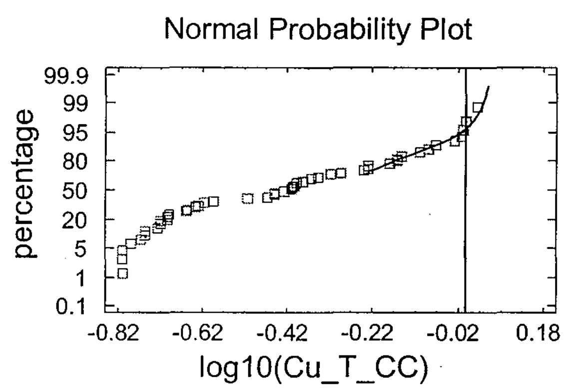
Summary Statistics for log10(Cu_T_CC)

Count = 48
Average = -0.434513
Median = -0.418799
Variance = 0.0704534
Standard deviation = 0.265431
Maximum = 0.0239742



Percentiles for log10(Cu_T_CC)

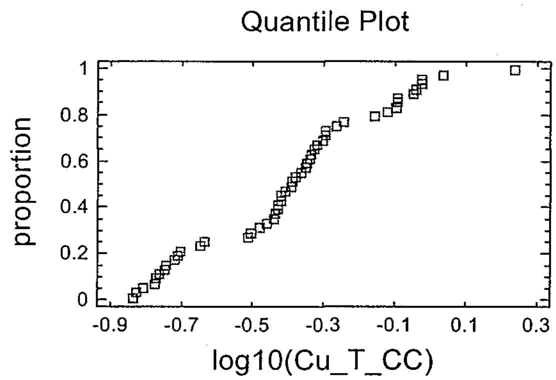
1.0% = -0.811343
5.0% = -0.808683
10.0% = -0.766193
25.0% = -0.70124
50.0% = -0.418799
75.0% = -0.203974
90.0% = -0.0288596
95.0% = -0.0112233
99.0% = 0.0239742



One-Variable Analysis - log10(Cu_T_CC) (site=94)

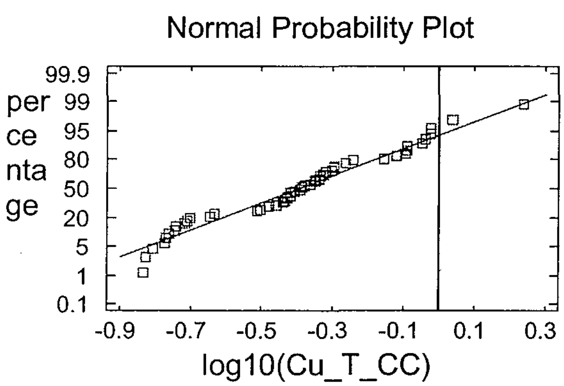
Summary Statistics for log10(Cu_T_CC)

Count = 50
Average = -0.400037
Median = -0.390844
Variance = 0.0670809
Standard deviation = 0.259
Maximum = 0.236192



Percentiles for log10(Cu_T_CC)

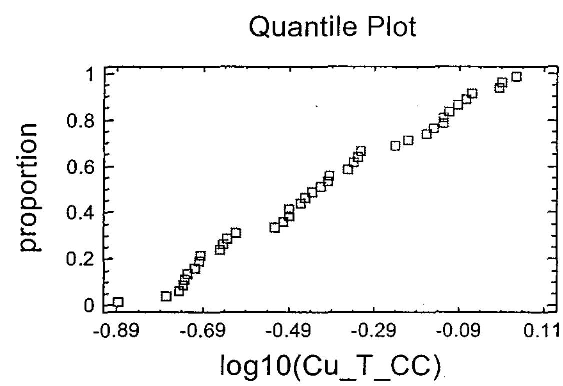
1.0% = -0.836343
5.0% = -0.808053
10.0% = -0.767562
25.0% = -0.635444
50.0% = -0.390844
75.0% = -0.265632
90.0% = -0.0443201
95.0% = -0.0226786
99.0% = 0.236192



One-Variable Analysis - log10(Cu_T_CC) (site=95)

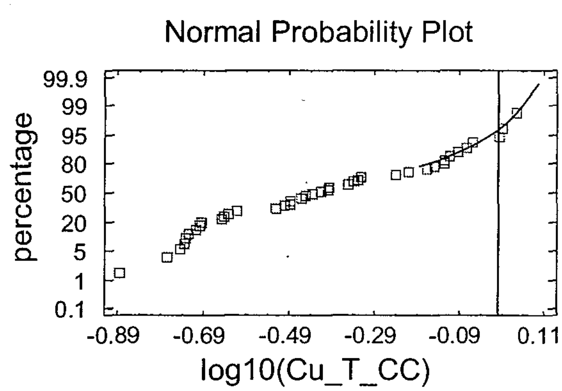
Summary Statistics for log10(Cu_T_CC)

Count = 40
Average = -0.411728
Median = -0.425915
Variance = 0.0677506
Standard deviation = 0.260289
Maximum = 0.0436439



Percentiles for log10(Cu_T_CC)

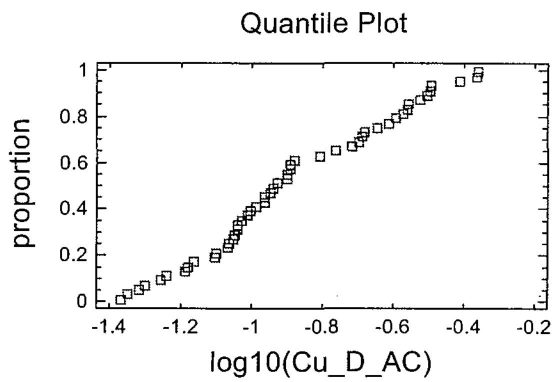
1.0% = -0.886389
5.0% = -0.76107
10.0% = -0.734846
25.0% = -0.646363
50.0% = -0.425915
75.0% = -0.158253
90.0% = -0.0655416
95.0% = 0.00644575
99.0% = 0.0436439



One-Variable Analysis - log10(Cu D AC) (site=91)

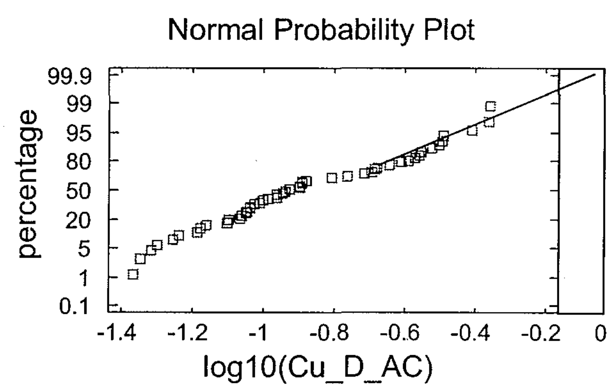
Summary Statistics for log10(Cu_D_AC)

Count = 50
Average = -0.882939
Median = -0.933974
Variance = 0.0759142
Standard deviation = 0.275525
Maximum = -0.358948



Percentiles for log10(Cu_D_AC)

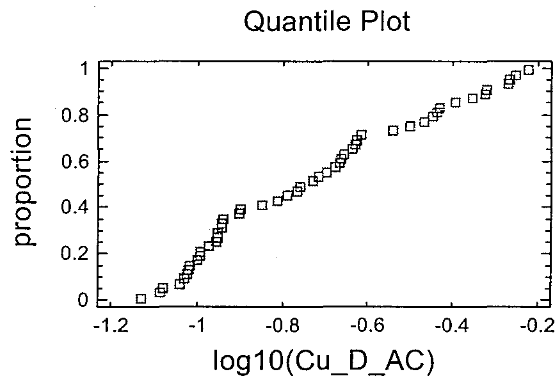
1.0% = -1.36948
5.0% = -1.3152
10.0% = -1.24662
25.0% = -1.06452
50.0% = -0.933974
75.0% = -0.643328
90.0% = -0.498526
95.0% = -0.41219
99.0% = -0.358948



One-Variable Analysis - log10(Cu D AC) (site=92)

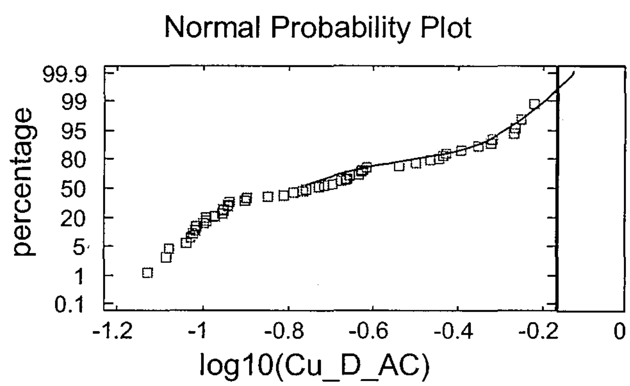
Summary Statistics for log10(Cu_D_AC)

Count = 50
Average = -0.727801
Median = -0.744983
Variance = 0.0707261
Standard deviation = 0.265944
Maximum = -0.223018



Percentiles for log10(Cu_D_AC)

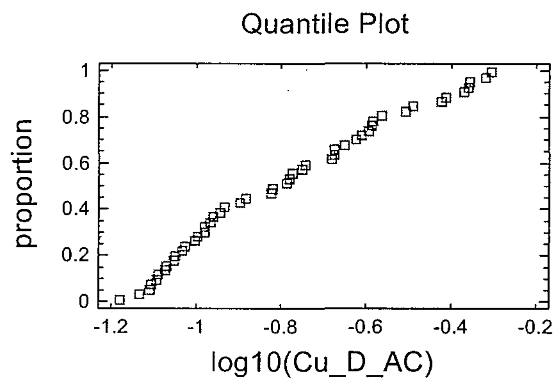
1.0% = -1.12993
5.0% = -1.08004
10.0% = -1.02626
25.0% = -0.958256
50.0% = -0.744983
75.0% = -0.499287
90.0% = -0.321383
95.0% = -0.268074
99.0% = -0.223018



One-Variable Analysis - log10(Cu D AC) (site=93)

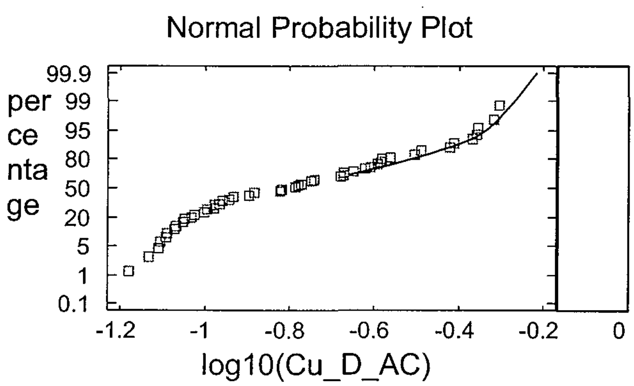
Summary Statistics for log10(Cu_D_AC)

Count = 48
Average = -0.788253
Median = -0.80423
Variance = 0.0659415
Standard deviation = 0.256791
Maximum = -0.306943



Percentiles for log10(Cu_D_AC)

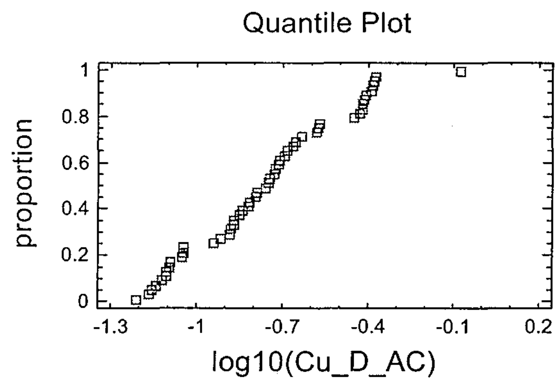
1.0% = -1.18096
5.0% = -1.11008
10.0% = -1.09204
25.0% = -1.01615
50.0% = -0.80423
75.0% = -0.589653
90.0% = -0.370461
95.0% = -0.357379
99.0% = -0.306943



One-Variable Analysis - log10(Cu D AC) (site=94)

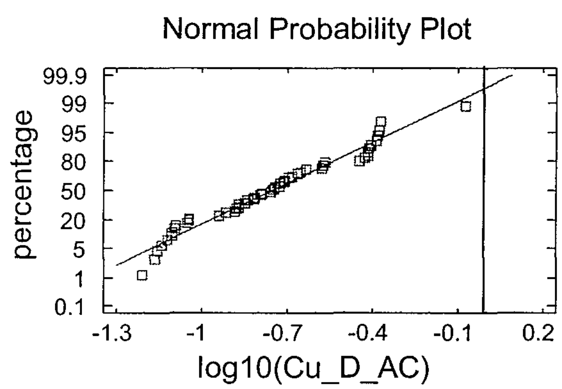
Summary Statistics for log10(Cu_D_AC)

Count = 50
Average = -0.758788
Median = -0.75577
Variance = 0.0716555
Standard deviation = 0.267686
Maximum = -0.0744833



Percentiles for log10(Cu_D_AC)

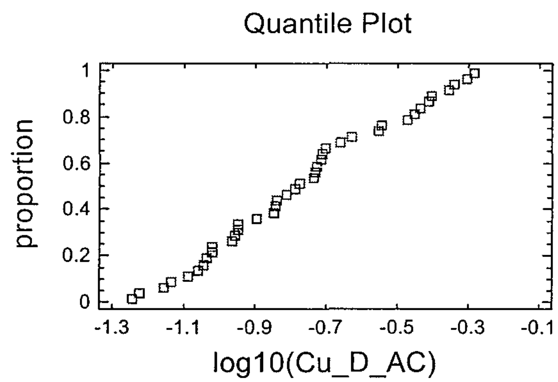
1.0% = -1.2102
5.0% = -1.1531
10.0% = -1.11297
25.0% = -0.941408
50.0% = -0.75577
75.0% = -0.572771
90.0% = -0.399729
95.0% = -0.378633
99.0% = -0.0744833



One-Variable Analysis - log10(Cu D AC) (site=95)

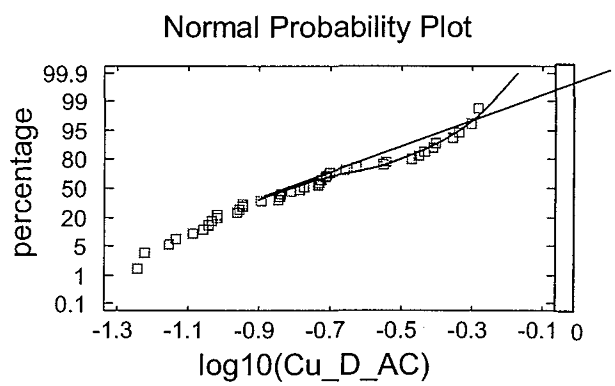
Summary Statistics for log10(Cu_D_AC)

Count = 40
Average = -0.771071
Median = -0.782482
Variance = 0.0733137
Standard deviation = 0.270765
Maximum = -0.284285



Percentiles for log10(Cu_D_AC)

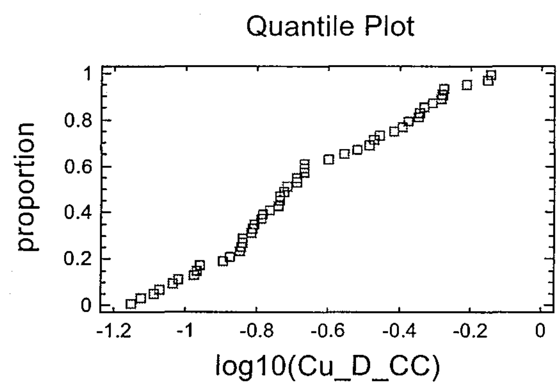
1.0% = -1.24477
5.0% = -1.19028
10.0% = -1.11146
25.0% = -0.991605
50.0% = -0.782482
75.0% = -0.548878
90.0% = -0.380191
95.0% = -0.32197
99.0% = -0.284285



One-Variable Analysis - log10(Cu_D_CC) (site=91)

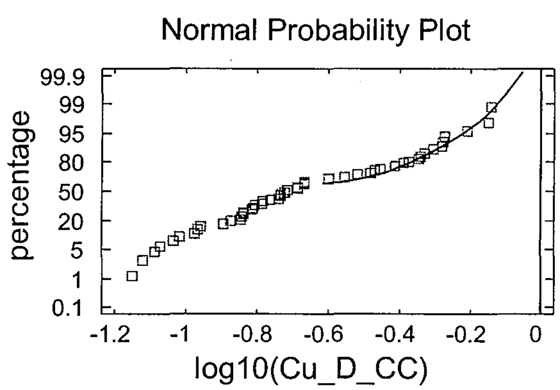
Summary Statistics for log10(Cu_D_CC)

Count = 50
Average = -0.665887
Median = -0.72043
Variance = 0.0751555
Standard deviation = 0.274145
Maximum = -0.142382



Percentiles for log10(Cu_D_CC)

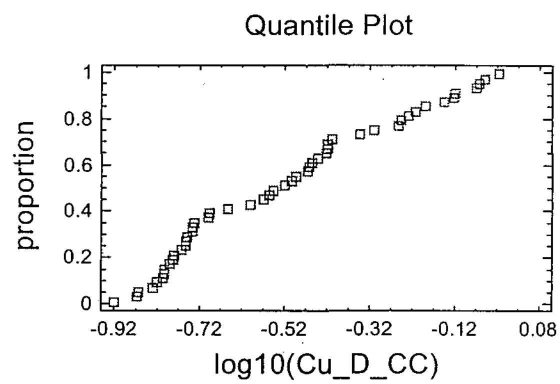
1.0% = -1.15176
5.0% = -1.0884
10.0% = -1.02795
25.0% = -0.844153
50.0% = -0.72043
75.0% = -0.415668
90.0% = -0.282158
95.0% = -0.210046
99.0% = -0.142382



One-Variable Analysis - log10(Cu_D_CC) (site=92)

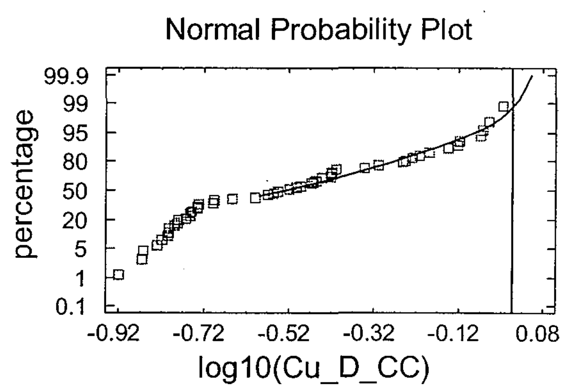
Summary Statistics for log10(Cu_D_CC)

Count = 50
Average = -0.520281
Median = -0.534281
Variance = 0.069343
Standard deviation = 0.263331
Maximum = -0.0160527



Percentiles for log10(Cu_D_CC)

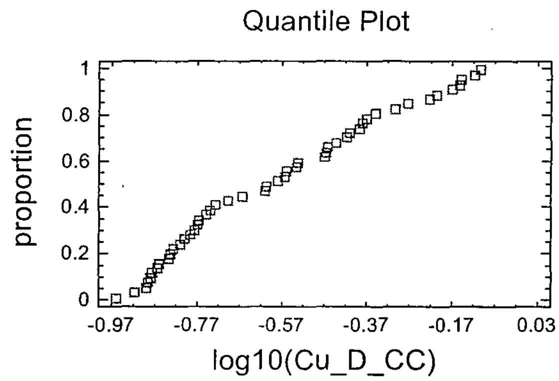
1.0% = -0.919475
5.0% = -0.862092
10.0% = -0.812814
25.0% = -0.752894
50.0% = -0.534281
75.0% = -0.308589
90.0% = -0.121534
95.0% = -0.0639253
99.0% = -0.0160527



One-Variable Analysis - log10(Cu D CC) (site=93)

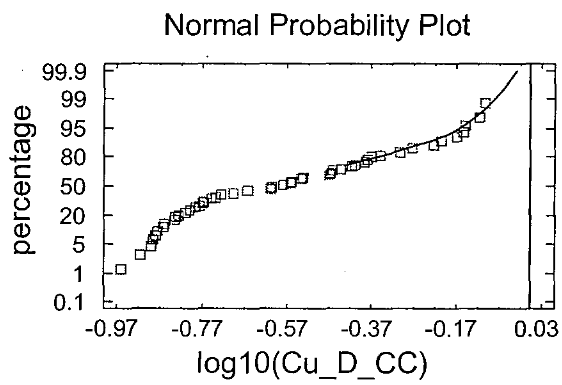
Summary Statistics for log10(Cu_D_CC)

Count = 48
Average = -0.578498
Median = -0.593301
Variance = 0.0646338
Standard deviation = 0.254232
Maximum = -0.103912



Percentiles for log10(Cu_D_CC)

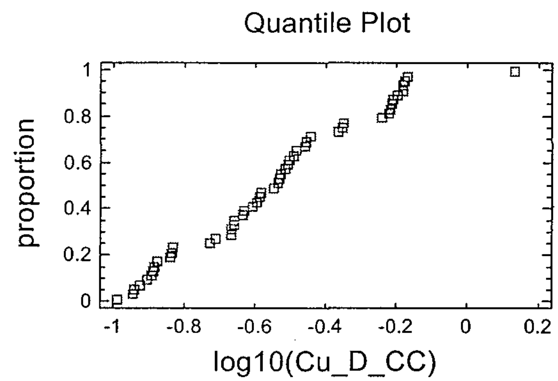
1.0% = -0.960403
5.0% = -0.88934
10.0% = -0.880184
25.0% = -0.805754
50.0% = -0.593301
75.0% = -0.383417
90.0% = -0.169093
95.0% = -0.150735
99.0% = -0.103912



One-Variable Analysis - log10(Cu D CC) (site=94)

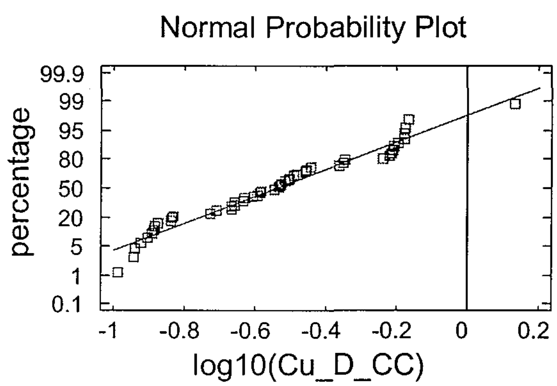
Summary Statistics for log10(Cu_D_CC)

Count = 50
Average = -0.548574
Median = -0.542936
Variance = 0.0702682
Standard deviation = 0.265082
Maximum = 0.132534



Percentiles for log10(Cu_D_CC)

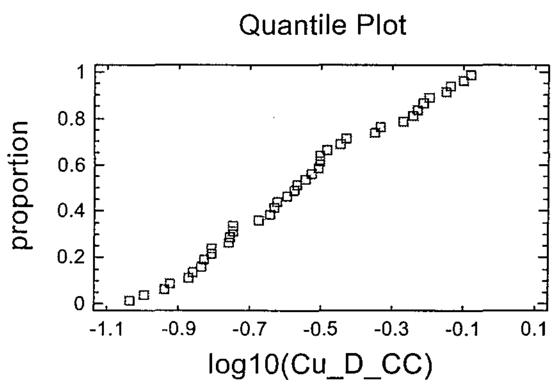
1.0% = -0.987946
5.0% = -0.94
10.0% = -0.896546
25.0% = -0.728322
50.0% = -0.542936
75.0% = -0.353134
90.0% = -0.188402
95.0% = -0.177115
99.0% = 0.132534



One-Variable Analysis - log10(Cu D CC) (site=95)

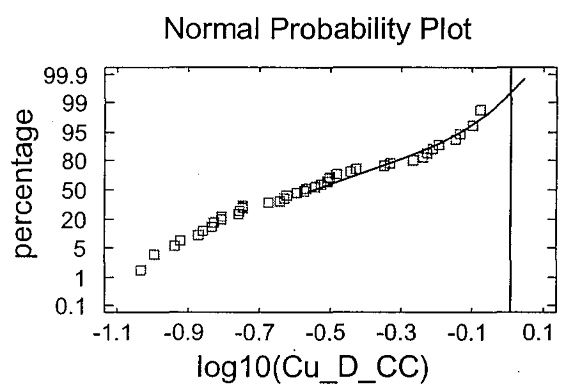
Summary Statistics for log10(Cu_D_CC)

Count = 40
Average = -0.56162
Median = -0.571391
Variance = 0.0721667
Standard deviation = 0.268639
Maximum = -0.081728



Percentiles for log10(Cu_D_CC)

1.0% = -1.03574
5.0% = -0.967457
10.0% = -0.898041
25.0% = -0.783064
50.0% = -0.571391
75.0% = -0.339853
90.0% = -0.172027
95.0% = -0.117161
99.0% = -0.081728



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Attachment A
Appendix D: Water Quality Modeling for the Lower Des Plaines River

Emre Alp
Charles Melching

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CHAPTER 1 - INTRODUCTION

The enhanced water quality model, QUAL2E, permits simulation o any branching one-dimensional stream system. The aim of this study is to develop a QUAL2E model for the Lower Des Plaines River. The model is calibrated for the flow and water-quality data measured in 1990. Verification of the model is done for the flow and water quality data measured in 1991.

The study area is the Lower Des Plaines River from its confluence with the Chicago Sanitary and Ship Canal to the I55 Bridge (Figure 2.). The total length of the modeled river system is 13.25 mile. Locations along the waterways are referred by the U.S. Army Corps of Engineers (COE) river mile point system. The model begins at River Mile 291 at the downstream of Lock Port and Dam and ends at River Mile 277.75 at the I55 Bridge. Mile point references in this report are rounded to the nearest 0.25-mile.

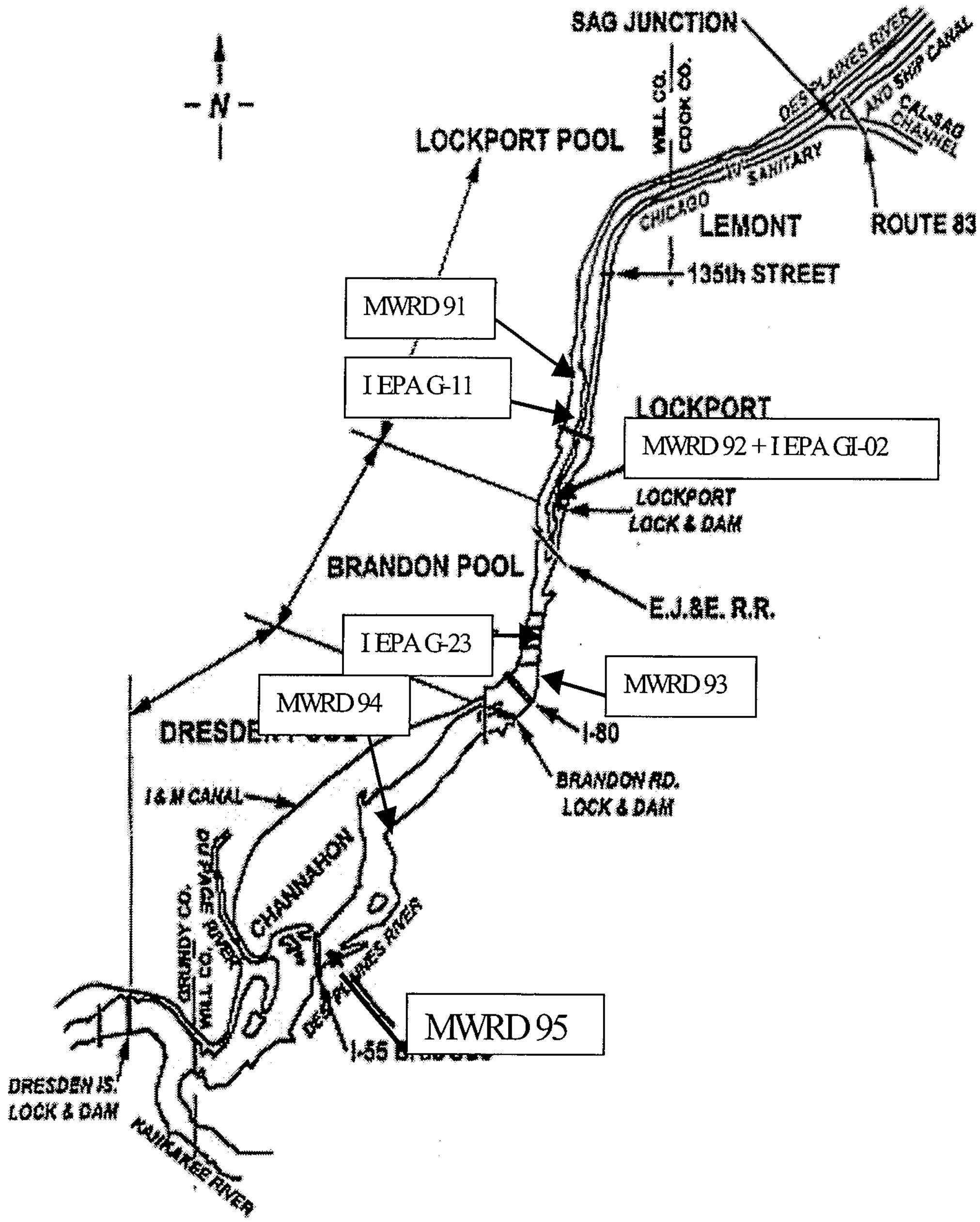


Figure 2. Lower Des Plaines River Study Area

CHAPTER 2 - MODEL DEVELOPMENT

2.1 Overview of the QUAL2E Model

QUAL2E is a widely used water quality model that can predict the physical, chemical and biological processes that affect the dissolved oxygen in a river system. For this study, QUAL2E simulates the major water quality interactions in the river system, including nitrogen cycle, phosphorus cycle, algal production, sediment oxygen demand, carbonaceous biochemical oxygen demand, and dam aeration.

2.1.1 Application

The stream water quality model QUAL2E is used for waster load allocation, discharge permit determinations, and other conventional pollutants evaluation. QUAL2E can simulate up to 15 water quality constituents in any combination desired by the user. Constituents which can be simulated include the fallowing: dissolved oxygen, biochemical oxygen demand, temperature, algae as chlorophyll-a, nitrogen, phosphorus, and coliform.
The model assumes that the major transport mechanisms for chemical constituents are advection, and dispersion, and that these mechanisms are significant only along the main direction of flow. It allows for multiple waste discharges, withdrawals, tributaries flows, and incremental inflow and outflow.

Hydraulically, QUAL2E limited to the simulation of the time periods during which both the stream flow in riverbasins and input waster loads are essentially constant. QUAL2E can operate either as a steady state or as a dynamic model. When simulated as a steady state model, it can be used to study the impact of waste loads on stream water quality and also can be used in conjunction with a field sampling program to identify the magnitude and quality characteristics of non point source waste loads. By operating the model dynamically, the user can study the effects of diurnal variations of algal photosynthesis on water quality.

The application of the QUAL2E model to the study area requires several assumptions to be made. Hydrologically, QUAL2E is limited to the simulation of the periods during which both the river flow and plant flows (water reclamation plants, and tributaries) are constant. Rivers must also be well mixed horizontally and vertically, and the major transportation mechanisms, advection and dispersion, are significant only along the main direction of flow. The data presented in this report will indicate that these assumptions are upheld for the application of the model.

2.1.2 Review of the previous Models and studies

There have been several studies on the Chicago Waterway and the Upper Illinois River in the past years. Major studies have included studies by the Illinois State Water Survey in 1974 and 1975, the 208 study by Hydrocomp, Inc in 1979, followed by a study by Northeastern Illinois Planning Commission in 1981. Camp Dresser & McKee used QUAL2EU to simulate dissolved oxygen on the Chicago Waterway and Upper Illinois River in 1992.

As a part of the model development, water quality data and some parameter values presented in the Camp Dresser & McKee (CDM) report were used in this report.

2.1.3 Process Simulated

The focus of this study is the dissolved oxygen (DO) concentration in the study area. QUAL2E simulates the processes that affect the dissolved oxygen in the water column.

2.1.3.1 Nitrification

Nitrification is a two-stage process. The first stage is the oxidation of ammonia to nitrate by Nitrosomonas bacteria. During the second stage of nitrification, Nitrobacter bacteria oxidize nitrite to nitrate.

2.1.3.2 Carbonaceous Biochemical Oxygen Demand

Biochemical oxygen demand is utilization of dissolved oxygen by aquatic microbes to metabolize organic matter. Carbonaceous biochemical oxygen demand (CBOD) represents the amount of oxygen required by the microorganisms to stabilize organic matter under aerobic conditions. CBOD or DO usage is simulated as a first order exponential reaction in QUAL2E. The rate of biological oxidation of organic matter is directly proportional to the remaining concentration of unoxidized material. All referenced CBOD values in this report are 20-day values ($CBOD_{20}$).

2.1.3.3 Sediment Oxygen Demand

Oxygen demand by benthic sediments and organisms has historically represented a large fraction of oxygen consumption on the Chicago Waterway and the Upper Illinois River (CDM, 1992). Benthal deposits at any given location in a system are result of the transportation and deposition of organic material. QUAL2E does not simulate the transport, deposit and decay of the benthal deposits, but instead represents the demand with a constant rate of oxygen consumption.

2.1.3.4 Algal Respiration and Photosynthesis

The effects of algae on dissolved oxygen concentration are the most complex of the processes simulated. Algae can bring about significant changes in dissolved can bring about significant changes in the dissolved oxygen by several interactions. Algal dynamics and nutrients uptake during algae growth in the main process that removes dissolved nutrients, nitrogen and phosphorus, from the water. Algal respiration and decay are major components of nutrient recycling. Algal processes can also cause diurnal variations in dissolved oxygen due to algal respiration during the night. Dead algae that settles on the river bottom is often a major source of organic matter for the benthic demand. QUAL2E simulates the algal dynamics including photosynthesis and respiration, nitrogen and phosphorus uptake and return.

2.1.3.5 Atmospheric and Dam Reaeration

Reaeration is the process of oxygen exchange between the atmosphere and a water body. Typically, the net transfer of oxygen is from the atmosphere and into the water, unless the dissolved oxygen levels in the river system are above the saturation and then the reverse is true. Dams can influence rearation by changing the dissolved oxygen deficit in a short reach of the river. The water passing over the dam is very turbulent and has a large volume of oxygen transferred. The water passing over the dam is very turbulent and has a large volume of oxygen transferred.

2.1.4 Water Quality Data Obtained for Model Calibration and Verification

Water quality data for the model calibration and verification presented in this report were taken from the previously done study (CDM, 1992). The ISWS developed a mobile sampling program to collect water quality data along the study area being modeled. Sampling was performed in three periods during six months as follows:

Table 1. Sampling Periods

Period I	Period II	Period III
September 1990	May 1991	July 1991
October 1990	June 1991	August 1991

Each sampling event consisted of six passes. Each pass was 8 hours long for a total of 48 hours of sampling for each event. Two types of sample stations were established: one was for full range of water quality samples and make water quality measurements, while a second was for DO and temperature only. Also, samples were taken at mouths of significant tributaries. Water quality data are given in Appendix A.

2.2. Hydraulic Model

The first step in the development of input data for the QUAL2E water quality model is the delineation of model reaches and the development of hydraulic data. The required hydraulic parameters for this application are: i) channel cross-section ii) dispersion constant iii) Manning's n.

2.2.1 Model Reaches

This model has 6 reaches with a computational element length of 0.25 mile. It lays from downstream of Lock Port and Dam to I 55 bridge, a distance of 13.25 miles. The reaches and the elements of the model is given in Table 2. Schematic diagram of the reaches, and location of the point sources are given in Figure 3.

Table 2. Model Reaches and Elements

Reach #	Starting Point (River Mile)	Ending Point (River Mile)	Number of Elements	Location
1	291	290	4	Downstream of LP & D - CSSC*
2	290	287.25	11	Brandon Pool- D. P. R**
3	287.25	286	5	Brandon Pool- D.P.R
4	286	285.25	3	Dresden Pool –D.P.R
5	285.25	280.25	20	Dresden Pool –D.P.R
6	280.25	277.75	10	Dresden Pool –D.P.R

*CSSC = Chicago Sanitary Ship Canal; **D.P.R = Des Plaines River

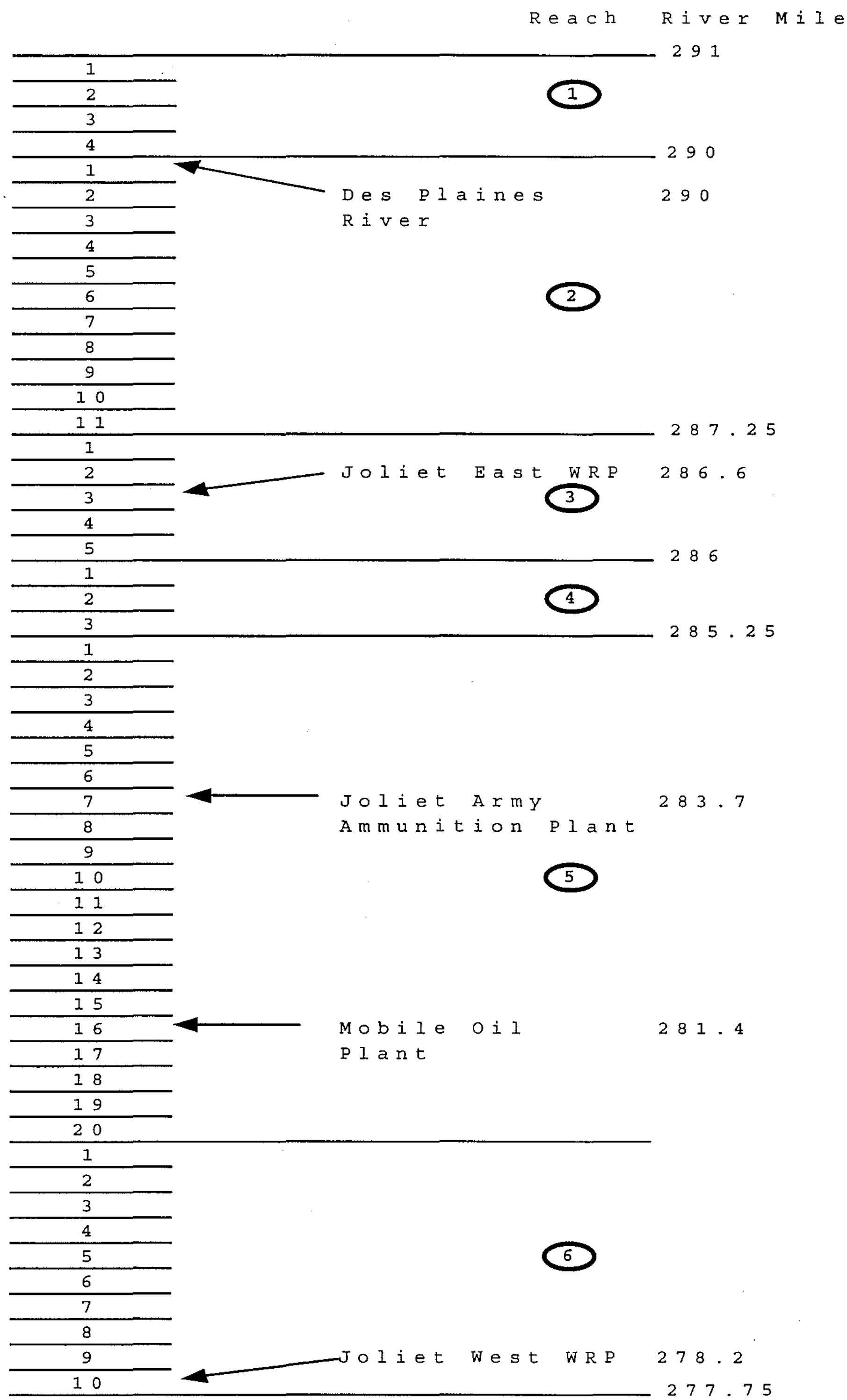


Figure 3. Schematic diagram of the Lower Des Plaines River QUAL2E model

Channel cross section data were obtained to determine approximate channel dimension. A total of 40 cross sections were provided. Based on the cross section data, trapezoidal approximation was done to obtain average bottom and top width, and water depth to use in QUAL2E model. Reach slopes were calculated using bottom elevations at different points in the reach. Table 3 shows a summary of the cross section data developed for the model reaches.

Table 3. Summary of the cross section data

Reach #	Bottom width (ft)	Top Width (ft)	Channel slope (ft/ft)	Side slope 1 (H/V) (ft/ft)	Side slope 2 (H/V) (ft/ft)
1	230	310	0.00090	1.50	1.50
2	275	350	0.00090	0.60	0.70
3	1100	1100	0.00180	0.001	0.001
4	1000	1000	0.00110	0.001	0.001
5	200	1000	0.00023	17.50	8.5
6	280	1000	0.00029	9.00	10

2.2.2 Time of Travel and dispersion

Data on dispersion, flow and time of travel was obtained from ISWS, the USGS, and previously studies of the Chicago and Illinois waterways. Dispersion is transport due to mechanical mixing and/or diffusion. QUAL2E is a one dimesional model only longitudinal dispersion is considered. Velocity and depth were determined as a part of the dispersion studies. In this model, Dispersion Constant (K) = 180 is used. It is stated that, this value represents the best fit, based on the findings of all dispersion studies (CDM, 1992)

2.2.3 Flow Measurement and Flow Modeling

The flow magnitude during water quality monitoring was determined by ISWS using flow models. ISWS flow estimates for each of the sampling period are presented in the flowing tables.

Table 4. September Flow Balance

Mile Point	Source	Flow (cfs)	Cum. Flow (cfs)
291.2	Lockport L and D		3305
290.0	Des Plaines river	217	3522
286.6	Joliet	27	3549
283.7	Joliet AA	5	3554
281.4	Mobil	7	3561
278.2	Joliet West	6	3567

Table 5. October Flow Balance

Mile Point	Source	Flow (cfs)	Cum. Flow (cfs)
291.2	Lockport L and D		2491
290.0	Des Plaines river	392	2883
286.6	Joliet	27	2910
283.7	Joliet AA	5	2915
281.4	Mobil	6	2921
278.2	Joliet West	7	2928

Table 6. May Flow Balance

Mile Point	Source	Flow (cfs)	Cum. Flow (cfs)
291.2	Lockport L and D		3332
290.0	Des Plaines river	522	3854
286.6	Joliet	35	3889
283.7	Joliet AA	1	3890
281.4	Mobil	4	3894
278.2	Joliet West	7	3901

Table 7. June Flow Balance

Mile Point	Source	Flow (cfs)	Cum. Flow (cfs)
291.2	Lockport L and D		2788
290.0	Des Plaines river	688	3476
286.6	Joliet	25	3501
283.7	Joliet AA	1	3502
281.4	Mobil	5	3507
278.2	Joliet West	4	3511

Table 8. July Flow Balance

Mile Point	Source	Flow (cfs)	Cum. Flow (cfs)
291.2	Lockport L and D		3781
290.0	Des Plaines river	181	3962
286.6	Joliet WRP	17	3979
283.7	Joliet AA	0	3979
281.4	Mobil	8	3987
278.2	Joliet West	3	3990

Table 9. July/August Flow Balance

Mile Point	Source	Flow (cfs)	Cum. Flow (cfs)
291.2	Lockport L and D		3685
290.0	Des Plaines river	169	3854
286.6	Joliet	18	3872
283.7	Joliet AA	0	3872
281.4	Mobil	8	3880
278.2	Joliet West	3	3883

2.3 Headwaters, Point Sources and Initial Conditions

Headwaters and point source flows and constituent concentrations are diriving mechanisms in a QUAL2E application. Headwater data is defined as the most upstream conditions of the river system. These data include flow and various water quality parameters. In this model there is just one headwater, which is downstream of Lockport

Point loads are flows or withdrawals from the system that influence the balance of flow and water quality in the system. Point loads are typically discharged in to the system from water reclamation plants (WRP) and tributary rivers. For this study only point sources of one million gallons per day (mgd) or greater considered. Flow and water quality data on point sources was collected from information supplied by IEPA, as well as the District. There are 5 point sources in this model. Names and locations are given in the following table.

Table 10. Point Sources

Point Source	River mile
Des Plaines River	290.0
Joliet	286.6
Joliet AA	283.7
Mobil	281.4
Joliet West	278.2

QUAL2E requires that initial flow and water quality conditions be assigned for each system as a starting point for the system. Temperature is the only required variable for steady state simulations.

2.4 Atmospheric and Dam Rearation

Reaeration is the process of oxygen exchange between atmosphere and a water body. Large amounts of oxygen transferred to the water is a function of dam height, the quality of the water, and the type of the dam. Atmospheric and Dam Rearation coefficients that were obtained for the previous studies are used in this study.

Table 11. September Reaeration rate

Reach #	Flow (cfs)	Velocity (fps)	Depth (ft)	O'Connors and Dobbins, Ka (1/day)	Calibrated K2
1-2-3	3434	0.755	17.5	0.15	0.15
4-5-6	3434	0.479	15.1	0.15	0.15

Table 12. September - Dam Parameters

Dam	a factor	b factor	% flow over the dam	Height of Waterfall, (ft)
Brandon Road Dam	1.1	1.8	100%	34

2.5 Algal Growth

Algal growth is an important consideration in modeling water quality. It is closely linked to nutrient dynamics and can cause daily and seasonal variations in dissolved oxygen. The major components of algal growth simulated by QUAL2E are respiration rate, specific growth rate, net algal oxygen production, the algal light relationship, and algal-nutrient relationship. Global parameters, and reach variables parameter used in this report are given in Table 13 and Table 14 and Table 15. The study area is divided in two regions: the Brandon Pool, and the Dresden Pool. All of the global parameters do not vary throughout the model system. Reach variable parameters show differences among different reaches and time periods.

Table 13. September-and October – Global Nutrient-*Nitrification* Parameters

Parameter	Symbol	Unit	Value
Nitrogen Content of algae	$\alpha 1$	mg-N/mg-A	0.08
Phosphorus Content of algae	$\alpha 2$	mg-P/mg-A	0.012
Nitrogen Half saturation coef.	KN	mg/L	0.02
Phosphorus Half saturation coef.	KP	mg/L	0.002
Algal preference factor for NH3	F	-	0.9
O2 uptake per NH3 oxidation	$\alpha 5$	mg-O/mg-N	3.43
O2 uptake per NO2 oxidation	$\alpha 6$	mg-O/mg-N	1.14
Nitrification Inhibition Coefficient	KNITRF	-	0.7

Table 14. September (calib.)–July – Reach –*Algal*- Parameters

Parameter	Reach 1-2-3	Reach 4-5-6
Chla: Algae Ratio$\alpha 0$ (μg-Chla/mg-A)	16	16
Algal settling Rate , $\alpha 1$ (ft/day)	1	1
Non-algal Light extinction , $\lambda 0$ (/ft)	0.69	0.90

Table 15. October(Calib.)/May/June —*Algal*- Parameters

Parameter	Reach 1-2-3	Reach 4-5-6
Chla: Algae Ratio$\alpha 0$ (μg-Chla/mg-A)	16	16
Algal settling Rate , $\alpha 1$ (ft/day)	0.5	0.5
Non-algal Light extinction, $\lambda 0$ (/ft)	0.85	1

CHAPTER 3 - CALIBRATION

3.1 Introduction

This section presents the calibration of the QUAL2E model to two data sets, September 25, 26, 27, 1990 , and October 23, 24, 25, 1990 .

3.2 Model Requirement

Model calibration requires flow balance for the two ISWS sampling periods in September and October 1990. All flows from point sources in excess of 1 mgd were considered. Rivers, WRP's, and industrial discharges are all considered to be point sources. The headwater flow from downstream of Lockport Lock and Dam is modeled as "headwater".

3.3 Overview of the Calibration Process

Calibration is the process where selected model variables are adjusted so concentrations predicted by the model agree with actual instream measurements. The major constituent of interest for this study is dissolved oxygen. The method employed in this study is to first calibrate the individual constituents. Thus, variables in the model will be adjusted so the predicted values of flow, carbonaceous biochemical oxygen demand (CBOD20), organic nitrogen, ammonia, nitrite, nitrate, ortophosphorus, and chlorophyll-a will match the instream measured values. Then selected variables will be adjusted, if needed, to reach agreement between instream concentrations of dissolved oxygen. The goal of the calibration is to have the predicted values fall within one standard deviation of the mean of the instream measured constituent variance with the predicted.

3.4 Calibration variables

The fist step in the model calibration process is to accurately predict the flow values. The flow balance of the point sources versus river flow developed for September and October bents was presented in the previous section. These values were taken from previously conducted QUAL2E model (CDM, 1992). Calibration to water depth are done by adjusting Manning's n values.

CBOD20 is input into the model via headwater and point sources. The decay and settling rates (K1 and K2) are used to calibrate instream CBOD20 values. As CBOD20, phosphorus is input into the model from headwater and point sources. Calibration of phosphorus is done by adjusting the organic decay rate, β_4, the organic phosphorus source rate, σ_2. Nitrogen is simulated in four forms, organic, ammonia, nitrite, and nitrate. Calibration is done on each form of nitrogen by adjusting five rates, organic nitrogen settling rate, β_3, ammonia oxidation rate, β_1, nitrite oxidation rate, β_2, organic nitrogen settling rate, σ_4, and ammonia source rate, σ_3.

3.5 September /October–1990

In the light of information given in the previous sections, the model was calibrated using September and October flows and water quality data. Calibration values are presented in Table 16. Figure 4 and Figure 5 present the model predicted values of the parameters against measured instream measured values. Biologically, the system is divided into two regions: Brandon Pool and Dresden Pool. Reaches 1-2-3 belong to the Dresden Pool and Reaches 4-5-6 belong to the Dresden Pool. In Figure 4, and Figure 5, vertical arrows indicate The Des Plaines River, which makes the largest flow contribution to the system. Lockport Lock and Dam values are shown by horizontal arrows.

Table 16. CBOD Decay, and Settling, *Phosphorus*, Nitrification –*Algal*- Parameters (September/October –1990)

Parameter	**Reach 1-2-3 (Sept.)**	**Reach 4-5-6 (Sept.)**	**Reach 1-2-3 (Oct)**	**Reach 4-5-6 (Oct)**
CBOD Decay Rate (K1)	0.05	0.05	0.01	0.01
CBOD Settling Rate (K3)	0.20	0	-0.05	0
Rate Coef. for Org. P to PO4 ,β4 (1/day)	0.1	0.1	0.1	0.1
Rate Coef. for Org. P settling ,σ5(1/day)	0	0	0	0
Source rate for PO4 settling ,σ2(mg-P/ft2-day)	300	0	-100	0
Rate Coef. for Org. N to NH3 ,β3 (1/day)	0.05	0.05	0.05	0.08
Rate Coef. for Org. N settling ,σ4(1/day)	0	0	0	0
Rate Coef. for Org. NH3 to NO2 ,β1 (1/day)	0.3	0.2	0.2	0
Source rate for NH3 ,σ3(mg-N/ft2-day)	0	0	0	0
Rate Coef. for Org. NO2 to NO3 ,β2 (1/day)	1	0.3	0.3	0
Chla: Algae Ratioα (μg-Chla/mg-A)	16	16	16	16
Algal settling Rate , α1 (ft/day)	1	1	0.5	0.5
Non-algal Light extinction , λ0 (/ft)	0.69	0.90	0.85	1

Figure 4. September 1990 Calibration

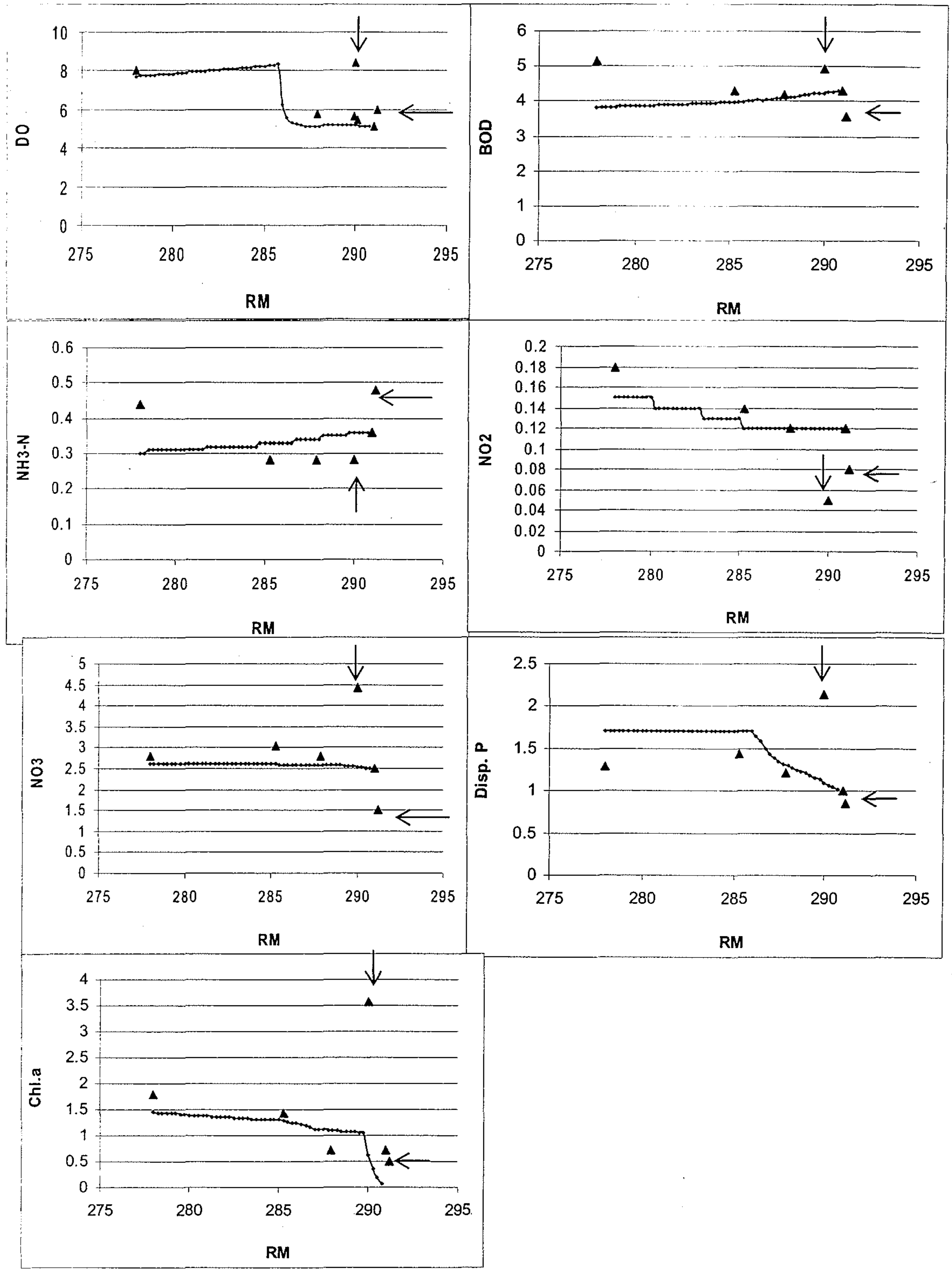
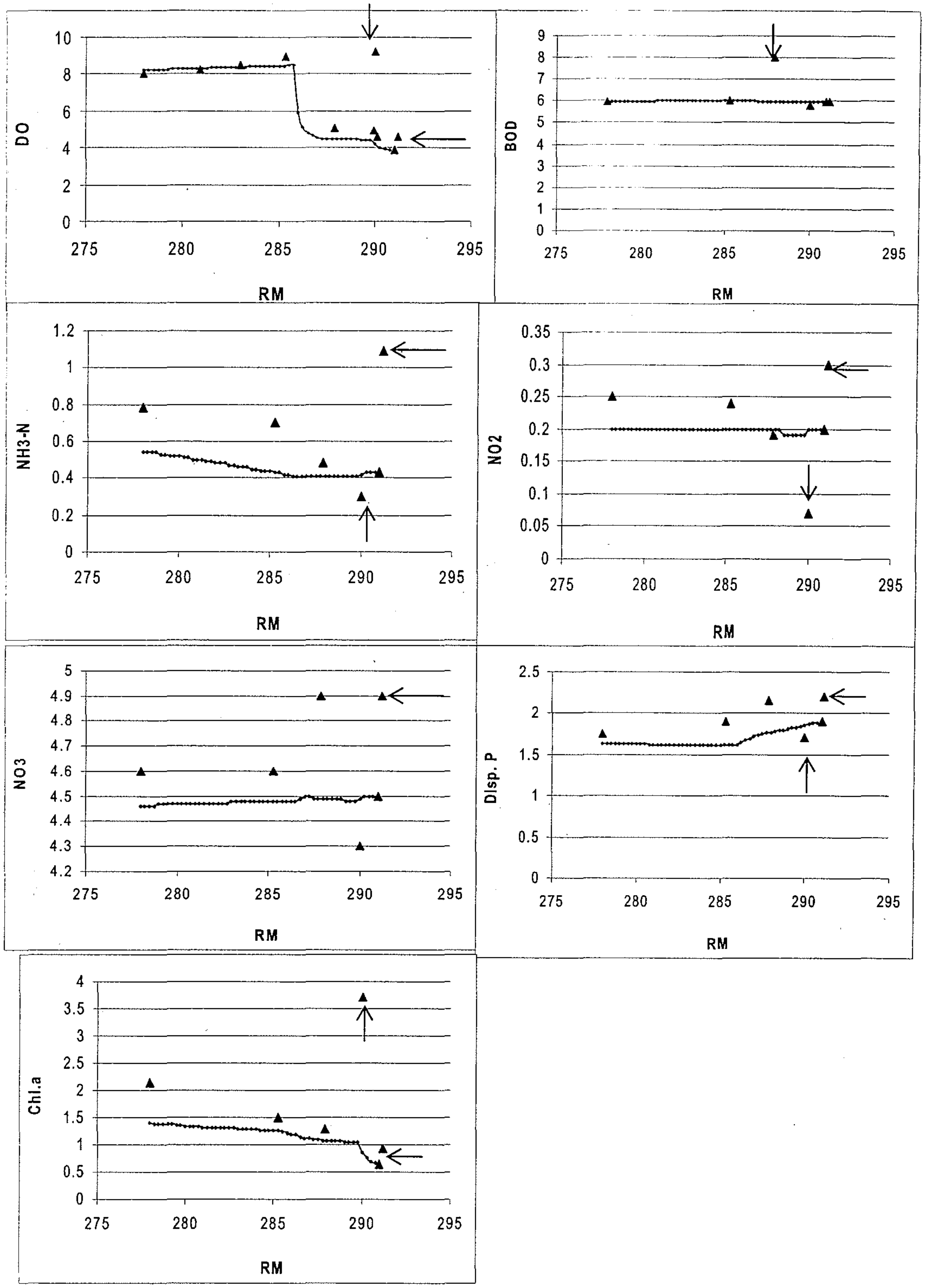


Figure 5. October 1990 - Calibration



CHAPTER 4 -VERIFICATION

4.1 Introduction

In this section, verification of the QUAL2E model with two data sets is presented. October 1990 values (fall/spring non diversion) are used to verify May 1991 and June 1991 model. September 1990 values (summer diversion) are used to calibrate July 1991 values.

4.2 Overview of the Verification Process

Data collected during May 21-23, 1991 and June 4-6 1991 was used to verify the calibrated fall/spring non-diversion model. Data collected during July 16-18 1991 was used to verify calibrated summer, diversion model.

Calibration is the process of fine-tuning model parameters so that model accurately predicts the observed instream quality. Verification is the process of using calibrated model with different data, for which the water quality is known, to examine the effectiveness of the in predicting the instream concentrations of water quality constituents under different conditions (CDM, 1992). During calibration, model parameters are changed to match the observed data. During verification, conditional parameters such as flow and constituent concentrations are changed to examine effectiveness of the calibrated model. For each data set, calibrated model is also modified if the predicted values with the calibrated model did not match the observed values. In order to compare the calibrated model and modified model parameters, both of the model parameters are presented in Table 17 and Table 18. Figure 6, Figure 7, Figure 8 and Figure 9, Figure 10, and Figure 11 present the calibrated/modified model predicted values of the constituents against measured instream measured values. Vertical arrows indicate The Des Plaines River and horizontal arrows show Lockport Lock and Dam values.

Table 17. September 1990(calibrated)–July 1991 (modified) - Reach CBOD Decay, and Settling, *Phosphorus*, Nitrification –*Algal*- Parameters

Parameter	**Reach 1-2-3 (Sept.)**	**Reach 4-5-6 (Sept.)**	**Reach 1-2-3 (July.)**	**Reach 3-4-6 (July)**
CBOD Decay Rate (K1)	0.05	0.05	0.05	0.05
CBOD Settling Rate (K3)	0.20	0	-0.5	-0.5
Rate Coef. for Org. P to PO4 ,β4 (1/day)	0.1	0.1	0.1	0.1
Rate Coef. for Org. P settling ,σ5(1/day)	0	0	0	0
Source rate for PO4 settling ,σ2(mg-P/ft2-day)	300	0	300	0
Rate Coef. for Org. N to NH3 ,β3 (1/day)	0.05	0.05	0.05	0.05
Rate Coef. for Org. N settling ,σ4(1/day)	0	0	0	0
Rate Coef. for Org. NH3 to NO2 ,β1 (1/day)	0.3	0.2	0.3	0.2
Source rate for NH3 ,σ3(mg-N/ft2-day)	0	0	0	0
Rate Coef. for Org. NO2 to NO3 ,β2 (1/day)	1	0.3	1	0.3
Chla: Algae Ratioα (μg-Chla/mg-A)	16	16	16	16
Algal settling Rate , α1 (ft/day)	1	1	1	1
Non-algal Light extinction , λ0 (/ft)	0.69	0.90	0.69	0.90

Table 18. October(Calibrated) 1990, - May/June (modified) 1991 –Reach CBOD Decay, and Settling, *Phosphorus*, Nitrification –*Algal*- Parameters

Parameter	**Reach 1-2-3 (Oct)**	**Reach 4-5-6 (Oct)**	**Reach 1-2-3 (May)**	**Reach 4-5-6 (May)**	**Reach 1-2-3 (June)**	**Reach 4-5-6 (June)**
CBOD Decay Rate (K1)	0.01	0.01	0.01	0.01	0.01	0.01
CBOD Settling Rate (K3)	-0.05	0	-0.05	-0.5	-0.05	0
Rate Coef. for Org. P to PO4 ,β4 (1/day)	0.1	0.1	0.1	0.1	0.1	0.1
Rate Coef. for Org. P settling ,σ5(1/day)	0	0	0	0	0	0
Source rate for PO4 settling ,σ2(mg-P/ft2-day)	-100	0	-100	0	-100	0
Rate Coef. for Org. N to NH3 ,β3 (1/day)	0.05	0.08	0.05	0.05	0.05	0.05
Rate Coef. for Org. N settling ,σ4(1/day)	0	0	0	0	0	0
Rate Coef. for Org. NH3 to NO2 ,β1 (1/day)	0.2	0	0.5	0.5	0.5	0.5
Source rate for NH3 ,σ3(mg-N/ft2-day)	0	0	0	0	0	0
Rate Coef. for Org. NO2 to NO3 ,β2 (1/day)	0.3	0	1	1	1	1
Chla: Algae Ratioα0 (μg-Chla/mg-A)	16	16	16	16	16	16
Algal settling Rate , α1 (ft/day)	0.5	0.5	0.5	0.5	0.5	0.5
N0.5on-algal Light extinction , λ0 (/ft)	0.85	1	0.85	1	0.85	1

Figure 6. MAY 1991 (October-1990 Calibration values)

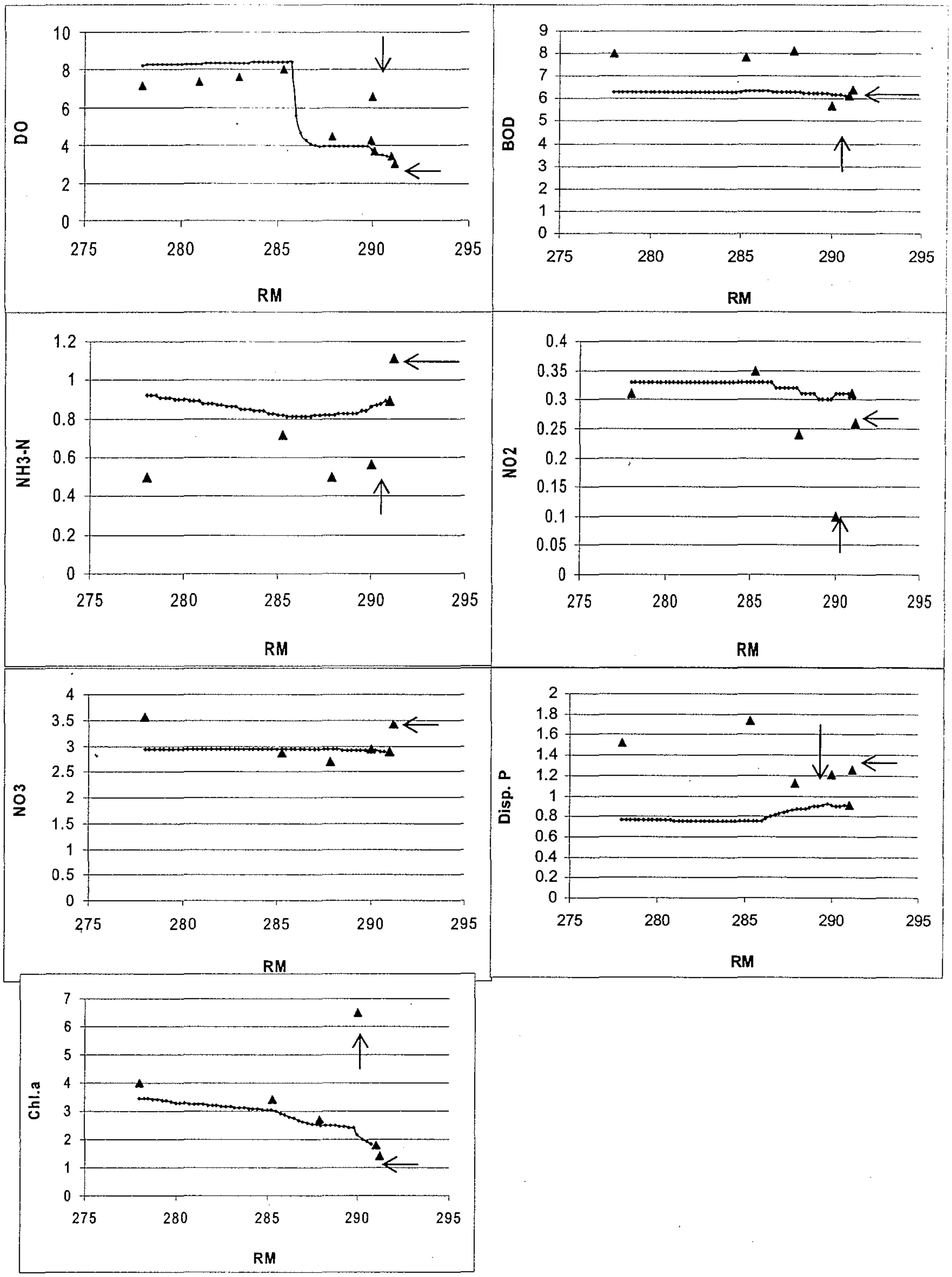


Figure 7. MAY 1991 (modified)

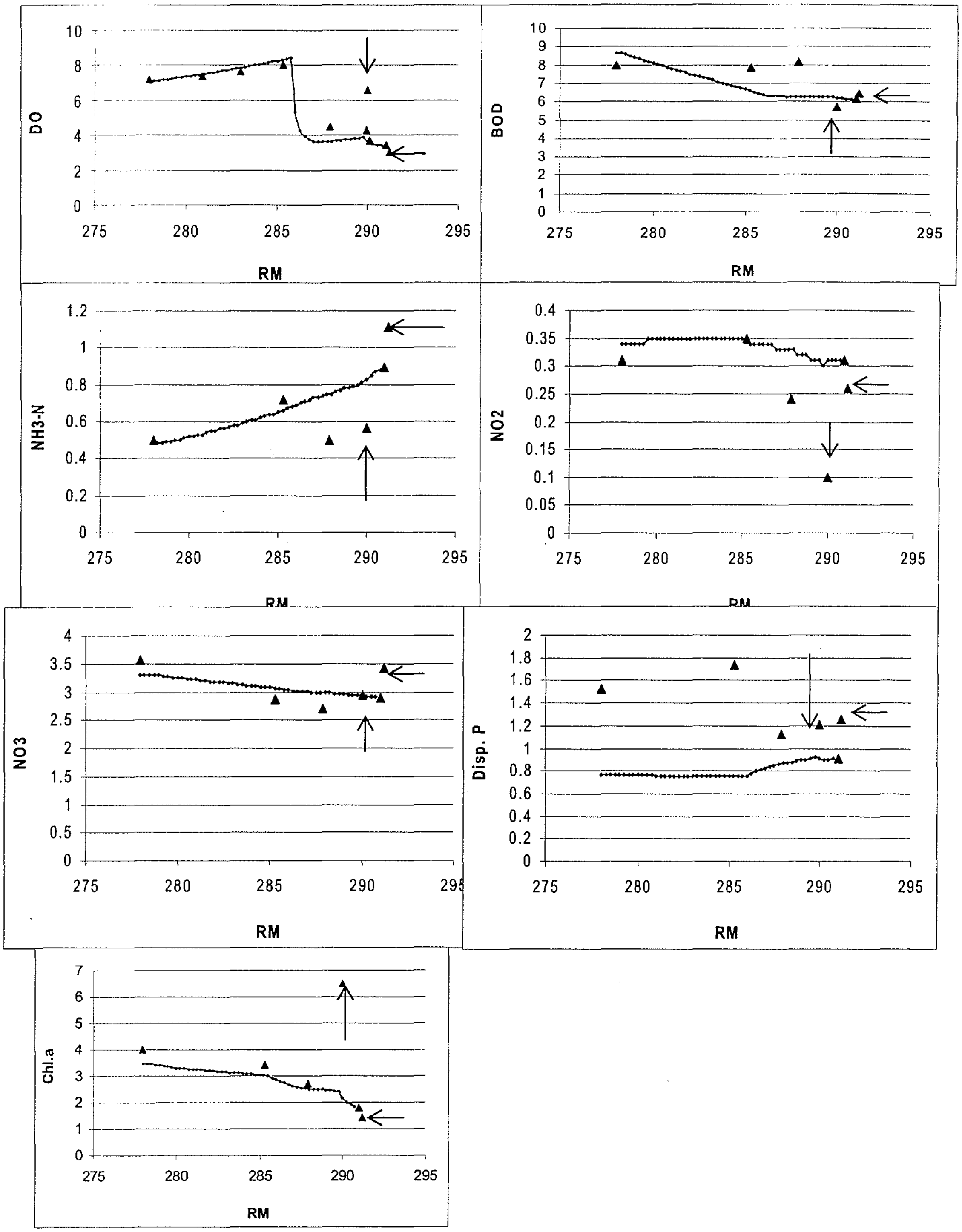


Figure 8. JUNE 1991 (October-1990 Calibration values)

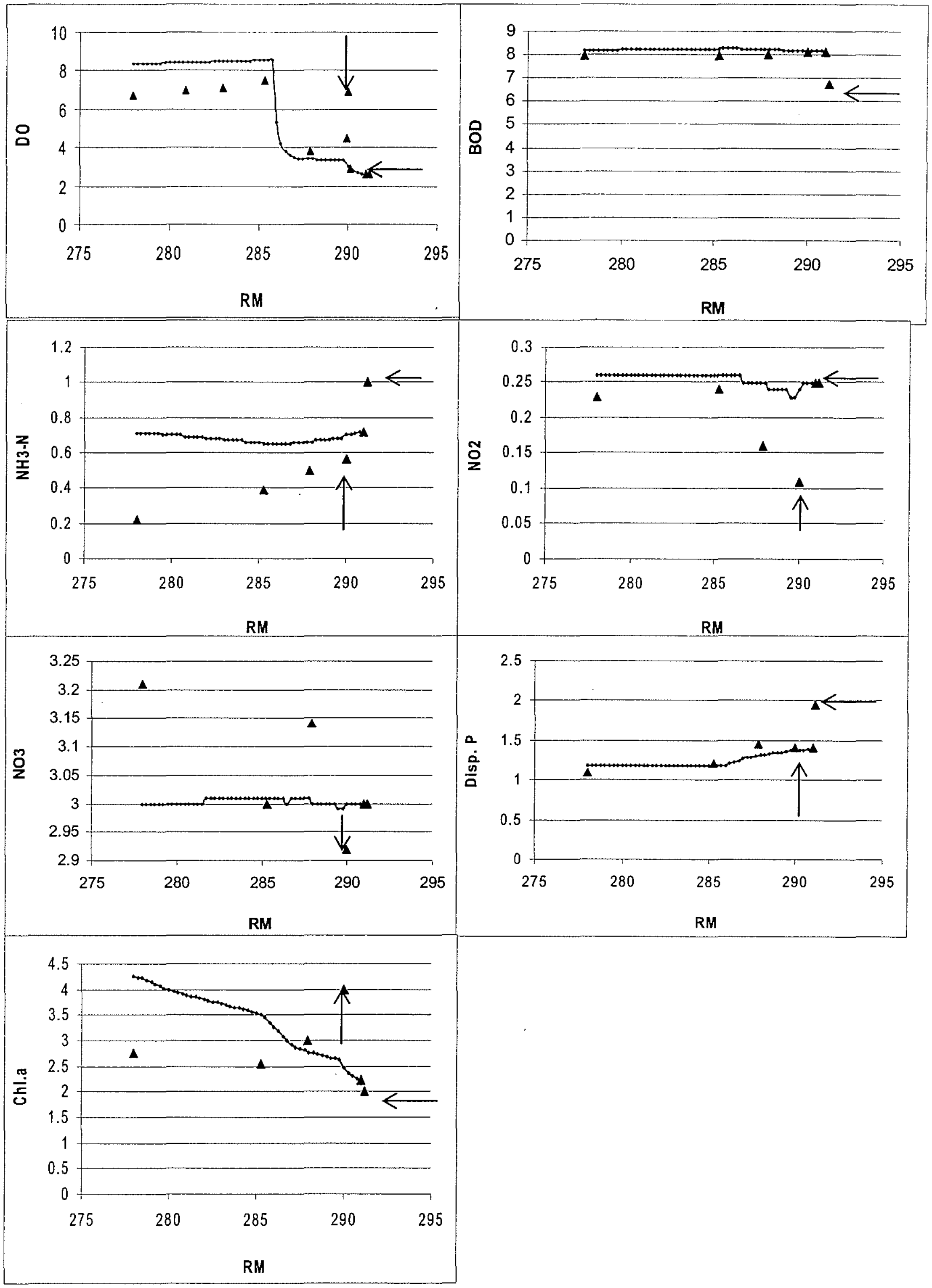


Figure 9. JUNE 1991 (modified)

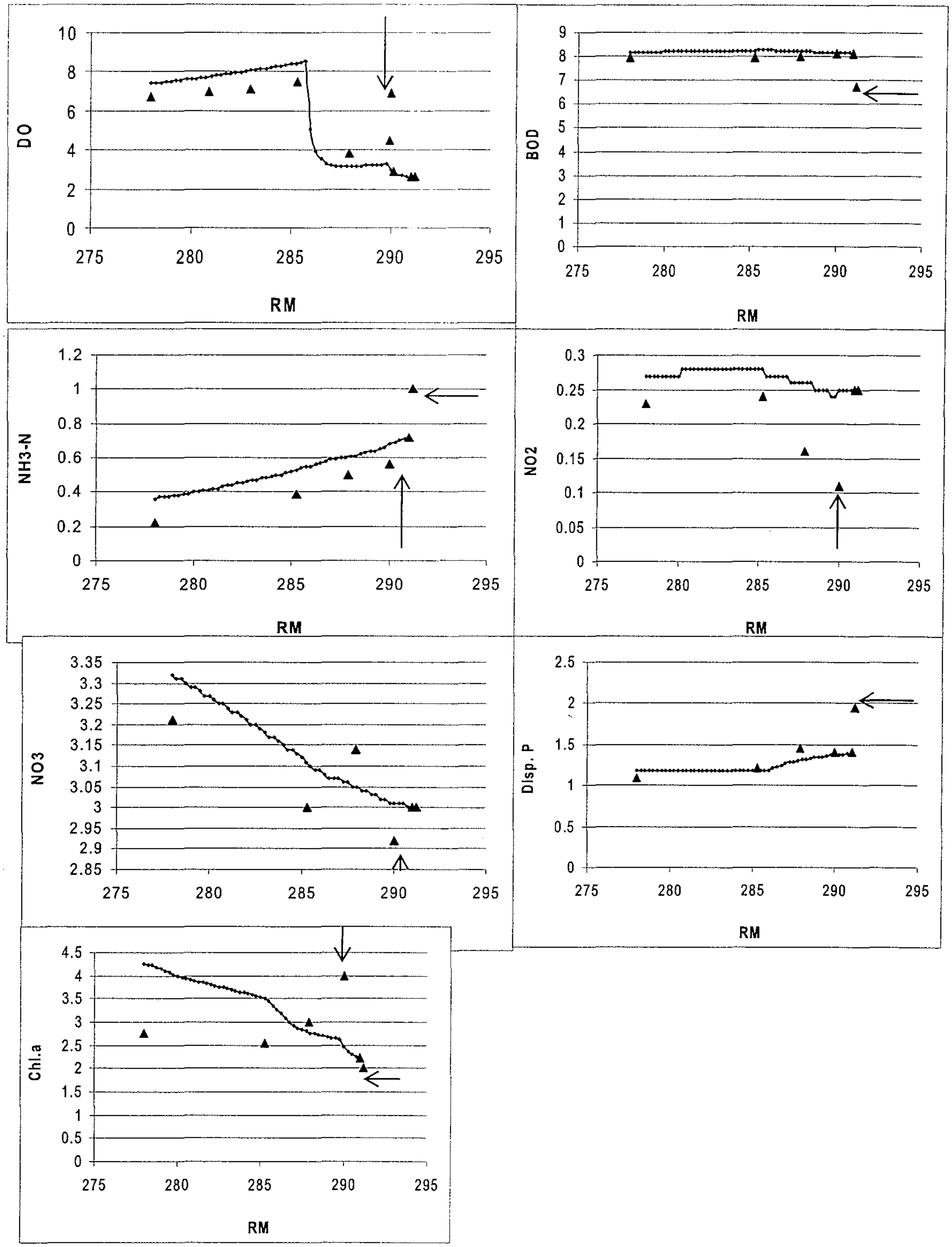


Figure 10. JULY 1991 (September-1990 Calibration values)

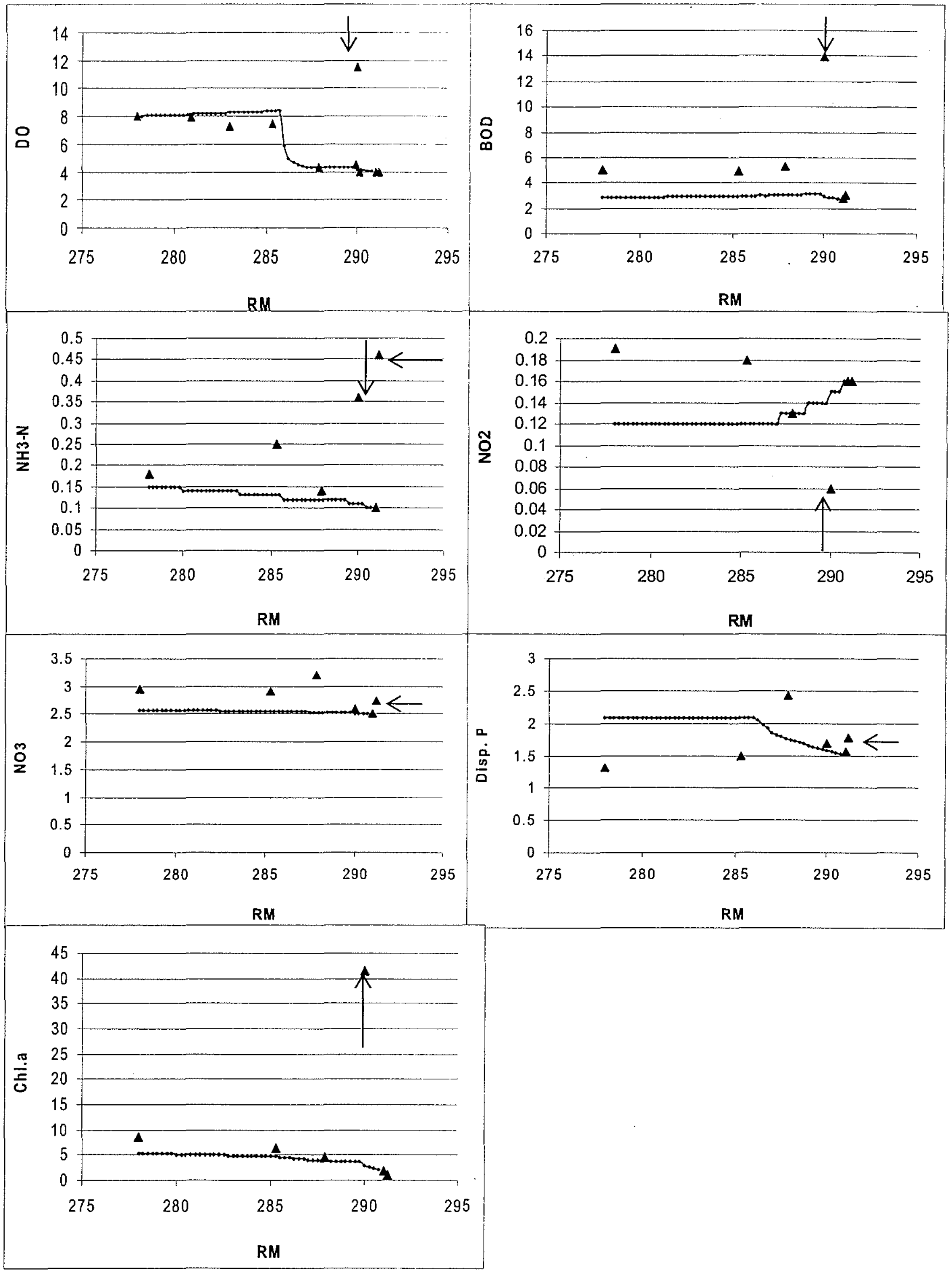


Figure 11. JULY 1991 (modified)

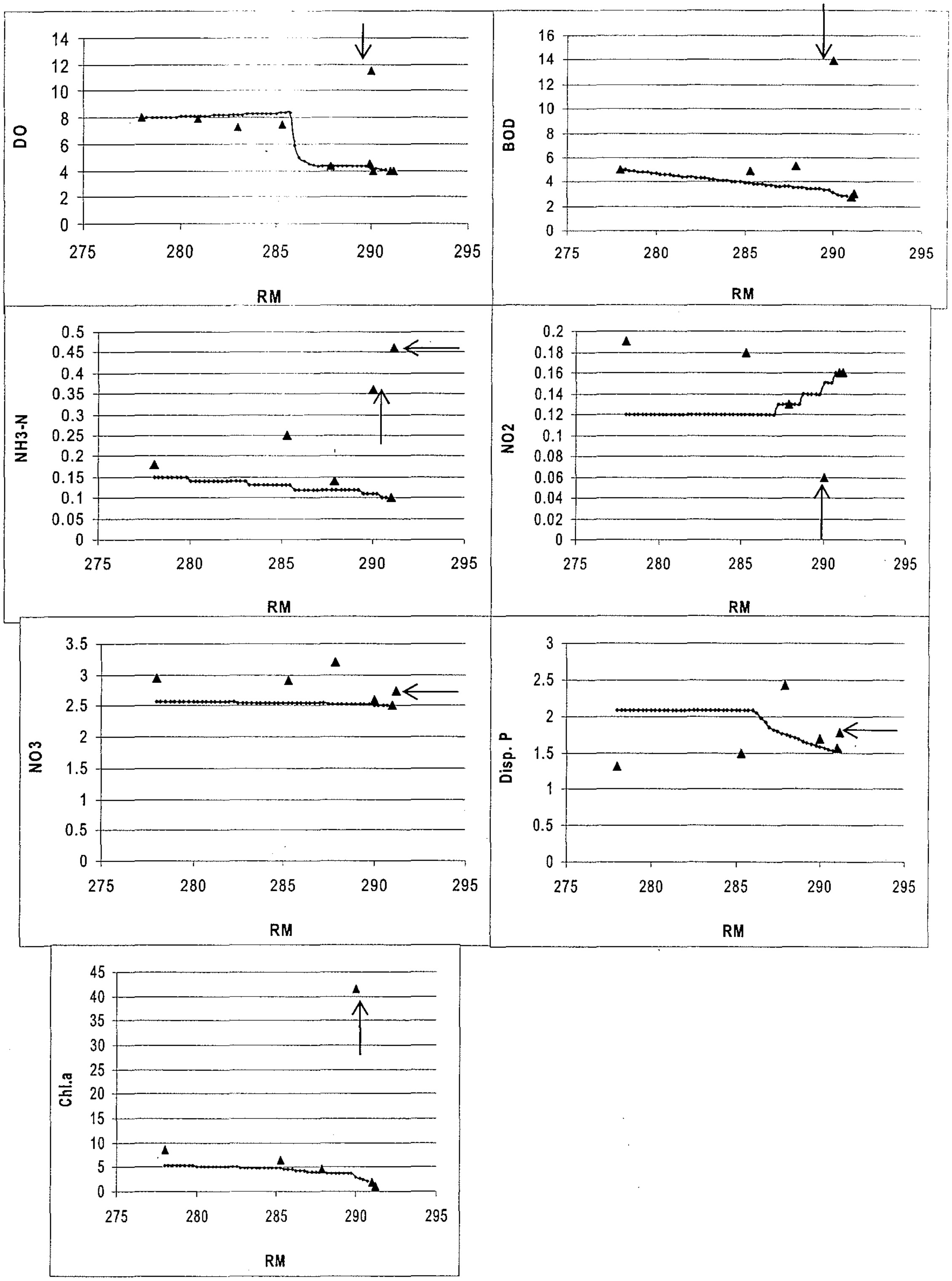
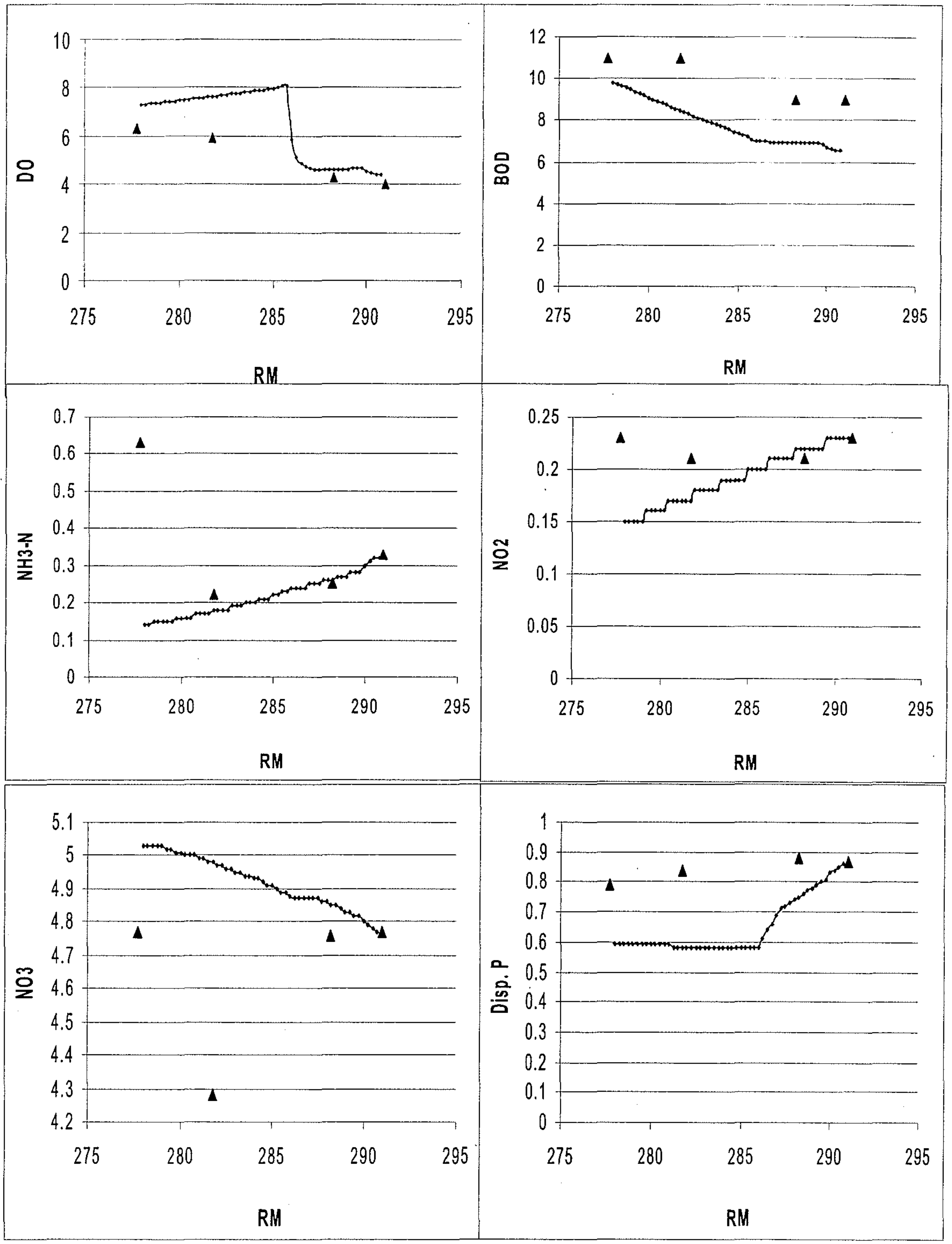


Figure 12. JULY 27, 2000 (May_modified 1991 values)



APPENDIX A

WATER QUALITY DATA

(SEPTEMBER-OCTOBER 1990, MAY-JUNE-JULY-1991)

Table a1. September 1990 (mean and standard deviation)

River Mile	TKN (mg/L)		NO2 (mg/L)		NO3 (mg/L)		Ortho.P (mg/L)		S.D (in.)		Chl.a (ug/L)	
278	1.14	0.14	0.18	0.02	2.79	0.10	1.29	0.07	31.25	5	1.78	0.35
285.3	1.29	0.28	0.14	0.02	3.04	0.14	1.43	0.07	21.25	6.67	1.42	0.71
287.9	1.21	0.21	0.12	0.03	2.79	0.10	1.21	0.07	27.92	5	0.71	0.01
290	1.29	0.29	0.05	0.01	4.43	0.21	2.14	0.42	15.42	7.5	3.57	0.71
291	1.31	0.29	0.12	0.02	2.5	0.14	1	0.28	33.75	2.5	0.71	0.01
291.2	1.21	0.29	0.08	0.02	1.5	0.43	0.85	0.20	37.5	8.33	0.5	0.01

River Mile	DO (mg/L)		NH3-N(mg/L)		CBOD20(mg/L)	
278	8	0.22	0.44	0.12	5.15	0.52
285.3			0.28	0.16	4.32	0.42
287.9	5.77	0.33	0.28	0.12	4.21	0.53
289.9	5.66	0.22				
290	8.44	1.33	0.28	0.08	4.94	0.63
290.1	5.44	0.44				
291	5.11	0.22	0.36	0.16	4.32	1.05
291.2	6	0.44	0.48	0.12	3.58	0.21

Table a2. October 1990 (mean and standard deviation)

River Mile	TKN (mg/L)		NO2 (mg/L)		NO3 (mg/L)		Ortho.P (mg/L)		S.D (in.)		Chl.a (ug/L)	
278	2	0.35	0.25	0.04	4.6	0.01	1.75	0.01	18	2	2.14	0.57
285.3	2	0.12	0.24	0.04	4.6	0.2	1.9	0.05	23	0.5	1.5	0.49
287.9	2.1	0.12	0.19	0.06	4.9	0.4	2.15	0.8	12	0.01	1.29	0.29
290	1.47	0.17	0.07	0.06	4.3	0.6	1.7	0.15			3.71	1.43
291	2.47	0.30	0.2	0.09	4.5	0.2	1.9	0.7			0.64	0.14
291.2	2.30	0.12	0.3	0.06	4.9	0.4	2.2	0.1			0.94	0.21

River Mile	DO (mg/L)		NH3-N(mg/L)		CBOD20(mg/L)	
278	8	0.24	0.78	0.09	5.95	0.6
280.9	8.24	0.24				
283	8.47	0.35				
285.3	8.94	0.01	0.7	0.08	6	0.6
287.9	5.05	0.47	0.48	0.17	8	1.2
289.9	4.94	0.58				
290	9.18	0.82	0.30	0.17	5.8	0.01
290.1	4.59	0.35				
291	3.85	0.01	1.09	0.09	5.95	0.2
291.2	4.59	0.94	0.43	0.17	5.95	0.4

Table a3. May 1991 (mean and standard deviation)

River Mile	TKN (mg/L)		NO2 (mg/L)		NO3 (mg/L)		Ortho.P (mg/L)		S.D (in.)		Chl.a (ug/L)	
278	2.36	0.18	0.31	0.01	3.57	0.42	1.52	0.52	23	1.74	4	2.2
285.3	2.18	0.09	0.35	0.01	2.86	0.14	1.74	0.7	26.5	3.48	3.4	0.3
287.9	2.55	0.36	0.24	0.08	2.71	0.43	1.13	0.17	32.6	3.48	2.7	0.6
290	1.81	0.27	0.1	0.04	2.93	0.29	1.21	0.17	10	1.74	6.5	1.2
291	2.90	0.55	0.31	0.11	2.90	0.42	0.91	0.35	44.4	6	1.8	0.2
291.2	2.55	0.55	0.26	0.09	3.43	0.71	1.26	0.17	38.3	5.2	1.4	0.5

River Mile	DO (mg/L)		NH3-N(mg/L)		CBOD20(mg/L)	
278	7.2	0.6	0.5	0.01	8	0.01
280.9	7.4	0.3				
283	7.6	0.4				
285.3	8	0.6	0.72	0.01	7.86	0.29
287.9	4.5	0.8	0.5	0.16	8.14	0.28
289.9	4.3	1				
290	6.6	0.8	0.56	0.11	5.71	0.29
290.1	3.7	0.4				
291	3.4	0.4	0.89	0.28	6.14	0.01
291.2	.3	0.2	1.11	0.17	6.43	0.01

Table a4. June 1991 (mean and standard deviation)

River Mile	TKN (mg/L)		NO2 (mg/L)		NO3 (mg/L)		Ortho.P (mg/L)		S.D (in.)		Chl.a (ug/L)	
278	1.27	0.45	0.23	0.01	3.21	0.01	1.09	0.09	15.6	5	2.77	0.66
285.3	1.63	0.01	0.24	0.02	3	0.14	1.22	0.04	16.25	3.75	2.55	1
287.9	1.73	0.18	0.16	0.01	3.14	0.57	1.45	0.27	22.5	1.25	3	0.66
290	1.36	0.46	0.11	0.04	2.92	0.43	1.4	0.13	10	0.6	4	0.88
291	2.09	0.36	0.25	0.07	3	0.42	1.4	0.27	45	5	2.22	0.44
291.2	2.09	0.01	0.25	0.02	3	0.28	1.95	0.18	30	5	2	0.61

River Mile	DO (mg/L)		NH3-N(mg/L)		CBOD20(mg/L)	
278	6.7	0.3	0.22	0.01	7.95	0.28
280.9	7	0.4				
283	7.1	0.4				
285.3	7.5	0.2	0.39	0.01	7.95	0.57
287.9	3.8	0.2	0.5	0.22	8	0.28
289.9	4.5	0.8				
290	6.9	0.6	0.56	0.22	8.14	0.57
290.1	2.9	0.8				
291	2.6	0.4	0.72	0.22	8.14	0.14
291.2	2.6	0.4	1	0.01	6.71	1.42

Table a5. July 1991 (mean and standard deviation)

River Mile	TKN (mg/L)		NO2 (mg/L)		NO3 (mg/L)		Ortho.P (mg/L)		S.D (in.)		Chl.a (ug/L)	
278	1.47	0.17	0.19	0.01	2.95	0.1	1.32	0.14	24.34	3.4	8.5	3.5
285.3	1.47	0.17	0.18	0.02	2.9	0.2	1.5	0.36	27.8	4.34	6.5	1
287.9	1.70	0.24	0.13	0.02	3.2	0.4	2.43	0.71	43.04	1	4.5	1
290	2.70	0.24	0.06	0.01	2.6	0.1	1.68	0.19	8.7	1.74	41.5	10
291	1.47	0.23	0.16	0.06	2.5	0.4	1.57	0.36	46	1.74	2	0.1
291.2	1.47	0.1	0.16	0.01	2.75	0.2	1.78	0.42	46	4.34	1	0.1

River Mile	DO (mg/L)		NH3-N(mg/L)		CBOD20(mg/L)	
278	8	0.52	0.18	0.01	5	1.38
280.9	7.95	1				
283	7.30	0.7				
285.3	7.47	0.34	0.25	0.03	4.95	0.83
287.9	4.34	1.04	0.14	0.03	5.27	2.22
289.9	4.52	1.39				
290	11.47	5.91	0.36	0.07	13.89	5.56
290.1	4	0.7				
291	4	1	0.1	0.01	2.77	0.01
291.2	4	0.34	0.46	0.07	3	0.01

Table a6. August 1991 (mean and standard deviation)

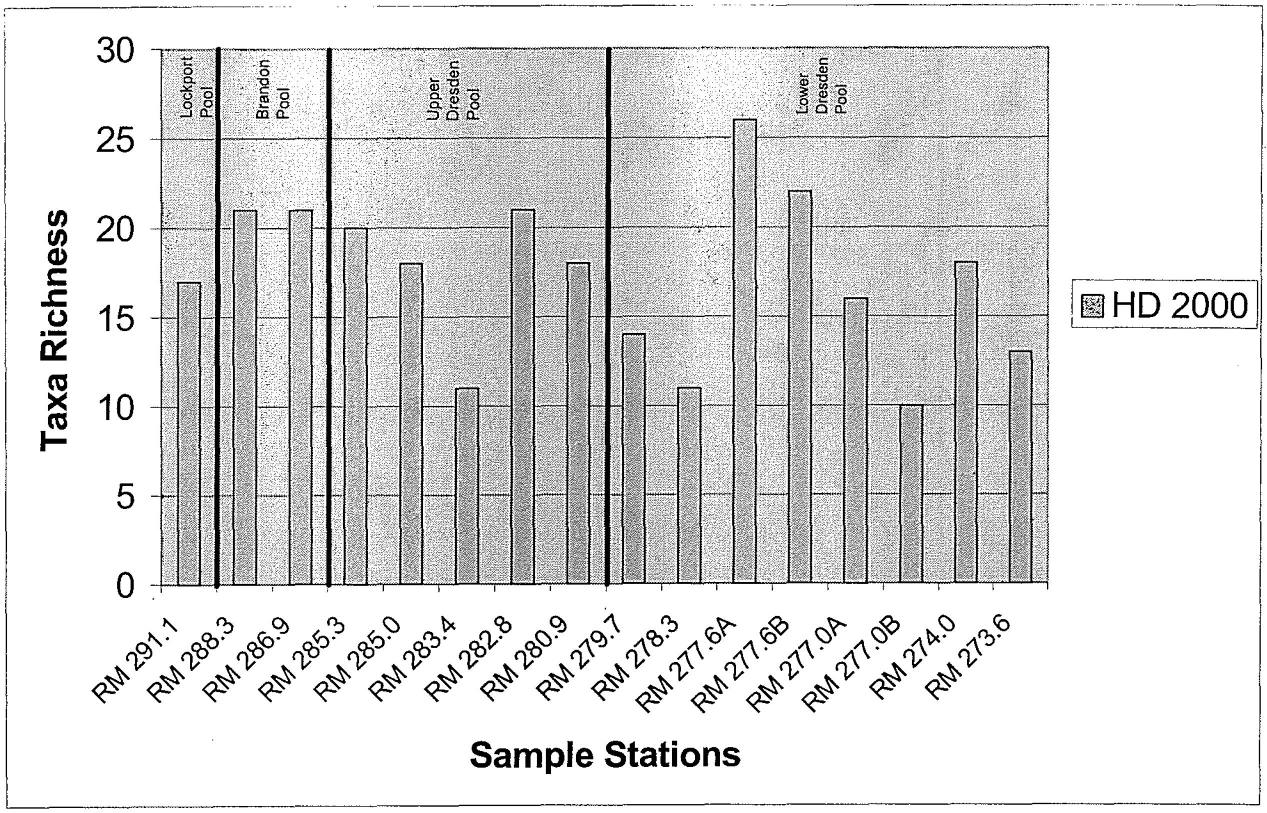
River Mile	TKN (mg/L)		NO2 (mg/L)		NO3 (mg/L)		Ortho.P (mg/L)		S.D (in.)		Chl.a (ug/L)	
278	1.3	0.2	0.18	0.01	2.97	0.11	1.48	0.14	25	5	7	3
285.3	1.1	0.2	0.17	0.01	2.97	0.11	2	0.44	25	5	6.5	0.1
287.9	1.7	0.1	0.11	0.02	3.37	0.34	2.4	0.74	44	10	2.5	1
290	2	0.6	0.05	0.01	3.54	0.11	2.22	.44	8.5	2	51	13
291	1.7	0.1	0.11	0.01	0.91	0.05	2.30	0.3	57.5	5	1	0.01
291.2	1.7	0.1	0.12	0.02	0.89	0.05	2.30	0.3	50	14	1	0.01

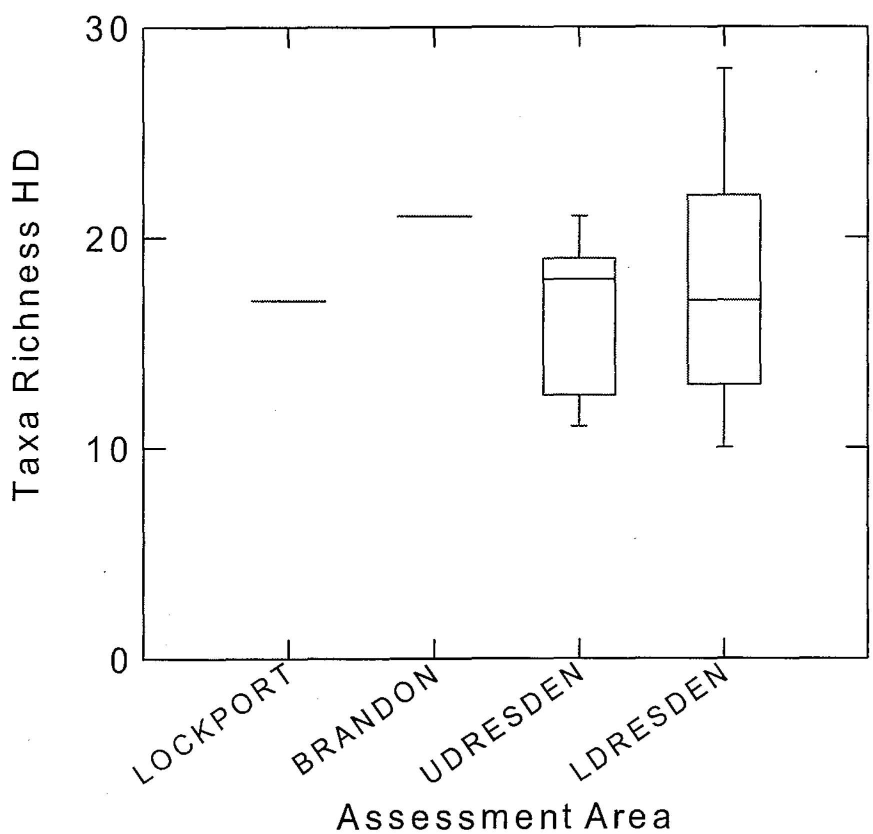
River Mile	DO (mg/L)		NH3-N(mg/L)		CBOD20(mg/L)	
278	7.47	0.34	0.30	0.01	5.94	0.55
280.9	7.13	0.34				
283	7.13	0.7				
285.3	7.13	0.34	0.34	0.01	8.61	0.01
287.9	4	0.34	0.30	0.01	5.38	0.01
289.9	4.17	0.34				
290	10.26	3.9	0.55	0.13	21.38	1.11
290.1	4	0.34				
291	3.82	0.17	0.30	0.13	6.11	0.01
291.2	3.82	0.34	0.90	0.1	6.66	0.5

Appendix E

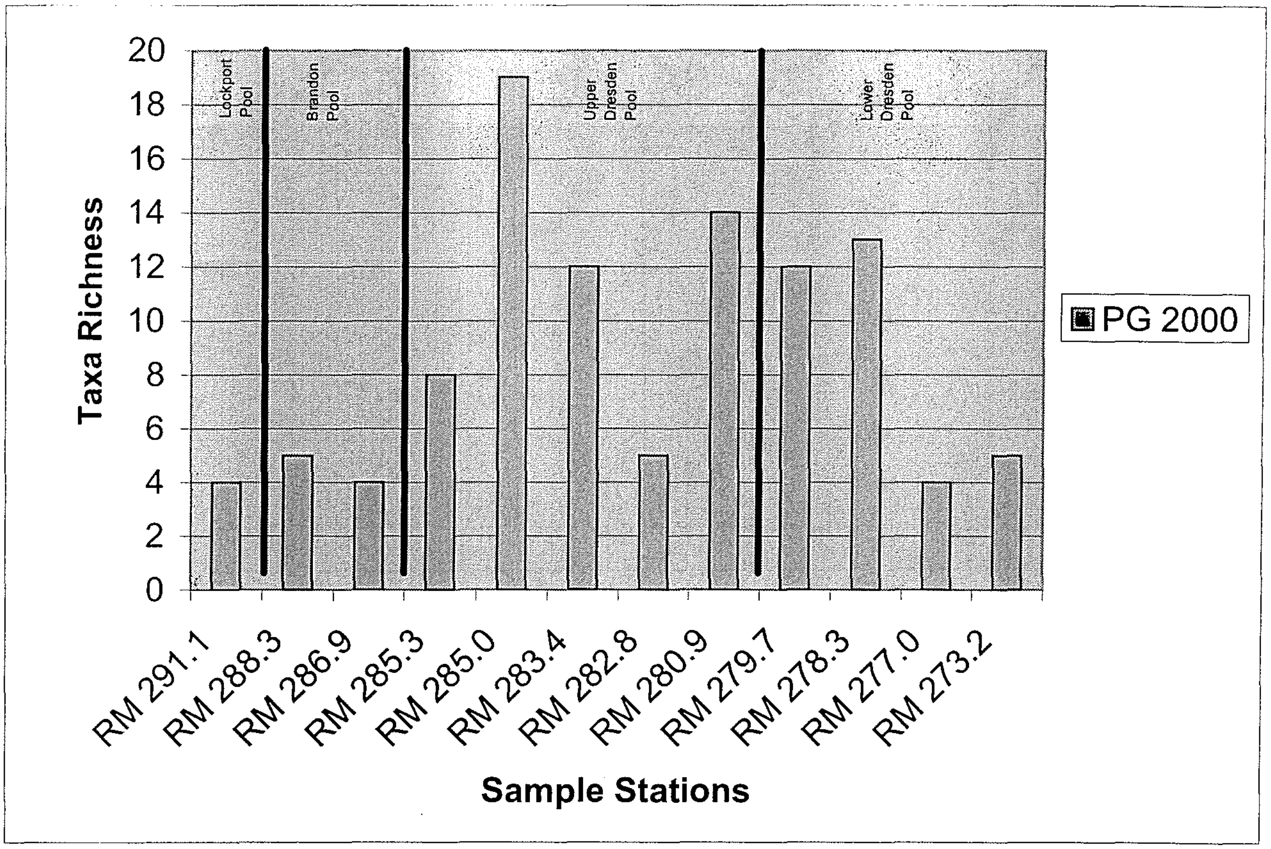
Macroinvertebrate Plots

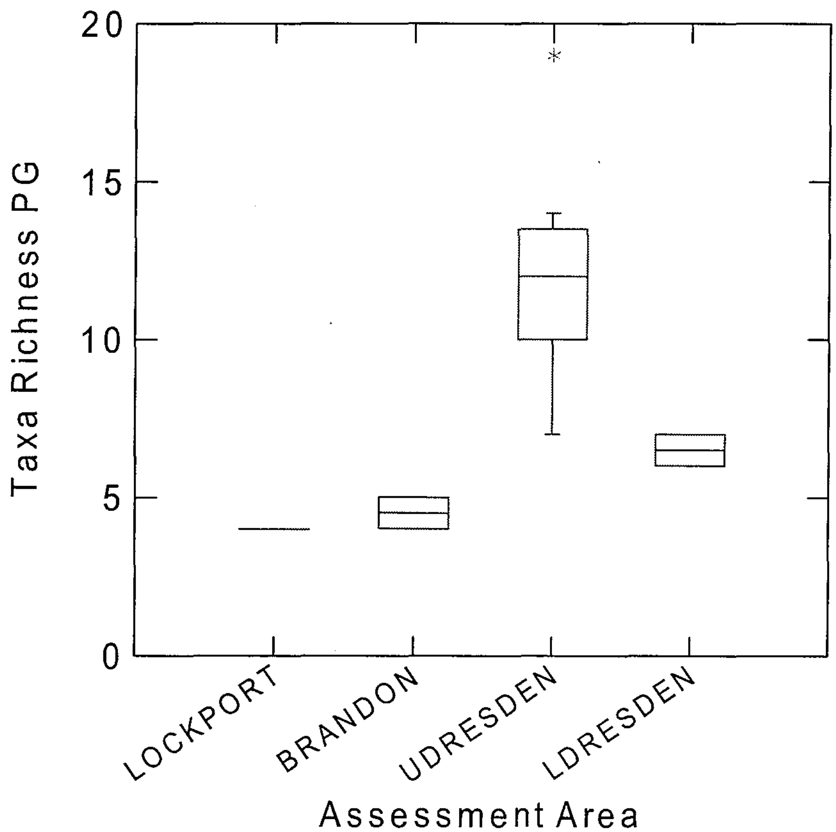
Figures 1 and 2



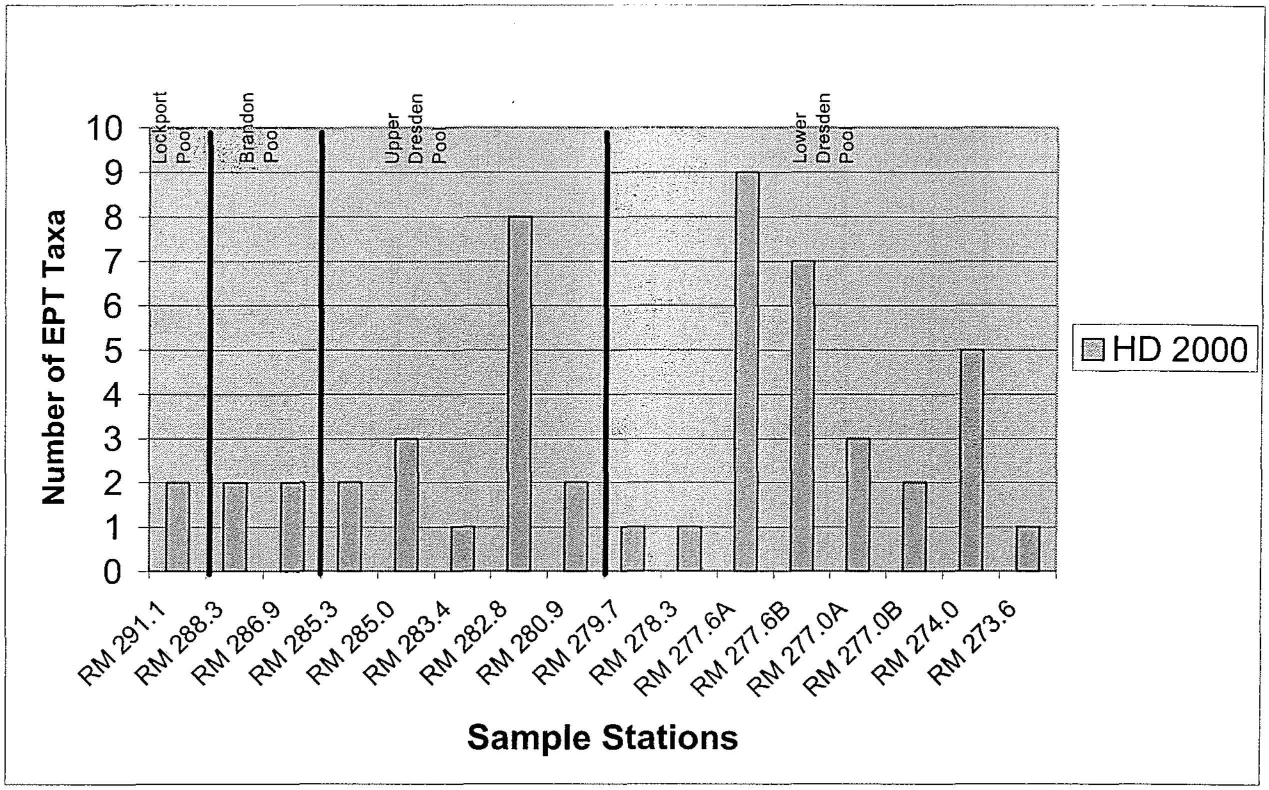


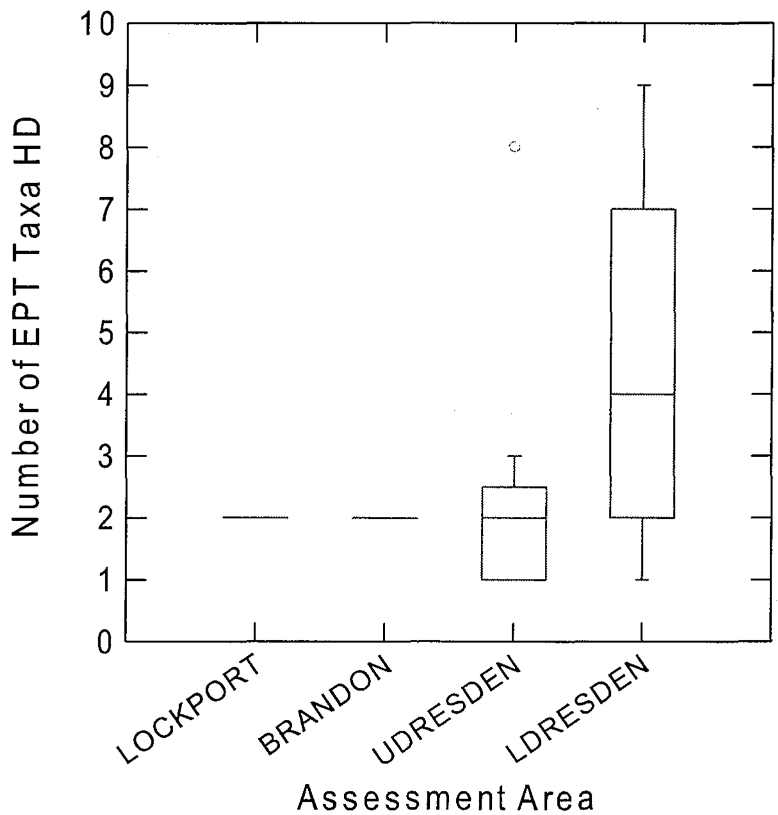
Figures 3 and 4



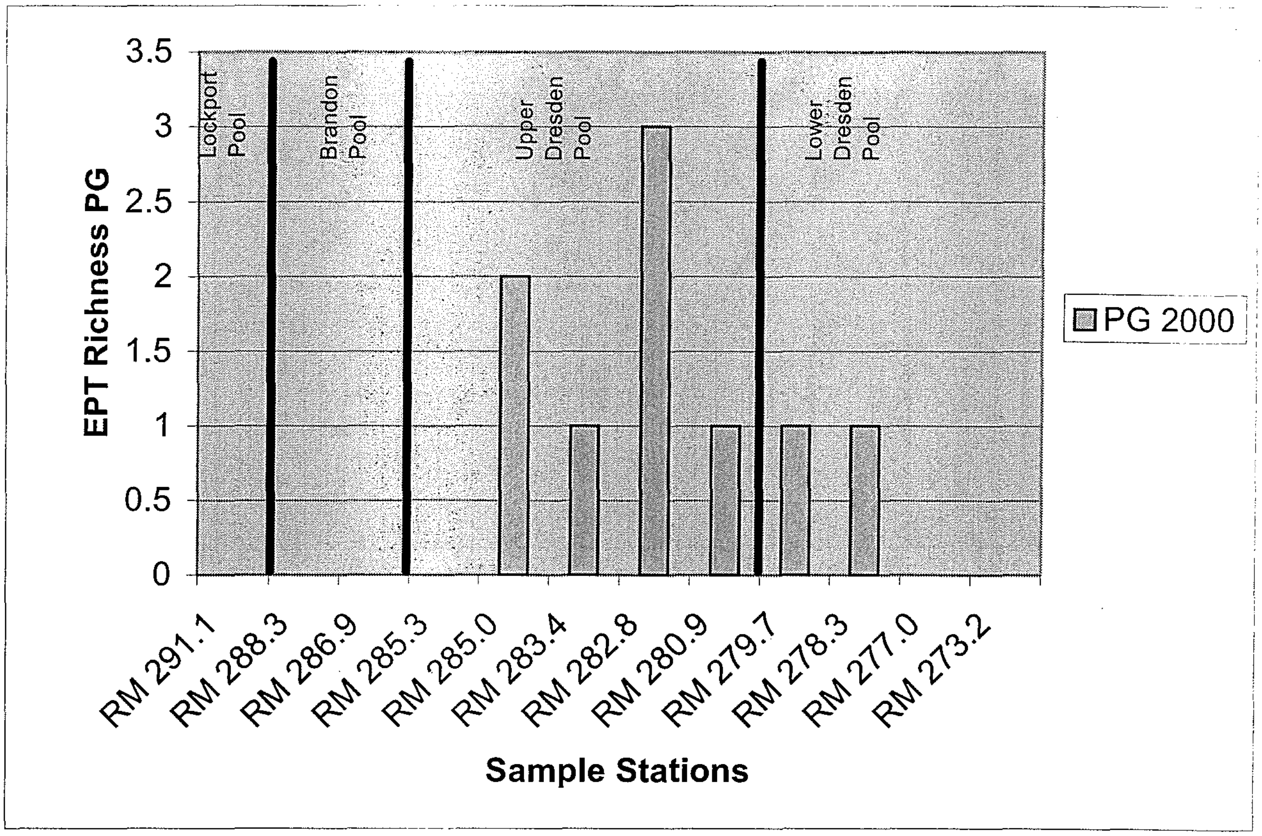


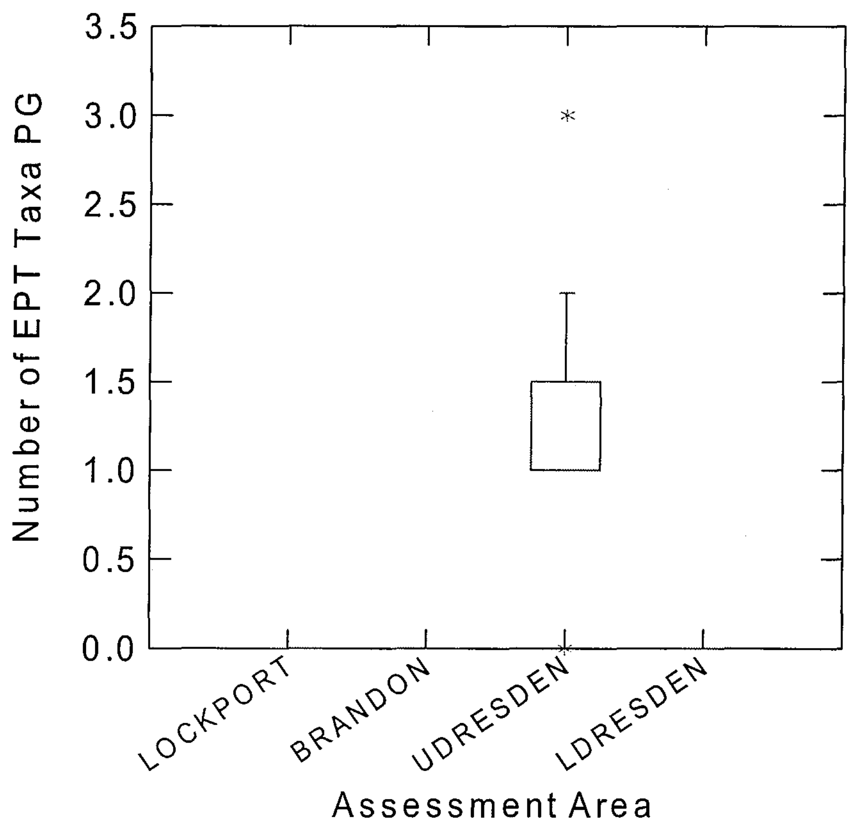
Figures 5 and 6



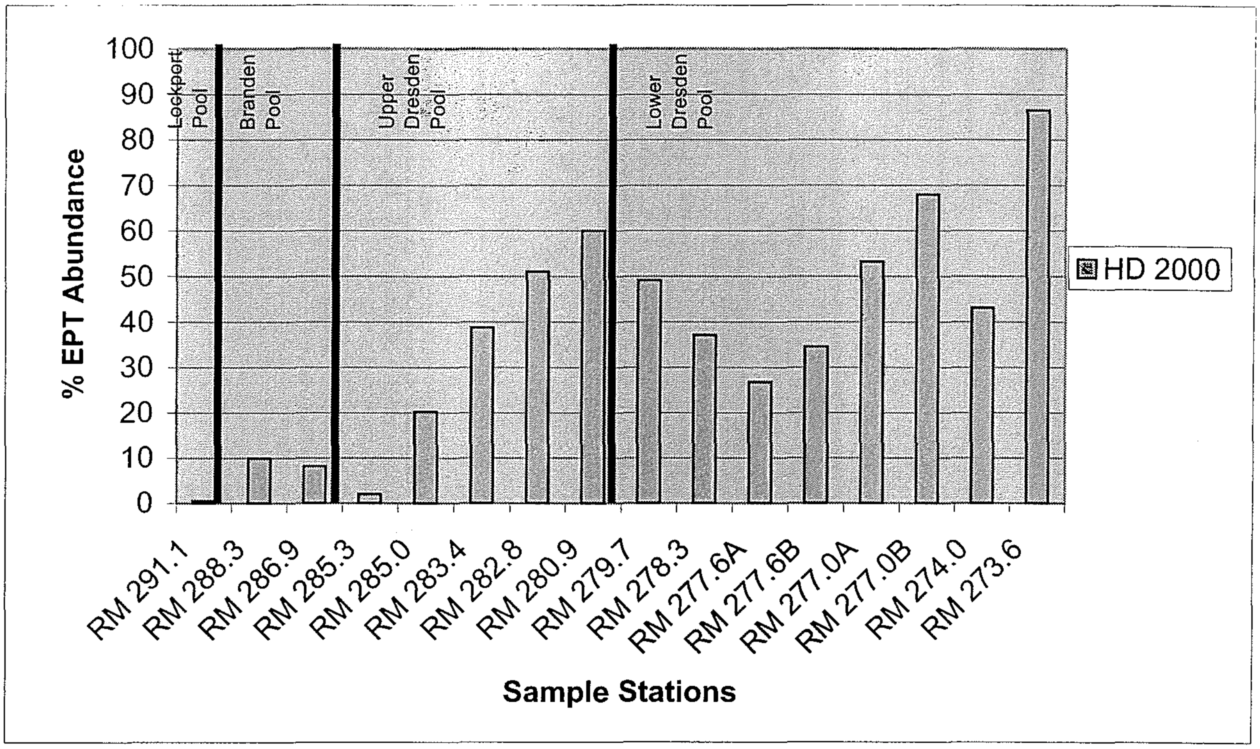


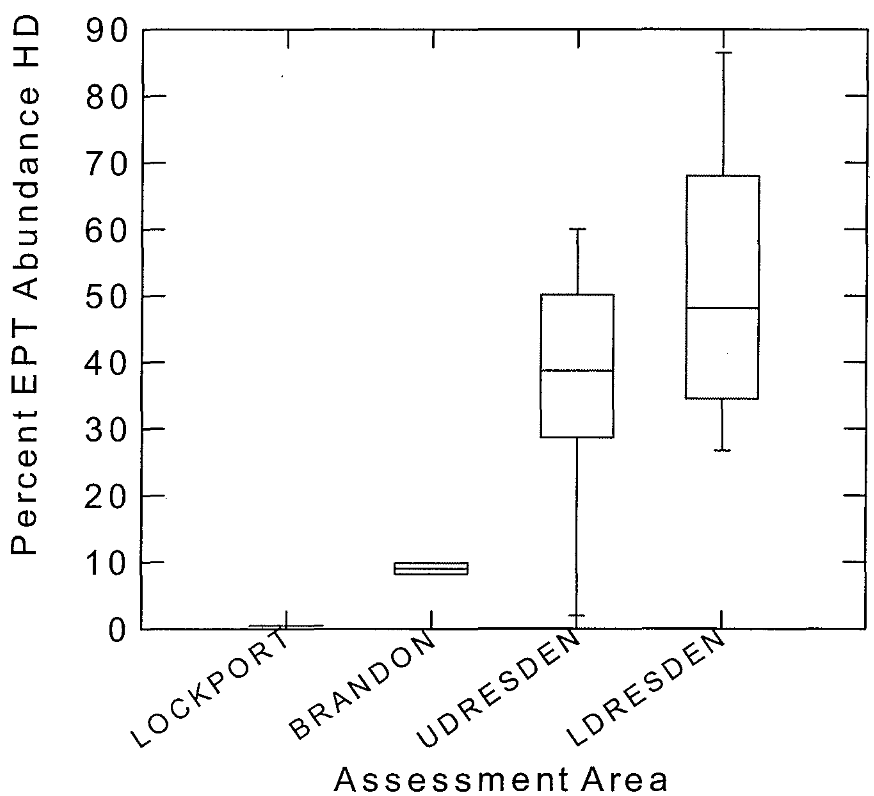
Figures 7 and 8



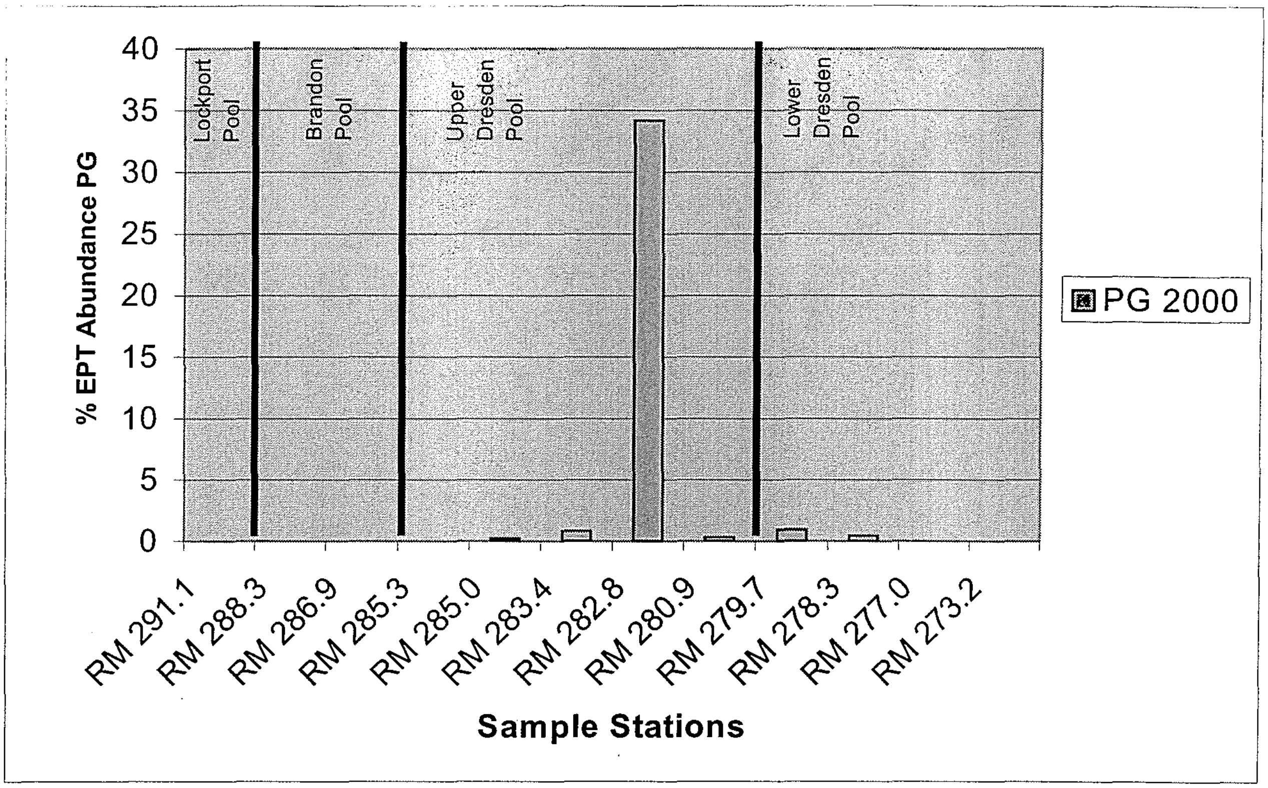


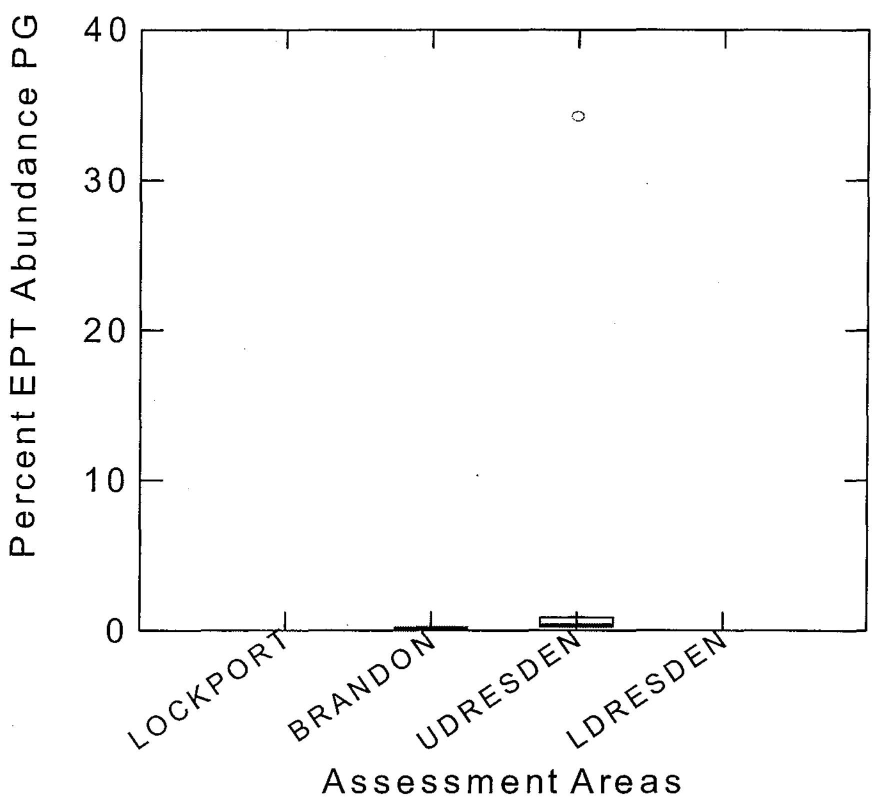
Figures 9 and 10



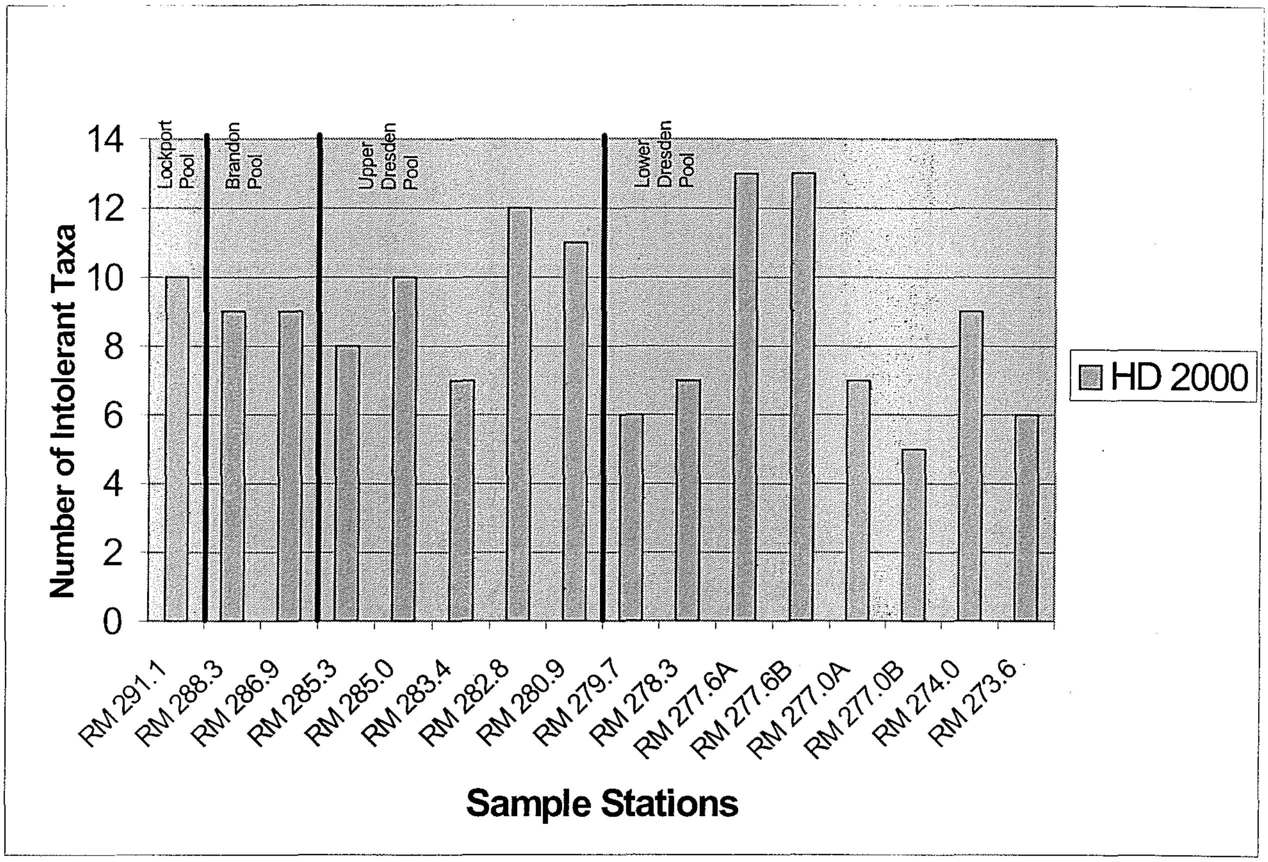


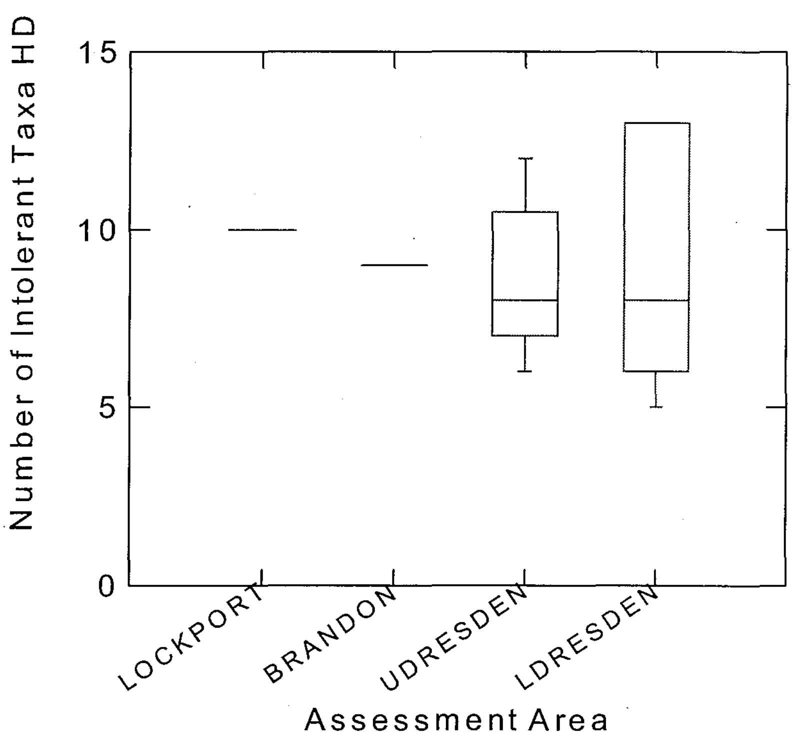
Figures 11 and 12



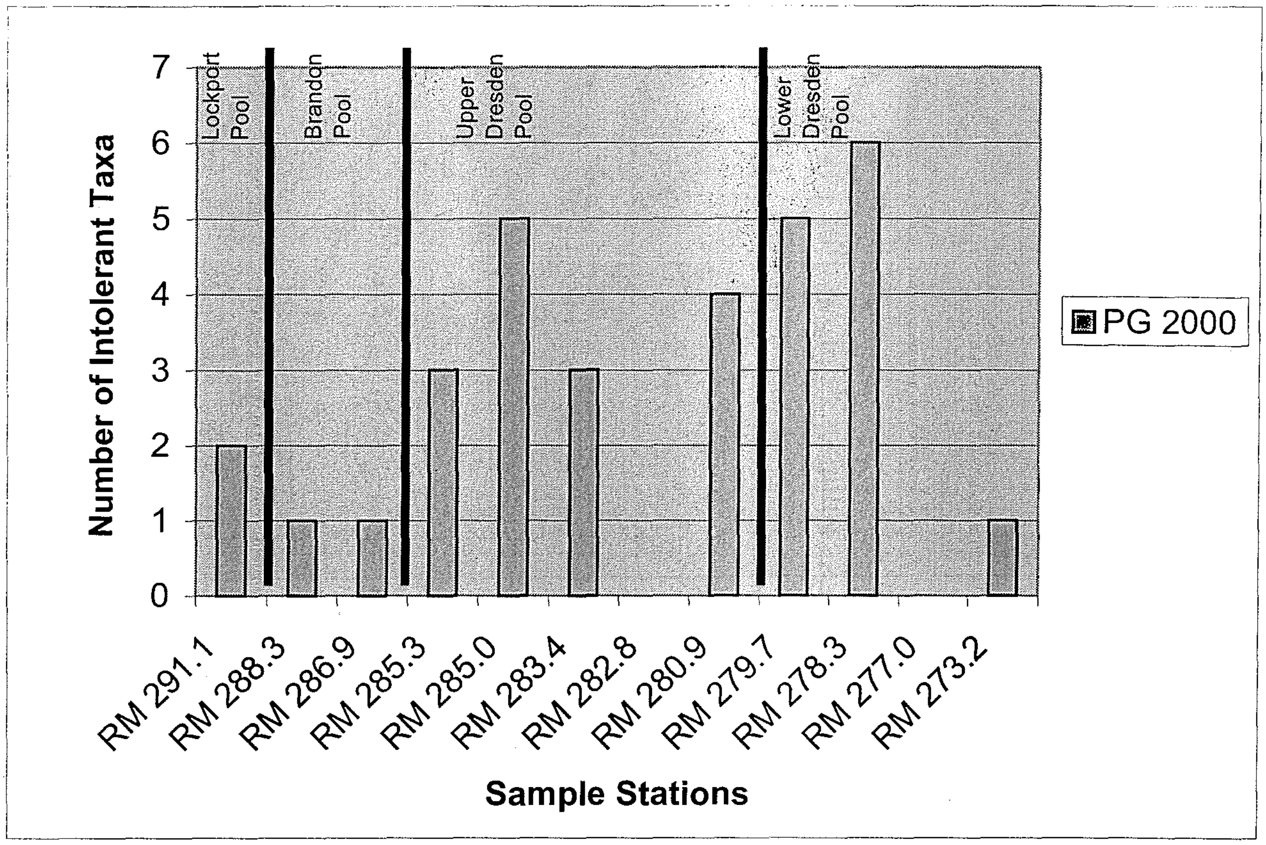


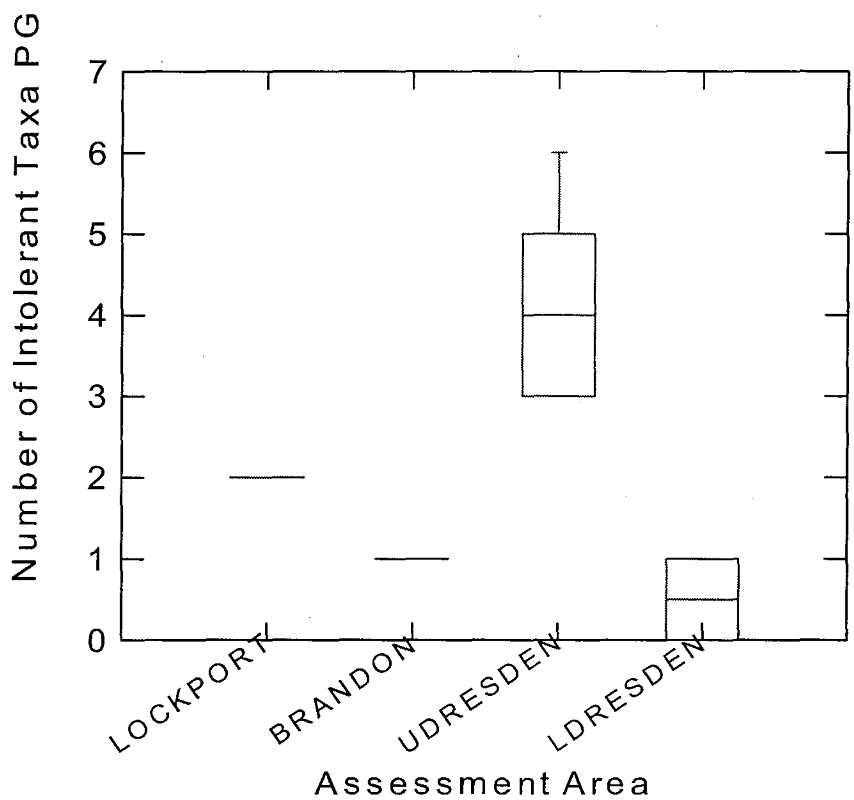
Figures 13 and 14



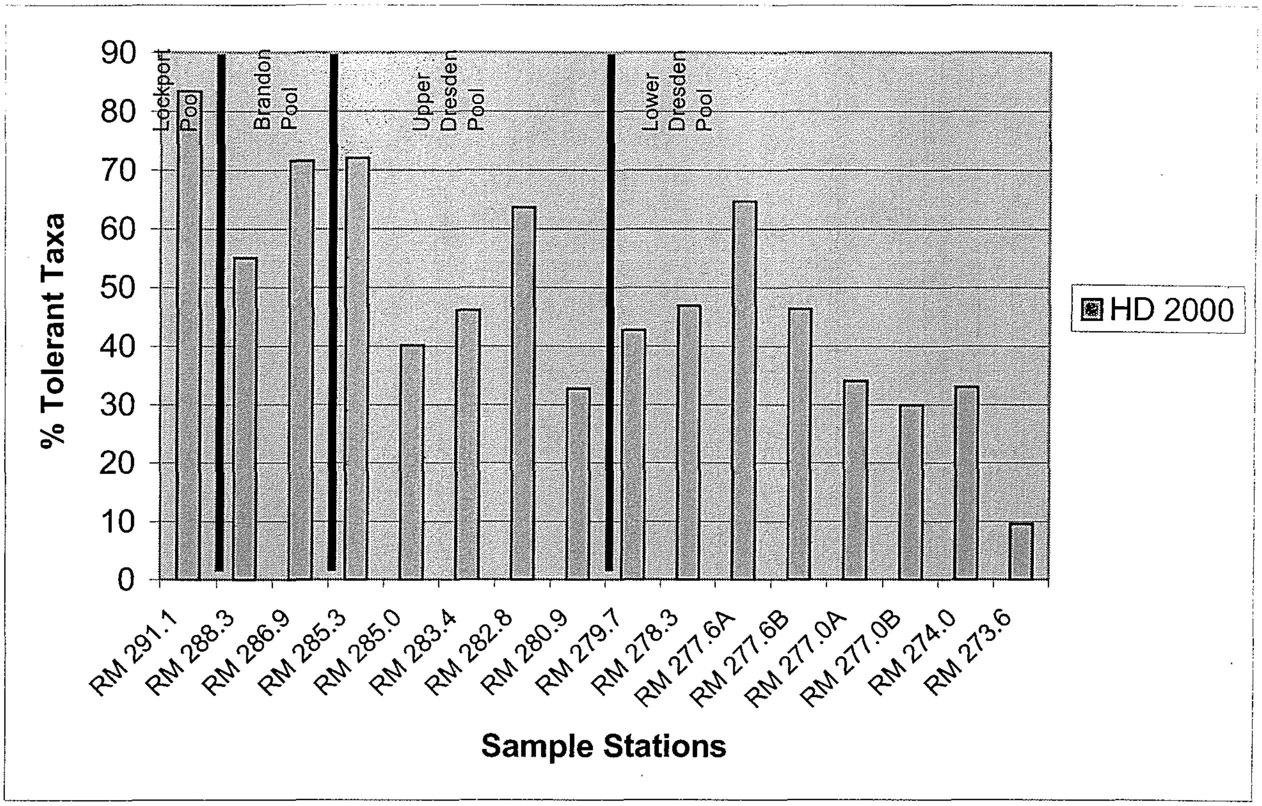


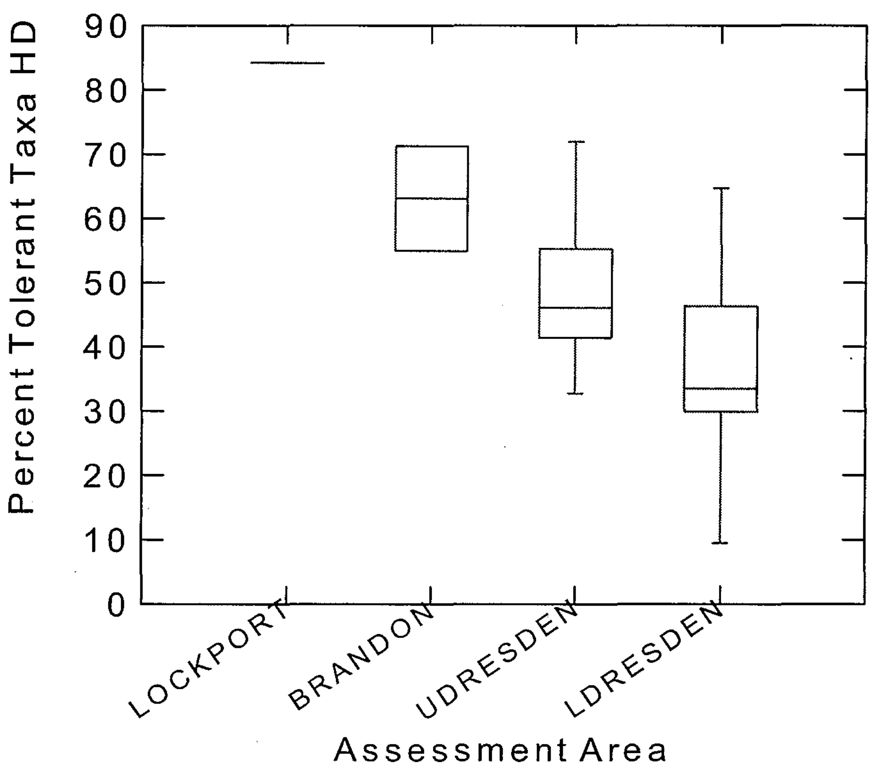
Figures 15 and 16



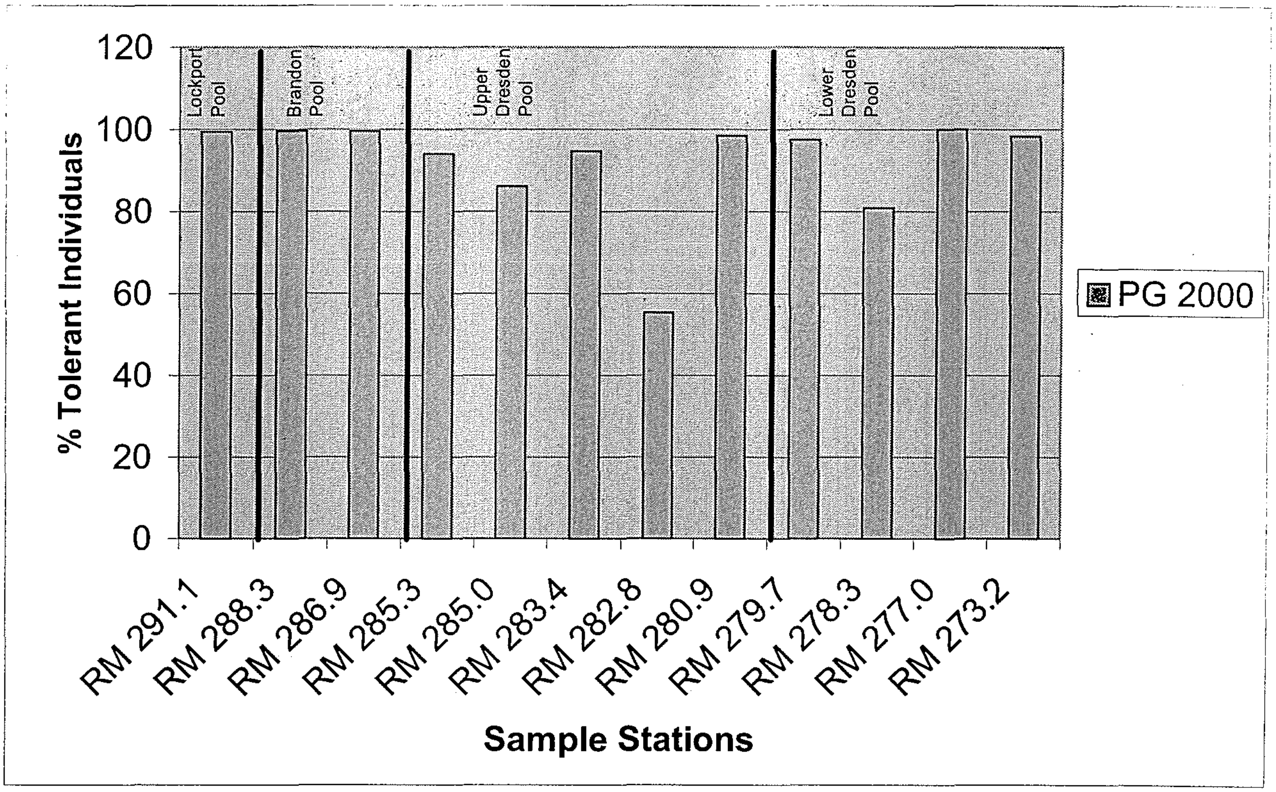


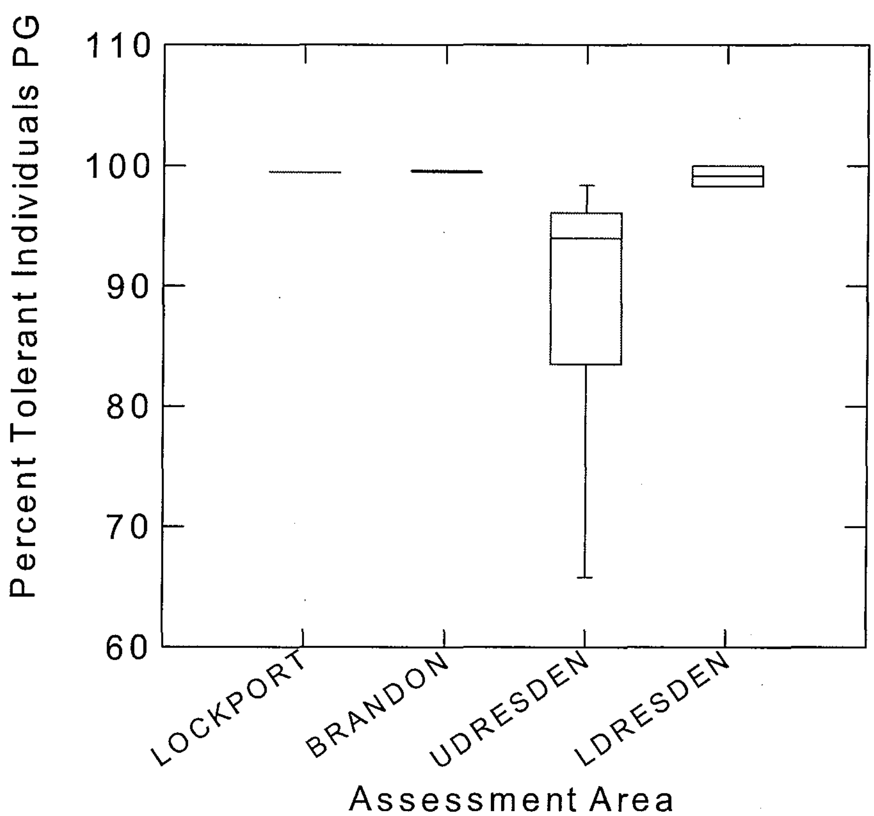
Figures 17 and 18



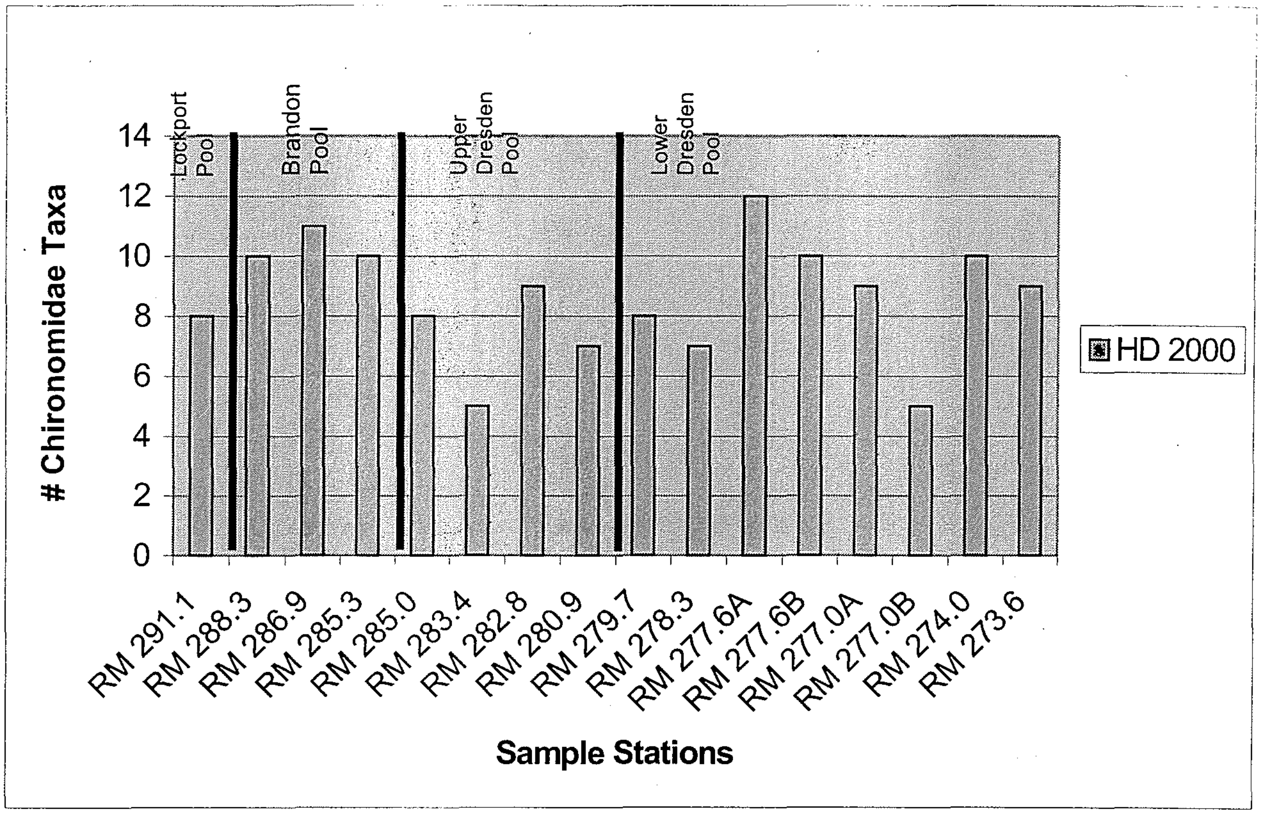


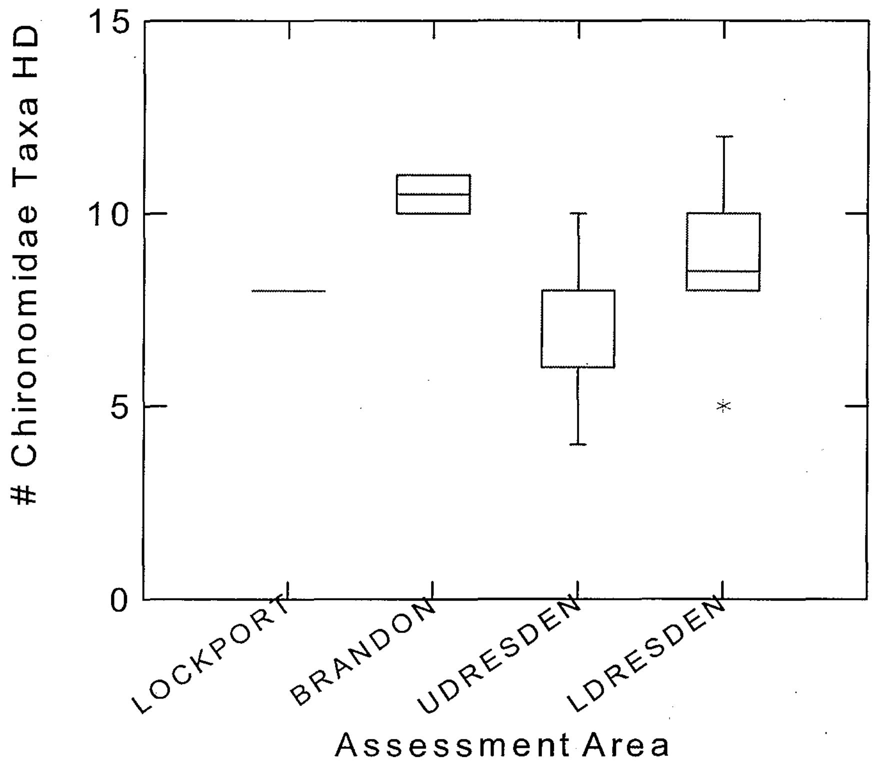
Figures 19 and 20



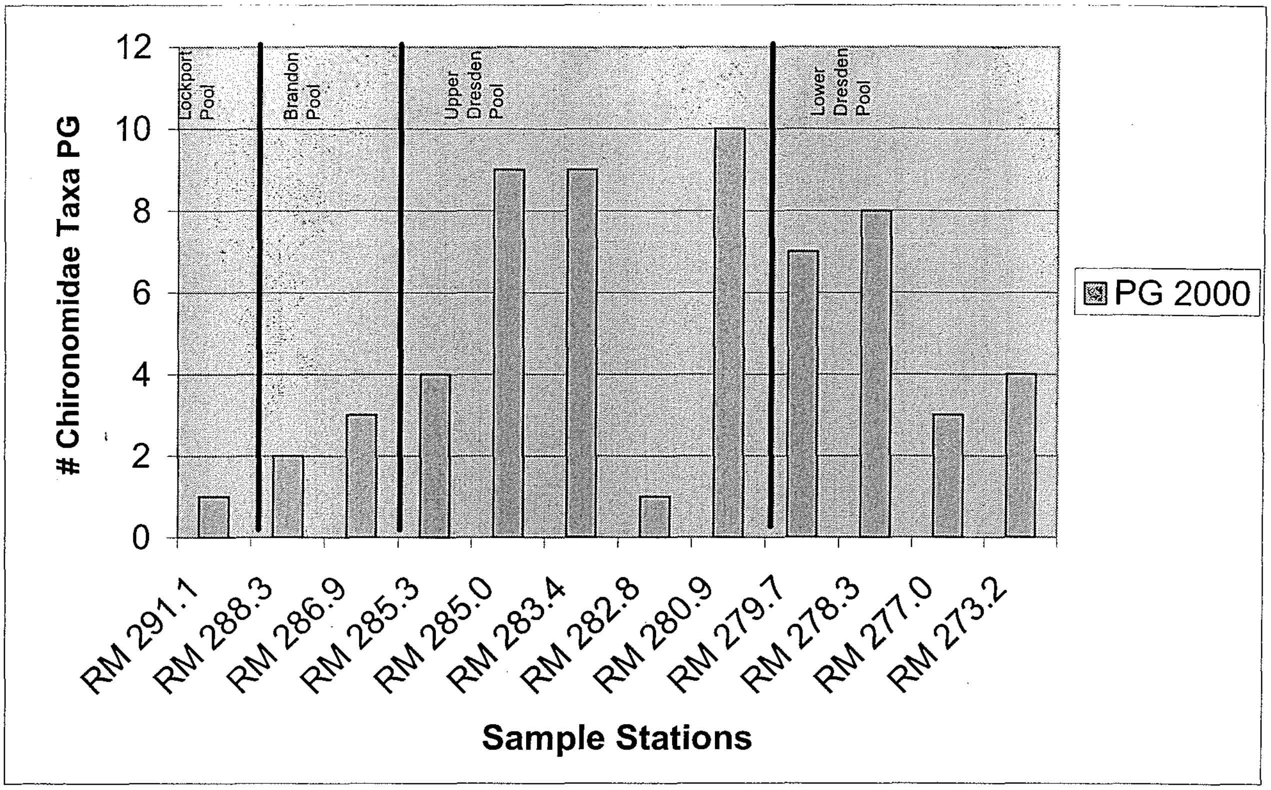


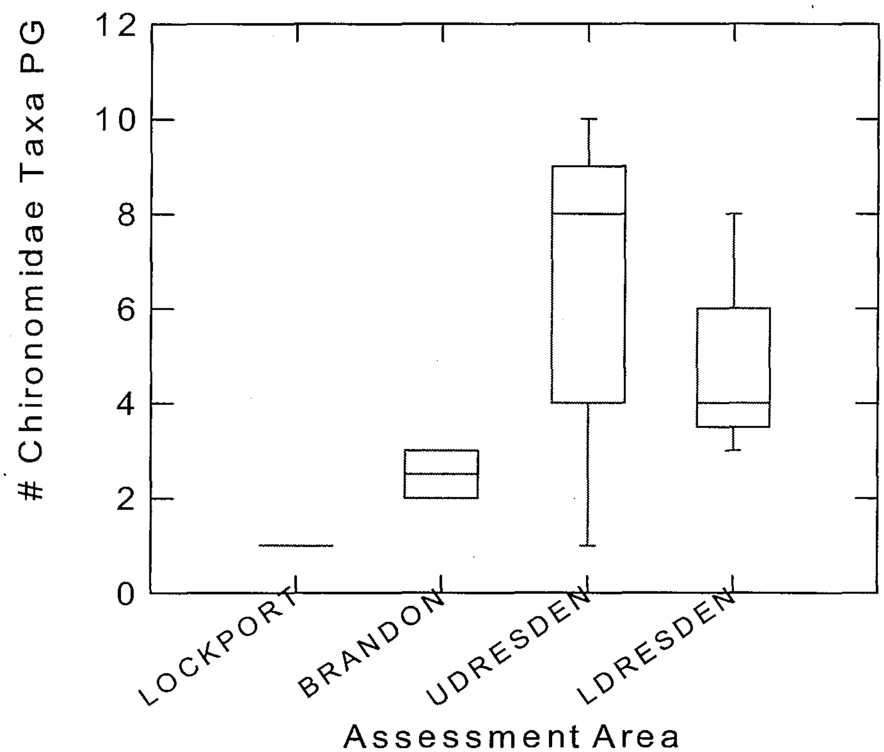
Figures 21 and 22



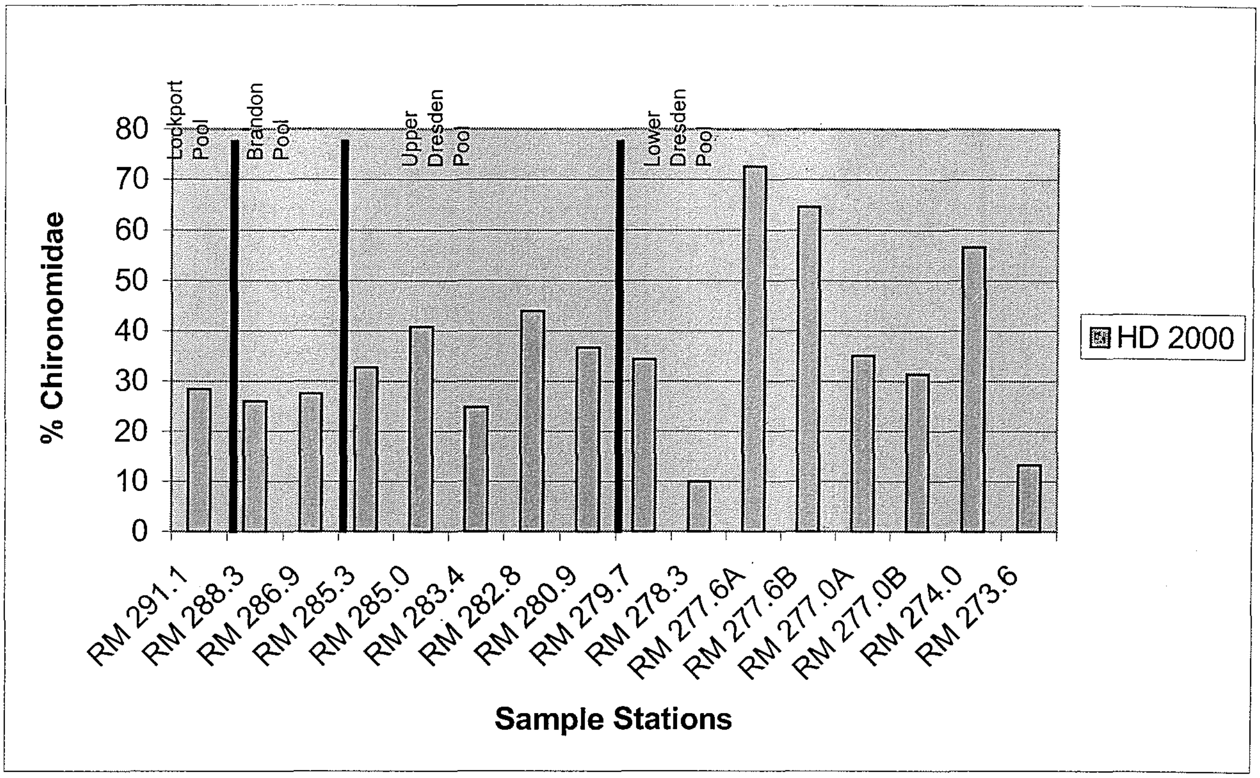


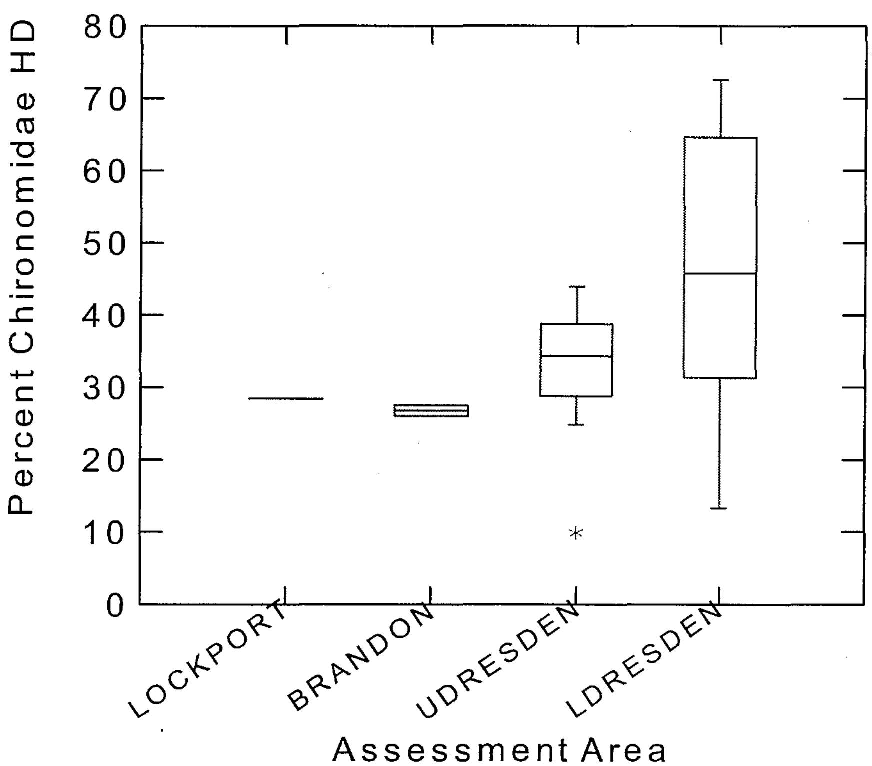
Figures 23 and 24



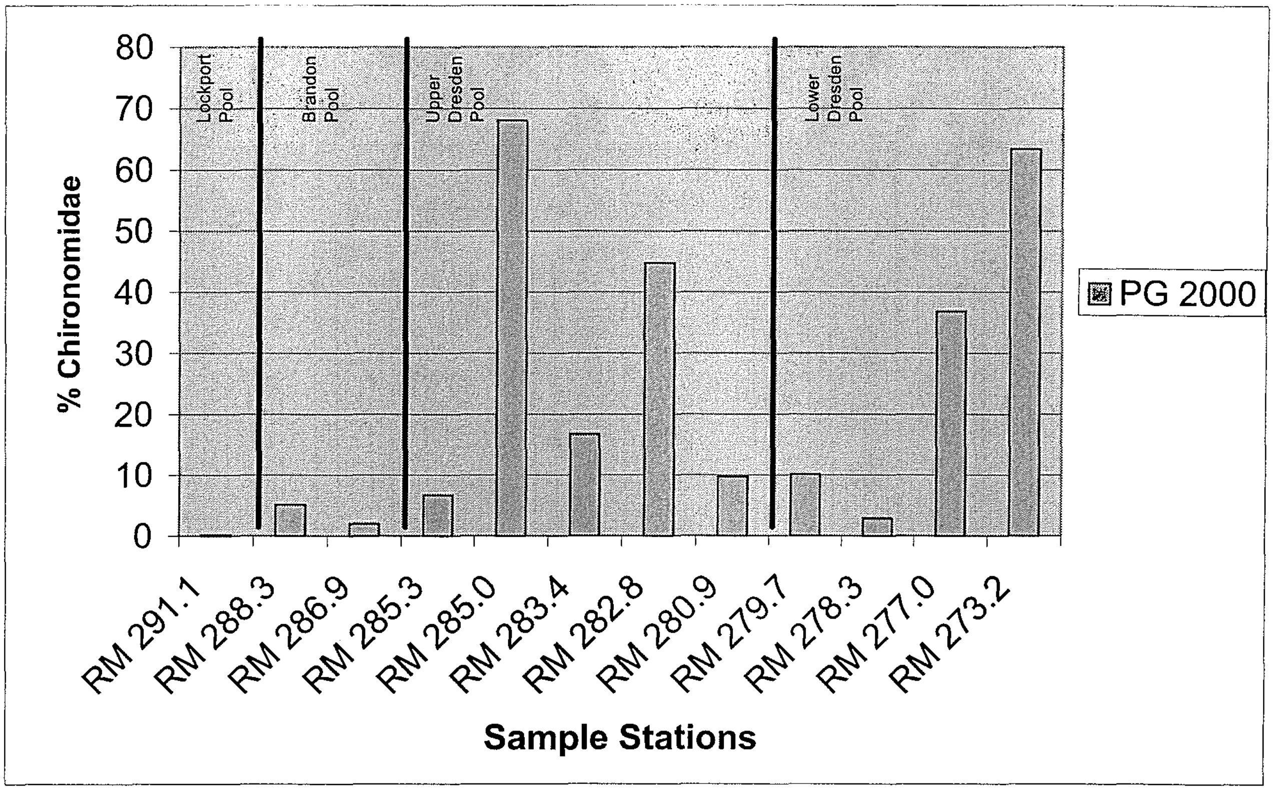


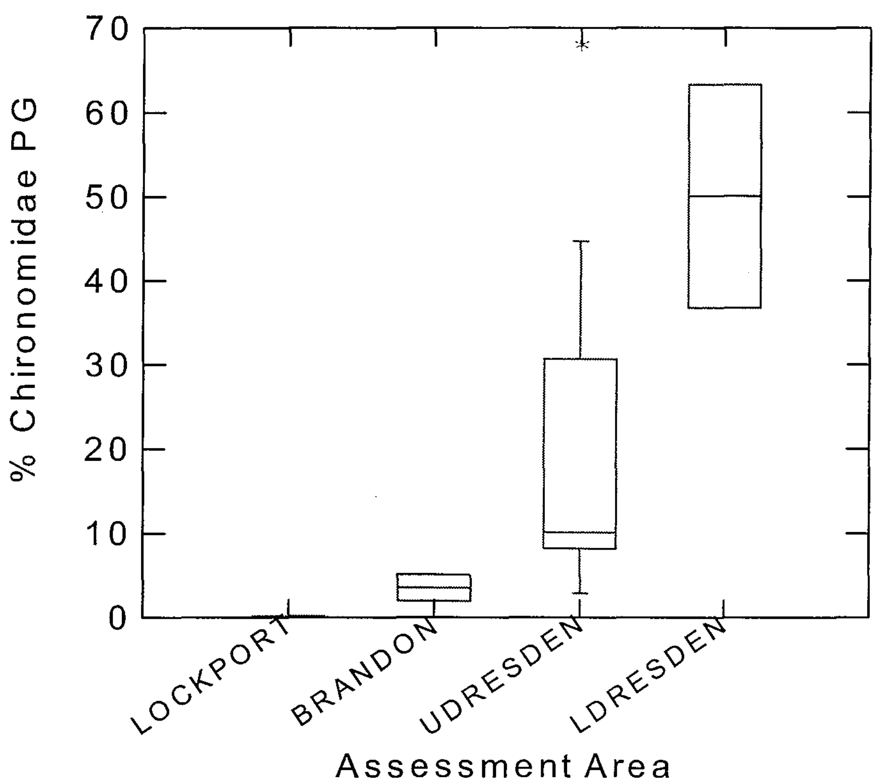
Figures 25 and 26



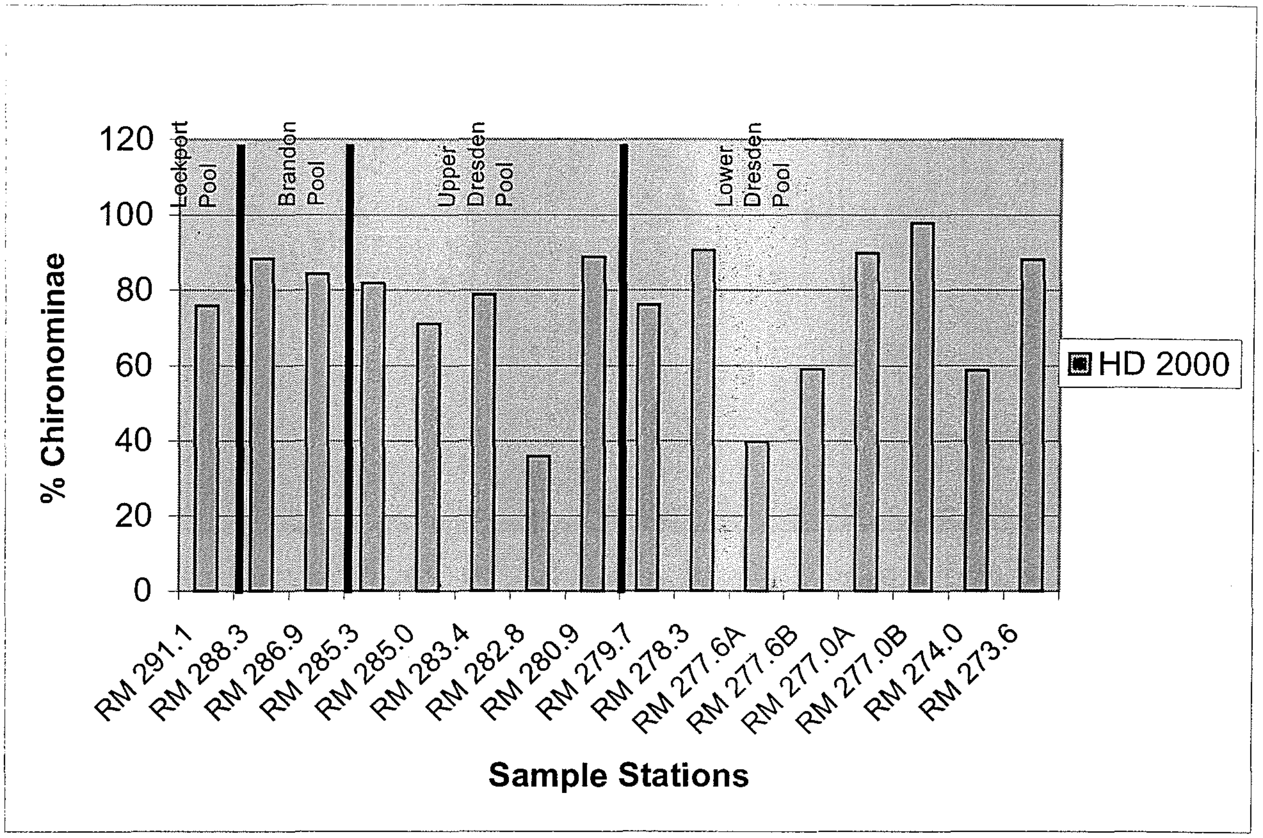


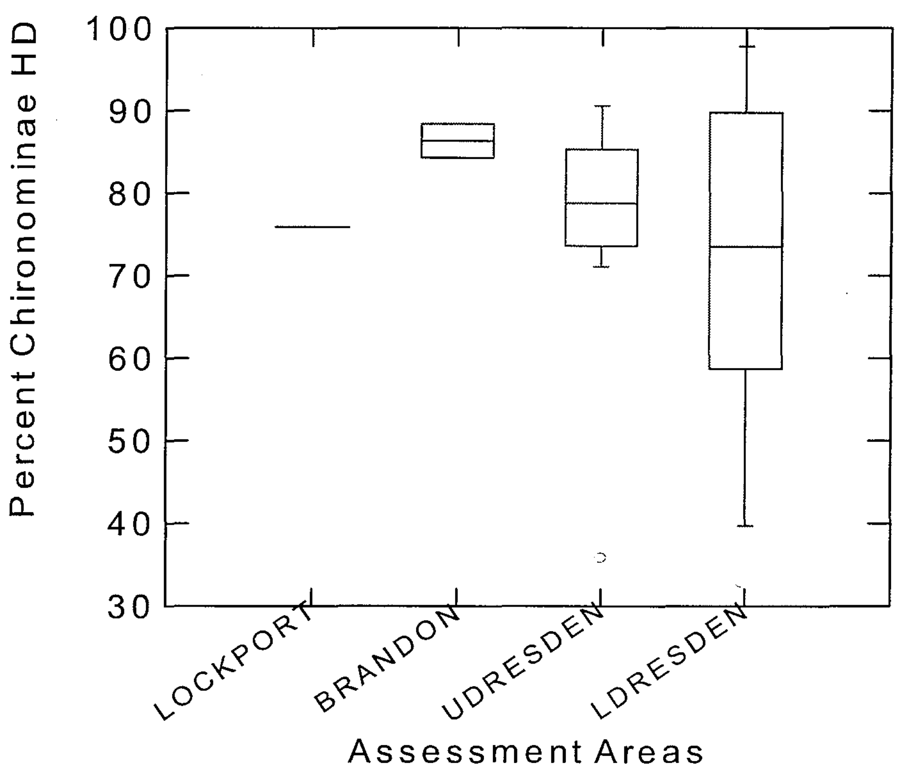
Figures 27 and 28



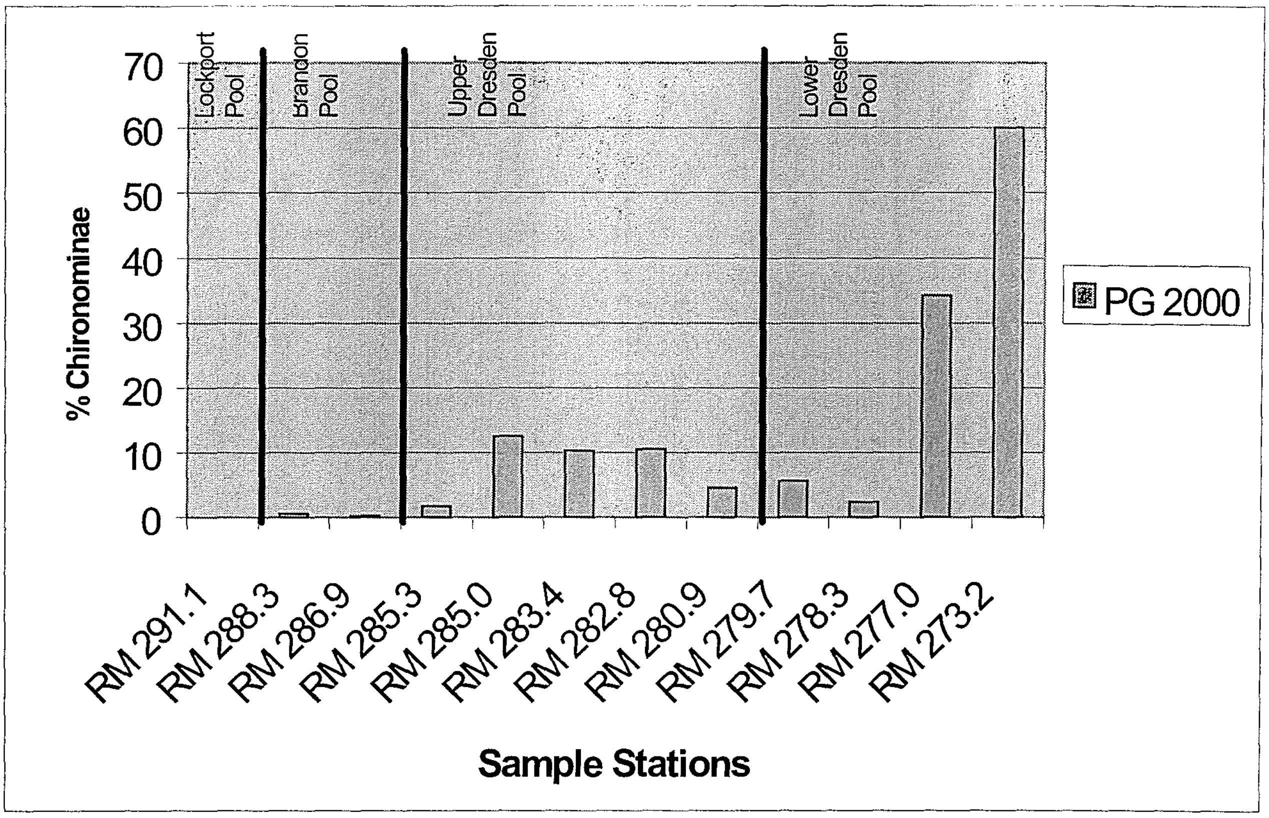


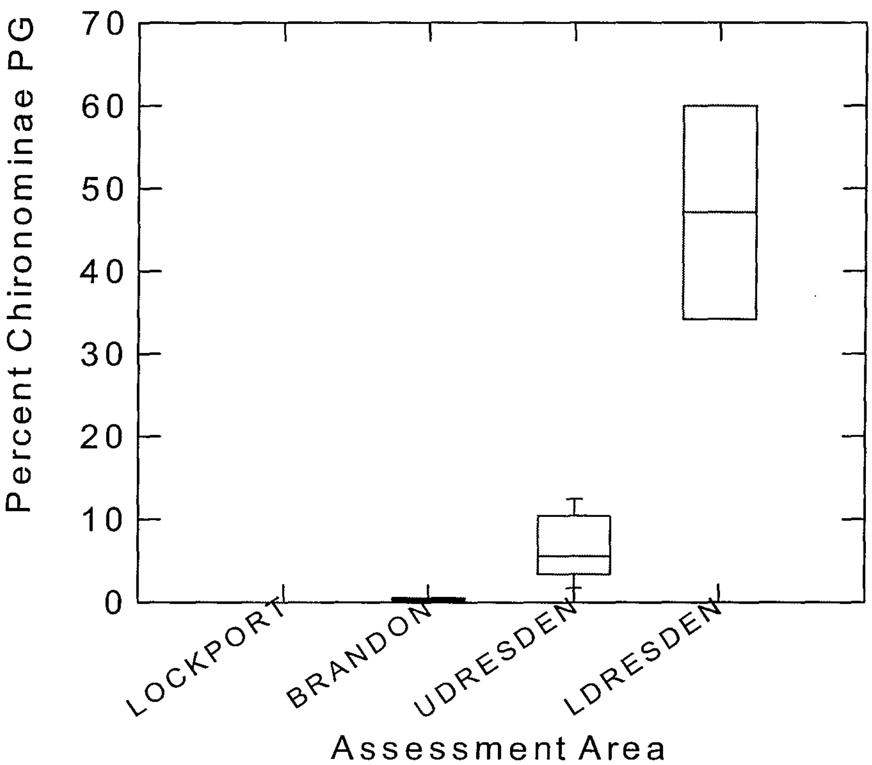
Figures 29 and 30



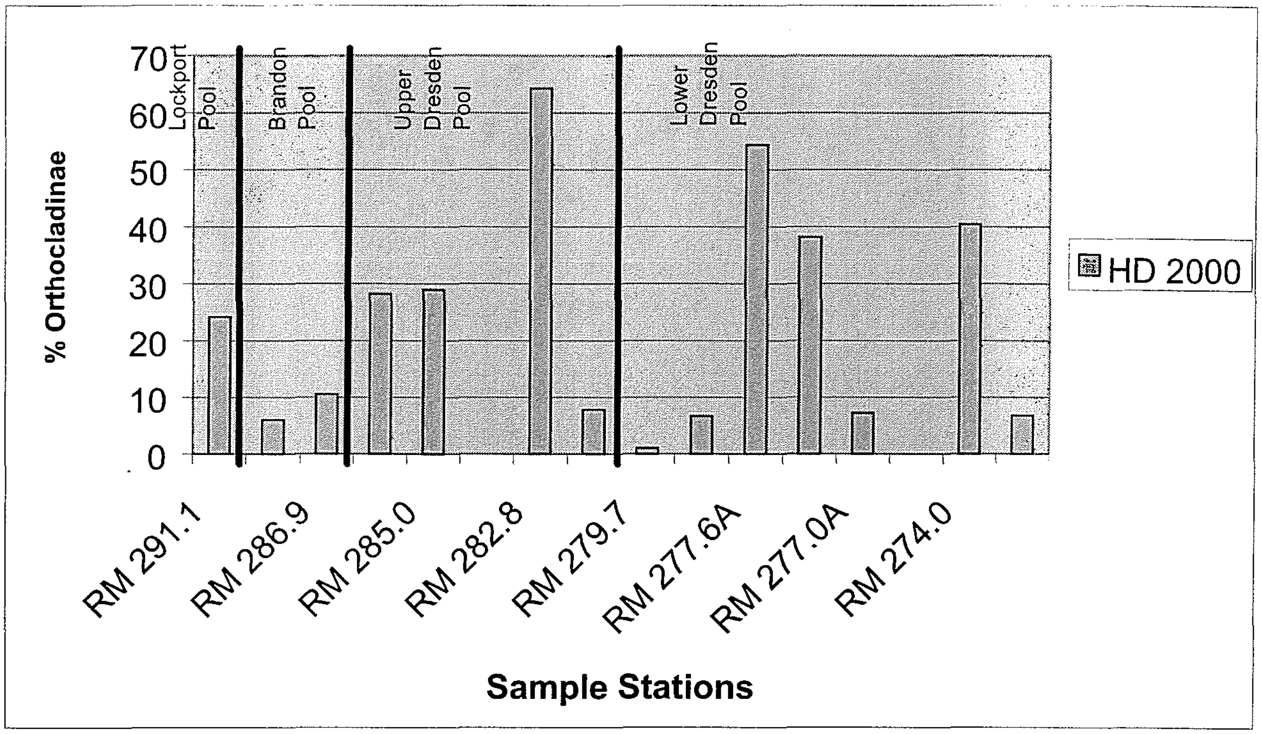


Figures 31 and 32





Figures 33 and 34



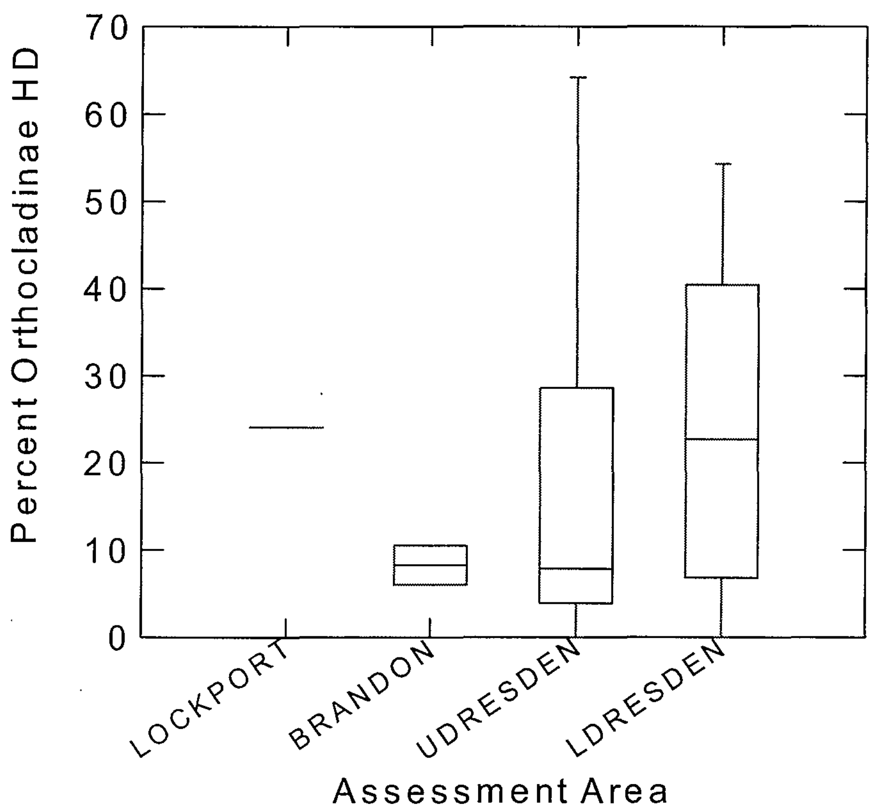
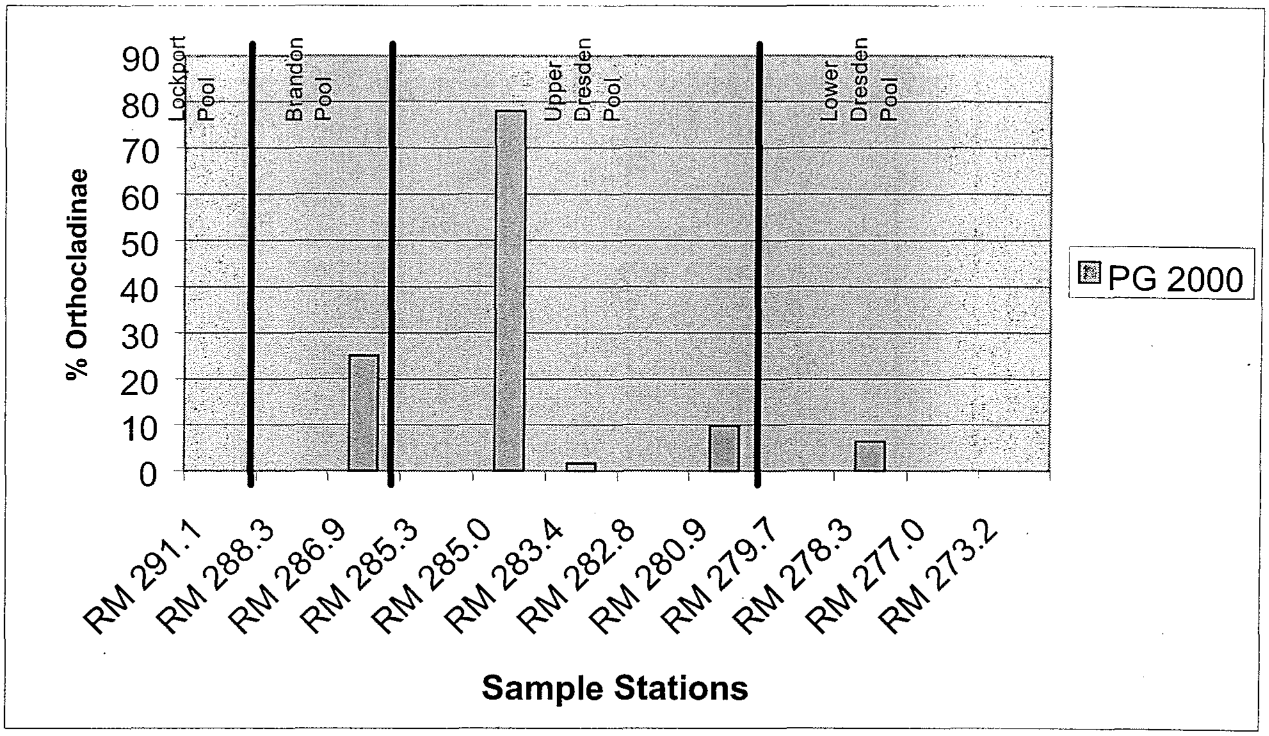
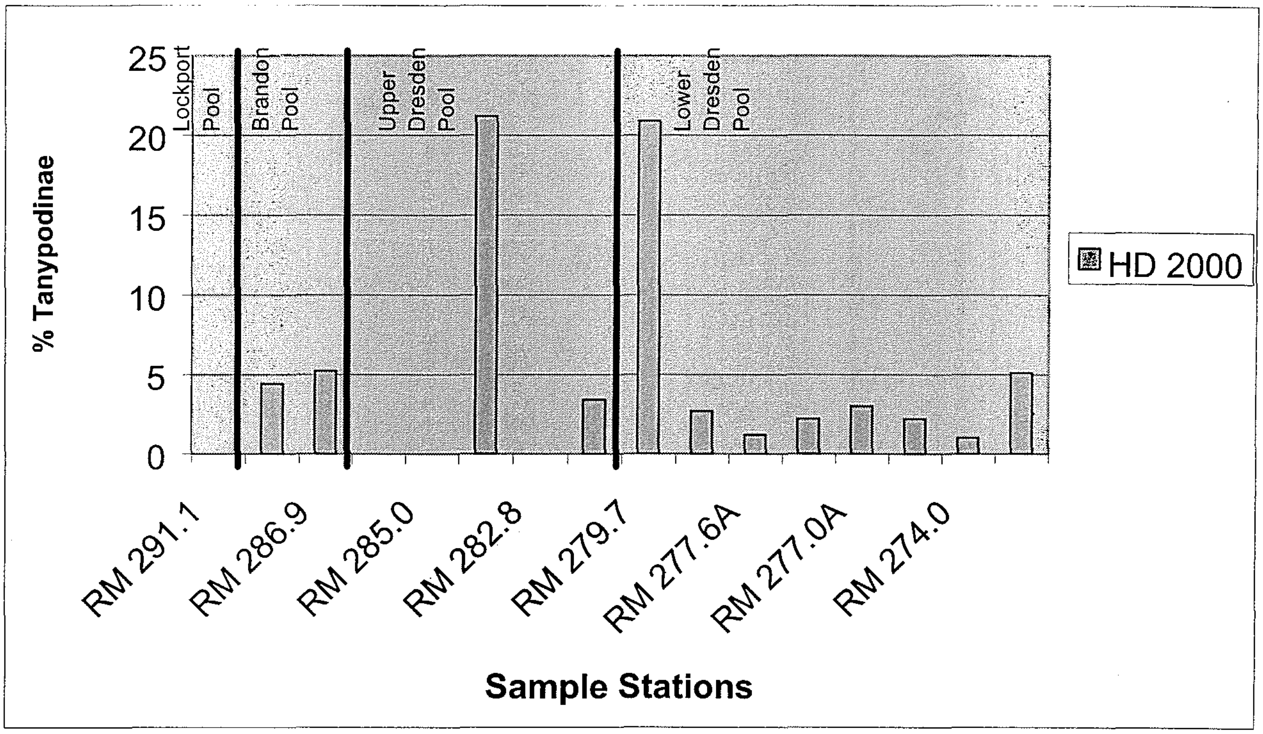


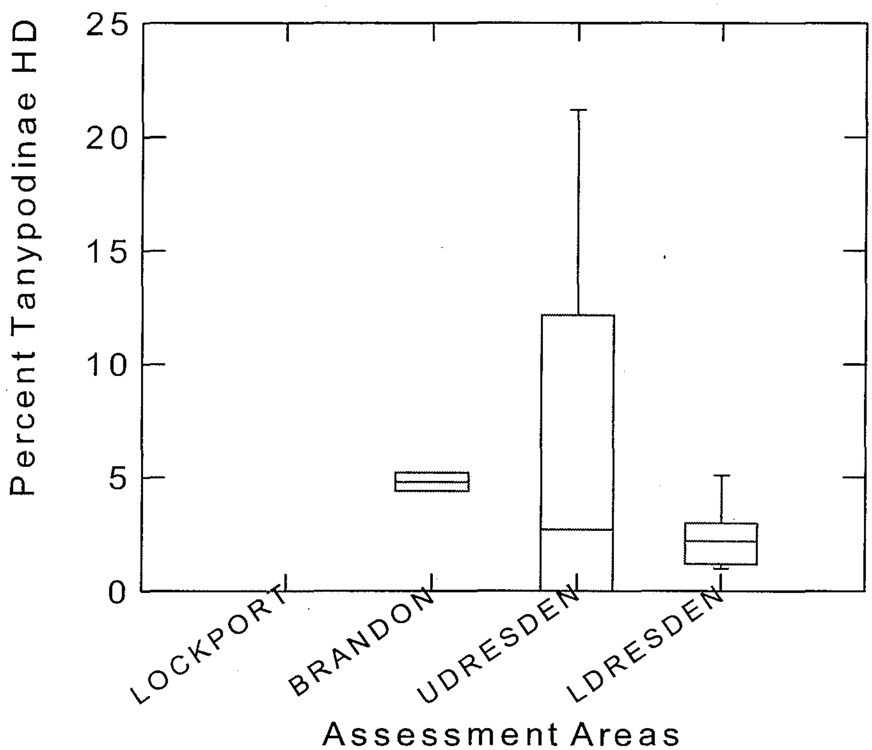
Figure 35



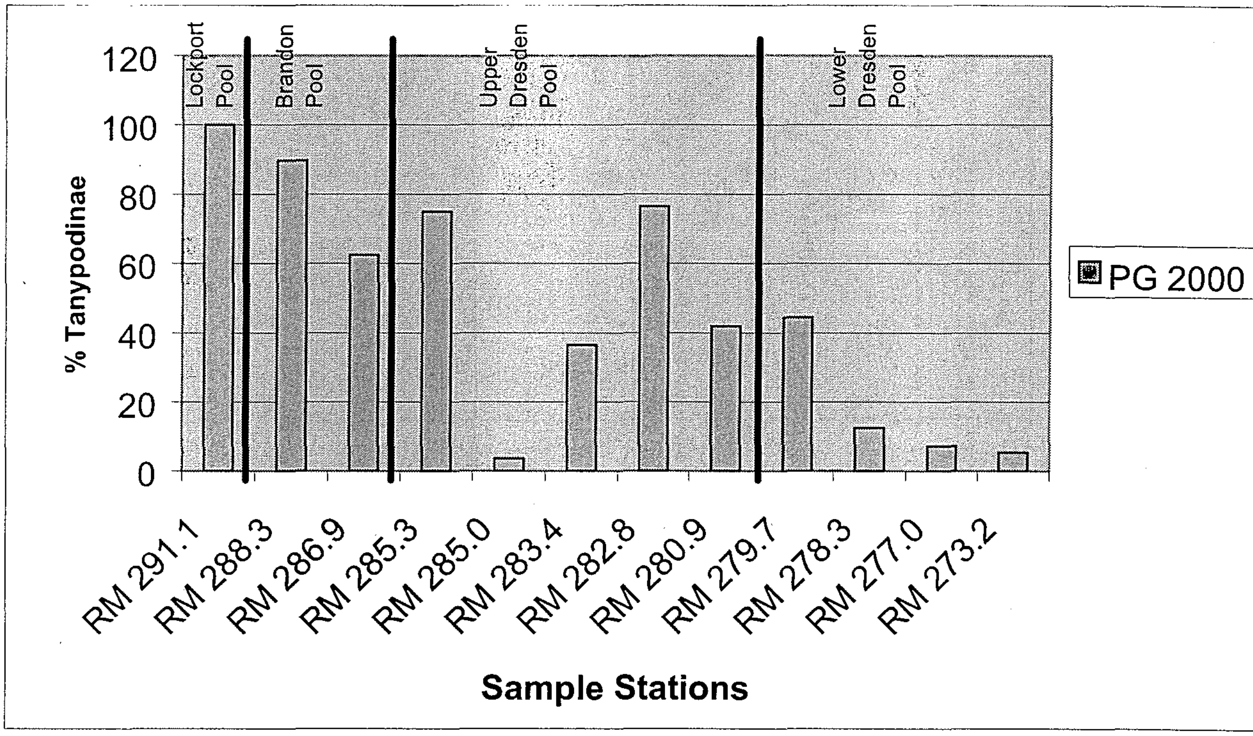
Lockport Pool
Brandon Pool
Upper Dresden Pool
Lower Dresden Pool
% Orthocladinae
90
80
70
60
50
40
30
20
10
0
RM 291.1
RM 288.3
RM 286.9
RM 285.3
RM 285.0
RM 283.4
RM 282.8
RM 280.9
RM 279.7
RM 278.3
RM 277.0
RM 273.2
Sample Stations
PG 2000

Figures 36 and 37





Figures 38 and 39



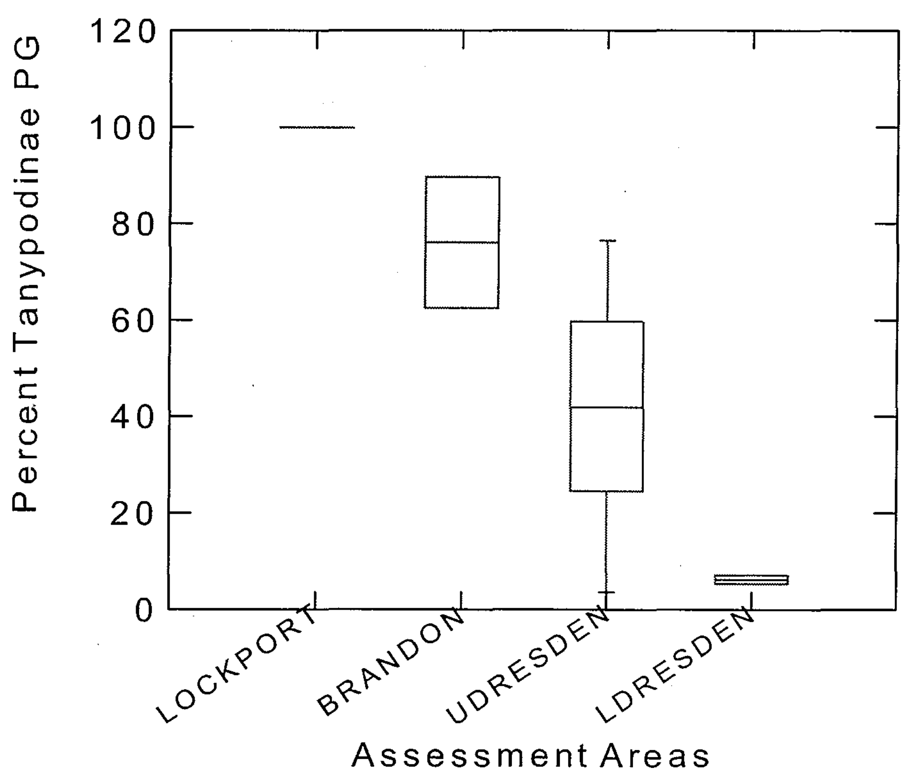
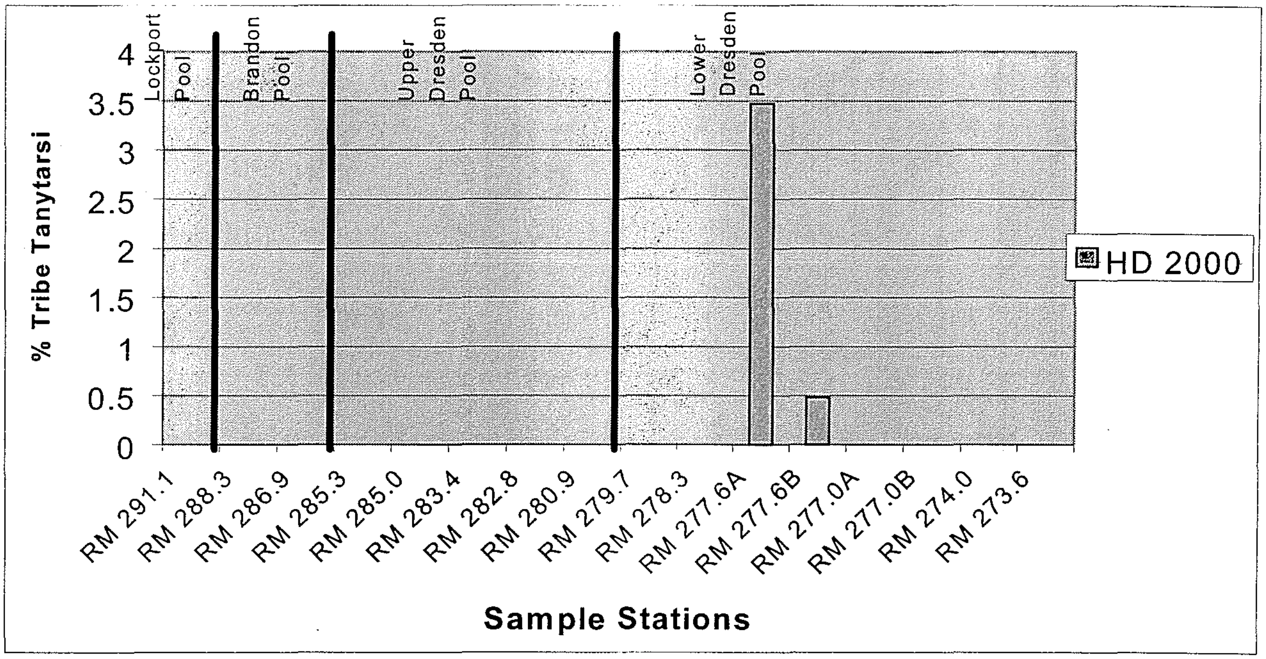
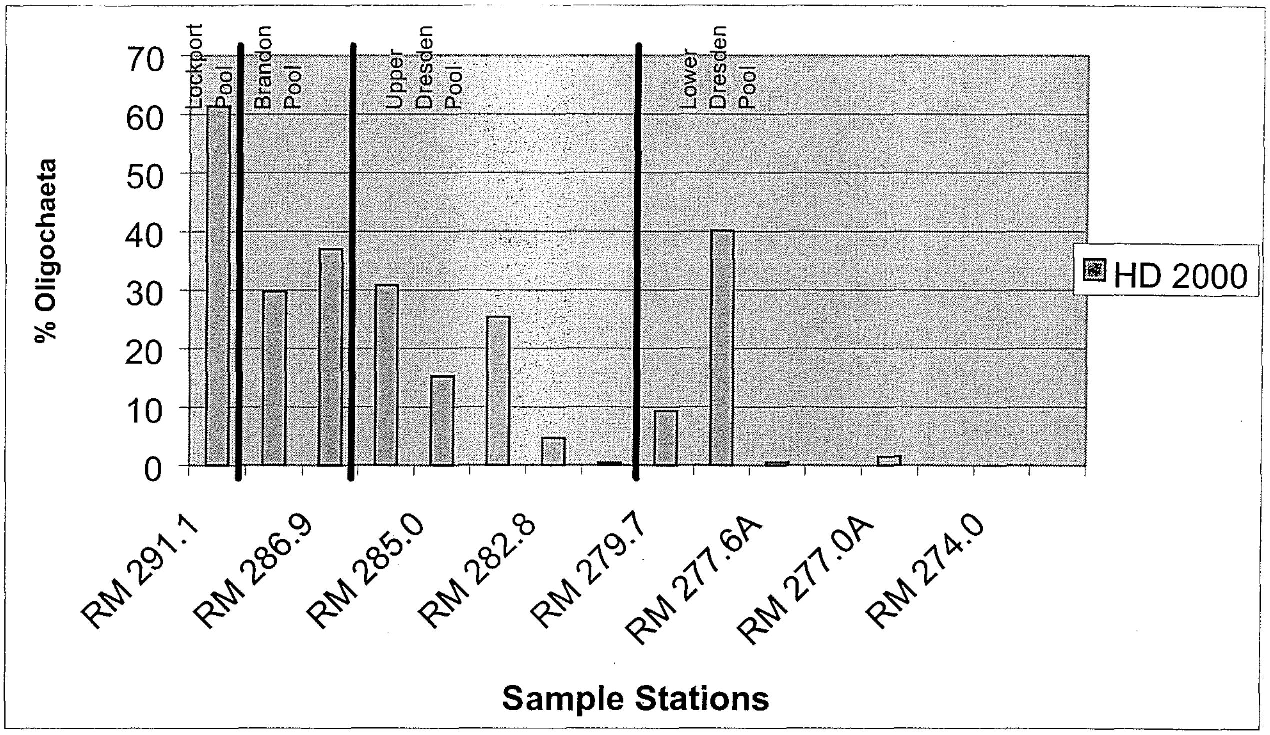


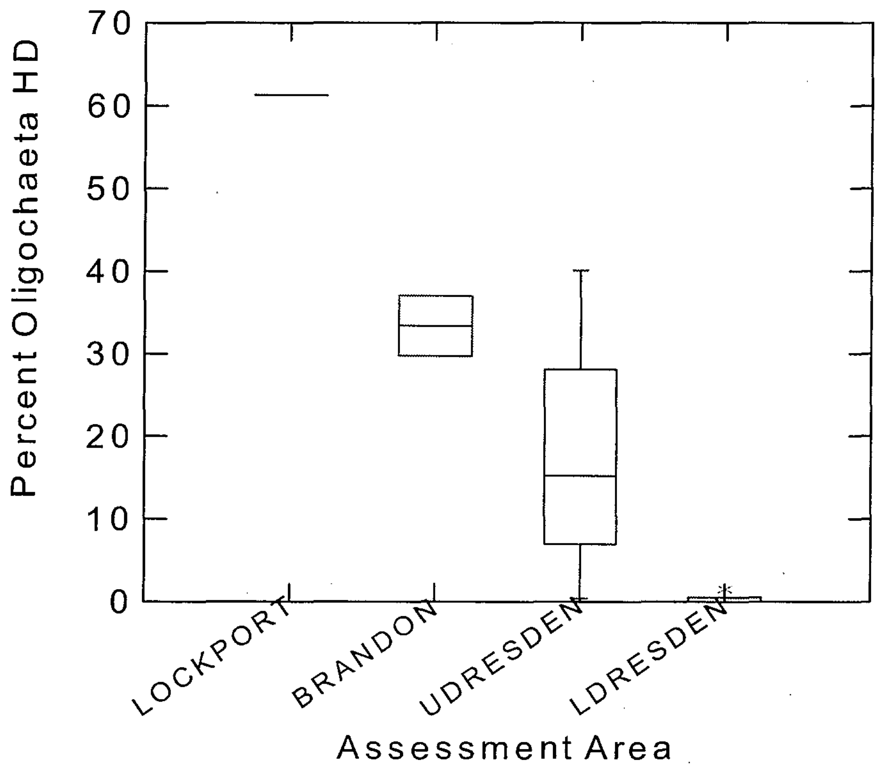
Figure 40



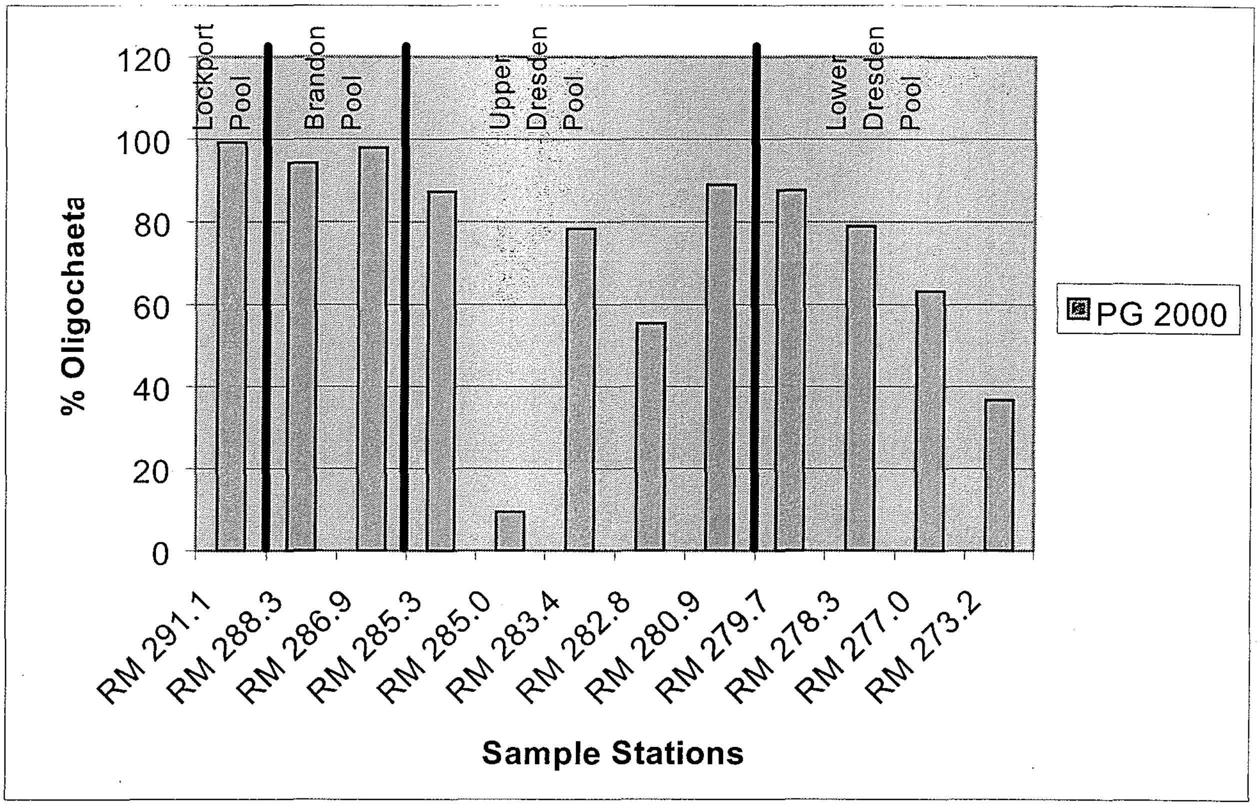
Lockport Pool
Brandon Pool
Upper Dresden Pool
Lower Dresden Pool
% Tribe Tanytarsi
4
3.5
3
2.5
2
1.5
1
0.5
0
HD 2000
RM 291.1
RM 288.3
RM 286.9
RM 285.3
RM 285.0
RM 283.4
RM 282.8
RM 280.9
RM 279.7
RM 278.3
RM 277.6A
RM 277.6B
RM 277.0A
RM 277.0B
RM 274.0
RM 273.6
Sample Stations

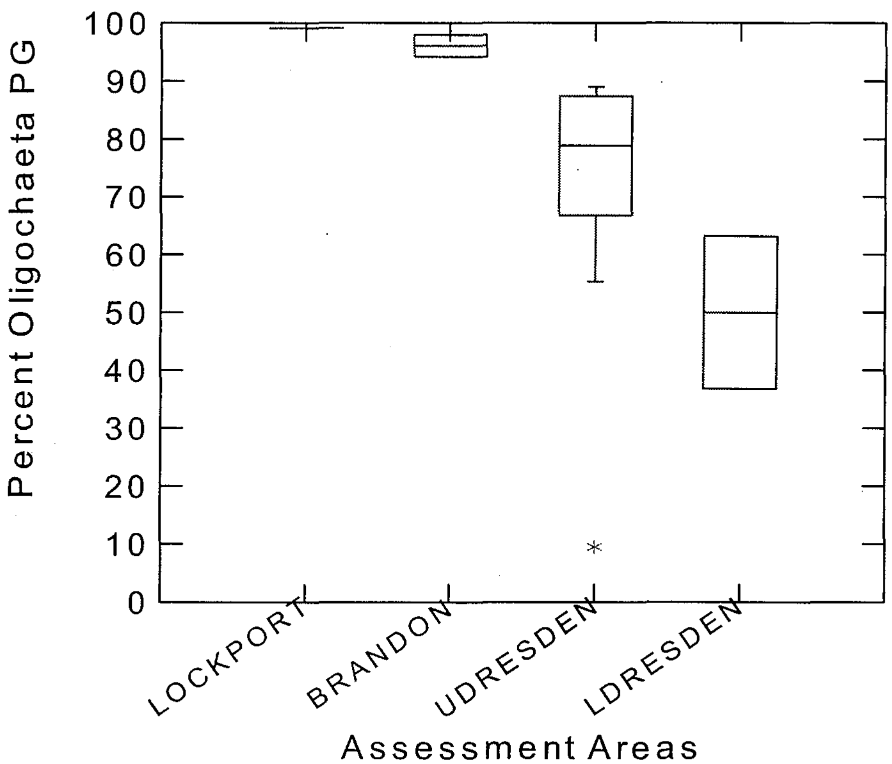
Figures 41 and 42

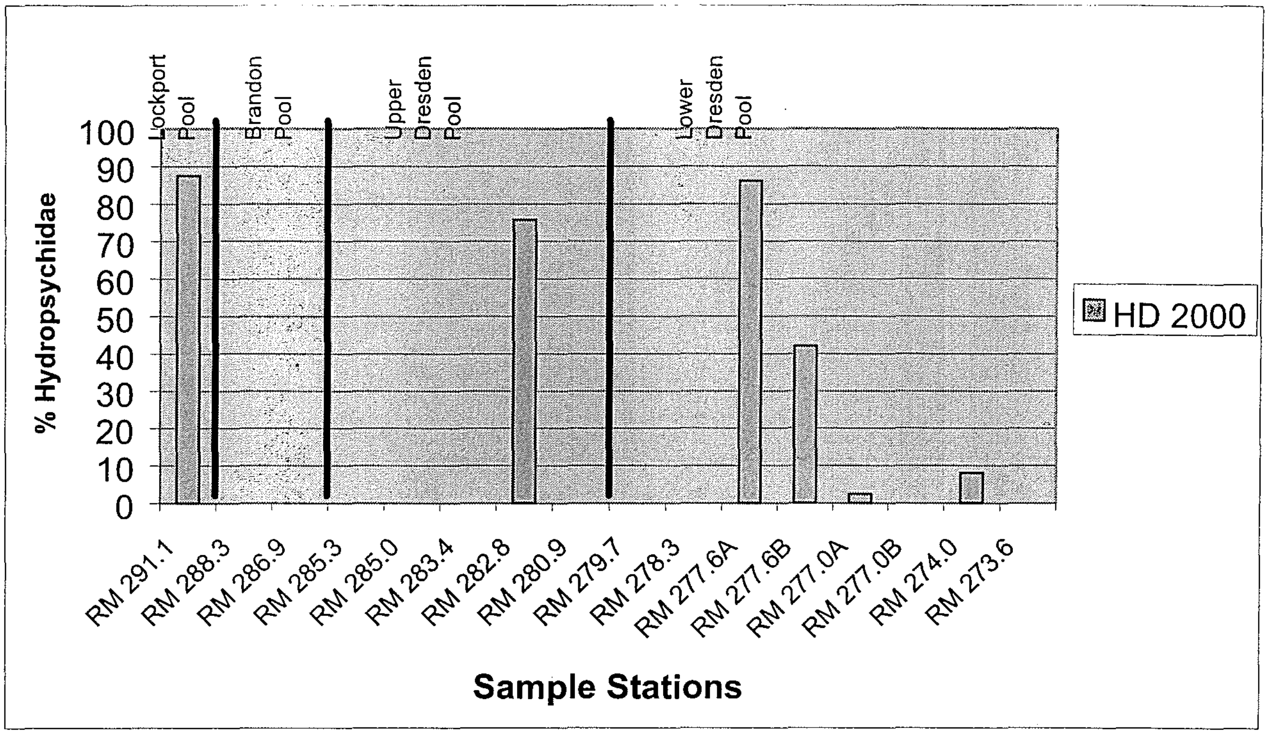




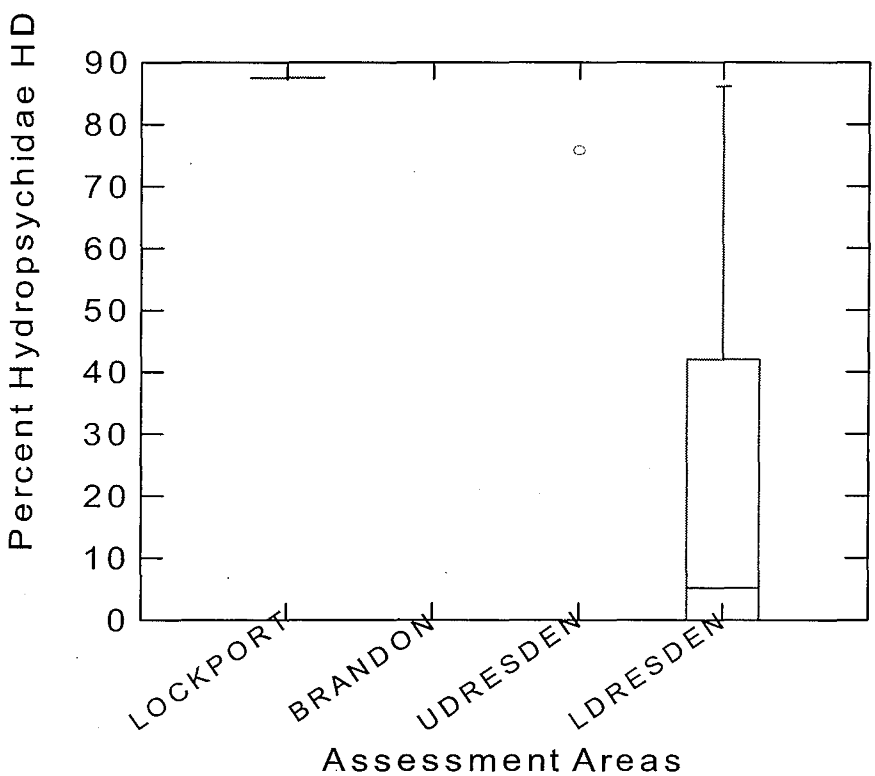
Figures 43 and 44





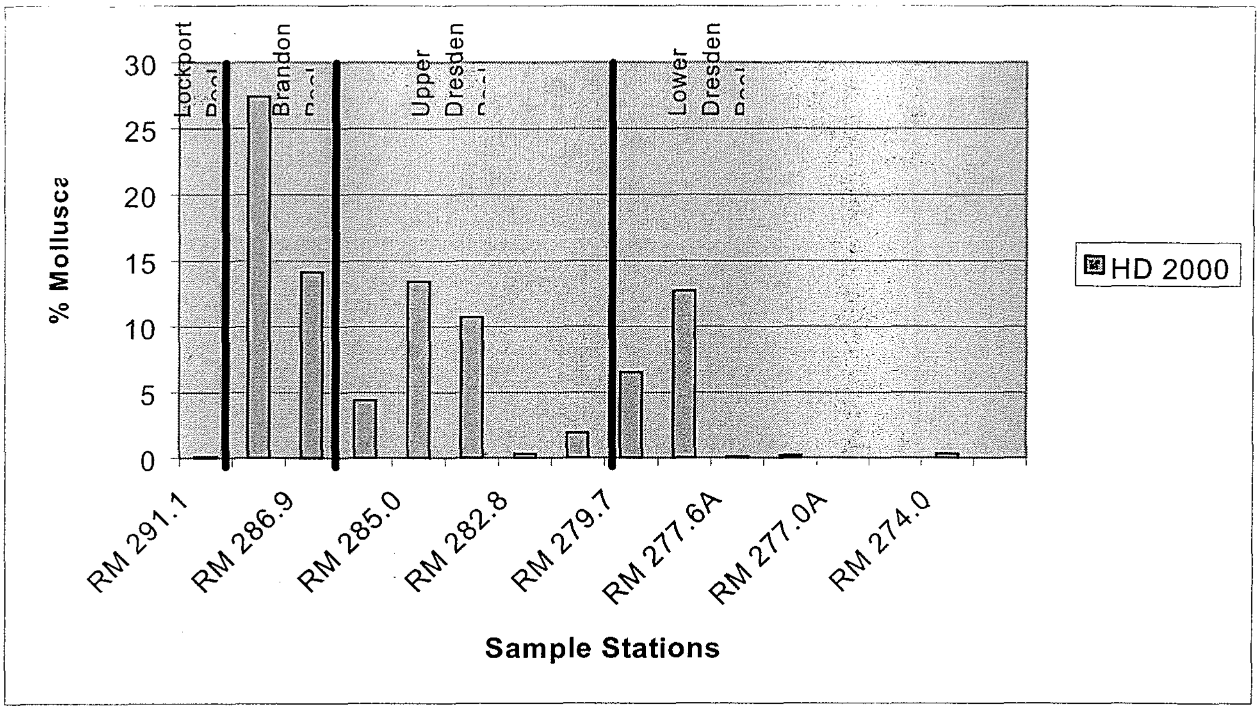


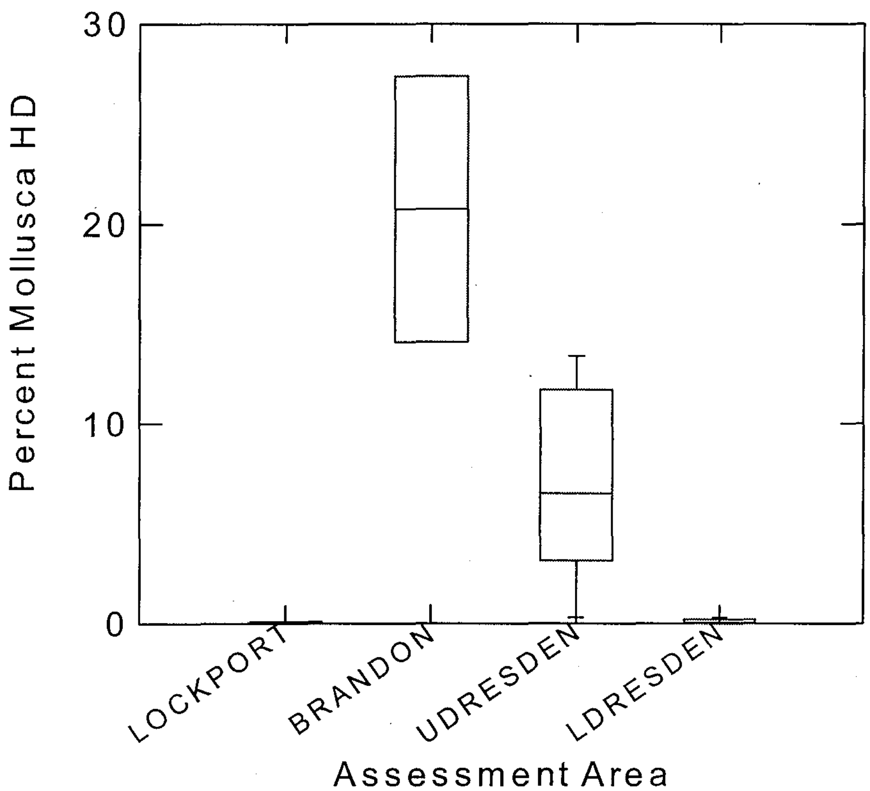
Lockport Pool
Brandon Pool
Upper Dresden Pool
Lower Dresden Pool
% Hydropsychidae
100
90
80
70
60
50
40
30
20
10
0
HD 2000
RM 291.1
RM 288.3
RM 286.9
RM 285.3
RM 285.0
RM 283.4
RM 282.8
RM 280.9
RM 279.7
RM 278.3
RM 277.6A
RM 277.6B
RM 277.0A
RM 277.0B
RM 274.0
RM 273.6
Sample Stations



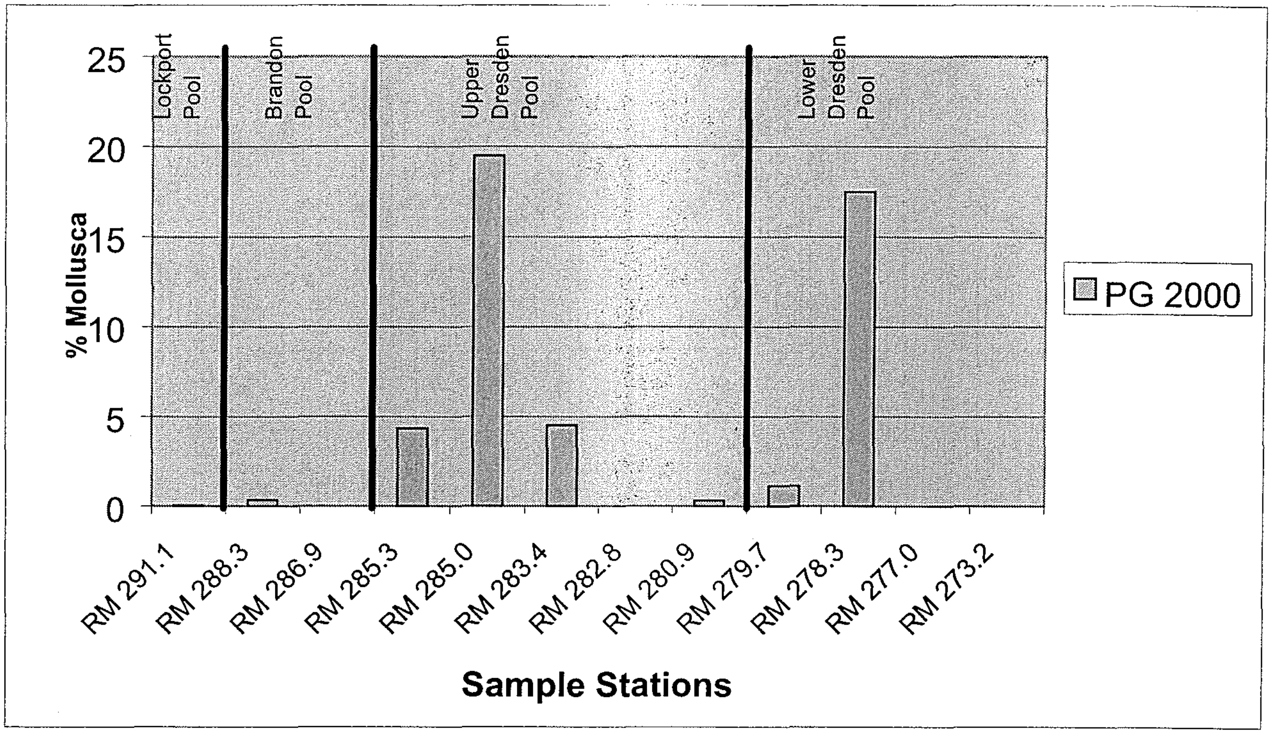
Percent Hydropsychidae HD
90
80
70
60
50
40
30
20
10
0
LOCKPORT
BRANDON
UDRESDEN
LDRESDEN
Assessment Areas

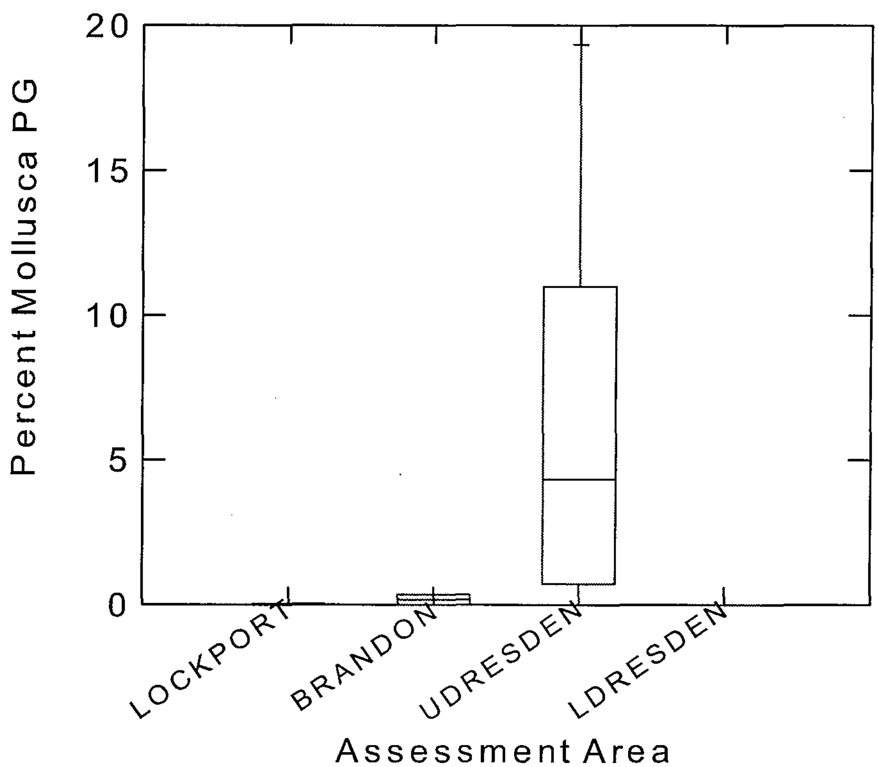
Figures 47 and 48



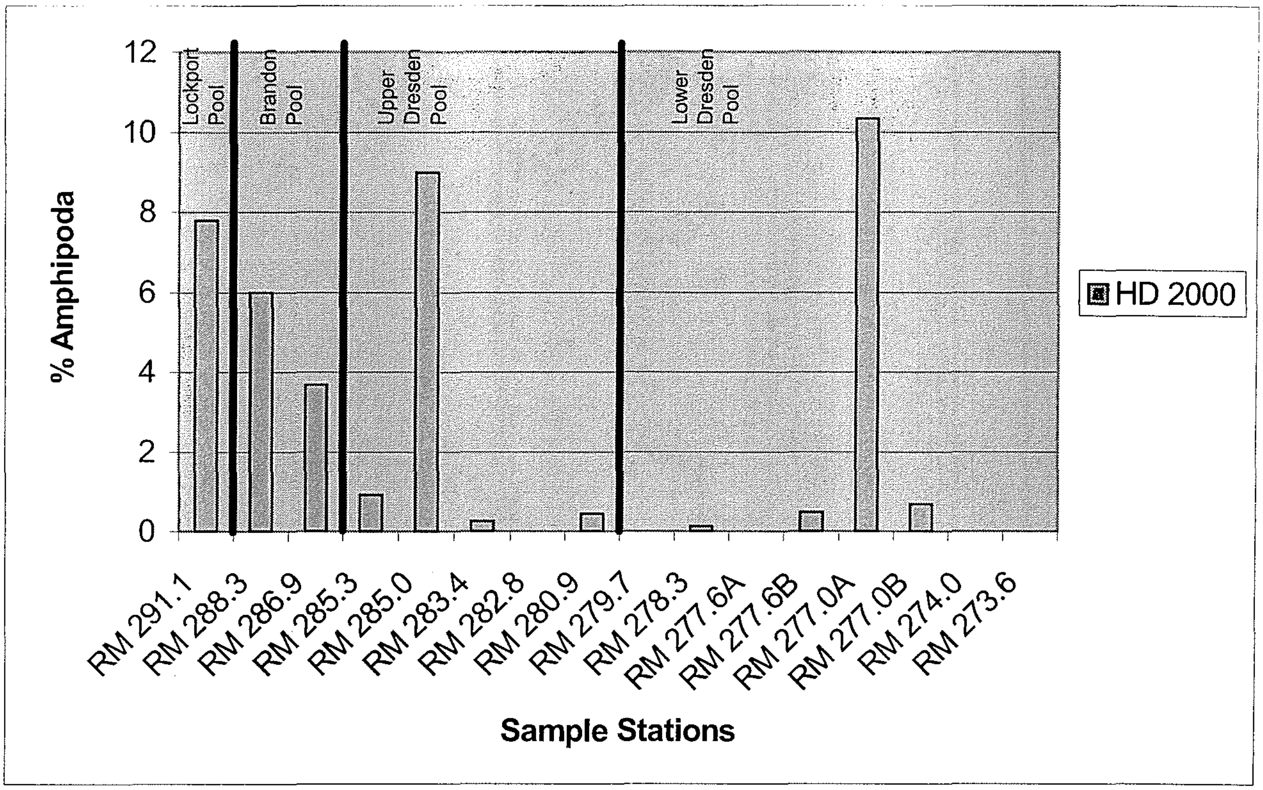


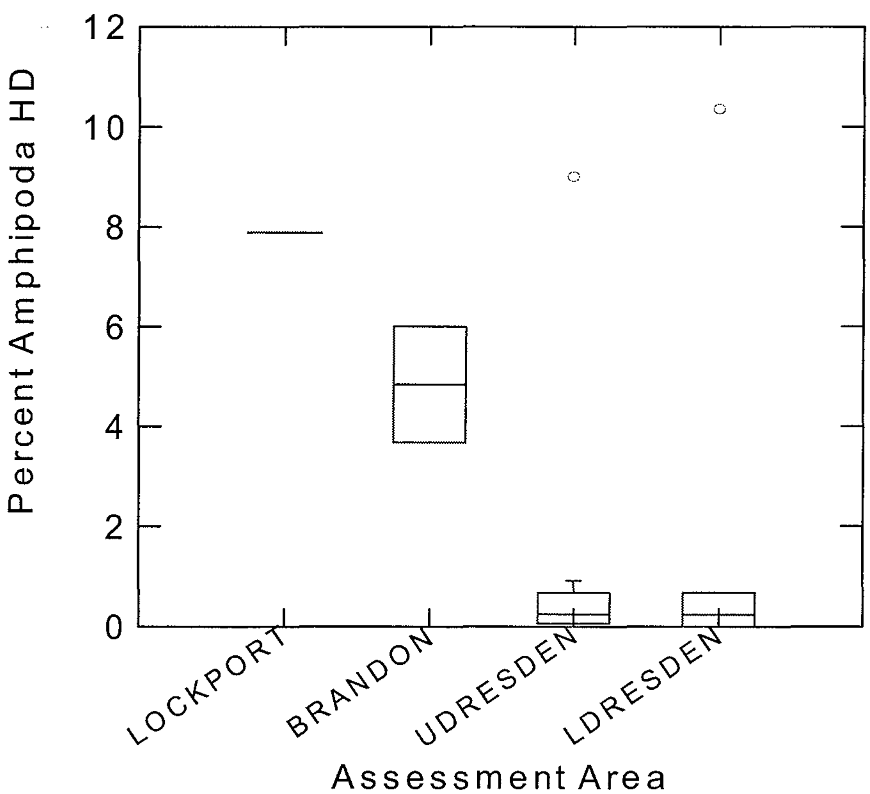
Figures 49 and 50



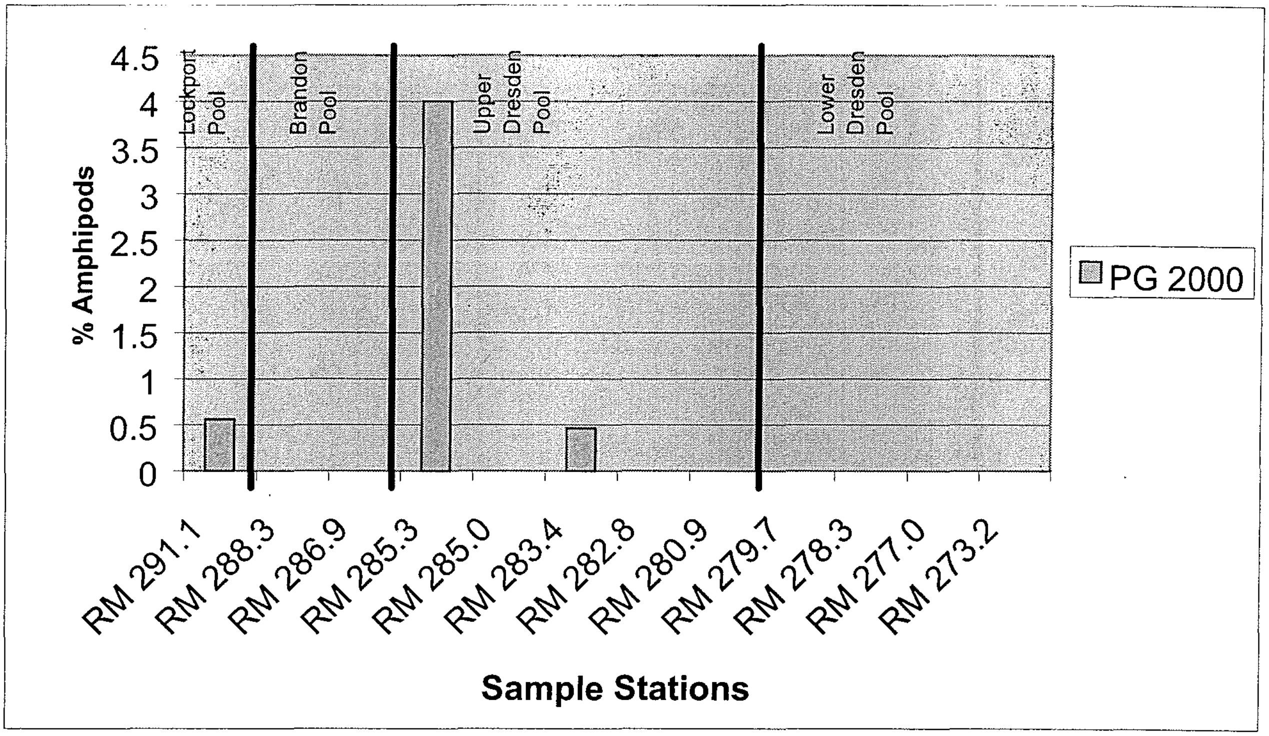


Figures 51 and 52





Figures 53 and 54



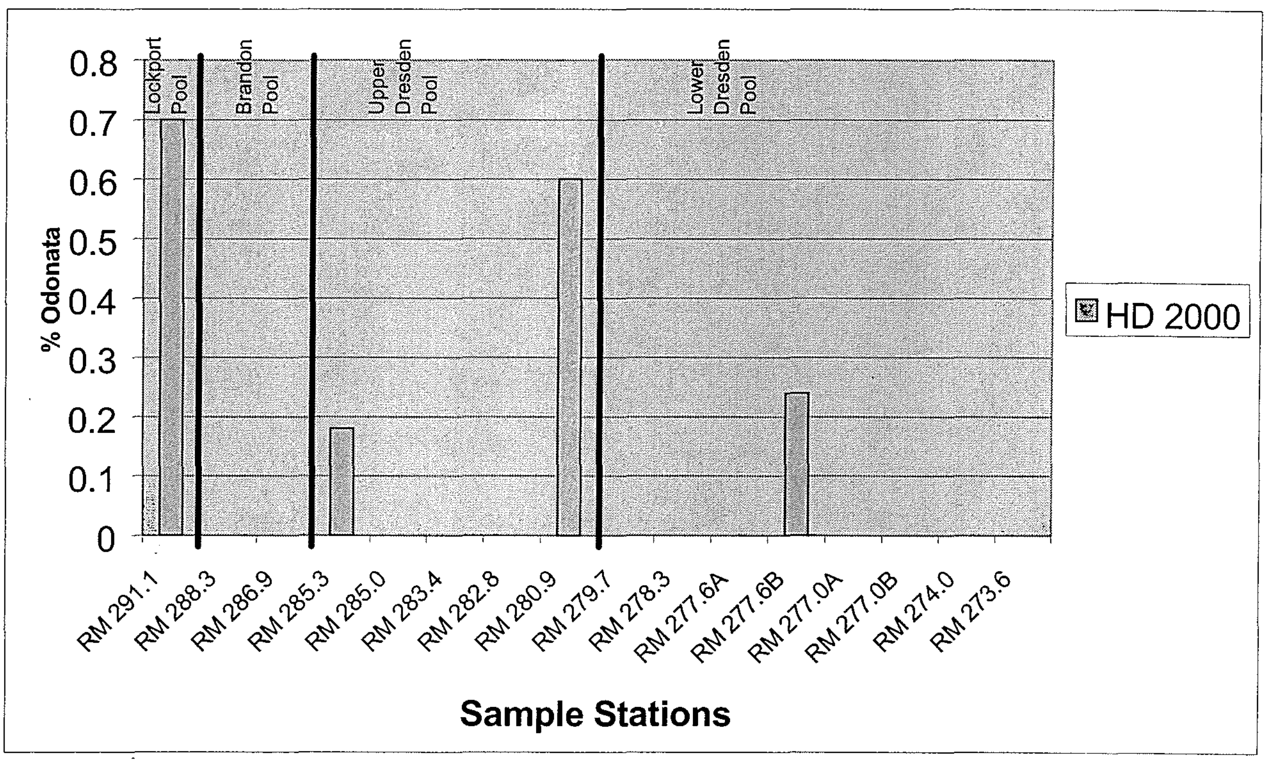
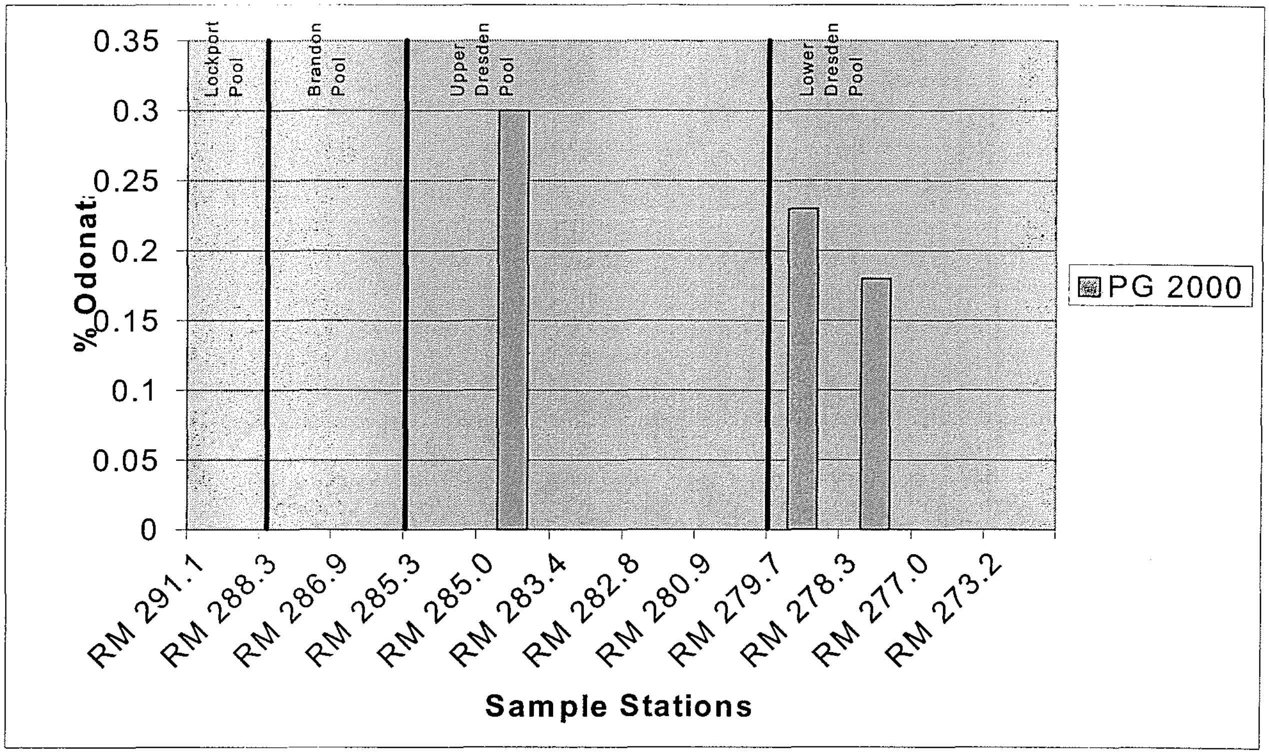
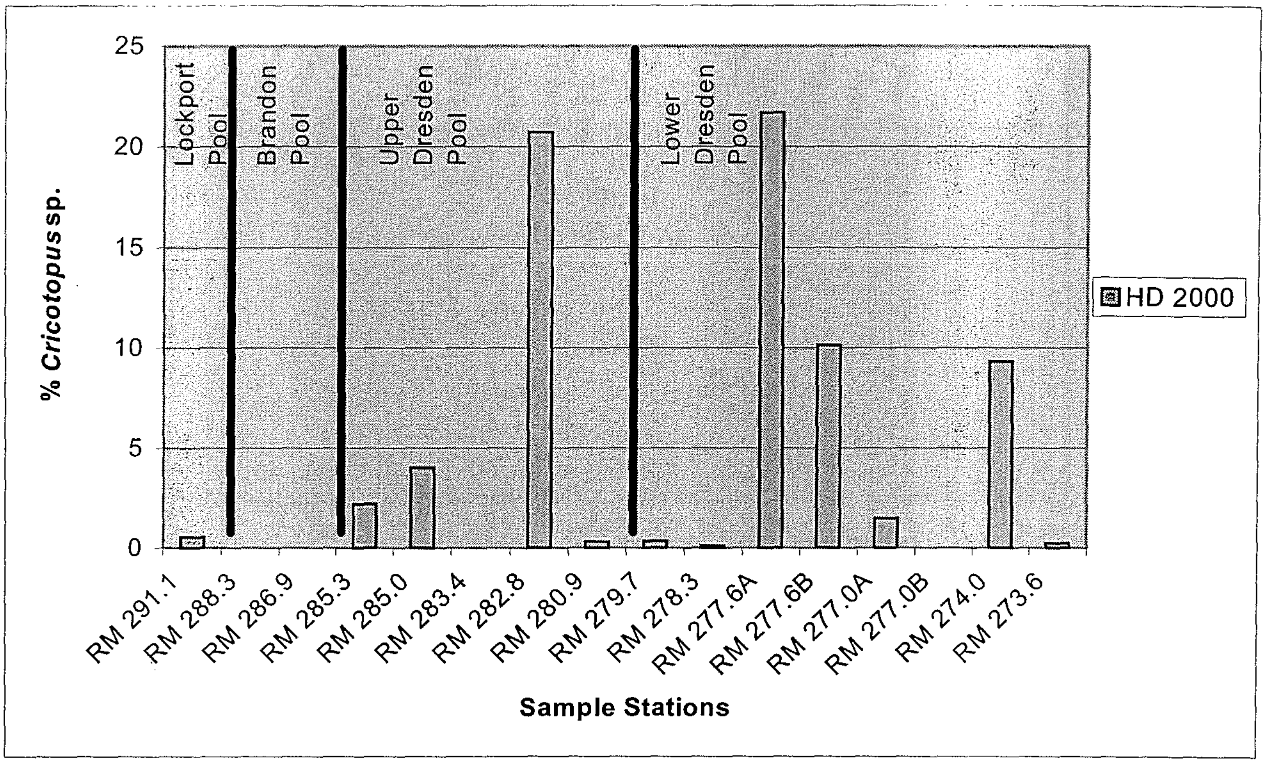


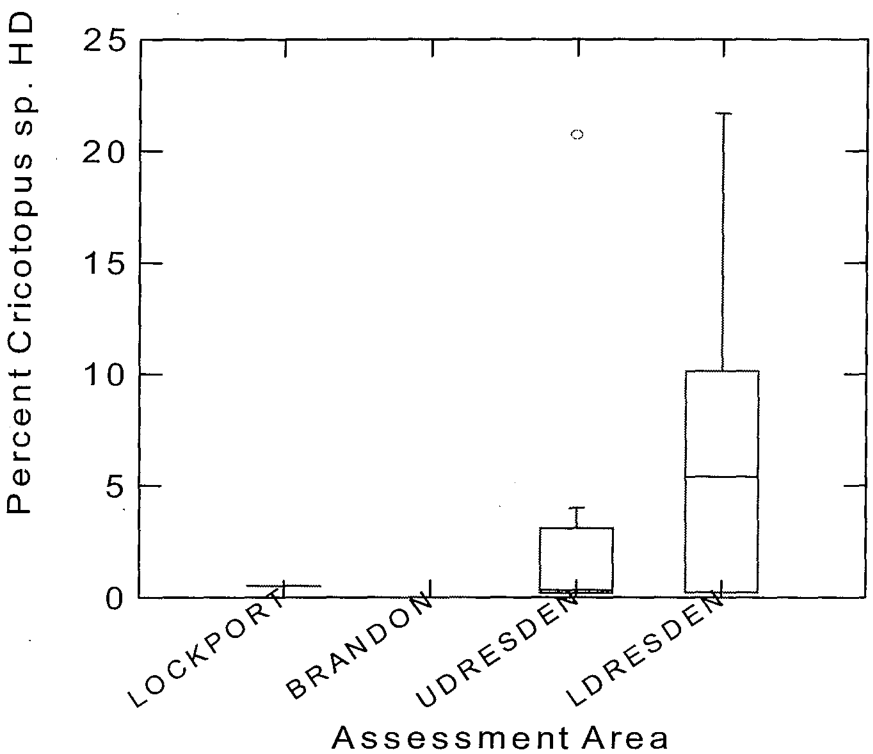
Figure 55



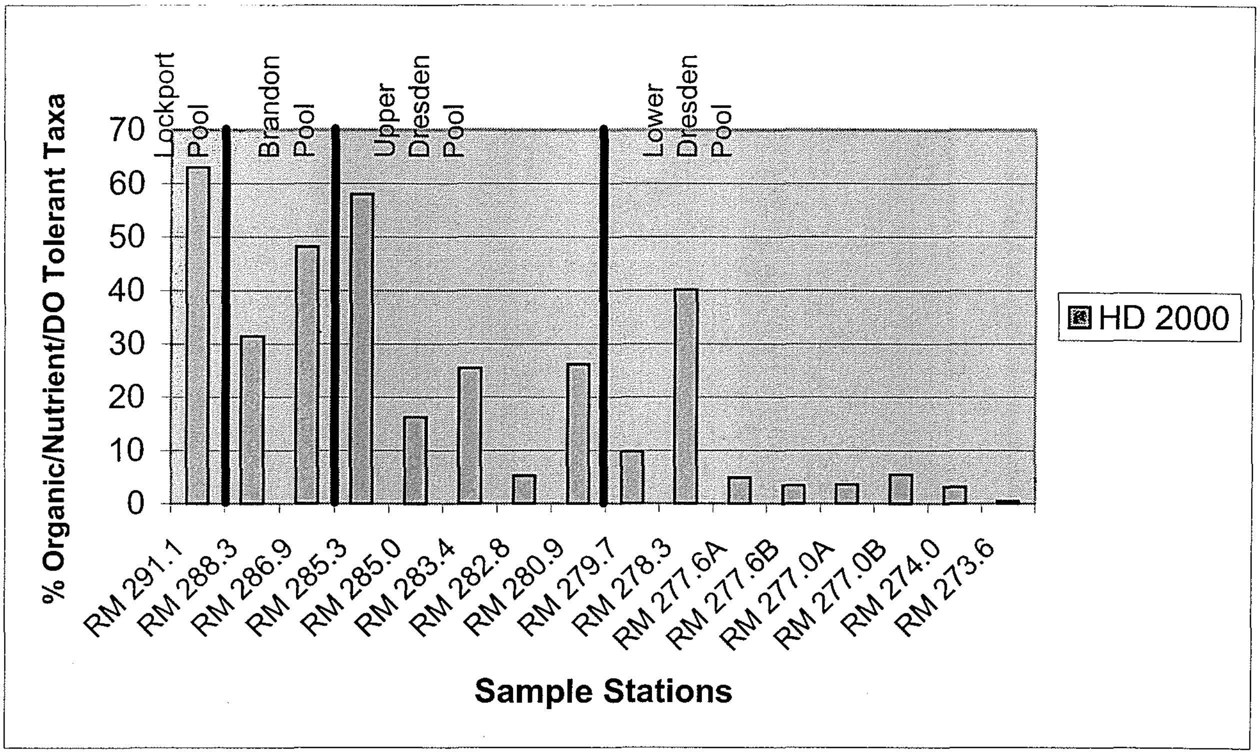
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
% Odonat
Lockport Pool
Brandon Pool
Upper Dresden Pool
Lower Dresden Pool
RM 291.1
RM 288.3
RM 286.9
RM 285.3
RM 285.0
RM 283.4
RM 282.8
RM 280.9
RM 279.7
RM 278.3
RM 277.0
RM 273.2
Sample Stations
PG 2000

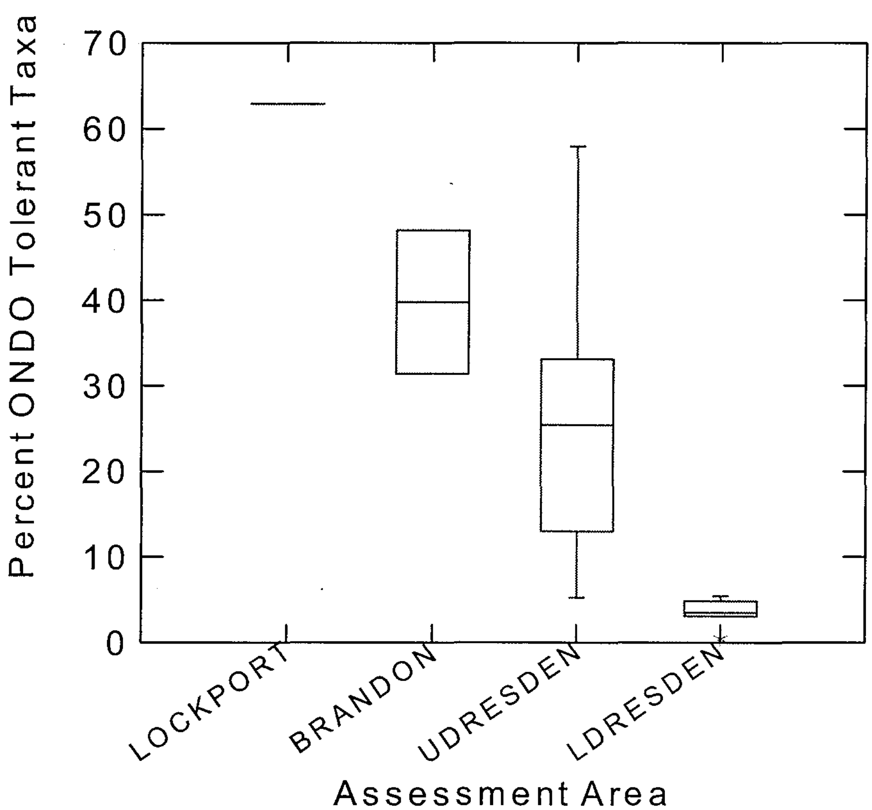
Figures 56 and 57



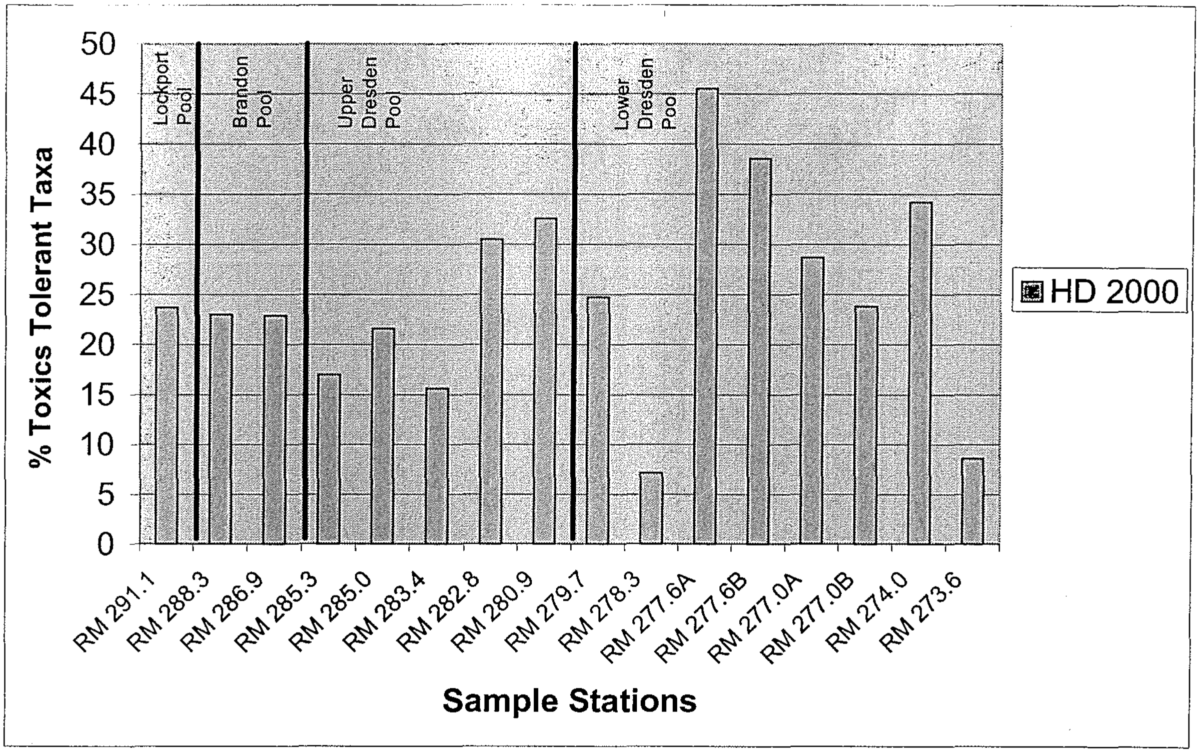


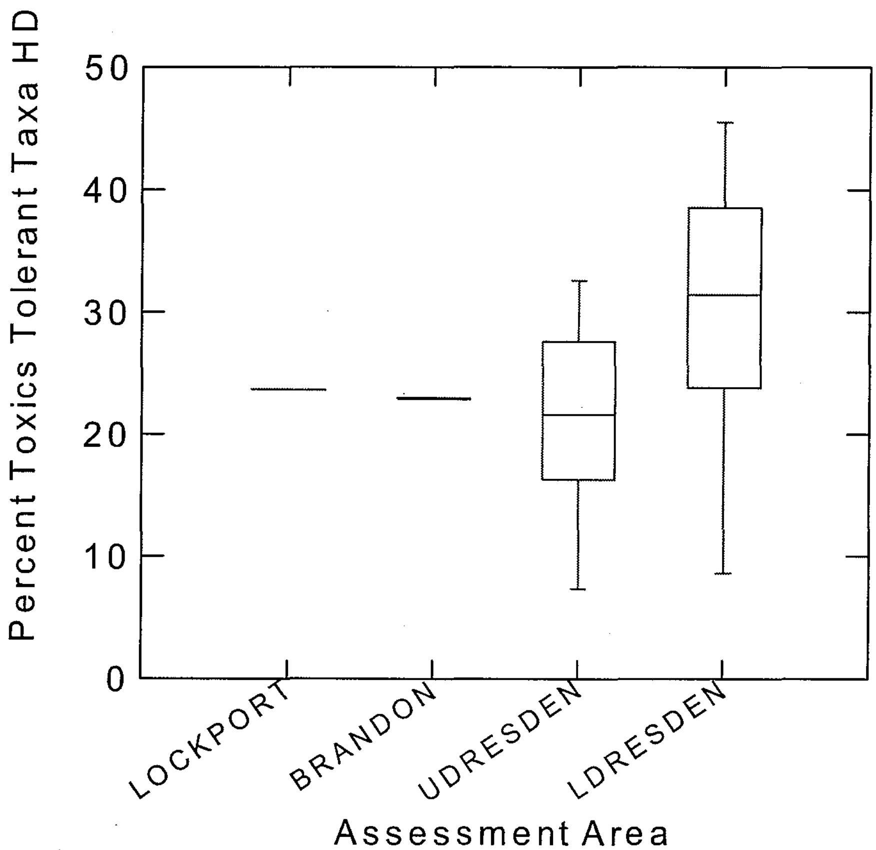
Figures 58 and 59



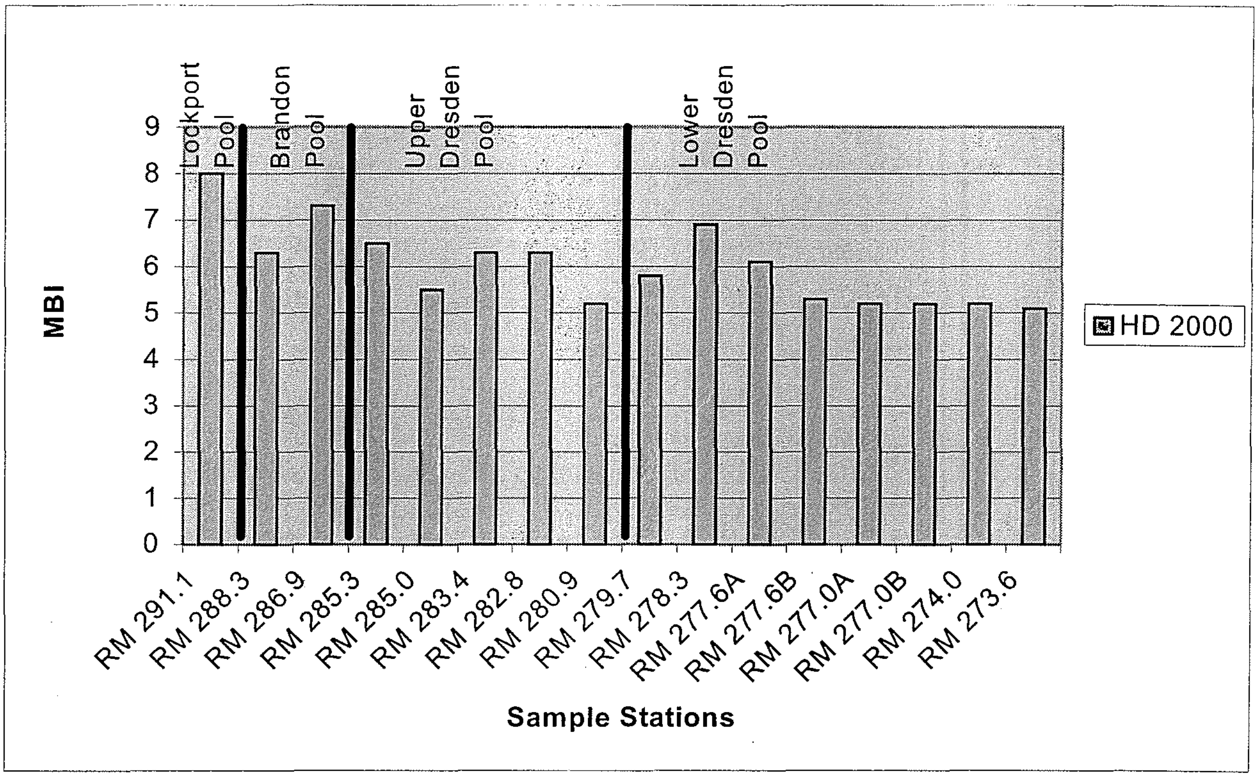


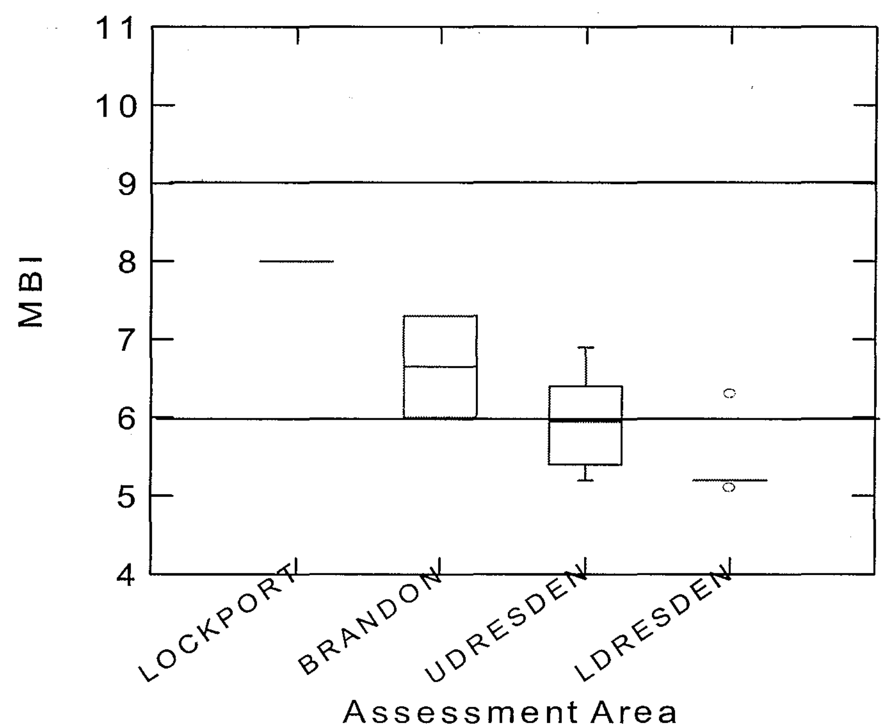
Figures 60 and 61



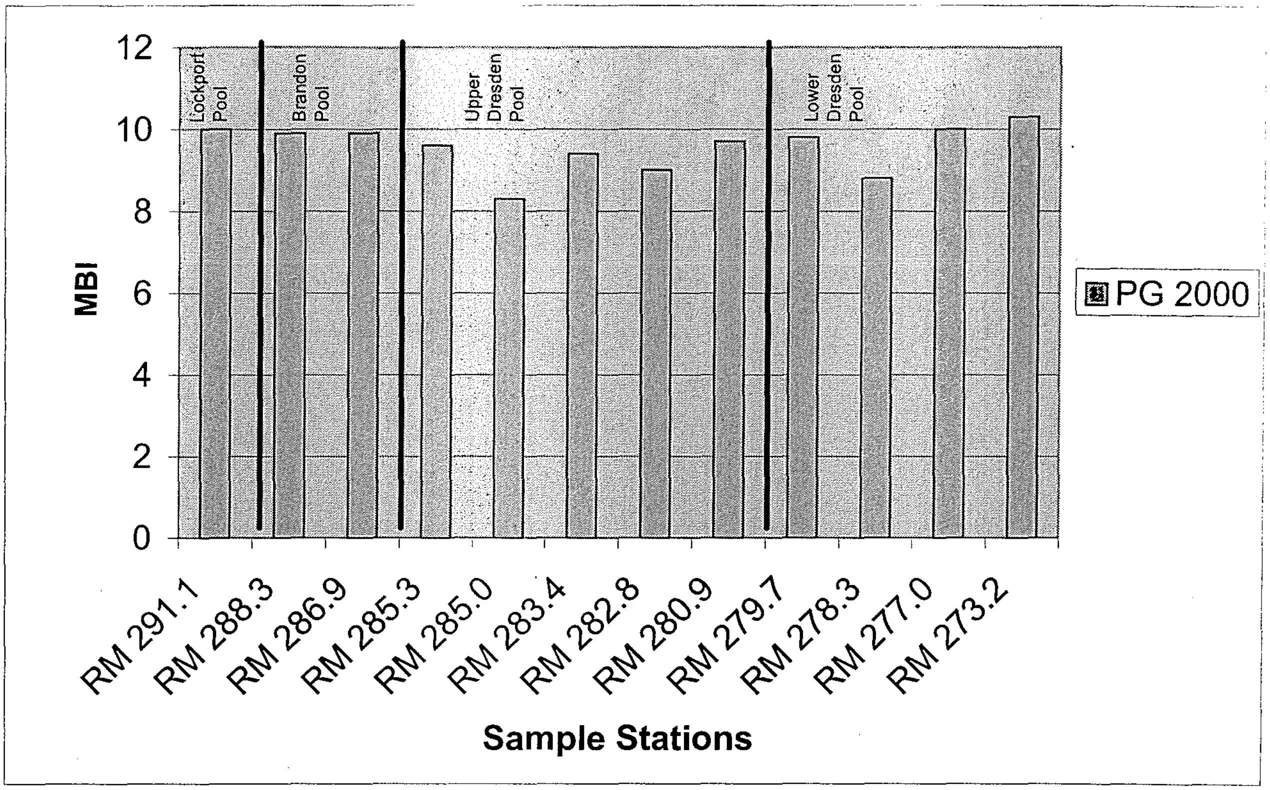


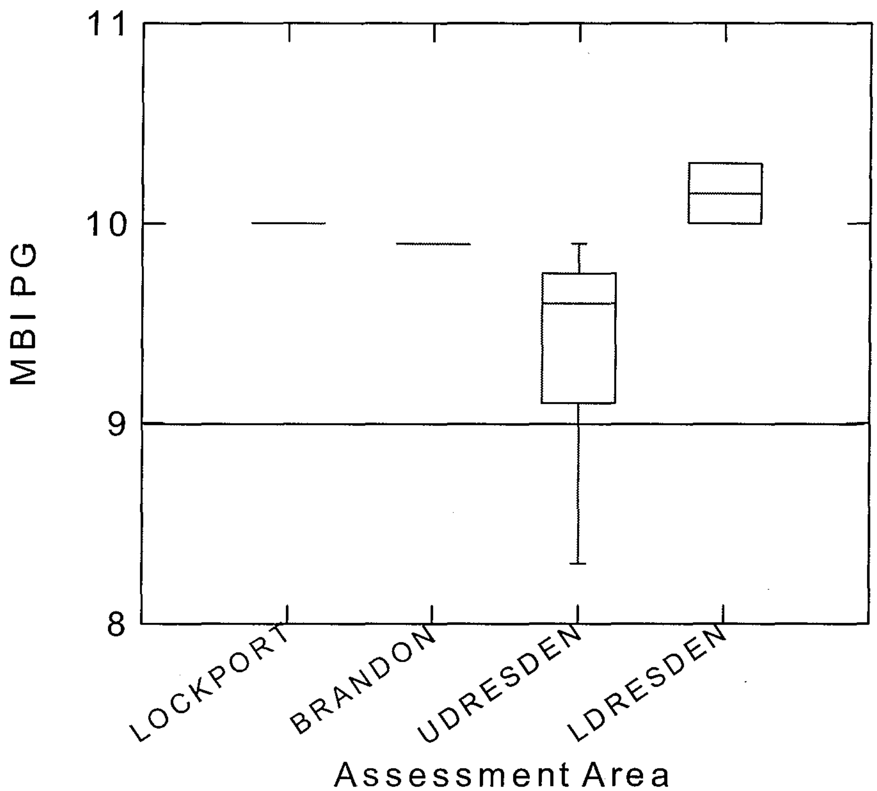
Figures 62 and 63



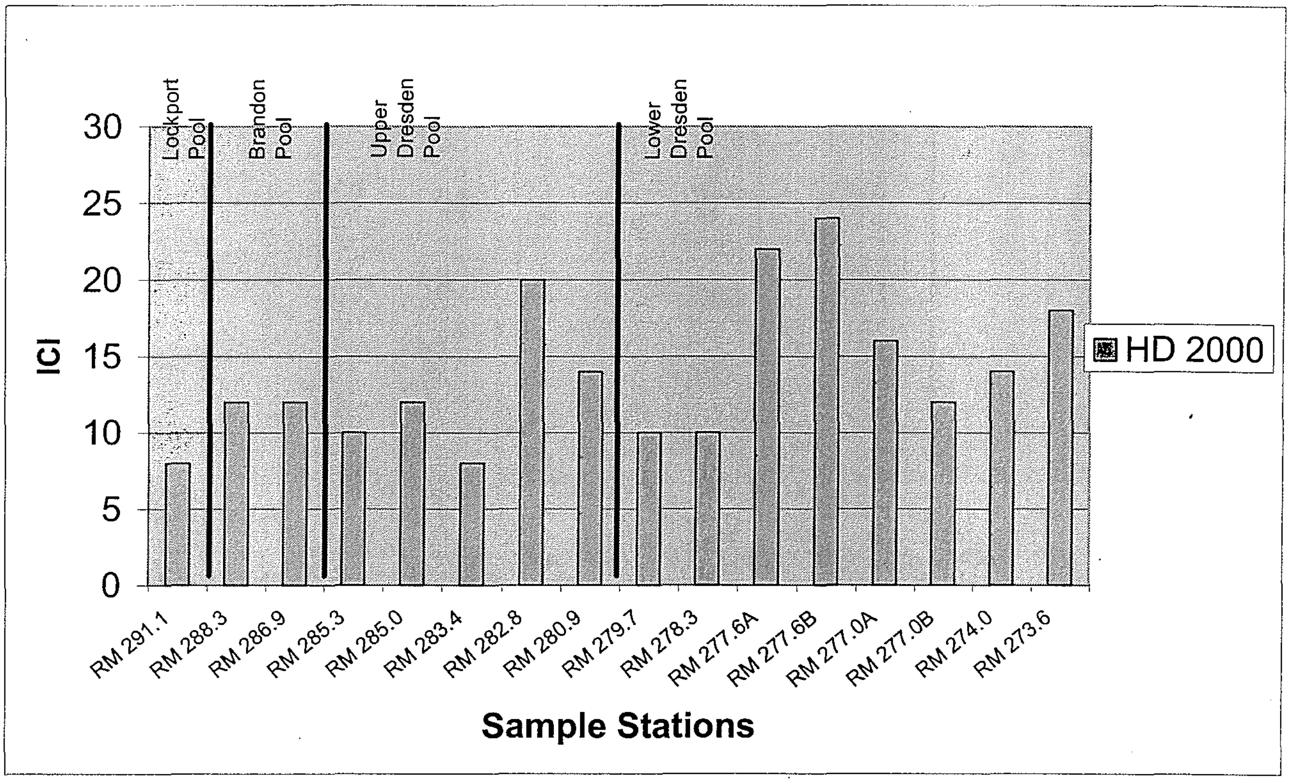


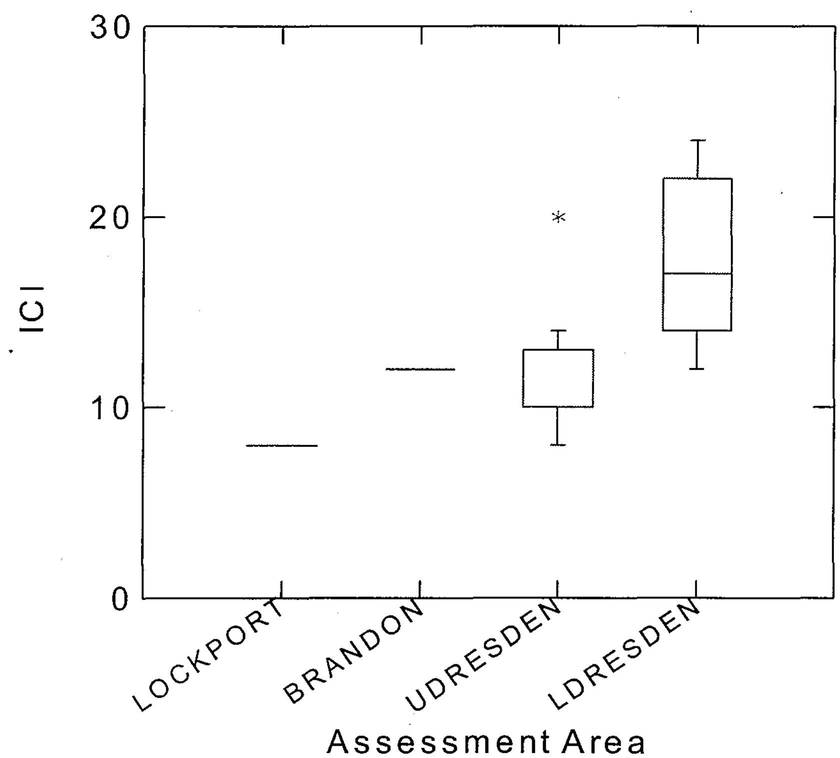
Figures 64 and 65





Figures 66 and 67





Attachment A
Appendix F: Fishery Data

Appendix F.4

		River	Des Plaines	Des Plaines	Des Plaines	Des Plaines	Des Plaines	Des Plaines	Des Plaines
		Station	G-07	G-11	G-18	G-28	G-33	G-34	G-35
		Habitat Type							
		OH Boatable IBI	36	20	30	32	32	24	28
Ohio IBI Metrics	#	Native Species	17	13	16	16	20	14	12
	#	Sunfish Species	4	1	4	6	4	3	4
	#	Sucker Species	2	1	2	2	2	1	2
	#	Intolerant Species	3	1	2	4	4	1	2
	#	Non Tolerant CPE	110	89	190	56	104	104	68
	%	Tolerant Species	25.2	48.5	17.4	37.8	55.7	71.0	43.3
	%	Round Bodied Suckers	11.6	9.6	0.4	5.6	5.5	1.4	10.8
	%	Top Carnivores	14.3	11.4	5.7	21.1	23.8	1.1	18.3
	%	Omnivores	23.8	49.7	16.5	26.7	47.2	31.3	30.0
	%	Insectivores	61.9	13.2	10.4	52.2	27.2	68.5	51.7
	%	Simple Lithophils	14.3	10.8	0.4	7.8	6.8	1.7	10.8
	%	DELT Anomolies	nr	nr	nr	nr	nr	nr	nr
		Total CPE	147	172	230	90	235	358	120
Ohio IBI Scores	#	Native Species	3	3	3	3	3	3	3
	#	Sunfish Species	5	1	5	5	5	3	5
	#	Sucker Species	1	1	1	1	1	1	1
	#	Intolerant Species	3	1	3	5	5	1	3
	#	Non Tolerant CPE	3	1	3	1	3	3	1
	%	Tolerant Species	3	1	3	1	1	1	1
	%	Round Bodied Suckers	1	1	1	1	1	1	1
	%	Top Carnivores	5	5	3	5	5	1	5
	%	Omnivores	3	1	3	3	1	1	1
	%	Insectivores	5	1	1	3	3	5	3
	%	Simple Lithophils	1	1	1	1	1	1	1
	%	DELT Anomolies	3	3	3	3	3	3	3

Fox Key

	River	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox
	Station	ALLO	ALM1	ALM2	ALUP	CVLO	CVUP	DALO	DAM1	DAM2	DAUP	ELLO	ELM1	ELM2	ELUP	GELO	GEUP	HILO	HIUP	MHLO	MHUP	MOLO	MOUP	NALO	NAUP	NBLO	NBUP
	Habitat Type	DS FF	MD IMP	MD IMP	US IMP	DS FF	UP IMP	DS FF	MD FF	MD FF	US IMP	DS FF	MD FF	MD IMP	US IMP	DS FF	US IMP	DS FF	US IMP	DS FF	US IMP	DS FF	US IMP	DS FF	US IMP	DS FF	US IMP
	OH Boatable IBI	30	20	26	20	32	26	42	48	50	28	32	32	26	20	26	26	46	28	30	26	36	28	38	20	24	20
Ohio IBI Metrics	# Native Species	18	6	8	6	17	13	21	13	16	9	15	21	10	8	16	7	13	11	13	11	16	8	13	9	10	7
	# Sunfish Species	3	2	2	3	3	4	3	0	5	1	2	4	3	2	3	2	1	2	4	2	1	3	1	3	2	2
	# Sucker Species	4	0	0	0	2	1	7	6	5	2	4	3	3	0	4	0	5	2	0	1	4	1	6	2	3	0
	# Intolerant Species	4	1	2	0	4	2	5	6	6	4	6	5	3	1	3	2	4	3	2	2	7	2	4	1	3	0
	# Non Tolerant CPE	128	34	29	25	102	37	205	90	100	46	86	81	26	27	96	11	123	43	91	67	122	16	136	21	88	29
	% Tolerant Species	28.9	47.7	39.6	41.9	26.3	41.3	8.5	13.5	9.1	41.8	25.9	32.5	38.1	43.8	29.1	54.2	9.6	20.4	26.6	23.0	20.5	28.6	16.0	41.7	32.0	31.7
	% Round Bodied Suckers	15.0	0.0	0.0	0.0	0.7	0.0	15.2	58.7	50.0	20.3	11.2	2.5	4.8	0.0	9.0	0.0	51.5	11.1	0.0	2.3	35.1	4.8	22.8	8.3	7.8	0.0
	% Top Carnivores	26.1	13.8	12.5	18.6	26.3	19.0	14.3	18.3	29.1	25.3	28.4	33.3	31.0	33.3	41.0	20.8	27.9	42.6	23.4	31.0	9.3	23.8	40.1	27.8	28.9	34.1
	% Omnivores	41.7	47.7	41.7	37.2	24.1	41.3	12.9	14.4	10.0	41.8	25.0	32.5	35.7	35.4	31.3	20.8	11.0	16.7	25.8	28.7	24.5	9.5	22.8	38.9	48.4	29.3
	% Insectivores	32.2	38.5	45.8	44.2	50.4	39.7	37.1	67.3	60.0	32.9	46.6	34.2	33.3	31.3	28.4	58.3	61.0	38.9	50.8	40.2	64.9	57.1	37.0	33.3	24.2	41.5
	% Simple Lithophils	15.0	0.0	2.1	0.0	4.4	0.0	17.4	59.6	50.0	20.3	12.9	9.2	4.8	0.0	10.4	0.0	51.5	11.1	0.0	2.3	37.7	4.8	24.1	8.3	7.8	0.0
	% DELT Anomolies	7.78	13.85	0.00	6.98	10.14	11.11	5.80	1.92	6.36	2.53	14.66	8.33	11.90	10.42	9.63	8.33	6.62	7.41	9.68	4.60	8.50	26.09	9.26	13.89	9.23	6.98
	Total CPE	180	65	48	43	138	63	224	104	110	79	116	120	42	48	135	24	136	54	124	87	153	23	162	36	130	43
Ohio IBI Scores	# Native Species	3	1	1	1	3	3	5	3	3	1	3	5	3	1	3	1	3	3	3	3	3	1	3	1	3	1
	# Sunfish Species	3	3	3	3	3	5	3	1	5	1	3	5	3	3	3	3	1	3	5	3	1	3	1	3	3	3
	# Sucker Species	3	1	1	1	1	1	5	5	3	1	3	3	3	1	3	1	3	1	1	1	3	1	5	1	3	1
	# Intolerant Species	5	1	3	1	5	3	5	5	5	5	5	5	3	1	3	3	5	3	3	3	5	3	5	1	3	1
	# Non Tolerant CPE	3	1	1	1	3	1	3	1	3	1	1	1	1	1	1	1	3	1	1	1	3	1	3	1	1	1
	% Tolerant Species	1	1	1	1	3	1	5	5	5	1	3	1	1	1	1	1	5	3	3	3	3	1	3	1	1	1
	% Round Bodied Suckers	1	1	1	1	1	1	1	5	5	3	1	1	1	1	1	1	5	1	1	1	3	1	3	1	1	1
	% Top Carnivores	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5
	% Omnivores	1	1	1	1	3	1	5	5	5	1	3	1	1	1	1	3	5	3	3	1	3	5	3	1	1	1
	% Insectivores	3	3	3	3	3	3	3	5	5	3	3	3	3	3	3	5	5	3	3	3	5	5	3	3	1	3
	% Simple Lithophils	1	1	1	1	1	1	1	5	5	3	1	1	1	1	1	1	5	1	1	1	3	1	3	1	1	1
	% DELT Anomolies	1	1	5	1	1	1	1	3	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	River	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Fox	Green	Green	Green	Green	Green	Rock	Rock	Rock	Rock	Rock	Rock
	Station	SBLO	SBUP	SCLO	SCM1	SCM2	SCUP	SELO	SEUP	SILO	SIUP	YOLO	YOM1	YOM2	YOUP	PB-02	PB-04	PB-08	PB-10	PB-19	P-11	P-15	P-20	P-21	P-23	P-24
	Habitat Type	DS FF	US IMP	DS FF	MD FF	MD IMP	US IMP	DS FF	US IMP	DS FF	US IMP	DS FF	MD FF	MD FF	US IMP											
	OH Boatable IBI	44	22	30	24	16	24	22	18	46	18	50	28	24	18	42	36	44	40	42	44	44	40	48	44	44
Ohio IBI Metrics	# Native Species	16	8	12	13	6	6	13	6	10	5	16	11	7	6	18	17	18	15	19	32	20	18	26	27	21
	# Sunfish Species	1	2	3	3	3	3	3	2	0	2	3	1	0	2	3	2	2	2	2	5	6	2	5	3	1
	# Sucker Species	6	1	2	3	1	0	2	0	4	1	6	3	2	1	6	6	5	7	7	8	5	4	7	8	9
	# Intolerant Species	4	3	3	3	0	0	3	1	4	1	7	3	3	0	5	3	4	5	7	12	5	6	7	9	8
	# Non Tolerant CPE	150	15	123	29	18	17	46	17	107	8	139	51	53	7	235	128	155	218	255	437	313	313	266	235	232
	% Tolerant Species	8.0	76.6	21.4	61.8	65.4	53.6	46.5	48.5	5.3	75.0	10.9	43.3	44.8	78.6	17.9	21.4	11.0	27.8	16.4	3.5	14.0	7.1	11.0	4.9	2.5
	% Round Bodied Suckers	38.0	0.0	2.8	2.6	0.0	0.0	3.5	0.0	54.0	3.1	61.5	32.2	32.3	0.0	6.3	10.1	22.5	26.2	36.1	13.1	10.7	2.7	33.8	18.2	27.3
	% Top Carnivores	35.0	12.5	40.7	22.4	9.6	14.3	26.7	39.4	34.5	18.8	10.3	23.3	24.0	10.7	14.7	25.8	28.3	11.9	5.2	8.8	11.6	9.5	10.0	9.3	5.5
	% Omnivores	15.3	78.1	22.8	61.8	67.3	42.9	46.5	42.4	5.3	71.9	19.9	42.2	42.7	78.6	18.9	25.8	15.6	31.8	28.5	23.0	11.3	13.9	32.4	27.1	35.7
	% Insectivores	49.7	9.4	44.1	15.8	25.0	75.0	26.7	18.2	60.2	9.4	69.9	34.4	33.3	25.0	66.7	46.6	53.2	55.3	65.6	42.7	32.8	29.1	53.8	52.2	58.0
	% Simple Lithophils	38.7	0.0	3.4	3.9	0.0	0.0	4.7	0.0	54.9	3.1	62.8	35.6	32.3	0.0	7.0	10.7	27.2	27.2	37.7	15.0	11.6	3.0	34.8	18.6	32.8
	% DELT Anomolies	11.04	1.56	12.82	18.42	9.43	2.70	15.12	18.18	9.73	6.25	2.56	5.56	19.79	3.13	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
	Total CPE	163	64	156	76	53	37	86	33	113	32	156	90	96	32	286	163	174	302	305	453	364	337	299	247	238
Ohio IBI Scores	# Native Species	3	1	3	3	1	1	3	1	3	1	3	3	1	1	3	3	3	3	3	5	3	3	5	5	5
	# Sunfish Species	1	3	3	3	3	3	3	3	1	3	3	1	1	2	3	3	3	3	3	5	5	3	5	3	1
	# Sucker Species	5	1	1	3	1	1	1	1	3	1	5	3	1	1	5	5	3	5	5	5	3	3	5	5	5
	# Intolerant Species	5	3	3	3	1	1	3	1	5	1	5	3	3	1	5	3	5	5	5	5	5	5	5	5	5
	# Non Tolerant CPE	3	1	3	1	1	1	1	1	3	1	3	1	1	1	5	3	3	3	5	5	5	5	5	5	5
	% Tolerant Species	5	1	3	1	1	1	1	1	5	1	5	1	1	1	3	3	5	1	3	5	5	5	5	5	5
	% Round Bodied Suckers	5	1	1	1	1	1	1	1	5	1	5	3	3	1	1	1	3	3	3	1	1	1	3	3	3
	% Top Carnivores	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	5	3	5	3	3
	% Omnivores	5	1	3	1	1	1	1	1	5	1	3	1	1	1	3	3	5	1	1	3	5	5	1	3	1
	% Insectivores	3	1	3	1	1	5	1	1	5	1	5	3	3	1	5	3	3	5	5	3	3	3	3	3	5
	% Simple Lithophils	3	1	1	1	1	1	1	1	5	1	5	3	3	1	1	1	3	3	3	1	1	1	3	1	3
	% DELT Anomolies	1	3	1	1	1	3	1	1	1	1	3	1	1	1	3	3	3	3	3	3	3	3	3	3	3

DS Downstream of Dam
US Upstream of Dam
MD Middle Reach between Dams
FF Free Flowing
IMP Impounded

Attachment A
Appendix G: Comments

Date: 10/30/2003
To: Toby Frevert
From: Howard Essig
Subject: Additional Comments on Draft Lower Des Plaines River Use Attainability Analysis (3/10/2003).

Page 2-39, third paragraph. "However, most of the nutrient loads come from the upper reaches of the Chicago Area Waterway System ..." **Comment:** A substantial portion of the nutrient loading to the lower Des Plaines River is also coming from the upper Des Plaines River. Are there any plans to deal with this source?

Page 2-40, first complete paragraph, second sentence. "The acute criterion is a function of pH..." **Comment:** Insert "Federal" in the beginning of the sentence – The Federal acute criterion ...

Page 2-40, first complete paragraph, third sentence. "The chronic standard is a function ..." **Comment:** Insert "Illinois" - The Illinois chronic standard...

Page 2-41, last paragraph, second sentence. "The margin of safety would be large for all stations of the lower Des Plaines River except MWRDGC 95 (I-55)..." **Comment:** The margin of safety would also be low for the upper Des Plaines station IEPA G-11. What about the IEPA station on the CSSC (GI-02)?

Page 2-45, Copper, first paragraph, second sentence "The difference in the analyses was a partial problem." **Comment:** IEPA analyzed both total and dissolved copper while MWRDGC analyzed only for total. What were the differences in total copper concentrations between IEPA station G-23 and MWRDGC station 93? The compliance issue may be more of a QA/QC problem. According to page 2-35, IEPA and MWRDGC stations that were located in similar locations (i.e., G-23 and MWRDGC 93, GI-02 and MWRDGC 92, and G-11 and MWRDGC 91) exhibited different probabilities of compliance. Collection methods differ between the two agencies. IEPA employs a depth integrated equal width transect method while MWRDGC uses a bucket grab center of flow.

Page 2-45, Seasonal variation, last sentence. "However, this pattern is specific only for the MWRDGC data ..." **Comment:** Were other IEPA stations besides G-23 (i.e., G-39 Riverside, G-11, GI-02, F-02) checked to see if they exhibited this same pattern?

Page 2-46, Sources of Copper, second paragraph, last sentence. The IEPA detection limit for total and dissolved copper is 10 ug/L.

Page 2-47, second paragraph, fourth sentence. "Chloride concentrations found in urban runoff and streams after application of deicing salts ..." **Comment:** According to figure 2.17, elevated concentrations of total copper were found from September through January, with most of them apparently found in October and November when salt application rarely occurs in northeastern Illinois.

Page 2-48, Relation to Flow. Where did the flow data that is shown in figure 2.19 come from? Did other stations show this same trend in copper concentrations with flow (i.e., G-39 Riverside, G-11, G-23, GI-02)?

Page 2-49, last paragraph, third sentence and Page 2-50, Figure 2.21. "A high concentration spike is a result of a barge tow..." **Comment:** Could these TSS spikes be due to storm /high flow events? Did MWRDGC field notes indicate barge traffic on these dates? According to USGS flow data from the CSSC at Romeoville; it appears some of these TSS peaks were associated with increased flows. For example, IEPA station G-45 near Empress Casino was sampled on

July 10 and had a TSS concentration of 92 mg/L. The flow at Romeoville on this date was 6636 cfs, about 2.5 times the annual mean flow.

Did TSS results from other MWRDGC stations on these dates indicate a similar pattern (i.e., 91, 92, 93, 95)? Hickory Creek enters the lower Des Plaines River just below the Brandon Lock and Dam. IEPA and USGS have water quality monitoring and flow gaging stations on Hickory Creek in Joliet. The Joliet MWWTP discharges into Hickory Creek near the mouth. Were any of these data sources checked to see if they contributed to the results found at MWRDGC station 94?

Page 2-50, Sediment as a source of copper, first paragraph, first sentence. "Table 2.8 contains the sediment copper concentration data...and the reference Kankakee River at I-55 near Wilmington" **Comment:** In Table 2.4 on page 2-24 the Kankakee River at Momence (F-02) is indicated as the reference site.

Page 2-50, Sediment as a source of copper, first paragraph, second sentence. "The data were provided by the MWRDGC." **Comment:** The data from the Kankakee River was provided by IEPA. Why were IEPA data from 2000 at stations G-45 near Empress Casino (RM 282.8), G-01 at I-55 (RM 277.3) and G-24 (RM 273.2) not included in the analysis?

Page 2-50, Sediment as a source of copper, first paragraph, third sentence. "Only the data between 1994 and 2000 were considered." **Comment:** The summarized sediment data presented in Table 2.8 on page 2-51 includes data from the Kankakee River from 1982 through 1994, but does not include 2000 data.

Page 2-50, Sediment as a source of copper, first paragraph, fourth sentence. "All measurements were made in the month of October." **Comment:** The sediment data from the Kankakee River in 1994 was collected in July.

Page 2-50, Sediment as a source of copper, first paragraph, sixth sentence. "The sediment concentration of copper between these two locations doubles." **Comment:** According to the mean values given in Table 2.8 the copper concentration nearly triples. IEPA sediment data from 2000 at stations G-45 (RM 282.8), G-01 (RM 277.3) and G-24 (RM 273.2) indicate similar concentrations between these three stations (61 mg/kg, 60mg/kg and 57 mg/kg, respectively).

Page 2-50, Sediment as a source of copper, second paragraph, first sentence. "IEPA classified the sediments in the state waters..." **Comment:** It should be indicated that these classifications were based on field sieved (62*u*) samples and may not be applicable to whole sediment samples collected by MWRDGC.

Page 2-50, Sediment as a source of copper, second paragraph, second sentence. "Based on this comparative classification the copper content of the sediments..." **Comment:** The Dresden Pool at RM 185 should be RM 285. The lower copper concentration at RM 285 may be because of a higher content of coarser particles below the Brandon Lock & Dam. Percent volatile solids at this location was much lower than at RM 290.5 and RM 278 indicating that this may be part of the reason (see Table 2.8). Contaminants tend to concentrate on finer grain sediments and these particles are more likely to be re-suspended than coarser sediments. Field sieving to a more uniform small particle size (i.e. <62 *u*) limits the variability of constituent concentrations. IEPA sieved sediment copper concentrations from 2000 were similar at stations G-45 (RM 282.8), G-01 (277.3) and G-24 (RM 273.2). The concentrations at these three stations (57 ug/kg – 61 ug/kg) would be classified as elevated. Copper concentrations from 2000 were also available for the upper Des Plaines River at Lockport (G-11), Du Page River at Channahon (GB-01) and the Kankakee River near I-55 (F-01). Sediment results from these locations indicated non-elevated concentrations of 27 mg/kg, 20 mg/kg and 10 mg/kg, respectively. These results indicate that the source of copper is probably from above the Brandon Lock and Dam.

Page 2-51, Table 2.8. Indicate number of samples for each station. The Kankakee Data is from IEPA and is from 1982 – 1994. Percent volatile solids data is available for the Kankakee and was included in the data sent to the contractor. Why was 2000 data from the Kankakee (F-01), lower Des Plaines (G-11, G-45 and G-24) not included in this table? The minimum TVS value for RM 278 is obviously too high (44).

Page 2-54, Third paragraph. "An increase in copper concentrations occurs between sites 93 and 94..." **Comment:** IEPA collected water samples three times in 2000 at five stations between the Brandon Lock & Dam and the Dresden Lock and Dam. Total copper concentrations were below the detection limit (<10 ug/L) in all three samples from stations G-45 (Near Empress Casino, RM 282.8) and D-40 (Illinois River u/s Dresden L & D, RM 272.0). Copper was detected once at station G-12 (Brandon Road, RM 285.3) and G-01 (I-55, RM 277.0) and twice at G-24 (RM 273.6). These stations were sampled from the middle of the channel, as was MWRDGC station 93, and may not be comparable to MWRDGC stations 94 and 95, which were collected from the Empress Casino Dock and Mobil Oil Co. Dock, respectively.

PRELIMINARY WATER BODY ASSESSMENT: CHEMICAL INTEGRITY OF THE LOWER DES PLAINES RIVER

RESPONSE TO THE COMMENTS AND SUGGESTIONS OF THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

by

AquaNova International/Hey & Associates

January 2002

We greatly appreciate the comments and suggestions of the MWRDGC. We have carefully reviewed the comments, found them very helpful and will consider incorporating them into the final report. We would like to point out, as it was correctly recognized by the MWRDGC reviewers, that this is a draft report that has been reviewed by several agencies and has become a joint effort.

Comment #1 Inclusion of a Table of Contents and List of Figure and Tables.

These were included after the executive summary on pages numbered by small Roman numerals vi to ix . This is the standard format for reports.

Page i
Paragraph 1. Analysis of the current water quality conditions as compared to Secondary Contact and Indigenous Aquatic Life water quality standards.

The following paragraph was added to the report:

> The report evaluates the water quality data obtained from the agencies for compliance with the Illinois General Use Standards. If a parameter complies with the General Use it can be implicitly assumed that it also complies with the Indigenous Aquatic Life and Secondary Contact use for which the standards are less stringent. Some parameters (e.g., bacteria) have only a General Use standard.

Additional wording will be added to the DO evaluation where at some locations (e.g., Dresden Island Pool) the DO concentration may meet the Indigenous Aquatic Life/Secondary Contact use but not the General Use.

It appears that there a misunderstanding about the role this UAA. The need for the UAA is derived from the wording of the Clean Water Act that, in Section 101(a):

- $ wherever attainable, achieve a level of water quality that provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water , and take into consideration the use and value of public water supplies, and agricultural, industrial, and other purposes, including navigation (Sections 101(a)(2) and 303(c) of the Act); and

- $ restore and maintain the chemical, physical, and biological integrity of the nation's waters (Section 101(a)).

Under Section 303(c), EPA is to review and to approve or disapprove State - adopted water quality standards. This review involves, among others, to determine whether the State Standards include the uses specified in section 101(a)(2). If the designated use and ensuing standards are not in accordance with the above rules of the State, the State must submit an UAA. EPA disapproves the standards if the state standards are not in accordance with the uses specified in Section 101(a) and "*the State has not followed its legal procedures for revising and adopting standards*" and/or "*the State standards are not based upon appropriate technical and scientific data and analyses*".

The State developed its Secondary Contact and Indigenous Aquatic Life use in 1970's and has not received an approval from the US EPA.. This use is not in accordance with the CWA Section 101(a). The Illinois General Use is. Therefore, this UAA is not defending or making justification for the Secondary Contact and Indigenous Aquatic Life Use. Based on the law we must begin with the General Use and its standards and find out whether the use and its standards are attainable. The UAA regulations included in 40 CFR 131 specify six reasons by which the General use standards can be relaxed and the use modified.

We have already identified 19 parameters that fully meet the general use standards. We are now looking into remaining 6 parameters and trying to identify whether they are attainable. We are considering several alternative scenarios such as considering Water Effect Ratios, water quality in reference water bodies (the Kankakee River is a reference only for chemical constituents), definition of a new use based on irreversible physical restrictions caused by navigation, and habitat restriction. In the final outcome, all six reasons may be investigated. We already know that some may not be applicable (e.g., lack of flow).

If this UAA fails, e.g., by excluding reference streams from consideration that prevents then invoking Reason 1, or if the State fails to submit a technical and scientific documentation for altering the *General Use* standards then, by default, the General Use with its standards will become the only use allowed.

We have also noted that the Secondary Contact WQSs have standards for cyanide and total iron that is not included in the General use WQSs. Also present Secondary Contact WQSs for Unionized Ammonia (as N) and dissolved iron are more restrictive than the General use standards or federal criteria. We will address the compliance with the more stringent general Use standards in the final report and suggest a reconciliation.

"Dresden Island" identification was corrected.

Page ii

Paragraph 1 The data from Commonwealth Edison and the Midwest Generation have been collected only for I-55 and in this preliminary evaluation only DO and temperature would have been pertinent. These data only confirm what was found using the MWRDGC and IEPA data, i.e., that at the end of the investigated reach both parameters comply with the General Use standards. The data only covered the period from 1997 to 2000 and the continuously obtained measurements are not statistically the same as the randomly collected data. They could not be used for trend analysis.

These data are now being used in the detailed analysis of the DO and temperature situation of the Dresden Island Pool.

The table was corrected and editorials (e.g., MWRDGC.) were also corrected. We have eliminated numbering of the tables in the Summary because the sequence of the tables is not the same as in the text which would lead to confusion.

<u>Probabilistic analysis</u>. The 99.8 % probabilistic compliance of the acute standards is derived from the wording of the Federal EPA incorporated in the frequency and duration dimension of the water quality standards for priority pollutants (40 CFR 131). The regulations specify that the criteria are applied to a concentration that is exceeded once in three years which means that one out of 3 x 365 = 1,095 daily measurement (0.1 %) can exceed or 2 out 1,095 daily measurements (0.2%) can equal or exceed the standard. Therefore, 1,093 daily concentrations or 99.8 % must be less. Because very rarely one has daily grab measurements fitting the incomplete series of measured data to a probability distribution and deriving the 99.8 % value in this way is the only logic and scientific way.

Since the IEPA has accepted the federal criteria as state standards it is implicitly assumed that the duration and frequency component is applied too. Otherwise the impossible "never to be exceeded" rule would apply and the whole analysis would collapse to a discussion of what is meant by "never to be exceeded".

The log-normal probabilistic fitting has been, to our knowledge, applied and accepted by the US EPA. For example, in 1983 EPA scientists used log-normal probability analysis for the nationwide assessment of the stormwater pollution in the Nationwide Urban Runoff Project and reported the results to Congress. The US EPA's TMDL study of the New York Harbor uses almost exactly the same methodology as we proposed and conducted. For waste allocations, USEPA has developed and promotes a model called DYNTOX that performs normal and log-normal probability distributions in almost exactly the same way as we do on this project and provides probabilistic estimates of the exceedance or compliance with the criteria. The Sacramento Regional Sanitation County District consultants used DYNTOX to develop probability plots for the Sacramento River and presented them to the State of California that accepted and recommended the methodology. This is an established, scientific methodology.

Page iii
CCC was defined in the body of the text as Criteria Continuous Concentration, which means chronic toxicity criterion. CCC and CMC (acute) definitions were incorporated into the Summary. The reference to an "ideal standard" is being taken out from the report. It has low relevance. It was used in the original manuscript of the report by the NRC Committee to Evaluate the Scientific Basis of the TMDL to define a format of a standard.

Page iv
The scientific judgement was explained in the main report. We made a judgement that a component of a common salt (chloride) is not acutely toxic at the concentrations found in the river; therefore, the probability of exceedances greater than 0.2 but far less than 10 percent (allowable exceedance used by the US EPA and some states for non toxic pollutants in the 305(b) reports) was acceptable for non priority pollutants such as salt (chloride) or pH.
For example, tests on fish showed that after 13 months of exposure to pH of 4.5 the test fish were affected but not dead (1986 US EPA criteria document - the yellow book).

The paragraph that includes antidegradion and 303(d) listing has been replaced by the following sentence:

Water column concentrations of toxic metals (with exception of mercury) listed in the above table do not provide a justification for including metals into the 303(d) listing.

Page v
We have included probabilities in the main report. Also in the table listing noncompliance stations we have included a column an indication of compliance or non-compliance with the Illinois Indigenous Aquatic Life and Secondary Contact use and also included this evaluation in the main report.

'Threatened at all" means that the parameter is threatened at all stations. Page v is part of the summary. Detailed explanations are included or will be included in the report.

Page 1
Suggested corrections were made throughout the report.

The entire paragraph 3 was reworked to include better-referenced materials.

"Fair" classification of water quality of the river upstream from Lockport was found in the Illinois 305(b) report from which also Figure 1 was taken. The green color indicates "fair" water quality based on the most recent definition of the 305(b) report by the US EPA to Congress.

Page 2
A better identification of the study reach was made on the figure.

Page 3
Paragraphs 1 and 2 were modified to reflect the comments. The term "river" was replaced by a term "water body"; however, the name still remains the Des Plaines River, therefore, the reference to a river is appropriate. Modified or channelized rivers historically still remain rivers. A term "canal" typically refers to a completely man-made channel in a place that was not a river.

We feel, indeed, that we were asked to advise the Illinois EPA of possible modifications of the 303(d) list.

Paragraph 6
We do not have a problem with the substitution of this paragraph proposed by the MWRDGC.. The sponsoring agency (Illinois EPA) has also no objections against this substitution.

Box 1
Numbering the reasons appears in our report. Apparently it was lost in transmission and downloading. We believe that a study technically but not legally similar to a TMDL should be performed in order to use Reason 6. In some complicated cases, it is needed to find the loading capacity, margin of safety, perform load and waste load allocation and provide cost of abatement before one can make a socio-economic analysis of benefits and cost or financial impact.

For consistency, we have removed the last sentence from Reason 6 and put the following sentence below the Box : "Reason 6: The UAA may require estimating load capacity of the water body and perform load and waste load allocation processes in order to perform a socio-economic impact analysis based on benefit/cost or financial impact analyses (Novotny et al.[1])". This is consistent with the earlier EPA water quality standards documents such as EPA 44405 88 - 089 "Introduction to Water Quality Standards" or the 1986 Water Quality Standards Handbook.

Page 5
When a State states designates uses that are not in conformance with Section 101(a) statutory uses, an UAA *must* be performed. If none of the six reasons is found to apply the use must be upgraded. In this sense the UAA is used to upgrade the previous non-conforming use. If the agency chooses to accept for the body the General Use standards without a modification, an UAA is not needed. UAA is, however, needed if the upgrade of the use is less than the full general use. Thus, an UAA is needed for an upgrade to an optimal use that is less than the general use.

Paragraph 3- wording was modified.

Page 6
The abbreviations were replaced by full wording (e.g., BMP = best management practice)

Page 9
Paragraph 1. The typo was corrected. See discussion of probabilistic analysis on Page 3.

Paragraph 2. The reference is Delos, C. (1990) " Metals criteria excursions in unspoiled watersheds," Unpublished draft, Criteria and Standards Div., U.S. Environmental Protection Agency, Washington, DC. He suggested a range of compliance based on randomly taken data for CCC criterion from 99.2 to 99.8 %. His calculation using analysis of autocorrelation was credible. However, based on our judgement, the high limit of 99.8 % does not make sense because that would make the limiting probability of the CCC excursion equal to one daily grab sample in three years (allowing one to be equal) which corresponds to the CMC frequency. The low limit of 99.2 % compliance is more or less for randomly fluctuating sample series. Knowing the fact that daily water quality series are mildly autocorrelated but still random (based on our own research analyzing daily concentrations in WWTP influents and effluents) we opted for a middle range of 99.4 % compliance. In the subsequent document on the detailed analysis of copper, we pointed out the deficiency of the USEPA CCC criterion.

Page 10
Table 1 Typically, both DO federal criteria, i.e., 7 day average of 6 mg/L and daily minimum of 5 mg/L have to be satisfied. The concept of 7 day average obviously required continuous sampling.

Page 14 *Selection of the ammonium criterion.*
The following sentences will substitute the statement in the report: *Salmonid fish species are not indigenous to the Des Plaines River/Upper Illinois River System. Therefore, the criterion for salmonid fish absent will be used in this UAA.*

The issue of early life forms present or absent will be discussed in great detail in the document outlining the proposed Modified Warm Water Use. In this report we substituted the following sentence: *The conditions whether early life forms can develop in the river system will be a subject of this UAA study.*

A detailed analysis of the fish and other life forms present or potentially present will be included in the subsequent documents.

Page 15
The name for Brandon Road Lock and Dam was corrected.

WER values in the USEPA document are very conservative. We prefer a site-specific determination that is included in the subsequent detailed documents. Note that this preliminary analysis document was used only for screening and elimination from the further analysis of components that clearly have complied with the general use standards.

Although sulfides are known ligands they do not exist in oxygenated water. Data were not available for the sulfide content of sediments.

Page 16
Paragraph 1. Compliance with secondary standards was included in the Table as a comment. See note on Page 1.

Page 17 *Reference station*

The Biologic Subcommittee has been trying to find a reference point for biotic assessment. The Kankakee River is used for illustration and reference of chemical parameters. We cannot use the downstream pools of the Illinois River for chemical reference as suggested but not agreed on by the subcommittee. The Illinois River flow at these points contains pollutants from a population of over 9 million. Reference water bodies are unimpacted or least impacted bodies by humans. So far, the Kankakee River is the best we could identify so far. Reference bodies do not have to be pristine but they should not contain wastewater from 9 million inhabitants. Without a reference we would not be able to fully develop site specific criteria. We believe that the Kankakee River is a credible reference since its character resembles what the Des Plaines River would have been without urbanization.

Page 18

Same answer on the applicability of the reference as that for page 17.

Page 23

We substituted "visual fitting" for "eyeball estimate".
For the acceptability of the probabilistic methods see the reply note on p.2 of this reply.

Page 24 and 25

If a parameter meets the General Use it also meets the current Secondary Contact and Indigenous Aquatic Life Use (Table 5). We added a sentence in this regard. Table 6 was modified to include comments on the compliance with the Secondary Contact and Indigenous Aquatic Life use. We have noted that the secondary use standard for unionized ammonia (as N*) in the Secondary Use is more stringent than that in the General use. We will address it in the final report, i.e., if there is a conflict between the attainment of the US EPA ammonium criterion and IEP A standards we will suggest a reconciliation.. Our report has addressed attainment of the General use standards and US EPA criteria.

Page 27

As stated before it is our interpretation of the contract and RFP that were asked by the IEPA to identify those parameters that should be removed from the 303(d) list. All parameters identified as fully meeting the General use standards that are on the list should be removed. If we do not state this fact will be understood by the agency by default. We have added a sentence stating that all parameters in Table 5 meeting the Illinois General use standards also meet the Secondary Contact and Indigenous Aquatic Life use which has far less stringent standards.

We remove the antidegradation statement from the report. However, in submitting the standard modification document the State is required to consider and include the antidegradation statement.

Page 28

This report focus on screening parameters and locations for compliance or noncompliance. Some possible analyses for Tier II were described in our previous document "Methodology ..." that was already reviewed and commented on. Detailed Tier II methodology will be included in the subsequent documents (copper, dissolved oxygen, other pollutants).

Table 6
We have not commented on compliance or noncompliance of stations outside of the Lower Des Plaines River. Table 6 is a summary of noncompliance, we have reported in detail percent noncompliance for each occurrence in the pertinent section dealing with the parameter. Table 6 would become unmanageable and information redundant if the same comprehensive information was included.

Station 92 is right at the boundary of the investigated reach of the Lower Des Plaines River and it reflects the condition at the beginning. If there is a consensus that this station should be deleted we will delete it.

Page 29
We were provided standards by the IEPA that are either standing or proposed, including the federal criteria, and were asked to evaluate all three categories.

Using nearby unimpacted or least impacted streams as reference water bodies is a perfectly legitimate and needed component of any UAA. Not using a reference would deprive the UAA and the State of the use of the reference data to arrive at a site specific standard. For example, if reference data indicate that a nationwide standard is not attainable, the standard can be adjusted to reflect this fact (see Reason 1). It is contradictory to the UAA process to ask that reference data be removed and then demand that all 6 reasons be used in the UAA. Reason 1 cannot be invoked if reference data is not available.

Page 30
The editorial corrections were made.

Last paragraph
We do not suggest a downgrade of the Kankakee River. The Kankakee River is the reference stream but it is not subject to this UAA. If the river is found as not meeting the standing General Use standards, the IEPA can conduct an UAA invoking Reason 1 at a later time.

Page 31
Paragraph 2 - See the preceding reply.

Paragraph 5, subparagraph 1

As in the Summary we have removed the note on antidegradation and substituted the following sentence : *The Illinois EPA should reevaluate inclusion of the metals listed in Table 5 and ammonium in the 303(d) list*.

Only temperature was identified in Table 6 as a threatened parameter and referred for further analysis. The reason is the fact that the General Use temperature limit is being approached, the trend is increasing and a judgement was made by the AquaNova/Hey Associates team, discussed also with the Illinois EPA, that temperature should be evaluated in greater detail inside the pools between the sampling points.

Page 32 Paragraph 5
The trend analysis is a simple statistical fitting of data to time or

$$C = a + b \times (\text{time})$$

where a and b are statistically derived coefficients. If b is statistically significant and positive then we have an increasing trend. A visual observation of the plot is also done to confirm the reality of the plot (e.g., for some constituents a change in the detection limit may indicate a false decreasing trend). This type of analysis (regression analysis) is a part of any statistical package or a statistical text.

If a judgement was made that the trend is towards a possible exceedance of the standard within the next five years the parameter would be judged as threatened and referred for additional analysis.

Page 33
The following text was added to explain the trend analysis:.

The plots were evaluated visually. If the line of the best fit indicated more than 20 percent increase or decrease over a period of five years the trend was ranked as significant. A weak trend is when the change is evident but less than 20 percent over a period of 5 years or if the data shows a trend but may be distorted by laboratory detection limits. Compounds that had data distorted by detection limits to a point that a trend could not be detected were not included.

Page 34
As stated before we were under the impression that we were asked by the Illinois EPA to identify the parameters that should be deleted from the 303(d) list. After consulting this issue with the IEPA it was fount that all of the metals (Hg, Cr, Cu, Pb, Zn) and PCB listed in the 1998 303(d) for the G-23, G12, and G-01 were based on sediment data and not on water quality standards violations. Also, PCBs were listed as a cause because there is a fish consumption advisory for the Lower des Plaines River. Our wording will indicate that the water quality in the water column need not to be listed in the 303(d) report; however, these parameters (see our detailed report on copper) may need to be listed based on the sediment data.

Page 35
The DO link to temperature will be established by the QUAL 2E model.

Figure 9 explains the methodology for the next step. In the next step, the UAA must develop necessary reductions of the concentrations and loads. This figure was already presented, discussed and explained earlier when the committee discussed the methodology. The figure could be deleted from this particular report since it is not a part of the screening.

Page 36 - Summary of DO excursions

In the text describing the DO excursions we have reported percent compliance with the General Use standard as

Reference site	99 %	
IEPA GI -02	60 %	Upstream site
MWRDGC 92	50 %	Upstream site
IEPA G 23	75 %	Brandon Dam Pool
MWRDGC 93	80 %	Brandon Dam Pool
MWRDGC 94	99 %	Dresden Island Pool
MWRDGC 95	>99.8 %	Dresden Island Pool

It is evident that the term "great margin" can be used only for the Brandon Road Dam Pool (sites IEPA G23 and MWRDGC 93) and not for the Dresden Island Dam Pool (sites MWRDGC 94 and MWRDCGC 95). The site MWRDC 95 indicates compliance. We can state again that this preliminary report is used for screening and a detailed DO analysis is forthcoming.

We delete the statement on aeration from the screening report but may address the attainability of the (proposed) DO standards in the upcoming detailed report on DO..

Page 37 Recreation standard.
This response on the same issue was provided to the Midwest Generation:

Most of the wording was taken from the USEPA documents on this issue, namely the 1994 Water Quality Standards Handbook. The text detailing the three options and the statement "**Failure to support the swimmable goals for a stream is a major deficiency**..." are verbatim quotations from the Standards Handbook (p2-3) and we included them to point out the problems with defining the recreational use. We included them to document the USEPA positions expressed in this particular guideline report. We have provided the citation in the report by a superscript reference pointing to the 1994 Water Quality Standards Handbook (possibly this superscript was lost in downloading the document). The AquaNova- Hey Associates team has not completed the detailed analysis of regulations and options available to derive a proper recreational use. We are now collecting and analyzing data from reference streams and trying to identify the source of bacterial contamination that, as correctly pointed out by Ms. Wozniak in her comments, might be of an uncontrollable nonpoint origin.

As pointed out in our last paragraph, the USEPA has modified its position and now allows more flexibility and other recreation classifications. The January 2000 *Draft Implementation Guidance for Ambient Water Quality Criteria for Bacteria-1986* list the other options. This document does emphasize that all six reasons should be considered. One option was quoted as *"designating a secondary contact recreation may be appropriate where primary use is not an existing use and high levels of natural and uncontrollable fecal pollution exist* (p.30)". Physical restriction of the Brandon Pool and intensive navigation that may not be correctable as well as the fact that the reference streams also have high bacterial counts, will be considered along with Reason 6 of the

UAA regulations.

Finding an optimum use designation for recreation will not be simple and at this point we do not have any preconceived positions or fixed solutions.

We thank MWRDGC for your excellent comment and we will consider all of them. We hope that this response is satisfactory and we are looking forward to cooperation on the next, more difficult steps of the UAA.

Vladimir Novotny
Neal O'Reilly

AquaNova International, Ltd

Environmental, Ecological
and Water Resources
Engineers

November 12, 2003

Mr. Toby Frevert
Manager, Water Pollution Control
Illinois Environmental Protection Agency
Springfield, IL

Re: Three Rivers Manufacturer's Association

Dear Toby:

First, let me on behalf of AquaNova, Hey Associates and the entire Des Plaines River UAA team congratulate you on the promotion to the position of Manager of the Division of Water Pollution Control of the Illinois EPA. We are delighted to have had this opportunity of working with you on the Des Plaines River and hope that, after this project is over, we will be able to work with on other important water quality issues of the State of Illinois. We also appreciate your tactfulness, deep knowledge of the issued involved and guidance in this difficult project.

You have asked us top reflect on the three letters containing comments of the Three River Manufacturer's Association. I have received these letter only about ten days ago. I understand that, even though these letters were addressed to you, you expect our reaction.

We greatly appreciate the inputs of all stakeholders we met during this almost three years project and understand their concerns. We have made an extra effort to make this UAA objective and unbiased. We also understand that there may be some socio-economic issues involved that are beyond our analysis. As you are aware we have tried very hard to accommodate all comments and suggestions into our report and recommendations to the Agency and spent numerous hours with you and your staff and with stakeholders in and out the regular hearings of the two advisory committees and put in an effort that far exceeded the contractual expectations. In our replies we will focus on the last TRMA letter of June 8, 2003, hoping that these replies will also address their concerns in the previous two letters because there is some repetition.

Before we go into the discussion we have to emphasize that the outcome of this UAA will have little or no impact on those dischargers that have already implemented CWA Section 301 and 306 pollution abatement and comply with their NPDES permits. For most pollutants the Lower Des Plaines River is

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not water quality limited and additional expenses over those required to comply with the permit will not be needed.

Chapter 1

- We in principle agree with a comment that **any** of the reasons may justify. However, we stated on numerous occasions that our interpretation of the UAA rules is that the General Use is the starting point of our analysis, i.e., we arte not defending existing use, or status quo, which does not comply with the goals of the Clean Water Act but we ask and analyze whether the General Use is attained or attainable. The six reasons provide a list based on which the entire general use can be modified and corresponding standards relaxed or for modifying an individual General Use standard. However, the entire process must be realistic, defensible, and according to relatively strict water quality regulations. On the other hand we could not propose a change in a situation where most of the standing General Use standards have already been attained or could be attained, which is the case of the Lower Des Plaines River. There are several important examples where we hope we were successful in modifying the use or standards, e.g.:
    - We have prosed the *Modified Impounded Use* for the Brandon Road Pool that, if implemented, enables to relax the key standard for the dissolved oxygen and ammonium We have extensively documented that the reduced DO standard is not lethal nor chronically toxic to the resident and potentially indigenous aquatic population and is in accordance with the standing USEPA (1986) criteria document. For the same pool we have documented that the primary contact recreation is not the proper use and advised to the Agency to adopt secondary use E. Coli standard at a level that is clearly already attained. We have also found that most other chemical parameters, including temperature, already meet the General Use standards, therefore, there is no reason for trying some relaxed standards.
    - We have proposed an *Impounded (General) Use* for the Dresden Island Pool that recognizes the fact that impounded water bodies can not attain the ecological status of wadeable small stream based on which the current Illinois biotic integrity guidelines were formulated. It should be noted that there are no current biotic standards. We have also prosed a relaxation of the dissolved oxygen standard of 5 mg/L to be based on 24 hour mean rather than an absolute minimum. Again, this standard has been attained and would be attainable if our proposed frequency of allowable excursions, was adopted. We have also proposed to adopt a high risk "restricted" primary recreation that is again clearly attainable. It would require disinfection but there were no objections from the City of Joliet to consider this step of improving quality of their effluent, especially under the circumstances that this large urban area has a great need for waterborne recreation.
- We will add "flow" alteration as one of the reasons for 303(d) listing.
- The question is now whether we could go any further and further downgrade the status of the river as implied in the letter. What would be the reasons? Navigation? There are many navigation streams in the State of Illinois that have been classified as general use, so all of them would have to be downgraded. Impoundment? Same reasons. Contaminated sediments? Evidence shows that this is not a reason to downgrade the use because excessive legacy pollution should be remedied. Examples of the Fox and Sheboygan Rivers in Wisconsin, the Hudson River in New York State and other water bodies with contaminated sediments clearly document that sediment contamination is a reason for TMDL and a follow up clean up but not a reason for a downgrade of the use.
- Almost all our pictures were taken during our visit of the sites organized by the Metropolitan Water Reclamation District of Greater Chicago during summer of 2001. During this daylong

visit we saw one barge tow passing the Lockport lock and included the picture in our report. The rest of the river was as it looked on the picture. So, we had no reason to deceive anyone and resent this connotation. We have reported that the average number of tows during summer is about 7 - 8 per day which is hardly a reason to downgrade the use of the water body in the Dresden Island pool.

Chapter 2 comments

These comments object the use of statistics and temperature.

- Use of statistics is a mandatory tool of all water quality. We have discussed it extensively when we presented out methodology for approval to the stakeholder's committee and responded to the comments more than two years ago. It is the only way how to arrive, as close as possible, to an unbiased water quality evaluation. We have done it in accordance with the fundamental laws of statistical analysis of water quality data and water quality regulations that express the water quality standards in statistical terms of magnitude and probability of allowed excursions. The federal water quality criteria specifically require that the statistical notion of frequency (related to probability) must be considered. The statistics does not obscure, just the opposite, not using it would lead to arbitrary judgements and indefensible conclusions. Statistics is not for hiding a bias, it prevents a bias and subjectivity.
- We could not write an UAA without considering temperature. Not only that temperature is a pollutant, it also affect many other water quality parameters, reaction rates and health of biota. We have not tried nor attempted to define any new standards but have noticed that the current standard is clearly in the lethal range and reported so in the UAA. We have also noted and reported that the General Use thermal standard does not have this problem and should be used as a basis for any proposals for alteration of the thermal standard. We have acknowledged that the Midwest Generation is submitting their own document and are certain that this document will receive proper attention.

We can again ask what would be the reasons that would allow the thermal standard to be near or in the lethal zone even for most thermally adaptable fish and almost all macroinvertebrates (that can not move to colder waters miles downstream)? Navigation, impoundment, or sediment contamination or composition are clearly not the reasons. We cannot blankly state that we think that Reason 3 or any other reason applies. We have to scientifically document that it does and then why temperature standard could be relaxed. We could not do that and have not seen that anybody else could with the exception of the Reason 6. Most other water quality parameters meet the general use standards. Temperature is almost the only one that does not.

Chapter 3

- The 2001 USEPA sediment data are in public domain and we have made a request to the USEPA for the data. We do not have funds nor are privileged to distribute the USEPA data to other parties. A simple request to the USEPA would suffice. The same is true for any other data we obtained from agencies.

Chapter 4

- "Lack of riffle/run habitat, limited hard substrates, channelization", although they appear to be consistent with Reasons 3,4, and 5, are also common for any other navigable water body. At one time we have proposed to the stakeholders committee to develop a special impounded use but met a great resistance because it would have lead to reclassification of many other water bodies. Instead, we have in our UAA proposed a "modified impounded" use for the Brandon

Poll and "impounded (general)" use for the Dresden Island Pool. These modifications reflect the fact that the optimal ecologic status of these bodies is different from wadeable free flowing water bodies and the reasons are irreversible. However, this reclassification cannot downgrade chemical (including temperature) standards if they are attainable. There seems to be a misunderstanding on the part of some that such reclassification will lead to a blank relaxation of standards for pollutants.

- We do not imply that the barge traffic will be reduced in the long run.

Chapter 5 and 6 No comments

Chapter 7

- Again, we do not imply that navigation will be reduced in the future. On the contrary, we have emphasized that navigation is a protected use; however, navigation cannot reduce standards for aquatic life. We have used the argument of the conflict of primary recreation with navigation in our proposal for secondary recreation use in the Brandon pool. We could not have done it for the Dresden Island pool because the key limitations (physical configuration, narrow channel, not access) were not present in the Dresden pool. The reasons the TRMA state for eliminating recreation are based on a perception that it would be inconvenient to the manufacturers, a reason that the authors of the UAA nor the Agency cannot advocate.

Chapter 8

- We have used the argumentation stated in the first paragraph in an attempt to justify the "high risk" infrequent or highly reduced recreation in the upper Dresden Island pool. We believe that this was the only course of action that would allow the Agencies to apply a side specific standard that would not require subsequent periodic UAA evaluations needed for a secondary use classification. Furthermore, the standard for such use is attainable so we have lost the argument to go further with downgrading. 7- 8 barge tows in a summer day is not an argument to eliminate recreation in the entire Lower des Plaines River, just a cautionary limitation that must be conveyed to those infrequent users. In our survey, although not specifically asked, boat accidents were not mentioned by those contacted and asked about the limitations on the recreation use. In the news item attached to the TRMA letter the cause of the death in the boating accident was given as " windy weather, choppy water and an overloaded boat". These causes cannot downgrade the use designation.
- We proposed environmentally sensitive disinfection and discussed this alternative with MWRDGC and City of Joliet and there were no complaints, just an agreement.

Chapter 9

- We appreciate the support for the Modified Impounded Use designation.

We hope that this analysis of the TRMA comments is helpful when you prepare you response. Let me know it this suffice.

Lets hope that the next week meeting will be productive.

Sincerely,

Vladimir Novotny, PhD, P.E.

The overall impression

Date: 10/15/03
To: Toby Frevert
From: Howard Essig
Subject: Comments on Draft Lower Des Plaines River Use Attainability Analysis (3/10/2003)

Page 1-5, Des Plaines River Watershed, sixth sentence. "The overall resource quality shown in Figure 1.1 assessed in the 1998 Illinois Section 305(b) report ..." **Comment:** Why was the 1998 305(b) report used instead of the 2000 or 2002 305(b) reports? It should be noted that the 1998 303(d) list was based on the 1996 305(b) report, which used data up through 1994.

Page 1-5, Des Plaines River Watershed, seventh sentence. "The potential causes of water quality problems ... in the Illinois Section 305(a) ..." **Comment:** This should be Illinois Section 305(b) not 305(a). "Phosphorus attached to sediment particles" is a source for lake assessments only and not for rivers and streams.

Page 1-5, Des Plaines River Watershed, eighth sentence. "A total of 76 lakes ..." **Comment:** Why mention lakes? This is a UAA for the lower Des Plaines River.

Page 1-5, The Des Plaines River, first paragraph, last sentence. " Since other treatment plants ... discharge into the CSSC ... the lower segment of the Des Plaines River is effluent dominated ..." **Comment:** What other Chicago metropolitan treatment plants discharge into the CSSC? The upper Des Plaines River (IL/WIS state line to CSSC) is also dominated by MWWTP discharges including NSSD Waukegan and Gurnee, MWRDGC Kirie and Egan plus many others see Table 1.1 on page 1-10.

Page 1-5, The Des Plaines River, second paragraph, first sentence. "All of the Des Plaines River mainstem (156 miles) ..." **Comment:** According to Healy (1979) there are only 109.9 miles of the Des Plaines River in Illinois. The upper Des Plaines River, from the IL/WIS state line to the confluence of the CSSC, is 93 miles. The lower Des Plaines River from the CSSC confluence to the Kankakee confluence is 16.9 miles. Not all of the Des Plaines River miles were rated as fair in the 1998 305(b) report. Segments G11, G39, G22, G07, G08 (or about 18.6 miles) were rated as good. Miles for many of the Des Plaines River segments were corrected for the 2000 305(b) report resulting in a total of 110.7 miles, which is in better agreement with the 109.9 miles from Healy (1979). The 2000 305(b) report also indicated additional segments rated as good including G08, G07, G22, G26, G35 and G36 (or about 33.4 miles).

Page 1-5, The Des Plaines River, second paragraph, second sentence. "Degraded water quality conditions were attributed to nutrients and siltation ..." **Comment:** Other causes of degradation were also listed including priority organics, metals, ammonia, TDS/conductivity, suspended solids, flow alterations and habitat alterations. "Phosphorus attached to sediment particles" is a source for lake assessments only and not for rivers and streams. Other sources besides municipal and industrial point sources, urban runoff and contaminated sediments were listed including agriculture, CSOs, land development, flow regulation, channelization and streambank modification.

Page 1-5, The Des Plaines River, second paragraph, third sentence. " All of the 48 stream miles assessed on Salt Creek ..." **Comment:** Why mention Salt Creek? No other Des Plaines River tributaries are discussed.

Page 1-6, Figure 1-1. This figure does not present the entire Des Plaines River Watershed. Lake County is missing. Since the text on the previous page discusses the entire Des Plaines River this map should include the whole basin.

Page 1-7, The Study Reach, first paragraph, second sentence. "Almost the entire reach is impounded ..." **Comment:** The word impounded implies "lake like" or reservoir conditions with minimal velocities (e.g. <0.3 ft/sec). According to Irwin Polls average velocities in the Brandon and Dresden Pools are 0.75 and 0.65 ft/sec, respectively.

Page 1-7, The Study Reach, second paragraph, fifth sentence. "The water quality status of the Des Plaines River, upstream from the confluence ..." **Comment:** The entire Des Plaines River upstream from the CSSC is not rated as only fair. About 19 miles in the 1998 305(b) and 33 miles in the 2000 305(b) are rated as good.

Page 1-7, The Study Reach, second paragraph, sixth sentence. "It receives urban runoff from many suburban communities." **Comment:** There are also numerous MWWTPs and CSOs that discharge into the upper Des Plaines River and its tributaries.

Page 1-8, Water Quality, fifth paragraph. Indicate year of 303(d) list. It should be noted that the 1998 303(d) list was based on the 1996 305(b) report. Parameters of concern in the study area should include the following: low dissolved oxygen/organic enrichment and flow alteration.

Page 1-10, Table 1.1. Are the average effluent flows given in this table design average flows or are they average flows for a period of record? Include dates for period of record. Two Bensenville plants are listed in the Table. Bensenville (South) discharges into Addison Creek, tributary to Salt Creek. Hinsdale discharges into Flag Creek, tributary to the Des Plaines River. Wood Dale North and South are not included on this Table. They both discharge into Salt Creek and have DAFs of 3.05 and 1.75 cfs, respectively. Mokena and New Lenox discharge into Hickory Creek and should probably be included in this table.

Page 2-5, fourth paragraph, first sentence. "For chronic toxicity, composite samples (over a 24-hour period) are more appropriate." **Comment:** Why are federal chronic standards being used instead if Illinois chronic standards? Illinois standards require only that a minimum of four samples be collected over a period of at <u>least</u> four days. Samples collected monthly (or longer) are acceptable (i.e. four month average). The dataset is sufficient to apply the Illinois chronic standards because the standards do not require a maximum of four days.

Page 2-8, Table 2.1 continued (Zinc). The acute and chronic standards for zinc are incorrect. The acute "A" value should be 0.9035 and the Chronic "A" value should be –0.8165.

Page 2-9, Table 2.1 continued (total ammonia nitrogen). The total ammonia nitrogen general use standard is 15 mg/L.

Page 2-9, Table 2.1 continued (un-ionized ammonia). The new standards effective 11/8/2002 should be used in this Table and include acute, chronic and sub-chronic standards.

Page 2-16, First complete paragraph, first sentence. "Ten-fifteen years after the Palmer's survey's had been conducted the water quality of the Lower Des Plaines River was dramatically altered by the Chicago Sanitary and Ship Canal." **Comment:** According to Com Ed (1996) the CSSC opened in 1900, only 1 – 3 years after the Palmer survey. According to page 1-14, thirteen miles of the Des Plaines River were re-routed into a diversion channel in the late 1800s. The CSSC was finished at the beginning of the 20th century. According to Table 2.3 on page 2-15, Palmer's survey was completed from 1897 through 1899.

Page 2-21, First complete paragraph. This description of the Green River should include 305(b) assessments, i.e. fifty-seven miles of the Green River were rated as full support (good) and 26 miles as partial support (fair).

Page 2-21, First complete paragraph, last sentence. "The nutrient pollution has caused extensive phytoplankton blooms." **Comment:** Document this statement – provide citation.

Page 2-12, second paragraph. There are two AWQMN stations on the Green River, which station was used as a reference site for bacteria?

Page 2-23, Rock River, third paragraph, first sentence. "The Illinois part of the basin is divided into the upper and lower Rock River Basins." **Comment:** The Rock is not divided into upper and lower basins - the Fox Basin is divided into an upper and lower basin.

Page 2-23, Rock River, third paragraph, third sentence. "Of the total miles, 69 miles have "good" quality ..." **Comment:** When discussing quality of the river indicate where this assessment is from e.g. 2000 305(b) report. According to the 2000 305(b) report, 154 miles of the Rock River was rated full support (good) and 13 miles as partial support (fair). Nutrients, and suspended solids were not listed as causes of less than full support.

Page 2-23, Rock River, third paragraph, last sentence. "The river is impounded ..." **Comment:** The entire river is not impounded. There are six dams on the Illinois portion (167 miles) of the Rock River located at Rockton, Rockford, Oregon, Dixon, Sterling/Rock Falls.

Page 2-23, Fox River, second paragraph, first sentence. "The lower Fox covers about 1,100 sq miles ..." **Comment:** Why is this discussion limited to the lower Fox River? There are 15 dams on the Fox River with four dams in the upper river and 11 dams in the lower river.

Page 2-23, Fox River, second paragraph, third sentence. "Overall resource quality was "good" on 495 miles and "fair" in 53 miles." **Comment:** The length of the entire Fox River in Illinois (including the chain of lakes) is only 115 miles. The 495 miles includes ratings for tributaries, which should not be included because the purpose of this exercise is to compare large rivers with dams. The most current assessment of the Fox River is in the 2002 305(b) report. Data from USEPA and the Max McGraw Wildlife Federation were used to help complete these assessments. This data included biological and chemical data collected upstream and downstream of every dam on the Fox River. According to the 2002 305(b) report, 33 miles of the Fox River were rated as full use (good) and 67 miles as partial support (fair). The primary causes of less than full use included priority organics, PCBs, nitrates, siltation, low dissolved oxygen, flow alteration, habitat alteration, suspended solids, fecal coliform and pH. Sources of these problems included urban runoff, CSOs, MWWTPs, flow regulation/modification, upstream impoundment, streambank stabilization/modification and contaminated sediments.

Page 2-26, third paragraph, last sentence. "In the case of the reference sites, all existing data was used in the statistical analysis." **Comment:** Why was all data from the reference sites used? This would amount to over 20 years of data for the reference sites compared to only five years for the study sites. It seems that it would be more accurate to limit both datasets to the same time period.

Page 2-26, Percentiles for Comparison with Standards, fourth sentence. "If one exceedance is allowed by the criteria regulations, this ..." **Comment:** This sentence appears to be incomplete.

Page 2-27. Total Ammonium. Why are federal criteria being used instead of Illinois standards (revised 11/8/2002)?

Page 2-28, Table 2.4. Acute and Chronic Toxicity Standards Derived from Average Hardness for total Metal Concentrations. This should be Table 2-5 not 2-4. The reference (Kankakee) should be labeled as IEPA – F-02. The site labeled as USGS Riverside should be labeled as IEPA – G-39. Acute and chronic zinc values are incorrect. Wrong "A" values were used in the zinc equations and should be 0.9035 for acute and –0.8165 for chronic (see comments for page 2-8, Table 2.1).

Page 2-29, Table 2.5. Acute and Chronic Toxicity Standards Derived from Average Hardness for Dissolved Metal Concentrations. This should be Table 2.6 not 2.5. The reference (Kankakee) should be labeled as IEPA – F-02. The site labeled as USGS Riverside should be labeled as IEPA – G-39. Acute and chronic zinc values are incorrect. Wrong "A" values were used in the zinc equations and should be 0.9035 for acute and –0.8165 for chronic (see comments for page 2-8, Table 2.1).

Page 2-31, Probabilistic Analysis, sixth paragraph. IEPA collected total and dissolved metals data at all stations used in this study including F-02, G-39, G-11, GI-02 and G-23.

Page 2-31, Probabilistic Analysis, sixth paragraph, last sentence. "In this case the WER for these two metals …" **Comment:** What two metals? – Only copper is discussed in this paragraph.

Page 2-32, Parameters in Compliance, second paragraph, second sentence. "The Illinois EPA should reevaluate inclusion of the metals listed in Table 2.6 and ammonia in the 303(d) list". **Comment:** Ammonia was not listed as a cause in the 2000 and 2002 305(b) reports. It should be noted that the 1998 303(d) list was based on the 1996 305(b) report and therefore is out of date. The metals (chromium, lead and zinc) were listed as potential causes of degradation in the 305(b)/303(d) because of highly elevated concentrations in sediments.

Page 2-32, Parameters in Compliance, pH. Why are sites MWRDGC 91, G-11, G-39 (Riverside) not listed in the compliance probabilities for pH?

Page 2-33, Table 2.6, Parameters meeting Illinois General Use Standards and Federal Criteria. Why is a 97% probability of compliance acceptable for chloride?

Page 2-35, Table 2.7. Parameters Not Meeting Illinois General Use Standards or Threatened. All violations except for fecal coliform and dissolved oxygen occurred only at MWRDGC sites. This may be a QA/QC issue.

Pages 2-35 to 2-37. Why are stations G-11, G-39 (Riverside) and MWRDGC 91 not included in the compliance tables for copper, mercury, fecal coliform and dissolved oxygen?

Page 2-26, first paragraph, second sentence. "It is not possible to estimate loading … if a majority of the measurements have a detection limit that is above the standard." **Comment:** The detection limit for mercury (0.1 ug/L) is not above the mercury standards (acute 2.6 ug/L, chronic 1.3 ug/L).

Page 2-37, Parameters Not Addressed by this Report, Priority organics, first sentence. "Data on priority organics were not provided." **Comment:** Data was provided for phenols, which is a priority organic and has General Use (100 ug/L) and Secondary Contact and Indigenous Aquatic Life (300 ug/L) standards. In addition, sediment data was provided for PCBs, DDT, chlordane, Dieldrin, etc.

August 26, 2003

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United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
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Subject: Summary of Discussions Regarding Midwest Generation's Use Attainability Analysis (UAA) Thermal Report

We appreciate the opportunity to have met with you and your staff on August 6, 2003 to discuss the various issues highlighted in your June 3, 2003 letter to Illinois EPA. Based on the meeting discussion, Midwest Generation (MWGen) will revise certain portions of our report entitled "Appropriate Thermal Water Quality Standards for the Lower Des Plaines River," dated January 24, 2003 (the "Thermal Report") to provide greater clarification and additional data and information, where necessary, to address the issues raised by the U.S. EPA Region 5. We believe the revisions will lend further support to the Thermal Report's finding that the entire UAA reach (i.e., from Lockport to I-55) meets Factors 3 and 4 of the six UAA factors outlined in 40 CFR 131.10(g), allowing for the application of a use designation other than General Use.

We also appreciated hearing Region 5's concurrence with the Biological Subcommittee's conclusion that the biological potential of the Brandon Pool is limited due to habitat alterations resulting from a combination of Factor 3 (Human-caused conditions), Factor 4 (Dams, diversions and other hydrologic modifications), and/or Factor 5 (Physical conditions) influences. This confirmed our understanding that the scope of the UAA process includes consideration of physical and biological integrity, not simply chemical water quality, in order to determine the attainable use for the waterway. (We recognize that this understanding also was put forth in the results of the National Symposium on "Designating Attainable Uses for the Nation's Waters" held on June 3-4, 2002 in Washington, D.C. but it was still beneficial to have this clarified in our meeting discussion.)

MWGen believes that the information that is provided in our Thermal Report, as supplemented by the information that we discussed during our August meeting, will allow for similar concurrence by Region 5, as well as Illinois EPA and the UAA Biological Subcommittee, that the Upper Dresden Pool does not meet the physical and biological criteria necessary to support a General Use designation.

However, we also believe that any site-specific use designation for the Upper Dresden Pool must accurately reflect both the improvements made in chemical water quality over the past 30 years and the inherent physical and biological limitations which continue to exist in the waterway. MWGen supports the need to protect the existing water quality of the Upper Dresden Pool.

In an effort to summarize the information presented during the August 6th meeting, we have put together this synopsis, which is organized to respond to the items outlined in your comment letter in the order presented.

U.S. EPA Comment, Page 1, bottom:

The Agency refers to the finding in the Hey and Associates report that "thermal discharges from the power generation facilities owned and operated by MG are a contributing factor in preventing the lower Des Plaines River from reaching its full biological potential."

MWGEN Response: The information relied upon by Hey and Associates/AquaNova International (henceforth referred to as the "IEPA Consultants") to determine that MWGen's thermal discharges are having detrimental impacts was predicated on false assumptions and/or conclusions based on inaccurate, misrepresented or misused data. This matter was discussed in detail at the June 6th meeting of IEPA, MWGen and IEPA consultant representatives. As such, U.S. EPA should not rely on the IEPA Consultant's erroneous assumptions and conclusions to determine whether or not MWGen's discharges are having a detrimental impact on the existing aquatic community in the lower Des Plaines River. It is our understanding that the thermal portion of the draft UAA report has been revised by Hey and Associates, based on MWGen's submitted comments and corrections, will be issued for the UAA Workgroup's review shortly. MWGen has provided a significant amount of actual stream monitoring data which supports the position that our thermal discharges are not having a detrimental impact on the aquatic population which is or would be reasonably expected to be present in the waterway, especially given the other permanent limitations of the system (e.g. those characteristics that are considered under Factors 3 and 4 of the UAA regulations) .

U.S. EPA Comment, Page 2, Factor 2 Section:

Natural flow conditions prevent the attainment of use.

The Agency states that the Thermal Report did not describe how water levels prevent the attainment of use, and only stated that they are controlled by diversions, POTW flow and manipulated for barge traffic. The Agency commented that even with the flow variations experienced in the system, the base flow is sufficient to support a General Use classification.

MWGEN Comment: Some clarification of the text of the Thermal Report is needed to address this misunderstanding of the relevant issue here. Our intent was to describe the adverse impacts caused by the fluctuations in water levels within the UAA reach, not to focus on flow fluctuations. We intended to point out that there are certain areas within the UAA waterway that are continually disturbed by frequent and often dramatic level fluctuations. The Brandon tailwater area, which has been found to contain the best physical habitat in the Upper Dresden Pool, is the most heavily impacted by these level changes. This could result in stranding of eggs, larvae, or even adults and certainly could affect the reproductive success of various species, especially nest builders, and also could increase predation, especially during low water periods.

Water levels in the system as a whole are maintained by the Corps of Engineers controlling works at Brandon Road Lock and Dam and the MWRD-controlled Lockport Lock. Water levels in the main body of the river rarely fluctuate, being maintained at a relatively constant navigational depth, but water flow rates change hourly, and by several thousand cubic feet per second. While we agree that there is always sufficient water in the system (i.e. it is not, by any means, an ephemeral stream), the rate or velocity at which the water passes through the system can greatly affect the aquatic life which resides there, especially at critical times of the year.

In a completely natural system, spring thaws result in a "flushing effect", which is then followed by relatively constant flows through the course of the summer. In the lower Des Plaines, there is no seasonality to these flushing events, which occur any time there is significant rainfall in the Metropolitan Chicago area. The artificial conveyance designed to take treated sewage away from Lake Michigan (i.e. the Chicago Sanitary and Ship Canal) cannot accommodate the large volumes of runoff water which result from a heavy rainfall. The MWRD's TARP system also isn't presently large enough to accommodate the large influx of flow from both runoff and the combined sewer overflows (CSO's) which occur during heavy rains. As a result, all of this water must be quickly shunted down to the lower Des Plaines River to effect flow control, resulting in short-term river flows that surpass 20,000 cfs at times. During dry weather, the flows continue to fluctuate on an hourly basis. There is no "steady-state" flow in the river which would be beneficial for the colonization of higher quality benthic organisms, or accommodating to those fish species which need such conditions to successfully carry out their life histories.

In addition, the question of whether the flow conditions described above can be considered "natural" in the context of the UAA factor, is a difficult one. The entire waterway is not a natural stream, and has a man-made flow regime, as the result of human-induced conditions. As such, MWGen believes that the effects of this altered flow regime could be equally applicable under both UAA Factors 3 and 4.

U.S. EPA Comment, Page 3, Top; Factor 3 Section:

Human caused conditions or sources of pollution prevent attainment of use and cannot be remedied.

The Agency comments that MWGen does not demonstrate that, absent the thermal impacts of our generating facilities, that sediment contamination and flow alterations would be sufficient to preclude a more diverse aquatic community than already exists.

MWGen Response: Our report, "Appropriate Thermal Water Quality Standards for the Lower Des Plaines River" does address this issue on pages 26-32. Lack of clean, suitable substrate, along with an erratic flow regime, frequently traversed by barge traffic, will serve to limit the number of fish species which can be expected to inhabit the system, even in the absence of thermal discharges. While it may not be possible to separate the various stressors to the system to determine which ones are most responsible for the limitations on the biological potential of the waterway, thermal discharges alone are not sufficient to account for the lack of a balanced indigenous fish community in the lower Des Plaines River. As discussed during our meeting, additional supporting information on this finding will be included in a revision of MWGen's report.

Clarification on Sediment Issues:

The potential for sediment remediation was not addressed by MWGen in our report since it has not been established what entity would be responsible for such an undertaking, or if and when, realistically, it could potentially be done. Our report describes contaminated sediments as "limiting." We will clarify this description to explain that the physical characteristics of the sediment in the system (fine, silty, organic) are not amenable to many higher quality fish species which need a hard, clean substrate for spawning. Even if the stream was remediated and the existing sediment (contaminated or not) removed, the nature of the waterway itself (e.g. impounded) would ensure that additional fine, silty sediment (whether clean or contaminated) would continue to be deposited, thereby preventing an improved habitat for better quality aquatic life. It is the physical quality of the sediments in the system that are limiting further biological improvements, with existing, depositional area sediment contamination exacerbating the siltation problem.

In a recently completed (May, 2003) habitat evaluation on the Dresden Pool, it was found that sedimentation was moderate to severe in many (23 out of 34 or approx. 70%) of the areas where QHEI scores were calculated. Sedimentation appears to have gotten worse over the past 5-10 years. (*e.g.,* DuPage Delta). Our report will be revised to include this information.

With respect to the U.S. EPA sediment sampling results (Table 1 on Page 3 of June 3, 2003 letter), we do not believe that it is appropriate to average sets of samples from varying locations in the waterway for use in any meaningful analysis. (See also the data contained in Figure 1 in the same letter). Sediment distribution (and any associated contamination) is extremely heterogeneous in nature. Depositional areas, such as those found just above or below lock and dams or backwaters/side channels, have large accumulations of sediment, while locations near the main channel may have sparse or no sediment accumulation, due to the scouring effects of barges and sporadic high river flows. The depositional areas are also the primary sources of available habitat for the fish community of the lower Des Plaines. As such, the fish are likely exposed to whatever contamination currently exists within these specific areas. When multiple sites are averaged together, it becomes impossible to determine where any specific contamination "hot spots" may be located. In addition, lumping all data together to determine an "average" concentration of chemicals/metals/toxics does not provide a true picture of where the specific areas of contamination are, as well as the associated levels. Averaging dampens out the heterogeneity of sediment quality and distribution, which is an extremely important factor in determining exposures to biological organisms.

The data presented do not state where each of the respective sampling locations was, nor do they differentiate which locations had cores, versus ponar grabs, etc. This information is vital in order to assess the overall sediment quality of any particular location within the waterway. While the results do indicate the presence of sediment contamination, in varying degrees related to depth, for the reasons indicated above, we do not believe that compositing the results for the entire lower Des Plaines River is appropriate.

Clarifications/Cautions Regarding Burton Sediment Toxicity Studies:

Regarding the Burton 1999 studies, there are several reasons why MWGen feels that this data should be viewed with caution. First, we firmly believe that actual river temperature and biological data is more reliable and probative than any laboratory or artificially controlled in-situ study. Fisheries data collected on the lower Des Plaines River during the summer period for more than 20 years show the indigenous fish populations to be largely unaffected by water temperatures which are often above what Burton has stated to be the critical threshold temperature for indigenous species in the Upper Illinois Waterway.

Within the body of the Burton report itself, questions are raised regarding the reliability of some of the study conclusions.

The results of this particular series of tests had a considerable amount of scientific error and/or uncertainty associated with them. The greater mortality rates of the fathead minnows used in the study was attributed to handling/shipping induced stress resulting in overall poor organism health. In addition, some of the mortality observed during the laboratory tests has been, in part, attributed to increased ammonia levels associated with the feeding of the test organisms. The acclimation period for the organisms (24-36 hours) also may not have been sufficient. Also, since the testing was done by holding the test organisms in a chamber for a 7-day period with a constant exposure to contaminants and/or high temperatures, it should not be assumed that this is how organisms would react in a real-world situation in which there are refuge areas for them to move to if conditions become unfavorable. As stated in the report, the level of stress imparted on any test organism is dependent on: species sensitivity, exposure period, acclimation temperature and presence of other stressors, such as ammonia or water and sediment with associated contaminants. In sum, the testing done has inherent inaccuracies and variabilities common in biological testing protocols and should be considered as an effort to model the hypothetical "worst case" condition; a condition which has not been found in the actual river monitoring data and biological studies conducted to date.

U.S. EPA Comment, Page 4, Bottom:

One example of the far-reaching statements made in the report that are not entirely supported by the existing data is on page 27 of the 1999 Burton report referenced by Region 5 which states that "Most of the river upstream of I-55 does not contain depositional sediments, such as those found in the Brandon Lock & Dam pool."

MWGen Response: This statement is largely unsupported by the actual river data that was obtained and submitted as part of the UIW studies, as well as the recent studies done on the Dresden Pool. As evidenced by the recent QHEI score attributes, there is a significant amount of depositional sediment within the Upper Dresden Pool). Depositional sediments occur throughout the waterway, primarily in main channel border, side channel, backwater and tributary areas. Accurately stated, depositional sediments are found throughout the Upper Dresden Pool, to varying degrees, but are primarily found in main channel border, side channel and backwater areas and are not generally present in the main channel.

U.S. EPA Comment, Page 4, Surface Water Toxicity:

The Agency points out that in the 1995 Burton report, the studies demonstrated that heat from the Joliet Power plant was increasing surface water toxicity in the lower Des Plaines.

MWGEN Response: The Burton 1995 Report, submitted as part of the UIW Study effort, states that "(t)hese results suggest that the upper warm waters of the thermal plume may be exerting a slight effect on some species (with regard to toxicity); however the Des Plaines River exerts a greater effect". (emphasis added). [Page. 8 of December 18, 1995 report]. This was especially apparent after large storm events resulted in greater test organism toxicity, due to increased turbidity and CSO influences. In addition, the report goes on to say that "(t)he effects observed at 35 °C (referring to the greater study mortalities at higher continual temperature exposures) likely do not occur in the UIW because organisms are not exposed to 35 °C (95 °F) water for 7 day periods and no effects were observed in 7 day exposures at 30 °C (86 °F)." Our recent (2002) thermal plume study data confirm that the higher temperatures, in fact, located closer to the surface of the river and cooler temperatures are found at greater depths in the waterway.

In another section of the report, not cited by U.S. EPA, poorer survival of test organisms *C. dubia* and *H. azteca* was observed in the sediment and site water treatments at cold temperatures, as compared to controls. This suggests that colder temperatures increased the adverse effects of continual exposures when in the presence of other metal or organic stressors occurring in the sample sites (Page 9 of December 18, 1995 report).

U.S. EPA appears to be focusing only on those portions of the Burton 1995 Report that indicate potential thermal concerns. The Report as a whole ultimately suggests that there are likely inherent toxicity issues in the waterway which are not either directly linked to or significantly influenced by MWGen's thermal discharges.

MWGen's power stations comply with all applicable thermal water quality standards, which are, by regulatory definition, designed to be protective of the indigenous fish community. As such, our contribution of heat to the waterway is not, in and of itself, having a toxic effect. If, as the UIW studies have indicated, there is inherent toxicity in both the sediments and/or overlying water column at certain locations at certain times, depending on exposure time and concurrent temperature conditions at the sediment/water interface, then it should not be MWGen's charge to further limit our discharges when they are not directly or indirectly impacting toxicity. Since our thermal discharges are surficial in nature, higher temperature water does not come into direct contact with the bottom sediments, and thus does not have an exacerbating effect on any toxic fractions in the sediments.

U.S. EPA Comment, Page 5, Habitat Modifications to Support Navigation:

The Agency states that MWGen does not demonstrate the extent to which barge traffic impacts the aquatic community or the ways in which these impacts can be mitigated.

MWGen Response: As we understand it, U.S. EPA does not disagree that barge traffic is frequent and heavy on the lower Des Plaines River. Instead, Region 5 is asking for more information on the effects of that frequent and heavy traffic on the aquatic community. Observation of the response of the river to a passing barge tow shows a dramatic change in the shoreline water level before and after passing a given point along the channel. Tow boat props stir up sediments, which are then deposited either upstream or downstream of their point of origin--this can be seen in aerial photos, as well as by general observation. The entire river channel is effected, to some extent, when a barge tow passes. While temporary in nature, this disturbance is nonetheless a negative influence on the biota which reside in the waterway. Unfortunately, much of the scientific study of barge traffic effects has focused on the potential impacts on overall water quality by the passage of tows, and not on the impacts to the aquatic community which resides in the waterway. The physical forces in play during a barge tow likely have a significant impact on any organism who is trying to establish a "home" within these zones of frequent disturbance of the bottom sediments. MWGen has not studied these effects, but common sense suggests that they do occur.

Furthermore, a recent study by USGS and the INHS has documented direct mortality caused by towboats. Gutreuter et al (2003) found that various medium to large fish were killed as a result of propeller strikes in Pool 26 of the Mississippi River, as well as the lower portion of the Illinois River. They estimated that 790,000 gizzard shad were killed in just this area as a result of propeller strikes. The number of fish killed was a function of the number of fish killed per kilometer times the amount of barge traffic (kilometers traveled). On a large river such as the Mississippi, at least some fish will move away in response to oncoming barge traffic. (Lowery 1987, Todd et al 1989). In a smaller, narrower river like the Des Plaines, propeller avoidance would likely be more difficult, so it is reasonable to assume that the mortality rate estimated for the Mississippi River will at least be as high and may be higher in the Des Plaines River. So, in addition to detrimental effects due to re-suspension of sediment (contaminated and otherwise) and localized changes in water levels, direct mortality to the aquatic community due to barge traffic has now been established. This information will be incorporated into MWGen's revised thermal report.

In addition, the fact that the flow regime of the entire waterway is artificially controlled also negatively impacts the aquatic community in various ways, as discussed in our report on Page 13. It is our understanding that commercial navigation is a protected use under Section 303(c)(2)(A) of the Clean Water Act 40 CFR 131.10(a) and therefore will remain a factor limiting the overall potential of the aquatic community of the lower Des Plaines River in the future. Since the waterway is controlled to accommodate commercial navigation, the operation of the locks and dams, including flow/level control, as well as impoundment, the protected, navigational impacts appear to satisfy both Factor 3 (Human caused conditions), as well as Factor 4 (Dams, diversions and other types of hydrologic modifications) of the UAA criteria to support an alternate use designation.

Based on our discussion, we understand that Illinois EPA will take the lead on establishing a dialog with the U.S. Army Corps. of Engineers to determine whether beneficial changes can be made to existing water control operations to enhance the biological integrity of the entire UAA study reach, with particular emphasis on the Upper Dresden Pool. MWGen would also be benefited by the establishment of a more predictable flow regime for the lower Des Plaines River, if this could realistically be accomplished. We look forward to hearing the response of the U.S. Army Corps at a future UAA workgroup meeting.

U.S. EPA Comment, Page 5, mid-page: The Agency stated: "(R)egarding the habitat limitations in the UAA segment resulting from extensive modifications to the natural waterway, U.S. EPA states that the QHEI score cited in the MG report cannot be considered definitive when it falls between two categories of use such as the modified warmwater and warmwater use classifications. The Brandon Pool is more characteristic of a modified warmwater stream while the Dresden Pool shares characteristic of both use classes. When habitat scores fall between use designations a further analysis of the system is required along with an investigation into the possibilities for remediation. No information was provided that indicates that habitat alteration or other modifications could not improve the habitat."

MWGen Response: While using the Ohio use classification as a reference is useful, as agreed to by the Biological Subcommittee, until Illinois develops its own sub-classification system for its waterways, we are left with only General Use or Secondary Contact classifications to which to compare QHEI scores. The QHEI scores for the UAA waterway are all clearly well below what would be expected for a General Use stream under the Illinois use classification system.

Modifications to the QHEI factors which could improve overall habitat should be considered by Illinois EPA and their consultants as part of the UAA analysis, but this is not the charge of MWGen. On the whole, the individual QHEI metrics which are the major contributors to degraded habitat quality are those that cannot be easily or successfully mitigated, including flow alteration, sediment quality (not necessarily contamination, but the consistency of the sediments), lack of riffle areas, little or no sinuosity and poor riparian development.

As discussed at length during the meeting, EA Engineering, Science and Technology has reviewed the QHEI scores collected at 34 locations at 0.5 mile increments throughout Dresden Pool in May, 2003 and determined that poor habitat is pervasive throughout the Pool. Provided below are the 10 major components of the QHEI that contributed to the low scores:

Factor	No. of Locations Affected (out of 34)
Poor Development (of riffles)	ALL
No Riffles	32
Current Speed None or Slow	32
Recent Channelization or Lack or Recovery	30
No Sinuosity	23
Moderate to Heavy Silt	23
Extensive or Moderate/Extensive Embeddness	19
Only Substrate Silt or Detritus	10
Poor (≤ 6) Instream cover	8
Urban or Industrial Riparian Zone	6

Practically speaking, these factors either cannot be remediated (e.g. lack of sinuosity, substrate only silt) or the effort to remediate them, (e.g., the amount of instream cover) would be unprecedented for a stream of this size.

In addition, EA has reviewed the observed habitat characteristics of the Brandon and Upper Dresden Pools and has compared them to the published criteria for the Ohio use designations of Warm Water Habitat (WWH) and Modified Warm Water Habitat (MWH) to provide the additional analysis that U.S. EPA had requested. The results of this exercise are presented in the following table. As can be seen from this data, both the Brandon and Upstream Dresden Pool areas share many of the characteristics of modified warm water habitat streams, and except for depth, possess none of the characteristics associated with warm water habitat streams.

Comparison of warm water habitat (WWH) and modified warm water habitat (MWH) characteristics of the Des Plaines River.

	Brandon Pool	**Upper Dresden Pool**
WWH Characteristics		
No Channelization or Recovered		
Boulder, Cobble, Gravel Substrates		
Silt Free		
Good-Excellent Development		
Moderate-High Sinuosity		
Cover Moderate to Extensive		
Fast currents & Eddies		
Low/Normal Substrate Embeddness		
Max Depth > 40cm	X	X
Low/No Riffle embeddness		
Total WWH Characteristics	1	1
MWH Characteristics with High Influence		
Recent Channelization		
Silt/Muck Substrates	X	X
No Sinuosity	X	X
Sparse/No Cover	X	X
Total MWH (High)	3	3
MMH Characteristics With Moderate Influence		
Recovering Channelization	X	X
High or Moderate Silt Over Other Substrates		
Sand Substance (Boat)		
Fair/Poor Development	X	X
Low Sinuosity		
Only 1-2 Cover Types		
Intermittent or Interstitial		
Max Depth < 40cm		
High Embeddness of Riffle Substrates	X	X
Lack of Fast Current	X	X
Total MWH (Moderate	4	4
Total MWH (All)	7	7

As U.S. EPA has already agreed that the Brandon Pool cannot meet General Use due to unalterable physical/habitat alterations, MWGen believes that the above information meets the test for UAA Factors 3 and 4 to qualify the Upper Dresden Pool for a use designation other than General Use.

U.S. EPA Comment, Page 5, Bottom: The Agency states that: "MG fails to demonstrate that habitat, rather than temperature, is the primary factor limiting the aquatic community. MG presents data that show similarities between the fish community above the I-55 Bridge (secondary contact), and below the I-55 Bridge (general use) to illustrate that, since both segments have similar habitat, habitat rather than thermal regime must be limiting the aquatic community. What MG fails to disclose is that the segment below the bridge is subject to a thermal variance, allowing higher ambient temperatures than permitted under Illinois' general use standards. Temperatures at this location consistently remain at the upper levels of the temperature range. The most probable explanation for the similarities in the fish community is the similarities in the thermal regime." (emphasis added)

MWGen Comments: MWGen did not "fail to disclose" anything. There is no thermal variance which covers the waterway downstream of the I-55 Bridge--that area is subject to the General Use thermal limits. MWGen retains an alternate thermal standard (AS96-10) which is only applicable at the I-55 Bridge location, not any area downstream. This alternate thermal standard is a set of monthly/semi-monthly temperature limits which vary on a seasonal basis, but are identical to the General Use numeric limits during both the summer months (mid-May through September) and the winter months (January and February). Moreover, during the remainder of the months (April through early May and October- November), the monthly limits at I-55 are actually more stringent than General Use numeric limits would allow. As an example, in April, the General Use limits would allow a maximum temperature of 90 ^{o}F (with an allowable excursion up to 93 ^{o}F); the alternate I-55 standard for April only goes up to 80 ^{o}F (with an allowable excursion up to 83 ^{o}F).

AS96-10 ALTERNATE THERMAL LIMITATIONS FOR THE I-55 BRIDGE:

	Jan	Feb	Mar	Apr 1-15	Apr 16-30	May 1-15	May 16-30	Jun 1-15	Jun 16-30	Jul	Aug	Sep	Oct	Nov	Dec
oF	60	60	65	73	80	85	90	90	91	91	91	90	85	75	65

These standards may be exceeded by no more than 3^{O}F during 2% of the hours in the 12-month period ending December 31, except that at no time shall Midwest Generation's plants cause the water temperature at the I-55 Bridge to exceed 93^{O}F.

March and December are the only months in which the Alternate I-55 Thermal Standards allow a temperature of 65 °F when the corresponding General Use Thermal Standard for the same time period is 60 °F (with an allowable excursion of up to 63 °F).

Winter Temperatures in the Lower Des Plaines River:

So far, no one involved in the UAA has addressed the winter temperature limit, which is of equal concern to MWGen as the summer temperature limit. There are periods during the Winter and Spring when ambient river temperatures currently exceed the corresponding General Use thermal water quality limit, largely due to the influences of the MWRDGC's Stickney Treatment plant, which provides up to 100 % of the flow to the waterway during the winter months. The temperature of the Stickney outfall is elevated from what would be found in a natural waterway during this time of year, and as a result, the entire system follows an altered thermal regime, regardless of the input of heat from MWGen's plants.

U.S. EPA Comment, Page 6, second paragraph: The Agency questioned the validity of MWGen's selection of Representative Important Species (RIS) for the lower Des Plaines River and the analysis which showed that the biological community is not impacted by the thermal discharges. U.S. EPA believes that the species used in the RIS should include species representing the potential biological community and should not be dominated by those species that already exist in the system. The Agency believes that there are a number of cool water species that should be represented, including walleye, other percids and esocids, since they are present in the Kankakee River and could potentially migrate into the lower Des Plaines.

MWGen Response: U.S. EPA is correct that "potential" fish communities should be considered. This is why redhorse were included in MWGen's RIS. However, the species suggested by U.S. EPA are not appropriate representatives of the potential fish community. Not only is the Upper Dresden Pool near the edge of their natural ranges, but there is little or no habitat in the Brandon and Upper Dresden Pools to support them. We do not disagree that northern pike and yellow perch (we assume that U.S. EPA is referring to this species when they say "other percids") are cool water species. However, both require clear, well-vegetated lakes, pools, or backwaters to thrive and particularly to reproduce. Such areas are rare to nonexistent in these pools. Therefore, these species will be limited naturally.

U.S. EPA implies that if Upper Dresden Pool were assigned the General Use thermal standard, then good northern pike and yellow perch populations would become established based on recruits from the Kankakee River. Since, as shown during EA's recent habitat survey of the entire Dresden Pool, habitats upstream and downstream of I-55 are similar, it follows that these species should have been able to establish viable populations in lower Dresden Pool, which is already subject to the General Use thermal standard. However, data collected over the past nine years (See Table 1, attached), show that only one yellow perch and one northern pike have been collected from the General Use portion of the pool. Since populations of these two species in lower Dresden Pool are already protected by the General Use thermal standard, the only logical reason for their extreme rarity in lower Dresden Pool is lack of proper habitat or other non-thermal causes. Given that they are habitat limited, it follows that they should not be designated as RIS. Both species are also rare in upper Marseilles Pool (See Table 2, attached). U.S. EPA (1977) guidance supports MWGen's approach that species at the edge of their range should normally not be designated RIS. The U.S. EPA report stated (p. 36) that "[w]ide-Ranging species at the extremes of their ranges would generally not be considered acceptable as 'particularly vulnerable' or 'sensitive' representative species" though they still could be considered important." Here, based not only on their peripheral nature but also the obvious habitat limitations, the U.S. EPA guidance does not support their inclusion in the RIS designation.

Walleye are more thermally tolerant than yellow perch or northern pike and, as a result, are more widely distributed in Illinois (Smith 1979). Thus, they were not excluded from the MWGen RIS list based on being peripheral. However, like the two species just discussed, they clearly are habitat limited. Most walleye populations spawn over clear cobble or rubble areas, but some populations can spawn in flooded, well-vegetated backwaters. However, except for a small portion of the Brandon tailwaters, both habitat types are rare in Dresden Pool. Examination of data from Lower Dresden Pool and Upper Marseilles Pool supports our contention that walleye are habitat limited. Nine years of collecting fish has yielded only one walleye from the Lower Dresden Pool and only one from the Upper Marseilles Pool (See Tables 1 and 2) despite the fact that General Use thermal standards prevail in both areas. Thus, there is no reason to believe that walleye would be any more successful in the Upper Dresden Pool than the Lower Dresden Pool.

If we compare catches of walleye with those of smallmouth bass, a species considered to have similar thermal tolerance, or to redhorse, which are likely more thermally sensitive (Reash et al 2000), it is equally clear that walleye numbers in these areas are constrained by something other than temperature. For example, Lower Dresden Pool, which yielded only one walleye, produced 477 smallmouth bass and 571 redhorse (all redhorse species combined) during the same period (See Table 1), and upper Marseilles Pool, which also yielded only one walleye, yielded 172 smallmouth bass and 348 redhorse. The only possible interpretation of this data is that walleye are habitat limited while the other two species, which have roughly similar thermal requirements, are not. Given that it is habitat limited, walleye is clearly not an appropriate RIS.

U.S. EPA Comment, last sentence of the 3rd paragraph : *"In addition, there are a number of other critical temperatures related to gamete maturation, spawning, early life history survival, preference, avoidance, and optimum growth."*

MWGen Response: We interpret U.S. EPA's comment to mean that there are other life cycle endpoints to consider. We agree. However, we believe these have been addressed. Not by comparison with laboratory – derived endpoints but rather by examining the large biological data set that has been collected form this area, a more reliable, holistic and ecologically meaningful exercise. Good populations will be maintained only if there is adequate early life history survival, successful spawning, etc. Our examination of the long term data sets has indicated that those species tolerant of the broad set of limiting conditions that exist in the study area (*e.g.,* gizzard shad, most centrarchids , various minnows, etc.) are doing quite well, whereas those that are more sensitive to these limitations (e.g., redhorse and darters) are not. Thus, it is factors other than temperature (*e.g.,* sedimentation, poor habitat, silty and/or contaminated sediments, etc.) that determine and limit the Upper Dresden and Brandon fish communities. Temperature plays a small and largely secondary role. In other words, there would be no significant change in these fish populations even if General Use thermal standards were applied to the Upper Dresden and Brandon Pools.

U.S. EPA Comment, Page 6, Fourth paragraph: The Agency states that temperature affects dissolved oxygen levels in this system by depressing the saturation levels, which has the effect of exacerbating diurnal DO sags due to increased algal growth and photosynthesis. The Agency also states that it is aware of other factors that may be responsible for some of the low DO's observed at the I-55 continuous monitoring station. Region 5 is recommending that the QUAL2E model developed and calibrated by MWRDGC be reevaluated and re-run with current conditions in the waterway.

MWGen Comments: If algal growth and photosynthesis is increased, then this would also result in super-saturation during the daylight hours. The DO measurements taken at I-55 over the past 6 years show this to occur. DO sags are also common occurrences, but do not normally drop down and remain at a level which would be biologically limiting. Overall, the average DO in the waterway is well above that needed to sustain the indigenous biological community, as evidenced by both our continuous I-55 monitoring, as well as measurements taken as part of our long-term fisheries monitoring program. These data continue to show more than adequate levels of DO at all of the sampling locations in the lower Des Plaines River, including the immediate generating station discharge canals, where water temperatures are the highest.

Use and/or manipulation of QUAL2E is not the responsibility of Midwest Generation. MWRDGC is already in the process of having QUAL2E recalibrated by Marquette University in order to make it a more dynamic, versus steady-state, model of the waterway. Since MWGen has several years of continuous, in-stream temperature/DO measurements near the I-55 Bridge, as well as frequent DO grabs throughout the lower Des Plaines River, this real data should take precedence in making a determination on the overall impact (or lack thereof) of water temperature on the dissolved oxygen levels in the waterway. Our analysis of this data, as well as the fisheries monitoring results, shows that there have been no adverse impacts on the indigenous aquatic community of the lower Des Plaines River from any hypothesized temperature-related effects on DO levels.

U.S. EPA Comment, Page 6, Factor 4, last paragraph:

Dams, diversions or other types of hydrologic modifications preclude attainment.

U.S. EPA does not agree that hydrologic modifications are sufficient to preclude improvements to the aquatic community. U.S. EPA believes that MWGen should provide more information to support its claim that the hydrologic modifications of the lower Des Plaines River are limiting the aquatic community. "Consistent with Federal regulations at 40 CFR 131.10(g), such a demonstration should also show that the hydrologic modifications cannot be operated in such a manner as to mitigate the impacts on the aquatic community.".

MWGen Response: The QHEI data provided to U.S. EPA and the UAA workgroup clearly demonstrate the impact of a hydrologically altered system on habitat availability/quality. In addition, the nature of the sediments in the system (fine, silty) regardless of the presence of contamination or not, is not conducive to those fish species which require gravel/cobble substrates for successful spawning to occur. The flow regime is not that of a natural waterway, and has large, localized fluctuations in level below the Brandon Lock and Dam that would be adverse to any nest-building species. The velocity at which water is released from the lock and dam may also have negative effects on the biota in the immediate vicinity of the release.

As acknowledged by U.S. EPA and well-established in the literature, dams reduce the abundance and diversity of riverine species. This is a result of interrupting or eliminating migration, the pooling effect upstream of each dam, the sediment that build up behind dams, etc. The studies that U.S. EPA conducted and/or sponsored on the Fox River clearly demonstrate these impacts as shown by declines in IBI scores upstream of each dam. These adverse impacts are recognized by other Region 5 States. For example, Wisconsin and Michigan are actively promoting dam removal. Ohio has a separate use classification based on effects from dams. Species most effected are so-called fluvial specialists (e.g., most darters, many suckers, etc.), whereas habitat generalists (e.g., common carp, gizzard shad, channel catfish), and pelagic species (e.g. emerald shiner, freshwater drum) do quite well under impounded conditions. Similarly, simple lithophiles (e.g., redhorse and most darters), which require clean, hard substrates, do poorly in impounded situations because of increased siltation while those that are nest builders (e.g., centrarchids), or have modified spawning strategies (e.g., bluntnose minnow) do quite well under the same set of circumstances.

To ignore the impacts associated with hydraulic modifications is to disregard the considerable body of research that has been collected during the past 20 years and the precedents that have been established by other states, such as Ohio. Even the IEPA Consultant's Draft UAA report acknowledged (pg 8-16) that expectations for Upper Dresden Pool were lower because of hydraulic impacts and thus created the category "General Use Impounded". Clearly, the biological expectations for such areas are indeed lower than for "full" General Use. These conditions support either retention of the existing Secondary Contact use (or creating a new use that includes modified thermal and other standards). There is nothing in the regulations which would require Secondary Contact to retain the identical thermal limitations that it has now. These may be modified in order to protect the current and expected assemblage of aquatic life that would reside in the Upper Dresden Pool, given the permanent constraints on the system under UAA Factors 3, 4 and/or 5.

The system's hydraulic modifications are solely under the control of MWRDGC and the U.S. Army Corps of Engineers, and are in place exclusively to accommodate flood control and commercial navigation. As stated earlier, Illinois EPA has assumed the responsibility to address this issue with the Corps.

U.S. EPA Comment, Page 7, First paragraph, Factor 5:

Physical conditions related to the natural features of the water body, such as lack of proper substrate, cover, flow depth, preclude attainment of use.

U.S. EPA states that, "given the extensive modifications of this system, it is difficult to attribute the habitat limitations to "natural features" of the waterbody. Therefore, this factor does not seem to be relevant to the UAA for the lower Des Plaines River. In fact, where the river does exhibit more "natural" features, the habitat resembles closely that of other waters that are classified as General Use."

MWGen Response: If U.S. EPA agrees that the waterway's habitat limitations are the result of the fact that it is not a natural system, then such "permanent" alternations (natural or manmade) should be considered equally in assessing whether the waterway can support a higher use. Habitat is defined by the existing and future anticipated physical conditions of the waterway, whether the result of natural or man-made influences. QHEI scores for the entire UAA reach are much lower than would be expected for a General Use waterway. In fact, even the General Use waterway directly downstream of I-55 has QHEI scores lower than what would be considered as General Use. IBI scores in the entire Dresden Pool are also similar, and much below that expected for a General Use Stream (see MWGen's Thermal Report, pages 39-41, also included in attachments). As stated earlier, this is not due to the input of heat, since the General Use thermal standards apply to this segment. The only logical explanation is that the habitat of the entire system (although it may appear, from the surface, to be more "natural") still has inherent limitations which prevent it from sustaining more sensitive/higher quality aquatic species.

Indeed, the results of the recent pool-wide habitat assessment and the poor IBI scores throughout Dresden pool suggest that, if anything, it is lower Dresden pool that is misclassified. Because of poor habit conditions due to impounding and the other factors discussed previously, the biological data supports a lowering of the use classification of lower Dresden Pool and does not support upgrading the use designation of the upper Dresden Pool.

U.S. EPA Comment, Page 7, Second paragraph. Factor 6:

Controls more stringent than those required by Section 301(b)(1)(A) and (B) of the Clean Water Act would result in substantial and widespread economic and social impact.

U.S. EPA states that no "extraordinary controls" would be required on point source dischargers in the lower Des Plaines to improve chemical water quality in the lower Des Plaines River. Therefore, "it seems unlikely that point source discharge(r)s would incur any extraordinary costs to achieve the chemical water quality needed to support an improved aquatic community."

MWGen Response: While this may be true of many of the more conventional chemical pollutants, U.S. EPA's position does not adequately consider the bacterial contamination of the waterway Secondary Contact water quality limits currently have no fecal coliform (or e. coli) limit on dischargers. Imposition of General Use water quality standards would require a bacterial limit, as well as a Total Residual Chlorine limit which is very stringent. Effecting such control for a municipal or industrial discharger will result in considerable costs. In order to implement the disinfection process needed to control the bacterial content of the discharge, the amount of chlorine required would certainly require dechlorination. These combined processes (chlorination/dechlorination) would introduce additional contaminants into the waterway (chloramines--bioaccumulative, bisulfite--a known oxygen scavenger, etc) which could pose additional risks to the aquatic community. And in the end, the result would be an effluent which is likely of higher quality than the receiving stream itself, due to the continued presence of bacterial contamination from wildlife, runoff and CSO events. The economic burden on the regulated community would be significant, but the environmental benefit would be negligible. The Upper Dresden Pool is unlikely to become a sought-after primary contact recreational area, and bacterial contamination has little impact on the indigenous aquatic community.

U.S. EPA Comment, Page 7, Paragraph 3: The U.S. EPA identified the statement in MWGen's Thermal Report that heat from the Will County generating plant is lost to the atmosphere prior to it reaching the Brandon Pool portion of the UAA. U.S. EPA contends that if that were the case, this portion of the system would be meeting the General Use standard.

MWGen Response: The wording in the MWGen report will be revised to clarify the meaning. The heat from Will County Station's thermal discharge is gradually dissipated to the atmosphere along the approximate five mile reach from the station to the Lockport Lock, and receives further cooling as it mixes with the discharge from the Upper Des Plaines River below Lockport. We did not intend to imply that the added heat was completely lost before reaching the Brandon Lock and Dam. The revised report will reflect this clarification.

The intake temperatures at Will County Station often meet or exceed the General Use thermal limits, especially during the winter months, so even if the heat discharged by the station were to fully dissipate by the time it reaches Brandon Road Lock and Dam (which, in most cases, it does not), the ambient temperature in the waterway is already close to or over the applicable General Use thermal limit before it reaches Joliet Station. The temperature regime of the entire waterway is strongly influenced by the discharge from the MWRDGC Stickney plant, which contributes up to 100% of the entire flow in the waterway during the winter months (per conversation with Dick Lanyon, MWRDGC). This factor must be taken into consideration regarding future seasonal temperature limits for the waterway, especially for winter conditions.

U.S. EPA Comment, Page 7, Paragraph 4, Factor 6:

Controls more stringent than those required by Section 301(b)(1)(A) and (B) of the Clean Water Act would result in substantial and widespread economic and social impact.

U.S. EPA states that MWGen does not provide the economic data necessary to demonstrate that providing additional cooling at its facilities will result in substantial and widespread social and economic impacts. In addition, the cost that has been expended by society to improve the water quality of this system must be factored into this analysis.

MWGen Response: MWGen did not provide economic data for the installation of additional cooling capacity for our facilities because the information in our report demonstrated that other UAA factors were applicable to the waterway, such that a full socio-economic impact study was not necessary. We have agreed to provide Illinois EPA with the cost information that will be necessary for them to fully consider the cost/benefit of the imposition of more stringent standards, and will provide additional biological/habitat data that will allow Illinois EPA to make an informed decision regarding the overall environmental benefit to be attained by the imposition of more stringent thermal limits on the lower Des Plaines River.

It is unclear what costs the U.S. EPA is including by its reference to the cost borne by "society" to improve water quality. Accordingly, we are unable to respond to this comment. However, it is also questionable whether this comment is relevant to or supported by the language of the UAA regulation concerning the review of social and economic impacts caused by the proposed use upgrade.

U.S. EPA Comment, Page 7, Paragraph 5: The Agency has reviewed MWGen's current operation of the Joliet #29 cooling towers and assumes that it would be possible to operate them when discharge temperatures are less than low-to mid 90 °F to accommodate seasonal temperature needs. In terms of space, it was noted that there appears to be space adjacent to Joliet 9 and there may be space that can be purchased. U.S. EPA references the effectiveness of the cooling towers at Joliet 29 and assumes that temperatures consistent with more protective thermal criteria could be achieved.

MWGen Response: Current operation of the cooling towers is geared towards remaining in compliance with both the near-field (Secondary Contact) and far-field (I-55) temperature standards. The towers are normally turned on when the circulating water discharge temperature exceeds 93 °F for an extended period of time. The towers do not operate as efficiently when the inlet to the towers (e.g. the circulating water discharge temperature) is less than 90 ° F, so it cannot be assumed that simply by turning them on sooner, or running them for a longer period of time, that this would allow a lower near-field temperature limit to be met. (i.e. tower efficiency is not a constant). Seasonality also has a significant impact on tower operation, since the towers are not currently designed to operate during the cooler times of the year. They do not have plume abatement controls, which means that significant fogging/icing could be expected during winter operation to meet a more stringent near-field limit, should it even be technically feasible to do so. Such fogging is a major concern, due to the proximity of both a major interstate highway, as well as a small municipal airport. Installation of plume abatement technology can also easily double the overall cost of any supplemental cooling system.

U.S. EPA's solution to MWGen's current space constraints for additional cooling towers is very simplistic. We agree that there is some space available on the Joliet 9 side of the river for some towers, however, Joliet 9 does not have the same thermal effect on the waterway as the larger Joliet 29 does. Even if towers were installed at Joliet 9, they would only serve to control Joliet 9's discharge, and would do nothing for Joliet 29's near-field compliance. Space constraints at Joliet 29 were the primary focus of the statements made in MWGen's report. Purchasing additional property on which to build towers, even if it were available (which is doubtful) would place them at a significant distance from the site, which would involve additional piping, pumping and electrical hook-ups to route the cooling water through them and back to the river. Installation of supplemental cooling when there is evidence of a significant detrimental effect of the thermal discharge on the indigenous aquatic community, or if a facility cannot comply with currently applicable thermal limits, may be warranted, but without such evidence or supporting data, the need for, and any environmental benefit to be derived from, such measures is questionable.

U.S. EPA Comment, Page 7, Bottom: U.S. EPA's position is that MWGen has not demonstrated that any of the six factors listed in the Federal regulations at 40 CFR 101.10(g) prevent improvements to the aquatic community in the lower Des Plaines River regardless of the thermal impacts resulting from MWGen's generating facilities. (emphasis added).

MWGen Response: U.S. EPA admits, on page 7 , first paragraph of their comment letter, that there have been "extensive modifications of this system", yet it disregards these modifications and assumes that thermal effects are a primary cause of the limited aquatic community in the waterway. However, even in the draft UAA report, several chapters come to the conclusion that one or more of the 6 factors are met in the waterway, thus allowing for consideration of a less than full General Use designation. The fact that these individual chapter conclusions are not incorporated into the final UAA summary is problematic.

We hope that this summary has provided you with detailed information and clarifications regarding the issues raised in your June 3, 2003 letter and subsequently discussed on August 6, 2003. We will revise our draft report to be consistent with the changes indicated herein and forward it for review by Illinois EPA and the UAA Biological Subcommittee.

MWGen maintains that UAA Factors 3, 4 and 5 are applicable to the Upper Dresden Pool, which prevent it from being able to meet full General Use criteria. As such, we would be glad to work with Illinois EPA to develop appropriate temperature limitations for this river reach, under either the existing use designation (Secondary Contact) or under a new use designation which will reflect both the improvements and the inherent limitations of the lower Des Plaines River which prevent it from being able to support a balanced, indigenous aquatic community.

Please contact Julia Wozniak or myself if you have any questions or comments regarding this matter.

Sincerely,

Basil G. Constantelos
Director, Environmental Health and Safety

cc: Ed Hammer--U.S. EPA Region 5
Toby Frevert--Illinois EPA

Attachments: Tables 1 and 2
MWGen Thermal Report Figures 4, 5 and 6

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FOR THE LOWER DES PLAINES RIVER

Summary Report
Prepared by Midwest Generation and EA Engineering, Science and Technology, Inc.

October 13, 2003 Revision

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(Letter from MWRDGC)

November 7, 2001

Mr. Neal O'Reilly
Hey and Associates, Incorporated
240 Regency Court, Suite 301
Brookfield, WI 53045

Dear Mr. O'Reilly:

Subject: Draft Report - Preliminary Water Body Assessment: Chemical Integrity of the Lower Des Plaines River

The draft report prepared for the Illinois Environmental Protection Agency (IEPA) by AquaNova International and Hey and Associates has been reviewed by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). We are providing the following comments and questions concerning the subject report. The numbering that follows corresponds directly to the pages referenced in the subject report.

The subject report should include a Table of Contents and List of Figures and Tables.

PAGE i

Paragraph 1. The subject report should also include an analysis of the current water quality conditions as compared to Secondary Contact water quality standards. This analysis will be needed in a petition to the Illinois Pollution Control Board (IPCB) if IEPA intends to change the designated use of Secondary Contact and Indigenous Aquatic Life Waters. Therefore, we believe that the report should include an analysis to determine if water quality is meeting the current water quality standards for Secondary Contact waters.

Paragraph 2. Insert the word "Island" following the word "Dresden."

PAGE ii

Paragraph 1. Insert a semicolon following the word "agencies." Insert period following "USGS." Delete the letter "s" in the word "Generations." Explain why was water quality data provided by Commonwealth Edison and Midwest Generation not used in the preliminary analysis?

Table. The subject table should be numbered Table 1. The following information concerning a description of the waterbody and the location should be added to the subject table.

91	Des Plaines River, upstream of Brandon Road Pool	Material Service Access Road near Lockport Power House
92	Chicago Sanitary and Ship Canal, Lockport Pool	Lockport Power House Forebay
93	Des Plaines River, Brandon Road Pool	Jefferson Street Bridge, Joliet
94	Des Plaines River, Dresden Island Pool	Empress Casino Dock
95	Des Plaines River, Dresden Island Pool	Interstate 55 Bridges
G-11	Des Plaines River, upstream of Brandon Road Pool	Division Street Bridge, near Lockport Power House
GI-02	Chicago Sanitary and Ship Canal, Lockport Pool	Lockport Power House Forebay
G-23	Des Plaines River, Brandon Road Pool	Ruby Street Bridge, Route 53, Joliet
G-39	Des Plaines River, upstream of Brandon Road Pool	Barry Point Road, Riverside
F-02	Kankakee River	Route 17 Bridge, Momence

Probabilistic analysis of the water quality data. This section should first discuss the rationale for using probabilistic analysis for setting water quality standards. Supply a reference for the defined "ideal" standard shown in italics.

On one hand the report advocates the use of probability of non-exceedance for toxic pollutants, or 99.8 percent, and on the other hand advocates "scientific judgement" for compliance of nontoxic pollutants with a probability of non-exceedance in the range of 90 to 99.8 percent. It should be explained if this approach is approved and/or endorsed by the IEPA, if this approach has been acceptable to the IPCB in past rulemakings and if this approach approved or used by other state regulatory agencies.

PAGE iii

Paragraph 1. Define CCC.

Table 1. MWRDGC station 83 should be 93. Define CMC and CCC for ammonia. The table should also include the results of an analysis for compliance with Secondary Contact water quality standards.

PAGE iv

Paragraph 1. Explain the application of scientific judgement and supply references as appropriate.

Paragraph 2. Delete the words "For these parameters" and replace with "For the parameters in Table 1." The antidegradation statement was not correctly applied unless a comparison with the Secondary Contact standards, not General Use standards, was intended. Perhaps the antidegradation statement should be deleted from the subject report, as it is irrelevant. The statement suggesting that most metals should be deleted from the current 303(d) list for Illinois should not be included in the subject report because this is not a report on use impairment. We recognize that a reassessment of the IEPA 303(d) list for this study reach was included in the scope of work, but you have not included a complete reassessment to support the statement regarding removal. IEPA staff makes 303(d) listing determinations based on an independent analysis following defined agency procedures. A similar approach must be used for this reassessment.

Paragraph 3. The sentence is incomplete.

Paragraph 5. *Nutrients.* The Nitrate-N drinking water limit is 10 mg/L. The Nitrate standard is 45 mg/L.

Paragraph 6. *Siltation and habitat alteration.* Explain what is meant by "...and potential for the Des Plaines River."

PAGE v

Table 2. Capitalize the first letter of the first word in the table (parameters). Identify the monitoring stations that are included in the subject report. MWRD Stations #91 and #92 should not be included in the analysis because these stations are not in the study reach of the lower Des Plaines River. The number and percent of values exceeding the standard should be included in the subject table. Define "Threatened at all" for water temperature. The discussion concerning water temperature observations in footnote 2 should be deleted because it is not relevant to the issue. Explain what is a "possible trend to exceedance. Define Tier I and Tier II analyses. A second table should be prepared showing the water quality parameters that meet the Secondary Contact standards as this will be needed in the IPCB petition.

PAGE 1

Paragraph 1. Regarding the purpose of the subject report, see comment above for page i. The criteria and process for determining when a water quality parameter is not in compliance for a designated use, or its potential to meet a standard for a higher use designation should be fully explained here or elsewhere in the report. Explain what conditions are assumed in determining if there is a threat to meeting water quality in the future. MWRD should be MWRDGC throughout the report. Delete "s" in the word Generation.

Paragraph 2. "Chicago Ship and Sanitary Canal" should read Chicago Sanitary and Ship Canal.

Paragraph 3. The contribution of "approximately 80 percent of flow" was determined by comparing USGS flow data for the Riverside and Romeoville USGS gauges. The reference "(Polls, personal communication)" is not correct. The 80 percent was in a MWRDGC work product prepared for this UAA. It is recommended that the flow comparison be checked and the USGS be referenced. It is stated, "The river upstream from the Chicago Sanitary and Ship Canal has been classified as fair." Provide a reference for this statement. How was the term "fair" determined? Is this relevant? Fair is not a classification established by the IPCB. The Des Plaines River also receives treated effluent from several POTWs, combined sewer overflows and agricultural drainage.

PAGE 2

Figure 1 does not clearly identify the Lower Des Plaines River reach. Highlight it clearly. Also, it does not define the Lower Des Plaines River watershed or all of the Chicago Sanitary and Ship Canal as the title implies.

PAGE 3

Paragraph 1. The reach is not natural and the shorelines are not natural. The reach has been modified for navigation, meanders have been cut-off and the shoreline is eroded by wave action caused by navigation. Water depths are artificially controlled. Any perceived resemblance to a natural river is a misinterpretation of reality.

Paragraph 2. Delete the words "the Tunnel and Reservoir Project (TARP)" and replace with the words "combined sewers." The sentence "Consequently, the environmental potential of the river..." is very subjective and should be deleted from the subject report. Despite the name "Des Plaines River," the study reach is a drainage and navigation canal identified by the federal government as the Illinois Waterway. See 33 CFR 207.300 and 207.425.

Paragraph 3. It is stated, "The Des Plaines River contributes about 41 percent of the nutrients to the Illinois River." Specify, which nutrients are included and provide a reference for this statement.

Paragraph 4. Regarding the reference to the current 303(d) list, see comment above for page iv, paragraph 2.

Paragraph 5. In the first sentence, delete "water" and replace with "effluent" and add "North Side" following "Stickney." Dry weather flows do not flow into TARP. The words "lesser use" should be deleted. Secondary Contact is the current water use promulgated by the IPCB. Water supply is not included in Secondary Contact uses. The last sentence should be changed to read "Wastewater discharges and drainage are other de facto uses."

Paragraph 6 continuing on to page 4. We believe that this paragraph needs to be re-written to properly characterize the statutory and regulatory framework. The following is suggested. "The IEPA is attempting to determine the potential to achieve and maintain higher valued uses, such as, a diverse and balanced self-supporting aquatic community and primary contact recreation, consistent with the goals and objectives of the Clean Water Act (CWA) and the intent of the Illinois General Use Water classification. The CWA at 33 USC Sec. 1251(a)(2) sets forth the "...national goal that wherever attainable...water quality...provides for the protection and propagation of fish...and wildlife and provides for recreation in and on the water be achieved by July 1, 1983." Designated as a Secondary Contact Water since the 1970s, the lower Des Plaines River does not meet this goal. However, the purpose of water quality standards, as defined at 40 CFR Part 131.2, is to achieve the aforementioned goal. Consequently, the USEPA Region 5 has requested the IEPA to re-examine the SCW use classification. A UAA, as defined at 40 CFR Part 131.3(g) "...is a structured scientific assessment of the factors affecting the attainment of the use..." Further, in compliance with 40 CFR Part 131.10(j)(1), the IEPA is performing this UAA because the Secondary Contact and Indigenous Aquatic Life Waters classification does not include the uses set forth in the national goal cited above. UAAs are also to be used per 40 CFR Part 131.10(g), when a state wishes to remove a designated use, which is not an existing use, or to establish sub-categories of a use if it can be demonstrated that attaining the designated use is not feasible for six specific factors. The UAA will identify the conditions necessary for the higher valued uses and test the feasibility of these conditions against the six specific factors identified in Box 1."

Box 1. Number each of the six reasons and make the language identical to the regulation. All six reasons are required for this UAA per 40 CFR 131.10(j). Change the parenthetical reference to 40 CFR Part 131.10(g). The last line of the last reason in the box includes a statement indicating that a TMDL is required. We disagree. A TMDL is not required because of a use designation, but when uses are found to be impaired.

PAGE 5

Paragraph 1. This language is not consistent with the regulation. A UAA is not required to upgrade a use designation. Please revise. Further, it should be qualified that the document in footnote 1 is not a USEPA publication and the USEPA has not approved this definition of a UAA.

Paragraph 3. Delete the words "harmful substance must have," and replace with the "pollutant has."

PAGE 6

Define BMPs, WAC, P/P and P/NP in the figure.

PAGE 9

Paragraph 1. 1/(355 x 3) should read as 1/(365 x 3). A frequency of once in three years of allowable excursions is used to calculate the probability of compliance. Explain the accepted practice, the practices used in other states and what is acceptable to USEPA, if known. Explain why this approach was chosen.

Paragraph 2. It is stated in the subject report, "For a first cut assessment, the 99.4 percentile will be used..." Why was a 99.4 percentile selected? The percentile should be 99.3, according to the USEPA interim guidance document mentioned. Give the complete citation for this document.

PAGE 10

Table 1. Do early fish life stages require both a seven-day mean dissolved oxygen (DO) concentration of 6.0 mg/L and a one-day minimum value of 5.0 mg/L?

PAGE 14

Near the top of the page, it is stated in bold italics, "In this UAA study it is assumed that the criteria for salmonid fish absent is applicable." Please state this in a less awkward fashion to indicate what fish are present and the criteria is applicable.

At the middle of the page it is stated in bold, "In this UAA Study it will be assumed that early life forms are present." Provide justification for this assumption for each segment of the reach above and below the Brandon Road Lock and Dam given the physical setting and current use of each segment. Also include the aquatic species and if they are indigenous to Secondary Contact waters or are aquatic life typical of General Use waters.

PAGE 15

Use the correct the name of the Brandon Road Lock and Dam.

Explain why WER values compiled by USEPA may not be applicable to the Des Plaines River segments. Recommend the development of WERs for the Des Plaines River segments before water quality standards are established or a use designation is recommended.

Last Paragraph. The ligands that immobilize metals also include sulfides.

PAGE 16

Paragraph 1. As mentioned and explained above, an analysis to determine compliance with Secondary Contact water quality standards should be included in the subject report.

Table 3. Subscript 1 should read "sampled weekly" not monthly.

PAGE 17

Paragraph 1. No reference station for the lower Des Plaines River has been agreed to by the UAA workgroup. The report should provide a comparison of the Kankakee River and watershed with the lower Des Plaines River and watershed to document the differences or similarities. A reference location is not necessary when existing chemical water quality standards and criteria are available.

PAGE 18

As explained above delete the use of a reference site and use the evaluation of lower Des Plaines River water quality based on existing criteria and standards.

PAGE 23

Paragraph 2. The UAA is a scientific assessment and use of the term "eyeball estimate" is not good science. As stated previously, please supply documentation that the probabilistic approach has been endorsed for regulatory proceedings.

PAGE 24

Paragraph 2. Toxic chemical concentrations should also be compared to Secondary Contact water quality standards.

PAGE 25

Paragraph 2. Tables should be prepared that show the chemical parameters that meet and do not meet the Secondary Contact water quality standards.

PAGE 27

Paragraph 1. As explained above, the statement suggesting that toxic metals and ammonia should be removed from the current 303(d) list for Illinois should not be included in the subject report. The antidegradation statement was not correctly applied and should be deleted from the subject report. The comparison should also be for the Secondary Contact standards, as well as General Use standards.

PAGE 28

Paragraph 1. Describe which analyses are included in Tier II.
Table 6. Delete the words "or Threatened" from the title of the table. Do measured copper concentrations above the General Use standard occur at all five MWRDGC monitoring stations or just at the stations in the lower Des Plaines River? Is fecal coliform and water temperature above the General Use standard at all monitoring stations? Which monitoring stations are included in the analysis? The number and percent of values exceeding the General Use water quality standards should be included in the subject table. A table should be prepared showing the parameters that do not meet the Secondary Contact water quality standards.

Paragraph 2. Why is MWRDGC monitoring station 92 included in the analysis? The station is not on the Des Plaines River or in the study reach. Were any measured concentrations above the chronic copper standard?

PAGE 29

Paragraph 1. The mercury standard in the subject report is not the current General Use standard, but a proposed standard. The reference site location should be deleted from the subject report as explained above.

Last paragraph. Is it being suggested that the Kankakee River be downgraded to a Secondary Contact water?

PAGE 30

Paragraph 1. It is stated that DO in the lower Des Plaines River falls frequently below the General Use standard. The adverb should precede the verb. Cite the results for Brandon Road and Dresden Island navigational pools separately.

Paragraph 2. The reference site, IEPA GI-02 and MWRDGC 92 should be deleted from the subject report because they are outside the study reach. The analysis should only include stations on the lower Des Plaines River.

PAGE 31

Paragraph 2. As explained above, the reference site, IEPA GI-02 and MWRDGC 92 should be deleted from the subject report.

Paragraph 5, subparagraph 1. The antidegradation statement was not correctly applied and should be deleted from the subject report. The comparison should be for the Secondary Contact standards, not General Use. Identify the threatened parameters and explain why they are threatened.

PAGE 32

Paragraph 5. Why was a trend analysis performed? Provide the methodology used to perform the trend analysis and a reference for the statistical trend analysis. Did the team review sampling and analytical methods and trends in river discharge since 1978 to determine the impact of these factors on the water quality trend(s).

PAGE 33

Table 7. Define the +, -, x, weak trend, significant decrease, and significant decrease in the table.

PAGE 34

Paragraph 1. Identify the water quality parameters that currently meet the Secondary Contact standards. The statement regarding removing water quality parameters from the current 303(d) list should be deleted from the report as explained above.

PAGE 35

Paragraph 1. It is stated, "However, there is a potential link to the oxygen depletion..." How will the water temperature effects be estimated concurrently with DO? Figure 9 relates to the discussion of TMDLs on page 34, therefore Figure 9 should also be deleted as explained above.

PAGE 36

Paragraph 1. It is stated, "The Illinois General Use standard has been exceeded by a great margin." Please explain this in scientific terms. Are the DO exceedances throughout the lower Des Plaines River? What is the range of exceedances? The comparison against the reference stream is not appropriate and should be deleted from the subject report as explained above. Why consider potential improvement in DO in the lower Des Plaines River only by supplemental aeration? Other technologies should also be investigated and alternatives should be compared on a benefit-cost ratio basis.

PAGE 37

Option 3, Paragraph 2. The information on Option 3 referenced from the 1994 Water Quality Standards Handbook is not current. New information concerning physical habitat factors to be considered in determining whether a waterbody should be used for primary contact is described in the 1998 USEPA's ANPRM proposed regulation.

Option 3, Paragraph 4. All six factors described on page 4 of the subject report should be considered in the UAA for determining if primary contact is an attainable water use for the lower Des Plaines River.

By copy of this letter, Mr. Frevert is requested to advise the MWRDGC if we have misinterpreted the IEPA's intent in conducting the UAA and/or the scope of work.

If you should have any questions concerning the MWRDGC's comments, please contact Mr. Irwin Polls at (708) 588-4219.

Very truly yours,

Richard Lanyon
Director
Research and Development

RL:js
cc: Frevert (IEPA)/Kollias/Tata/Sawyer/Polls

MEMORANDUM

Response to Comments, Chapter 5

TO: Neal O'Reilly

FROM: Mike Mischuk

DATE: November 16, 2003

Page 5-7: It is stated that the taxa richness for artificial samplers increased between the Lockport and Brandon Road navigational pools. Include in' the report numeric data showing the change in taxa richness.

I believe the graphic representation of the data allows the reader to view the data in a form that shows the trends better.

Page 5-7: It must be explained how the taxa richness for benthic invertebrates relates to the ecological integrity or stream impairment in the Brandon Road and Dresden Island navigational pools.

I believe that Table 5.4 presents a definition of the metrics and what happens to the metric with increase or decrease in perturbation. The suggestion is made that as perturbation increases ecological integrity decreases.

Page 5-8: It is stated that the number of EPT taxa was low. Include in the report numeric data showing the low values and indicate how many EPT taxa should be present in a healthy, deep-water river.

One could present a table of the data although we have already graphed it, which I think is adequate considering the limited data we had to work with. Comparison to a reference condition was suggested to the committee, but no consensus was agreed upon by the committee as to what river system to use.

Page 5-11: It is stated that aquatic worms were high in number in the Lockport and Brandon Road pools. Include in the report numeric data showing the abundance of aquatic worms.

Again, we presented a graphic of this data which one could obtain numeric values from. The presentation of the data in graphic form allows for better comparison between sample location and areas.

Page 5-14: The lower Des Pla ines River below the I-55 Bridge was used as a biological reference/comparison condition for the Lockport, Brandon Road, and Dresden Island pools. The Chicago Sanitary and Ship Canal in the Lockport pool and the Des Plaines River in the Brandon Road pool are channelized waterways. The Des Plaines River in the lower Dresden Island pool is a natural river. Because of the difference in physical habitats, it is not appropriate to use the Lower Des Plaines River as a reference/comparison condition.

Again, consensus was never reached as to an appropriate reference condition. Since the lower Dresden Island pool was a part of the same river system, and was meeting it's use classification, and since the committee could not come to consensus on an appropriate reference stream/river, the Lower Dresden pool was used.

Page 5-14: It is stated that some metrics indicate a restricted benthic community in the, Lockport and Brandon Road pools. Define "restricted" and identify the metrics that show a restricted fauna.

I believe one can obtain this from the graphics of the stated individual metrics.

Page 5-15: The Illinois Macroinvertebrate Biotic Index (MBI) does not include the effects of metals or habitat. Additionally, the MBI was developed for wadeable streams, not man-made impoundments or large river systems. The MBI may not be the appropriate index to use for this waterway.

The statement above may be right, but it is an index currently in use in Illinois. It was suggested by some members of the committee that we adopt the Ohio macroinvertebrate index even though Ohio does not use it in impounded waters for regulatory purposes. Again, the committee could not come to consensus on this.

Page 5-17: Describe the benthic community that would be indicative of a General Use classification.

A community that would indicate a Fully Supporting use classification. If one accepted the use of the Illinois MBI, it would be and MBI equal to or greater than 5.9. (Loaded question)

Page 5-18: It is stated that "The results of the macroinvertebrate sampling were heavily influenced by lack of habitat and barge traffic." it is recommended that the previous sentence be revised to read, "The lack of instream and riparian habitat"and barge traffic limit the biological integrity in the lower Des Plaines River."

I think it's better to use the first statement since we have not researched quantitatively the relationships between the macroinvertebrate community and the other factors.

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October 14, 2003

Julia P. Wozniak, Senior Biologist,
Midwest Generation EME, LLC
One Financial Place
440 South LaSalle Street
Suite 3500
Chicago, IL 60605

Re: Position Paper for the Upper Illinois Waterway UAA Draft Report

Dear Julia:

Attached is the position paper you requested. I will be in the office all week, but out Oct 18-23 if you have any questions or comments.

Sincerely,

G. A. Burton

G. Allen Burton, Jr., Professor and Director

Review of the Lower Des Plaines River Use Attainability Analysis (UAA) Draft Report

by
G. Allen Burton, Jr.
October 14, 2003

Introduction

I have been asked by Midwest Generation to review and comment on the UAA Draft Report (AquaNova & Hey 2003). Relatively late in the process of the 1990's Upper Illinois Waterway (UIW) Task Force process, I was asked to evaluate the role of sediment quality on the UIW. So, in the mid-1990's I led some evaluations of water and sediment quality on the Des Plaines River for Commonwealth Edison (Burton, 1995, 1998; Burton and Brown 1995). These studies involved evaluations of sediment contamination and toxicity on the upper ~55 miles of the UIW, reviews of the literature on temperature, turbidity and barge traffic effects, *in situ* toxicity evaluations around the Joliet power stations, and laboratory evaluations of temperature effects. Some of these studies have been heavily cited in the draft UAA, but there was not a balanced presentation of the data and, in many cases, misinterpretations of the conclusions.

My area of expertise is in the evaluation of freshwater ecosystem stressor effects, particularly focusing on the role of sediment and stormwater quality (Appendix 1). Therefore, my review of the UAA report deals with the stressors in the UIW and their role in biological impairment, focusing on sediments and stormwaters and inter-relationships of other key waterway factors.

Any evaluation of aquatic ecosystem quality is complex with numerous assumptions and uncertainties that confound the decision-making process. The evaluation requires an interdisciplinary approach and understanding of how dominant physical, chemical and biological factors interact. This dictates that state-of-the-science approaches be used that generate an adequate level of quality data and that the associated uncertainties and assumptions be clearly understood and stated. The current consensus is that reliable "weight-of-evidence" based approaches are necessary in environmental quality assessments, providing for sound decision-making (*e.g.,* Burton *et al.* 2002ab). These approaches should characterize the key "exposure" and "effects" components of the ecosystem using reliable and quantitative approaches where reference conditions, dominant stressors, and their risk is clearly defined for the users. Unfortunately, this important process was not followed in the draft UAA.

The Des Plaines Watershed

A wealth of data exists on the Des Plaines River and its watershed. It covers nearly 855,000 acres in Lake, Cook, DuPage and Will counties. The majority of Chicago's metropolitan area drains into the Des Plaines River and its tributaries. Much of the current data has been summarized by the Illinois Environmental Protection Agency (IEPA) in their recent 305(b) Water Quality Report (IEPA 2002). This human-dominated watershed is characterized primarily by urban and agricultural land uses (AquaNova & Hey 2003). The river is effluent dominated, receiving municipal wastewaters from many cities, including the 3rd largest in the nation. The municipal wastewater constitutes more than 90% of the low flow during the winter. The IEPA 305(b) and 303(d) reports identify priority organics, nutrients, metals, pathogens, ammonia, siltation and habitat alteration as the potential causes of water quality problems. The quality of the Des Plaines River ranks among the worst, with the 2nd highest number of impaired reaches (66; USEPA 303d Fact Sheet). In the 18 reaches assessed in the IEPA 2002 305b report, all had impaired uses, averaging 8 causes of impairment per reach (145 total). Of the 58 beneficial uses on the 18 assessed reaches, 52 were impaired and 66% had fish consumption advisories. Greater than 50% of the Des Plaines River reaches average over 12 different causes of impairment. The only causes of use impairment that were not identified in the Des Plaines were thermal modification, pathogens, algal/plant/exotic species, new age pesticides and dioxin (likely not analyzed for), pH and a few inorganic chemicals (IEPA 2002 305(b)). The dominant stressors and the percentage of reaches where they were identified as a problem are: metals (100%), nutrients (56-61%), PCBs (44%), flow alteration (44%), suspended solids (39%), organic enrichment (33%), low dissolved oxygen (33%), and TDS (33%). Though not identified as impairment causes, pathogens and new age pesticides are also likely problems in the Des Plaines River, since these have been identified as always being elevated in all human dominated waterways (USGS 1999; USEPA 2000). The high degree of impairment and the multiple causes are to be expected, based on the dominance of human activities and the limited nonpoint source runoff controls in the watershed. In fact, these dominant stressors and the resulting biological impairments are similar to other waterways that are human dominated (e.g., Burton *et al.* 2000; Burton and Pitt 2001).

The unique nature of this watershed makes the critically important issue of reference waterway selection difficult. The reality is that the Des Plaines watershed is one of the most heavily human-dominated waterways in the nation. This will not change. Less than 5% of the UIW has been identified as riverine habitat, with average habitat scores ranked as poor. Habitat is poorest in the Lockport, Brandon and Dresden Pools and the dominating main channel habitat area. Most of the habitat factors causing the poor ranking are irreversible (ComEd 1996). Comparing this waterway to one that is dominated to lesser degrees by better habitats or urban inputs (*e.g.,* Kankakee River) implies that the Des Plaines can be improved to a similar state; which would require massive urban NPS controls and habitat restoration, at a minimum. While there is little doubt the quality of the Des Plaines can be improved, it will always be a heavily modified waterway and never be of high quality. Until the stressors that dominate the beneficial use impairments (identified above) are reduced significantly, human and ecological risks will persist.

Sediment Quality

It is well known that chemicals (nutrients, synthetic organics and metals) and pathogens tend to associate with solids due to polar and nonpolar binding affinities (Burton 1992). Therefore, those sediments that have greater surface areas (clays, silts, colloids) will accumulate the greatest concentrations, and thus serve as both a sink and a source of contamination. Indeed, contaminated sediments are the cause of use impairment of 42 Great Lakes Areas of Concern and the dominant cause for Superfund site designation in our waterways. Depositional sediments are not stationary and continue to contaminate resident organisms and downstream waters *via* common fate processes, such as resuspension, advection, bioturbation and diffusion. These issues have been at the heart of the Fox and Hudson River cleanups. All of these fate processes exist on the Des Plaines River and vary spatially and temporally. While overlying water quality can be relatively good (*i.e.*, meet water quality standards), contaminant concentrations will steadily increase in depositional sediments and provide an environment for bioaccumulation in benthic organisms. The U.S. Environmental Protection Agency (USEPA) has shown dramatic correlations between fish tissue consumption advisories and sediment contamination. On the Des Plaines, 66% of the reaches assessed in the 305(b) report have fish consumption advisories and the levels of PCBs found in sediments suggest a substantial risk exists to those consuming fish from the Des Plaines River.

Contamination of the Des Plaines River sediments is not strictly historical and is on-going. Nutrients, metals, pathogens and synthetic organics (primarily polycyclic aromatic hydrocarbons (PAHs) and new age pesticides) are common constituents of both point and nonpoint source loadings in waterways such as the Des Plaines (Burton and Pitt 2002; USGS 1999). Therefore, removal of significantly contaminated and acutely toxic sediments from depositional areas identified throughout the UIW (Burton 1995), would provide but a temporary improvement. The hydrologic conditions and source loadings would eventually result in contaminated sediments re-accumulating since the myriad of sources will not be removed.

There are no reliable data establishing a trend of improving sediment quality, contrary to statements made in the UAA report. It was established by previous studies that extreme spatial heterogeneity exists in the UIW and is related primarily to sediment particle size and navigation channel *vs.* depositional areas. Spatial heterogeneity is a major issue in the assessment of sediment quality (USEPA 2001; Burton 1992) and can vary by orders of magnitude over horizontal and vertical distances of centimeters. There is no indication that this site-specific variation was characterized in the data being evaluated for trends. Indeed, the concentrations of organic contaminants in the depositional sediments of the UIW exceed reliable sediment quality guidelines (SQGs) for probable adverse biological effects (Table 1). The UAA report discussion of sediment criteria is based on an antiquated ranking approach and fails to use accepted sediment quality guidelines that have been applied in numerous regulatory situations throughout the U.S. (Wenning and Ingersoll 2002). It is naïve and clearly not appropriate from a scientific perspective to attempt to predict metal availability in the manner being proposed by Ambrose. Ambrose (1999) is cited heavily suggesting a partitioning approach for metals concentrations in pore waters, but is a draft document that is 4 years old and has not been supported by the peer reviewed literature. The use of a 75th percentile to convert marine to freshwater values also has no scientific basis.

The peer-reviewed literature and approved USEPA approaches should be used for the UAA decision making process (Wenning and Ingersoll 2002). The 4th paragraph on p. 3-23 is full of inaccurate statements regarding use of WQC for sediment assessments, regarding prediction of sediment toxicity and benthic *vs.* water column organism sensitivity. More importantly, widely used SQGs are exceeded, suggesting these sediments are highly contaminated and are likely to cause adverse biological effects.

There are no sediment toxicity data to refute the idea that these sediments are acutely toxic. Contrary to what is stated in the UAA report, the USEPA data of 2001 suggests the depositional sediments are still highly contaminated and acutely toxic (Table 1). These sediments exceed the respected SQGs known as Probable Effects Levels (PEL) for a multitude of organic chemicals which have been shown to be accurate ~70% of the time (*e.g.*, Buchman 1999; McDonald *et al.* 2000ab). Since the USEPA's more recent survey found highly contaminated depositional sediments similar to what we found in the mid-90's (Burton 1995), it is likely that depositional sediments are not being cleaned out. As discussed above, these sediments are being routinely contaminated from urban, residential, transportation and agricultural runoff and a wide variety of small to large point sources (Burton and Pitt 2001; Burton *et al.* 2000). These sources will continue to contaminate the depositional sediments and, as these sediments are resuspended they will continue to contaminate the more biologically sensitive and productive lower reaches of the Illinois River system. The authors of the draft report do not establish that the highly heterogeneous sediments are improving. They do not establish that sediments over a multi-year period were sampled from the exact same locations (as required for trend evaluations) and imply that data originating from navigational sediments (poor fish habitat) that are clean can be compared to depositional areas that are contaminated. There are no data adequate for trends analyses of sediment contamination. Despite their contention that sediments are cleaner, they still exceed that of many Superfund sites and are highly likely to produce toxic effects. Figures 3.6-3.8 do not show the many problem stressors and do not indicate sediment spatial heterogeneity.

The draft UAA report (p. 3-8) states that main channel sediments are non-toxic, which would be expected of sand, gravel, cobble sediments. However most depositional sediments showed acute toxicity and lie in the limited habitat areas for fish. The main channel is not primary habitat and not suitable for spawning. Indeed the prime habitat for spawning, below Brandon Lock & Dam tailwaters is contaminated. These shallow areas allow for photoinduced-toxicity of low ug/L (ppb) levels of PAHs, contrary to the incorrect statements in the report (p. 3-8). The photoinduced PAHs will be toxic to zooplankton, benthic macroinvertebrates, fish and amphibians in surficial layers of waters throughout the UIW. This phenomenon is well cited in the peer-reviewed literature (*e.g.,* Hatch and Burton 1998, 1999; Ireland *et al.* 1996). The limited citations (p. 3-35-36) for PAH toxicity fail to recognize the wealth of literature that documents PAH contamination in urban waterways that is toxic in the low ppb level in waters and in the ppm level in sediments. The UIW has significant areas of biological productivity that are shallow (<1m depth) and thus subject to photoinduced PAH toxicity. In addition, the levels found in the sediments are high enough to cause acute toxicity without UV stimulation, with or without carbon loadings, based on accepted SQGs.

SQGs are but one of the lines-of-evidence that are used in an assessment of ecosystem quality. Other important LOE include indigenous biota, toxicity and bioaccumulation, and habitat conditions. Only when each LOE is comprised of high quality data from an adequate design to characterize spatial and temporal conditions, can it be used with confidence in a weight-of-evidence evaluation (Burton *et al.* 2002b). In addition, the dynamic nature of aquatic systems for both contaminants and organisms dictates that data be collected concurrently in order to link stressor exposures with biological responses. Unfortunately, the data used for much of the UAA does not allow for quantitative analyses of the separate lines-of-evidence, or their quantitative integration into a weight-of-evidence based decision.

The ammonium text (p. 3-13 – 15) and resulting conclusions are misleading. Ammonium is typically considered to be the ionic form, while the term ammonia is inclusive of both the ionic (dominant species) and unionized (NH_4OH) forms. The unionized form is more toxic to some species, such as rainbow trout, but not others (*e.g., Hyalella azteca*). All ammonia is not oxidized in the upper aerobic layer as stated (p. 3-14); otherwise there would be no sediment related ammonia toxicity. Ammonia originating in sediments can affect benthic organisms and pass into overlying waters via porewater movement (advection), bioturbation, loss of gas bubbles, sediment disturbance and diffusion (Wetzel 1983). To imply that the aerobic layer provides a virtual cap for ammonia and to suggest that benthic organisms are not affected by ammonia in sediments is scientifically unjustified, overly simplistic and refutes site-specific data. Nitrifying bacteria have a wide temperature tolerance range (1 to 37° C). Nitrification continues down to dissolved oxygen levels of 0.3 mg/L and is dominated by heterotrophic nitrifying bacteria found in both aerobic and anaerobic waters. However, nitrification is greatly reduced in undisturbed sediments because oxygen is typically low or absent (Wetzel 1983). So, as long as there continues to be high loadings of natural organic compounds and suspended solids, there will be ideal environments in the UIW for ammonia production. Ironically, the closing paragraph of the section (p. 3-15) states "This discussion of the ammonium toxicity in sediment by no means tries to downgrade the concerns about the toxicity of the sediments and ammonium in particular. However, stressors or a combination of stressors other than ammonium may be responsible for the low biotic integrity of the Brandon Road and Dresden Island pool…"; which is absolutely correct!

The UAA report fails to show the high levels of contaminants found in previous ComEd studies from virtually all depositional sediments along the UIW. It also fails to point out that ammonia was found to be one of the primary toxicants (as suggested in the Lawler *et al.* report) and its statistically significant correlation with sediment toxicity, particle size and organic contaminants

(Burton 1995). The discussion fails to point out the toxicity noted in waters and sediments not impacted by thermal plumes. In addition, the majority of the data from the Wright State University studies pointed to ammonia toxicity as a primary stressor. *Hyalella azteca* showed greater effects, as would be predicted, since it is epibenthic and in closer proximity to higher ammonia concentrations (and other contaminants co-existing in the sediment). So the UAA report's statements that ammonium did not affect the survival or that no proof are provided are both incorrect and puzzling. There are at least 3 lines of evidence showing ammonia is a major stressor throughout the UIW.

Ceriodaphnia dubia survival was affected by turbidity as would be expected (Burton 1998). Filter feeding zooplankton are known to be sensitive to suspended solids at levels of 50-100 mg/L (*e.g.*, IEQ 1995). This dominant stressor of the UIW likely impacts zooplankton populations throughout the waterway and is aggravated by barge traffic.

Another sediment contamination concern is that of pathogen risk. Nutrient rich, depositional sediments allow for extended survival of pathogens (Burton *et al.* 1987). Survival can extend for months and as sediments are resuspended, serve as a potential source of human risk. Fecal coliform is the most commonly violated NPDES permit limit (USEPA 2002). The large amount of municipal wastewater effluent and untreated stormwater runoff from urban, residential and agricultural areas will always comprise a high loading potential for pathogens in waters and sediments of the UIW.

The Toxicity Identification Evaluation (TIE) results also suggested ammonia and PAHs as primary toxicants (Burton 1998). The authors of the UAA report imply that pore water toxicity is greatly reduced by various complexing agents. This is true sometimes and not others, depending on the sediment's physical and chemical characteristics, species type and life history, feeding characteristics, the residence time of the pore water, and the microbial communities and their indigenous activities (Burton 1991, 1992). Obviously pore water concentrations are predictive of effects to overlying biological communities, because the USEPA has based their sediment quality guidelines of equilibrium partitioning on this assumption.

It is curious as to why the UAA focuses on copper. It is but one of the potential stressors, and an unlikely one at that. *Tubifex* is not the most sensitive benthic species to Cu as stated, rather the epibenthic amphipod *Gammarus* is (Brix *et al.* 2001). Cu is likely unavailable, as pointed out in our studies and due to the existing hardness, solids, and organic ligands available. *Tubifex* is quite resistant to the organic chemical pollutants and ammonia that exist in the UIW. The UAA report recommends Tubifex for toxicity evaluations of the UIW; however, it is not an organism of choice for testing and has not been recommended by the USEPA (USEPA 2000).

A substantial concern exists for the data gaps that will likely show even greater contamination and biological impact. The concentrations of compounds that highly bioaccumulate (chlorinated pesticides and PCBs) are excessive (higher than many Superfund sites) and have undoubtedly contaminated the indigenous biota. Fishing is common on the lower UIW, yet likely poses a health risk. In addition, no data are provided for the "new age" pesticides that are currently being used in this large watershed. We know that the new age pesticides and nutrient contamination have occurred in every studied urban and agricultural watershed of the US with elevated sediment and fish tissue levels (USGS 1999). In addition, pharmaceutical and personal care products (PPCP) are also common from urban waterways and have been shown to impact fish reproduction *via* hormonal disruption; however, no data are available on these likely contaminants.

TABLE 1. Sediment Threshold and Probable Effect Levels (ug/Kg) vs. USEPA UIW Sediment Survey Data*

Compound	*TEL***	*PEL***	*UIW Sediment*
Dieldrin	2.8	6.7	7.5
Endrin	2.7	62.4	7.0
DDT	6.9	4,450	20
Heptachlor epoxide	0.6	2.7	10
PCB (total for TEL/PEL)	34.1	277	600-16,000 for an individual congener
Chlordane	4.5	8.9	5
Anthracene	5.9	128	2,000
Fluoranthene	111	2,355	10,000
Fluorene	21	144	2,000
Benzo(a)anthracene	32	385	5,000
Napthalene	35	391	900
Phenanthrene	42	515	4,000
Benzo(a)pyrene	32	782	5,000

* Des Plaines River sediment data taken from Tables 3.8, 3.9, 3.14 and 3.15.
** Based on 1% TOC. Carbon data not available for UIW normalization. Other relevant SQGs could be used (e.g., AETs, ERLs/ERMs, C-TEC/C-EEC) showing similar exceedances.

Stormwater Quality

It is implied that because of watershed and MWRDGC improvements (including TARP) that there are no significant inputs of contaminants and contaminated solids. However, most urban waterways do not have CSOs and still have these same stressors and degraded biological communities, as discussed above. The sheer magnitude of urbanization and agriculture in the watershed and lack of effective NPS controls dictates that NPS-related degradation will be a dominant source of impairment for decades. This is not surprising since it is the leading cause of water quality problems in the U.S. (USEPA 2002). While the recent and near-future improvements from TARP are noteworthy, this still is a highly impacted waterway, being effluent dominated and receiving massive amounts of untreated NPS runoff containing a wide range of nutrients, pathogens, metals, petroleum products, "new-age" pesticides and PPCP many of which are known to be toxic at the part-per-trillion level and/or hormone disruptors (Burton and Pitt 2001; Burton *et al.* 2000). Stormwaters in streams are often acutely toxic (Burton *et al.* 2000; Burton and Pitt 2001; Hatch and Burton 1999; Tucker and Burton 1999). In addition to the chemicals, massive loadings of solids erode from urban, construction and agricultural lands and constitute the number one pollutant of river systems (USEPA 2002; Burton and Pitt 2001). Most of the stressors have been already identified by the IEPA as the causes of impairment on the Des Plaines. Other stormwater issues are discussed in the preceding and following text.

Temperature

It is noteworthy that thermal modifications have not been identified as one of the 23 impairment causes on the Des Plaines River (IEPA 2002). While temperature can certainly be a stressor, a literature review found that warm temperatures can be both advantageous and detrimental to aquatic biota (IEQ 1995). Another concern not discussed in the UAA Report is that there are winter maximum temperatures which are impacted by municipal wastewater effluents and may impede some fish reproductive processes. The "Selection of the Temperature Standard" and "Critique of the Current Secondary Contact and Indigenous Aquatic Life Standard" sections have inaccurate statements regarding temperature effects on riverine species and ecosystem processes. High and low temperatures may or may not be detrimental to aquatic life that resides in the UIW. There is not a simple relationship, as noted from many past studies (*e.g.,* Cairns *et al.* 1973;

Cairns *et al.* 1978; review by Burton and Brown 1995). Both low and high temperatures can increase and decrease toxicity due to exposures from other chemical stressors, such as found in the UIW, and is both species and toxicant type and concentration dependent. The UAA report's over-simplification that high temperatures increase toxicity is simply incorrect. Nitrification is also inhibited by cold temperatures and ammonia is not always consumed in the upper sediment layers. Nitrification is very sensitive to toxicants, which abound in the UIW's depositional sediments. The authors incorrectly imply that high temperatures are always detrimental by focusing on negative impacts and over generalizing.

Blue green algae are not a concern on the UIW due to its flow conditions. Toxic cyanobacterial blooms are common to pond, lake and reservoir ecosystems. So, many of the "Negative" examples used on p. 2-93 do not apply to the UIW, yet their presentation implies that they do.

On p. 2-97 the subsection title is "Experiments by Wright University to Establish Temperature Limits". My study at Wright State University did not attempt to establish temperature limits for the UIW. The discussion of my study is misleading, leaving out key portions of the conclusions and misinterpreting others. Our findings substantiated previous studies by my laboratory and others. The key findings documented that acute toxicity exists in short-term exposures to multiple species in waters and sediments of the UIW without any temperature elevation. Toxic sediments abound in most tributary mouth, tailwater, and pool depositional areas, which include the better (but limited) habitats for fish. These same habitats are typically shallow waters which are subject to rapid mortality as a result of photoinduced toxicity of PAHs, as discussed above. Both cold and hot temperatures accentuated toxicity originating from UIW waters and sediments. Statistically significant correlations between sediment ammonia and fluorene concentrations and toxicity were observed. Ammonia was also significantly correlated to depositional sediments and the presence of high concentrations of organics. These correlations were based on sediment data collected from throughout the UIW. *In situ* toxicity was not observed due to temperature outside the thermal discharge plume.

The laboratory toxicity test results produced by our studies further document the role of sediment toxicity and how it is increased in the presence of temperature extremes. The Toxicity Identification Evaluation Phase I experiments further substantiate the findings of the Chemical Screening Risk Assessment and the ammonia correlations with toxicity, suggesting that ammonia is a primary system stressor to benthic and epibenthic species. However, these 7 day, static renewal experiments do not adequately mimic dynamic, *in situ* conditions where light, temperature, turbidity, water quality and food conditions change over minutes to hours. The most reliable indicator of *in situ* conditions is the indigenous communities. Benthic and fish community data show populations thriving despite the highly modified nature of the waterway. These are the most reliable data for evaluations of thermal impacts.

UAA Factors

Contrary to the conclusions of the UAA report, the current and future status of this watershed and the data clearly show that several UAA factors are met. The rationale supporting the statements below are provided in the text above and literature citations; and through a weight-of-evidence based, decision-making process involving the following 12 lines-of-evidence: magnitude of SQG exceedances, prevalence of sediment contamination, likelihood of continuing sediment contamination, extreme degraded status of waterway compared to others in the nation, human dominance of watershed, profuse NPS inputs, excessive habitat modification and degradation, human risk from pathogens and fish consumption, toxicity levels in water and sediment, correlations of toxicity with chemical stressors, indigenous biotic indices, and excessive numbers of use impairments throughout the watershed.

UAA Reasons Which Are Met :
Reason 1. Naturally occurring pollutant concentrations prevent the attainment of the use: Sometimes ammonia is considered a "natural" pollutant (*e.g.,* see USEPA/USACOE dredging guidance). The weight-of-evidence suggests ammonia is a stressor of concern throughout this waterway, with multiple point and nonpoint sources. Erodable soils are another pervasive stressor contributing to siltation, embeddedness, and turbidity-related stress.

Reason 3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place:
This is the primary reason for not upgrading. The evidence of excessive impairments is clear from the results of recent IEPA efforts (IEPA 305(b) and 303(d) reports). A multitude of impairment causes and sources exist throughout the watershed as discussed and documented above. These causes are unlikely to be significantly corrected.

Reason 4. Dams, diversions or other hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original conditions or to operate such modifications in a way that would result in the attainment of the use:
The waterway's habitat is heavily and permanently modified. Barge traffic will continue to be a major use and will continue to result in degraded habitat, resuspended contaminated sediments and a physical hazard to recreational users.

Reason 5. Physical conditions associated with the natural features of the water body, such as the lack of proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to quality preclude attainment of aquatic life protection uses:
See rationale for Reason 4 above. Habitat is of poor quality through most of the UIW and cannot be significantly corrected.

Reason 6. More stringent controls than those required by Sections 301(b) and 306 of the CWA would result in substantial and widespread adverse social and economic impact:
It is simply impossible to remove the many and widespread impairment sources or substantially improve their quality (including NPS), which have been identified by the IEPA and USEPA, without severe social and economic impact.

Conclusions

An extensive database exists on the UIW concerning its physical, chemical, biological and toxicity characteristics. These multiple lines-of-evidence clearly establish this is a highly modified waterway that has poor habitat, is effluent dominated and receives massive amounts of untreated, nonpoint source runoff. Despite the many stressors that exist (and will continue to exist) in this waterway, a thriving fish community exists which runs contrary to the UAA report predictions of lethality. This line-of-evidence is a direct measure of indigenous biota and their ability to exist under the current conditions of the UIW. The toxicity studies conducted by my laboratory used worst-case exposure conditions for early life stages of two surrogate species. These results documented acute toxicity in UIW water and sediment and that high and low temperatures may accentuate the pervasive level of toxicity to these surrogate species. Other laboratory-based research by Cairns *et al.,* (1973, 1978) has shown the complexity of temperature and chemical interactions in organisms which refute the simplistic conclusions of the UAA report. Laboratory-based results require extrapolation to field conditions and indigenous benthic and fish communities, which have been thoroughly characterized in the UIW and are the most important line-of-evidence. Depositional sediments throughout the UIW are contaminated with levels of multiple contaminants that, in many locations, pose a hazard to aquatic biota, wildlife and humans. Major nonpoint source loadings of solids, nutrients, metals, and organics will continue from small to major urban areas, sewers, construction, and agriculture in this human-dominated watershed. Modified and limited habitats (channelization, barge traffic, lock and dams), extreme turbidity and siltation, and stressor loadings will not improve in the foreseeable future and will continue to dominate water quality conditions and use impairments. Development of new, modified standards will not address the key issue of excessive and pervasive pollution sources, excessive use impairments and limited habitats in this watershed.

The draft UAA report conclusions are quite misleading. The presentation of data, data interpretation, and supporting statements are often biased and fail to provide a scientifically-balanced representation of previous Upper Illinois Waterway (UIW) studies, peer-reviewed literature and accepted approaches that are the state-of-the-science. As such, this document fails to provide a scientific basis for an informed decision making framework for the UAA process.

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APPENDIX 1

Resume

Name	**Position Title**
G. Allen Burton, Jr., Ph.D.	Professor and Director, Institute for Environmental Quality

Education

Ouachita Baptist University	B.S.	1976	Biology & Chemistry
Auburn University	M.S.	1978	Microbiology
University of Texas @ Dallas	M.S.	1981	Environmental Sciences
University of Texas @ Dallas	Ph.D.	1984	Env. Sci. (Aquatic Toxicology)

Professional Positions:

1980-1984. Life Scientist. U.S. Environmental Protection Agency, Dallas, Texas
1984-1985. Visiting Fellow. Cooperative Institute for Research in Environmental Sciences, University of Colorado @ Boulder
1985-1990. Assistant Professor, Dept. of Biological Sciences, Wright St. Univ.
1990-1996. Associate Professor, Dept. of Biological Sciences, Wright St. Univ.
1985-present. Coordinator, Environmental Health Sciences Undergraduate Program, WSU.
1994-present, Director, Institute for Environmental Quality, WSU.
1996-present. Professor. Dept. of Biological Sciences, Wright St. Univ.
2000-2003. Brage Golding Distinguished Professor of Research, WSU.
2002-2003. Director, Environmental Sciences Ph.D. Program, WSU.
2003-present. Associate Director, Environmental Sciences Ph.D. Program, WSU.

Awards and Other Professional Activities (select):

1992-1999. U.S. EPA National Freshwater Sediment Toxicity Methods Committee
1994, 2001. Visiting Senior Scientist, Italian Institute for Hydrobiology.
1994, 1995, 1998, 1999. External Review Panel. Environmental Biology Research Program. Exploratory Research. Office of Research and Development, U.S. EPA.
1996. Visiting Senior Scientist, New Zealand Inst. of Water and Atmospheric Research.
1994-1997. NATO Senior Research Fellow, University of Coimbra, Portugal.
1993-1996. Board of Directors, Soc. of Environmental Toxicology and Chemistry
2002. Meeting Chair. 5th International Symposium on Sediment Quality Assessment.
1999-2001. U.S. EPA Scientific Advisory Panel, Office of Pesticide Programs
2001-2004, Editorial Board, Aquatic Ecosystem Health & Management and Chemosphere.
2000-2003. Brage Golding Distinguished Professor of Research.
2003-2006. World Council, Society of Environmental Toxicology & Chemistry

Recent Projects (select):

U.S. Environmental Protection Agency, Office of Exploratory Research. Sediment contamination assessment methods: validation of standardized and novel approaches. 1997-2000.
U.S. Environmental Protection Agency. Office of Exploratory Research. Intraspecies genetic diversity measures of environmental impacts. 1998-2001. Co-PI.
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International Lead Zinc Research Organization. Field Validation of Sediment Zinc Toxicity for European Union Zinc Risk Assessment. 2001-2003.

Nickel Producers Environmental Research Organization. Field Validation of Sediment Nickel Toxicity for the European Union Nickel Risk Assessment. 2003-2004.

Recent Publications (select):

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2. Burton, G.A., Jr., R. Pitt, and S. Clark. 2000. The role of whole effluent toxicity test methods in assessing stormwater and sediment contamination. CRC Critical Reviews in Environmental Science & Technology 30: 413-447.
3. Burton, G.A., Jr., and R. Pitt. 2001. Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists and Engineers. CRC/Lewis Publishers, Boca Raton, FL, 924 pp.
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Expertise Summary

Dr. Burton is an Environmental Sciences Professor of Research and Director of the Institute for Environmental Quality at Wright State University. He obtained a Ph.D. degree in Environmental Science from the University of Texas at Dallas in 1984. From 1980 until 1985 he was a Life Scientist with the U.S. Environmental Protection Agency. He was a Postdoctoral Fellow at the National Oceanic and Atmospheric Administration's Cooperative Institute for Research in Environmental Sciences at the University of Colorado. Since then he has had positions as a NATO Senior Research Fellow in Portugal and Visiting Senior Scientist in Italy and New Zealand. Dr. Burton has served on numerous national and international scientific committees and review panels, has had approx. $4.8 million in grants and contracts, and over 150 publications dealing with aquatic system responses to stressors.

See also: http://www.wright.edu/~allen.burton/burton

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October 14, 2003

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Re: Position Paper for the Upper Illinois Waterway UAA Draft Report

Dear Julia:

Attached is the position paper you requested. I will be in the office all week, but out Oct 18-23 if you have any questions or comments.

Sincerely,

G. A. Burton

G. Allen Burton, Jr., Professor and Director

Review of the Lower Des Plaines River Use Attainability Analysis (UAA) Draft Report

by
G. Allen Burton, Jr.
October 14, 2003

Introduction

I have been asked by Midwest Generation to review and comment on the UAA Draft Report (AquaNova & Hey 2003). Relatively late in the process of the 1990's Upper Illinois Waterway (UIW) Task Force process, I was asked to evaluate the role of sediment quality on the UIW. So, in the mid-1990's I led some evaluations of water and sediment quality on the Des Plaines River for Commonwealth Edison (Burton, 1995, 1998; Burton and Brown 1995). These studies involved evaluations of sediment contamination and toxicity on the upper ~55 miles of the UIW, reviews of the literature on temperature, turbidity and barge traffic effects, *in situ* toxicity evaluations around the Joliet power stations, and laboratory evaluations of temperature effects. Some of these studies have been heavily cited in the draft UAA, but there was not a balanced presentation of the data and, in many cases, misinterpretations of the conclusions.

My area of expertise is in the evaluation of freshwater ecosystem stressor effects, particularly focusing on the role of sediment and stormwater quality (Appendix 1). Therefore, my review of the UAA report deals with the stressors in the UIW and their role in biological impairment, focusing on sediments and stormwaters and inter-relationships of other key waterway factors.

Any evaluation of aquatic ecosystem quality is complex with numerous assumptions and uncertainties that confound the decision-making process. The evaluation requires an interdisciplinary approach and understanding of how dominant physical, chemical and biological factors interact. This dictates that state-of-the-science approaches be used that generate an adequate level of quality data and that the associated uncertainties and assumptions be clearly understood and stated. The current consensus is that reliable "weight-of-evidence" based approaches are necessary in environmental quality assessments, providing for sound decision-making (*e.g.,* Burton *et al.* 2002ab). These approaches should characterize the key "exposure" and "effects" components of the ecosystem using reliable and quantitative approaches where reference conditions, dominant stressors, and their risk is clearly defined for the users. Unfortunately, this important process was not followed in the draft UAA.

The Des Plaines Watershed

A wealth of data exists on the Des Plaines River and its watershed. It covers nearly 855,000 acres in Lake, Cook, DuPage and Will counties. The majority of Chicago's metropolitan area drains into the Des Plaines River and its tributaries. Much of the current data has been summarized by the Illinois Environmental Protection Agency (IEPA) in their recent 305(b) Water Quality Report (IEPA 2002). This human-dominated watershed is characterized primarily by urban and agricultural land uses (AquaNova & Hey 2003). The river is effluent dominated, receiving municipal wastewaters from many cities, including the 3rd largest in the nation. The municipal wastewater constitutes more than 90% of the low flow during the winter. The IEPA 305(b) and 303(d) reports identify priority organics, nutrients, metals, pathogens, ammonia, siltation and habitat alteration as the potential causes of water quality problems. The quality of the Des Plaines River ranks among the worst, with the 2nd highest number of impaired reaches (66; USEPA 303d Fact Sheet). In the 18 reaches assessed in the IEPA 2002 305b report, all had impaired uses, averaging 8 causes of impairment per reach (145 total). Of the 58 beneficial uses on the 18 assessed reaches, 52 were impaired and 66% had fish consumption advisories. Greater than 50% of the Des Plaines River reaches average over 12 different causes of impairment. The only causes of use impairment that were not identified in the Des Plaines were thermal modification, pathogens, algal/plant/exotic species, new age pesticides and dioxin (likely not analyzed for), pH and a few inorganic chemicals (IEPA 2002 305(b)). The dominant stressors and the percentage of reaches where they were identified as a problem are: metals (100%), nutrients (56-61%), PCBs (44%), flow alteration (44%), suspended solids (39%), organic enrichment (33%), low dissolved oxygen (33%), and TDS (33%). Though not identified as impairment causes, pathogens and new age pesticides are also likely problems in the Des Plaines River, since these have been identified as always being elevated in all human dominated waterways (USGS 1999; USEPA 2000). The high degree of impairment and the multiple causes are to be expected, based on the dominance of human activities and the limited nonpoint source runoff controls in the watershed. In fact, these dominant stressors and the resulting biological impairments are similar to other waterways that are human dominated (e.g., Burton *et al.* 2000; Burton and Pitt 2001).

The unique nature of this watershed makes the critically important issue of reference waterway selection difficult. The reality is that the Des Plaines watershed is one of the most heavily human-dominated waterways in the nation. This will not change. Less than 5% of the UIW has been identified as riverine habitat, with average habitat scores ranked as poor. Habitat is poorest in the Lockport, Brandon and Dresden Pools and the dominating main channel habitat area. Most of the habitat factors causing the poor ranking are irreversible (ComEd 1996). Comparing this waterway to one that is dominated to lesser degrees by better habitats or urban inputs (*e.g.,* Kankakee River) implies that the Des Plaines can be improved to a similar state; which would require massive urban NPS controls and habitat restoration, at a minimum. While there is little doubt the quality of the Des Plaines can be improved, it will always be a heavily modified waterway and never be of high quality. Until the stressors that dominate the beneficial use impairments (identified above) are reduced significantly, human and ecological risks will persist.

Sediment Quality

It is well known that chemicals (nutrients, synthetic organics and metals) and pathogens tend to associate with solids due to polar and nonpolar binding affinities (Burton 1992). Therefore, those sediments that have greater surface areas (clays, silts, colloids) will accumulate the greatest concentrations, and thus serve as both a sink and a source of contamination. Indeed, contaminated sediments are the cause of use impairment of 42 Great Lakes Areas of Concern and the dominant cause for Superfund site designation in our waterways. Depositional sediments are not stationary and continue to contaminate resident organisms and downstream waters *via* common fate processes, such as resuspension, advection, bioturbation and diffusion. These issues have been at the heart of the Fox and Hudson River cleanups. All of these fate processes exist on the Des Plaines River and vary spatially and temporally. While overlying water quality can be relatively good (*i.e.*, meet water quality standards), contaminant concentrations will steadily increase in depositional sediments and provide an environment for bioaccumulation in benthic organisms. The U.S. Environmental Protection Agency (USEPA) has shown dramatic correlations between fish tissue consumption advisories and sediment contamination. On the Des Plaines, 66% of the reaches assessed in the 305(b) report have fish consumption advisories and the levels of PCBs found in sediments suggest a substantial risk exists to those consuming fish from the Des Plaines River.

Contamination of the Des Plaines River sediments is not strictly historical and is on-going. Nutrients, metals, pathogens and synthetic organics (primarily polycyclic aromatic hydrocarbons (PAHs) and new age pesticides) are common constituents of both point and nonpoint source loadings in waterways such as the Des Plaines (Burton and Pitt 2002; USGS 1999). Therefore, removal of significantly contaminated and acutely toxic sediments from depositional areas identified throughout the UIW (Burton 1995), would provide but a temporary improvement. The hydrologic conditions and source loadings would eventually result in contaminated sediments re-accumulating since the myriad of sources will not be removed.

There are no reliable data establishing a trend of improving sediment quality, contrary to statements made in the UAA report. It was established by previous studies that extreme spatial heterogeneity exists in the UIW and is related primarily to sediment particle size and navigation channel *vs*. depositional areas. Spatial heterogeneity is a major issue in the assessment of sediment quality (USEPA 2001; Burton 1992) and can vary by orders of magnitude over horizontal and vertical distances of centimeters. There is no indication that this site-specific variation was characterized in the data being evaluated for trends. Indeed, the concentrations of organic contaminants in the depositional sediments of the UIW exceed reliable sediment quality guidelines (SQGs) for probable adverse biological effects (Table 1). The UAA report discussion of sediment criteria is based on an antiquated ranking approach and fails to use accepted sediment quality guidelines that have been applied in numerous regulatory situations throughout the U.S. (Wenning and Ingersoll 2002). It is naïve and clearly not appropriate from a scientific perspective to attempt to predict metal availability in the manner being proposed by Ambrose. Ambrose (1999) is cited heavily suggesting a partitioning approach for metals concentrations in pore waters, but is a draft document that is 4 years old and has not been supported by the peer reviewed literature. The use of a 75th percentile to convert marine to freshwater values also has no scientific basis.

The peer-reviewed literature and approved USEPA approaches should be used for the UAA decision making process (Wenning and Ingersoll 2002). The 4th paragraph on p. 3-23 is full of inaccurate statements regarding use of WQC for sediment assessments, regarding prediction of sediment toxicity and benthic *vs.* water column organism sensitivity. More importantly, widely used SQGs are exceeded, suggesting these sediments are highly contaminated and are likely to cause adverse biological effects.

There are no sediment toxicity data to refute the idea that these sediments are acutely toxic. Contrary to what is stated in the UAA report, the USEPA data of 2001 suggests the depositional sediments are still highly contaminated and acutely toxic (Table 1). These sediments exceed the respected SQGs known as Probable Effects Levels (PEL) for a multitude of organic chemicals which have been shown to be accurate ~70% of the time (*e.g.*, Buchman 1999; McDonald *et al.* 2000ab). Since the USEPA's more recent survey found highly contaminated depositional sediments similar to what we found in the mid-90's (Burton 1995), it is likely that depositional sediments are not being cleaned out. As discussed above, these sediments are being routinely contaminated from urban, residential, transportation and agricultural runoff and a wide variety of small to large point sources (Burton and Pitt 2001; Burton *et al.* 2000). These sources will continue to contaminate the depositional sediments and, as these sediments are resuspended they will continue to contaminate the more biologically sensitive and productive lower reaches of the Illinois River system. The authors of the draft report do not establish that the highly heterogeneous sediments are improving. They do not establish that sediments over a multi-year period were sampled from the exact same locations (as required for trend evaluations) and imply that data originating from navigational sediments (poor fish habitat) that are clean can be compared to depositional areas that are contaminated. There are no data adequate for trends analyses of sediment contamination. Despite their contention that sediments are cleaner, they still exceed that of many Superfund sites and are highly likely to produce toxic effects. Figures 3.6-3.8 do not show the many problem stressors and do not indicate sediment spatial heterogeneity.

The draft UAA report (p. 3-8) states that main channel sediments are non-toxic, which would be expected of sand, gravel, cobble sediments. However most depositional sediments showed acute toxicity and lie in the limited habitat areas for fish. The main channel is not primary habitat and not suitable for spawning. Indeed the prime habitat for spawning, below Brandon Lock & Dam tailwaters is contaminated. These shallow areas allow for photoinduced-toxicity of low ug/L (ppb) levels of PAHs, contrary to the incorrect statements in the report (p. 3-8). The photoinduced PAHs will be toxic to zooplankton, benthic macroinvertebrates, fish and amphibians in surficial layers of waters throughout the UIW. This phenomenon is well cited in the peer-reviewed literature (*e.g.,* Hatch and Burton 1998, 1999; Ireland *et al.* 1996). The limited citations (p. 3-35-36) for PAH toxicity fail to recognize the wealth of literature that documents PAH contamination in urban waterways that is toxic in the low ppb level in waters and in the ppm level in sediments. The UIW has significant areas of biological productivity that are shallow (<1m depth) and thus subject to photoinduced PAH toxicity. In addition, the levels found in the sediments are high enough to cause acute toxicity without UV stimulation, with or without carbon loadings, based on accepted SQGs.

SQGs are but one of the lines-of-evidence that are used in an assessment of ecosystem quality. Other important LOE include indigenous biota, toxicity and bioaccumulation, and habitat conditions. Only when each LOE is comprised of high quality data from an adequate design to characterize spatial and temporal conditions, can it be used with confidence in a weight-of-evidence evaluation (Burton *et al.* 2002b). In addition, the dynamic nature of aquatic systems for both contaminants and organisms dictates that data be collected concurrently in order to link stressor exposures with biological responses. Unfortunately, the data used for much of the UAA does not allow for quantitative analyses of the separate lines-of-evidence, or their quantitative integration into a weight-of-evidence based decision.

The ammonium text (p. 3-13 – 15) and resulting conclusions are misleading. Ammonium is typically considered to be the ionic form, while the term ammonia is inclusive of both the ionic (dominant species) and unionized (NH_4OH) forms. The unionized form is more toxic to some species, such as rainbow trout, but not others (*e.g., Hyalella azteca*). All ammonia is not oxidized in the upper aerobic layer as stated (p. 3-14); otherwise there would be no sediment related ammonia toxicity. Ammonia originating in sediments can affect benthic organisms and pass into overlying waters via porewater movement (advection), bioturbation, loss of gas bubbles, sediment disturbance and diffusion (Wetzel 1983). To imply that the aerobic layer provides a virtual cap for ammonia and to suggest that benthic organisms are not affected by ammonia in sediments is scientifically unjustified, overly simplistic and refutes site-specific data. Nitrifying bacteria have a wide temperature tolerance range (1 to 37° C). Nitrification continues down to dissolved oxygen levels of 0.3 mg/L and is dominated by heterotrophic nitrifying bacteria found in both aerobic and anaerobic waters. However, nitrification is greatly reduced in undisturbed sediments because oxygen is typically low or absent (Wetzel 1983). So, as long as there continues to be high loadings of natural organic compounds and suspended solids, there will be ideal environments in the UIW for ammonia production. Ironically, the closing paragraph of the section (p. 3-15) states "This discussion of the ammonium toxicity in sediment by no means tries to downgrade the concerns about the toxicity of the sediments and ammonium in particular. However, stressors or a combination of stressors other than ammonium may be responsible for the low biotic integrity of the Brandon Road and Dresden Island pool..."; which is absolutely correct!

The UAA report fails to show the high levels of contaminants found in previous ComEd studies from virtually all depositional sediments along the UIW. It also fails to point out that ammonia was found to be one of the primary toxicants (as suggested in the Lawler *et al.* report) and its statistically significant correlation with sediment toxicity, particle size and organic contaminants

(Burton 1995). The discussion fails to point out the toxicity noted in waters and sediments not impacted by thermal plumes. In addition, the majority of the data from the Wright State University studies pointed to ammonia toxicity as a primary stressor. *Hyalella azteca* showed greater effects, as would be predicted, since it is epibenthic and in closer proximity to higher ammonia concentrations (and other contaminants co-existing in the sediment). So the UAA report's statements that ammonium did not affect the survival or that no proof are provided are both incorrect and puzzling. There are at least 3 lines of evidence showing ammonia is a major stressor throughout the UIW.

Ceriodaphnia dubia survival was affected by turbidity as would be expected (Burton 1998). Filter feeding zooplankton are known to be sensitive to suspended solids at levels of 50-100 mg/L (*e.g.*, IEQ 1995). This dominant stressor of the UIW likely impacts zooplankton populations throughout the waterway and is aggravated by barge traffic.

Another sediment contamination concern is that of pathogen risk. Nutrient rich, depositional sediments allow for extended survival of pathogens (Burton *et al.* 1987). Survival can extend for months and as sediments are resuspended, serve as a potential source of human risk. Fecal coliform is the most commonly violated NPDES permit limit (USEPA 2002). The large amount of municipal wastewater effluent and untreated stormwater runoff from urban, residential and agricultural areas will always comprise a high loading potential for pathogens in waters and sediments of the UIW.

The Toxicity Identification Evaluation (TIE) results also suggested ammonia and PAHs as primary toxicants (Burton 1998). The authors of the UAA report imply that pore water toxicity is greatly reduced by various complexing agents. This is true sometimes and not others, depending on the sediment's physical and chemical characteristics, species type and life history, feeding characteristics, the residence time of the pore water, and the microbial communities and their indigenous activities (Burton 1991, 1992). Obviously pore water concentrations are predictive of effects to overlying biological communities, because the USEPA has based their sediment quality guidelines of equilibrium partitioning on this assumption.

It is curious as to why the UAA focuses on copper. It is but one of the potential stressors, and an unlikely one at that. *Tubifex* is not the most sensitive benthic species to Cu as stated, rather the epibenthic amphipod *Gammarus* is (Brix *et al.* 2001). Cu is likely unavailable, as pointed out in our studies and due to the existing hardness, solids, and organic ligands available. *Tubifex* is quite resistant to the organic chemical pollutants and ammonia that exist in the UIW. The UAA report recommends Tubifex for toxicity evaluations of the UIW; however, it is not an organism of choice for testing and has not been recommended by the USEPA (USEPA 2000).

A substantial concern exists for the data gaps that will likely show even greater contamination and biological impact. The concentrations of compounds that highly bioaccumulate (chlorinated pesticides and PCBs) are excessive (higher than many Superfund sites) and have undoubtedly contaminated the indigenous biota. Fishing is common on the lower UIW, yet likely poses a health risk. In addition, no data are provided for the "new age" pesticides that are currently being used in this large watershed. We know that the new age pesticides and nutrient contamination have occurred in every studied urban and agricultural watershed of the US with elevated sediment and fish tissue levels (USGS 1999). In addition, pharmaceutical and personal care products (PPCP) are also common from urban waterways and have been shown to impact fish reproduction *via* hormonal disruption; however, no data are available on these likely contaminants.

TABLE 1. Sediment Threshold and Probable Effect Levels (ug/Kg) vs. USEPA UIW Sediment Survey Data*

Compound	*TEL***	*PEL***	*UIW Sediment*
Dieldrin	2.8	6.7	7.5
Endrin	2.7	62.4	7.0
DDT	6.9	4,450	20
Heptachlor epoxide	0.6	2.7	10
PCB (total for TEL/PEL)	34.1	277	600-16,000 for an individual congener
Chlordane	4.5	8.9	5
Anthracene	5.9	128	2,000
Fluoranthene	111	2,355	10,000
Fluorene	21	144	2,000
Benzo(a)anthracene	32	385	5,000
Napthalene	35	391	900
Phenanthrene	42	515	4,000
Benzo(a)pyrene	32	782	5,000

* Des Plaines River sediment data taken from Tables 3.8, 3.9, 3.14 and 3.15.
** Based on 1% TOC. Carbon data not available for UIW normalization. Other relevant SQGs could be used (e.g., AETs, ERLs/ERMs, C-TEC/C-EEC) showing similar exceedances.

Stormwater Quality

It is implied that because of watershed and MWRDGC improvements (including TARP) that there are no significant inputs of contaminants and contaminated solids. However, most urban waterways do not have CSOs and still have these same stressors and degraded biological communities, as discussed above. The sheer magnitude of urbanization and agriculture in the watershed and lack of effective NPS controls dictates that NPS-related degradation will be a dominant source of impairment for decades. This is not surprising since it is the leading cause of water quality problems in the U.S. (USEPA 2002). While the recent and near-future improvements from TARP are noteworthy, this still is a highly impacted waterway, being effluent dominated and receiving massive amounts of untreated NPS runoff containing a wide range of nutrients, pathogens, metals, petroleum products, "new-age" pesticides and PPCP many of which are known to be toxic at the part-per-trillion level and/or hormone disruptors (Burton and Pitt 2001; Burton *et al.* 2000). Stormwaters in streams are often acutely toxic (Burton *et al.* 2000; Burton and Pitt 2001; Hatch and Burton 1999; Tucker and Burton 1999). In addition to the chemicals, massive loadings of solids erode from urban, construction and agricultural lands and constitute the number one pollutant of river systems (USEPA 2002; Burton and Pitt 2001). Most of the stressors have been already identified by the IEPA as the causes of impairment on the Des Plaines. Other stormwater issues are discussed in the preceding and following text.

Temperature

It is noteworthy that thermal modifications have not been identified as one of the 23 impairment causes on the Des Plaines River (IEPA 2002). While temperature can certainly be a stressor, a literature review found that warm temperatures can be both advantageous and detrimental to aquatic biota (IEQ 1995). Another concern not discussed in the UAA Report is that there are winter maximum temperatures which are impacted by municipal wastewater effluents and may impede some fish reproductive processes. The "Selection of the Temperature Standard" and "Critique of the Current Secondary Contact and Indigenous Aquatic Life Standard" sections have inaccurate statements regarding temperature effects on riverine species and ecosystem processes. High and low temperatures may or may not be detrimental to aquatic life that resides in the UIW. There is not a simple relationship, as noted from many past studies (*e.g.,* Cairns *et al.* 1973;

Cairns *et al.* 1978; review by Burton and Brown 1995). Both low and high temperatures can increase and decrease toxicity due to exposures from other chemical stressors, such as found in the UIW, and is both species and toxicant type and concentration dependent. The UAA report's over-simplification that high temperatures increase toxicity is simply incorrect. Nitrification is also inhibited by cold temperatures and ammonia is not always consumed in the upper sediment layers. Nitrification is very sensitive to toxicants, which abound in the UIW's depositional sediments. The authors incorrectly imply that high temperatures are always detrimental by focusing on negative impacts and over generalizing.

Blue green algae are not a concern on the UIW due to its flow conditions. Toxic cyanobacterial blooms are common to pond, lake and reservoir ecosystems. So, many of the "Negative" examples used on p. 2-93 do not apply to the UIW, yet their presentation implies that they do.

On p. 2-97 the subsection title is "Experiments by Wright University to Establish Temperature Limits". My study at Wright State University did not attempt to establish temperature limits for the UIW. The discussion of my study is misleading, leaving out key portions of the conclusions and misinterpreting others. Our findings substantiated previous studies by my laboratory and others. The key findings documented that acute toxicity exists in short-term exposures to multiple species in waters and sediments of the UIW without any temperature elevation. Toxic sediments abound in most tributary mouth, tailwater, and pool depositional areas, which include the better (but limited) habitats for fish. These same habitats are typically shallow waters which are subject to rapid mortality as a result of photoinduced toxicity of PAHs, as discussed above. Both cold and hot temperatures accentuated toxicity originating from UIW waters and sediments. Statistically significant correlations between sediment ammonia and fluorene concentrations and toxicity were observed. Ammonia was also significantly correlated to depositional sediments and the presence of high concentrations of organics. These correlations were based on sediment data collected from throughout the UIW. *In situ* toxicity was not observed due to temperature outside the thermal discharge plume.

The laboratory toxicity test results produced by our studies further document the role of sediment toxicity and how it is increased in the presence of temperature extremes. The Toxicity Identification Evaluation Phase I experiments further substantiate the findings of the Chemical Screening Risk Assessment and the ammonia correlations with toxicity, suggesting that ammonia is a primary system stressor to benthic and epibenthic species. However, these 7 day, static renewal experiments do not adequately mimic dynamic, *in situ* conditions where light, temperature, turbidity, water quality and food conditions change over minutes to hours. The most reliable indicator of *in situ* conditions is the indigenous communities. Benthic and fish community data show populations thriving despite the highly modified nature of the waterway. These are the most reliable data for evaluations of thermal impacts.

UAA Factors

Contrary to the conclusions of the UAA report, the current and future status of this watershed and the data clearly show that several UAA factors are met. The rationale supporting the statements below are provided in the text above and literature citations; and through a weight-of-evidence based, decision-making process involving the following 12 lines-of-evidence: magnitude of SQG exceedances, prevalence of sediment contamination, likelihood of continuing sediment contamination, extreme degraded status of waterway compared to others in the nation, human dominance of watershed, profuse NPS inputs, excessive habitat modification and degradation, human risk from pathogens and fish consumption, toxicity levels in water and sediment, correlations of toxicity with chemical stressors, indigenous biotic indices, and excessive numbers of use impairments throughout the watershed.

UAA Reasons Which Are Met :

Reason 1. Naturally occurring pollutant concentrations prevent the attainment of the use: Sometimes ammonia is considered a "natural" pollutant (*e.g.,* see USEPA/USACOE dredging guidance). The weight-of-evidence suggests ammonia is a stressor of concern throughout this waterway, with multiple point and nonpoint sources. Erodable soils are another pervasive stressor contributing to siltation, embeddedness, and turbidity-related stress.

Reason 3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place:
This is the primary reason for not upgrading. The evidence of excessive impairments is clear from the results of recent IEPA efforts (IEPA 305(b) and 303(d) reports). A multitude of impairment causes and sources exist throughout the watershed as discussed and documented above. These causes are unlikely to be significantly corrected.

Reason 4. Dams, diversions or other hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original conditions or to operate such modifications in a way that would result in the attainment of the use:
The waterway's habitat is heavily and permanently modified. Barge traffic will continue to be a major use and will continue to result in degraded habitat, resuspended contaminated sediments and a physical hazard to recreational users.

Reason 5. Physical conditions associated with the natural features of the water body, such as the lack of proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to quality preclude attainment of aquatic life protection uses:
See rationale for Reason 4 above. Habitat is of poor quality through most of the UIW and cannot be significantly corrected.

Reason 6. More stringent controls than those required by Sections 301(b) and 306 of the CWA would result in substantial and widespread adverse social and economic impact:
It is simply impossible to remove the many and widespread impairment sources or substantially improve their quality (including NPS), which have been identified by the IEPA and USEPA, without severe social and economic impact.

Conclusions

An extensive database exists on the UIW concerning its physical, chemical, biological and toxicity characteristics. These multiple lines-of-evidence clearly establish this is a highly modified waterway that has poor habitat, is effluent dominated and receives massive amounts of untreated, nonpoint source runoff. Despite the many stressors that exist (and will continue to exist) in this waterway, a thriving fish community exists which runs contrary to the UAA report predictions of lethality. This line-of-evidence is a direct measure of indigenous biota and their ability to exist under the current conditions of the UIW. The toxicity studies conducted by my laboratory used worst-case exposure conditions for early life stages of two surrogate species. These results documented acute toxicity in UIW water and sediment and that high and low temperatures may accentuate the pervasive level of toxicity to these surrogate species. Other laboratory-based research by Cairns *et al.,* (1973, 1978) has shown the complexity of temperature and chemical interactions in organisms which refute the simplistic conclusions of the UAA report. Laboratory-based results require extrapolation to field conditions and indigenous benthic and fish communities, which have been thoroughly characterized in the UIW and are the most important line-of-evidence. Depositional sediments throughout the UIW are contaminated with levels of multiple contaminants that, in many locations, pose a hazard to aquatic biota, wildlife and humans. Major nonpoint source loadings of solids, nutrients, metals, and organics will continue from small to major urban areas, sewers, construction, and agriculture in this human-dominated watershed. Modified and limited habitats (channelization, barge traffic, lock and dams), extreme turbidity and siltation, and stressor loadings will not improve in the foreseeable future and will continue to dominate water quality conditions and use impairments. Development of new, modified standards will not address the key issue of excessive and pervasive pollution sources, excessive use impairments and limited habitats in this watershed.

The draft UAA report conclusions are quite misleading. The presentation of data, data interpretation, and supporting statements are often biased and fail to provide a scientifically-balanced representation of previous Upper Illinois Waterway (UIW) studies, peer-reviewed literature and accepted approaches that are the state-of-the-science. As such, this document fails to provide a scientific basis for an informed decision making framework for the UAA process.

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APPENDIX 1

Resume

Name
G. Allen Burton, Jr., Ph.D.

Position Title
Professor and Director,
Institute for Environmental Quality

Education

Ouachita Baptist University	B.S.	1976	Biology & Chemistry
Auburn University	M.S.	1978	Microbiology
University of Texas @ Dallas	M.S.	1981	Environmental Sciences
University of Texas @ Dallas	Ph.D.	1984	Env. Sci. (Aquatic Toxicology)

Professional Positions:

1980-1984. Life Scientist. U.S. Environmental Protection Agency, Dallas, Texas
1984-1985. Visiting Fellow. Cooperative Institute for Research in Environmental Sciences, University of Colorado @ Boulder
1985-1990. Assistant Professor, Dept. of Biological Sciences, Wright St. Univ.
1990-1996. Associate Professor, Dept. of Biological Sciences, Wright St. Univ.
1985-present. Coordinator, Environmental Health Sciences Undergraduate Program, WSU.
1994-present, Director, Institute for Environmental Quality, WSU.
1996-present. Professor. Dept. of Biological Sciences, Wright St. Univ.
2000-2003. Brage Golding Distinguished Professor of Research, WSU.
2002-2003. Director, Environmental Sciences Ph.D. Program, WSU.
2003-present. Associate Director, Environmental Sciences Ph.D. Program, WSU.

Awards and Other Professional Activities (select):

1992-1999. U.S. EPA National Freshwater Sediment Toxicity Methods Committee
1994, 2001. Visiting Senior Scientist, Italian Institute for Hydrobiology.
1994, 1995, 1998, 1999. External Review Panel. Environmental Biology Research Program. Exploratory Research. Office of Research and Development, U.S. EPA.
1996. Visiting Senior Scientist, New Zealand Inst. of Water and Atmospheric Research.
1994-1997. NATO Senior Research Fellow, University of Coimbra, Portugal.
1993-1996. Board of Directors, Soc. of Environmental Toxicology and Chemistry
2002. Meeting Chair. 5th International Symposium on Sediment Quality Assessment.
1999-2001. U.S. EPA Scientific Advisory Panel, Office of Pesticide Programs
2001-2004, Editorial Board, Aquatic Ecosystem Health & Management and Chemosphere.
2000-2003. Brage Golding Distinguished Professor of Research.
2003-2006. World Council, Society of Environmental Toxicology & Chemistry

Recent Projects (select):

U.S. Environmental Protection Agency, Office of Exploratory Research. Sediment contamination assessment methods: validation of standardized and novel approaches. 1997-2000.
U.S. Environmental Protection Agency. Office of Exploratory Research. Intraspecies genetic diversity measures of environmental impacts. 1998-2001. Co-PI.
U.S. Environmental Protection Agency. Enhancement of Environmental Communication in the Lower Great Miami Basin: A Pilot Demonstration. 1999-2000. Co-PI.
City of Dayton. Stormwater Quality Assessment of Wolf Creek. 2003.
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Expertise Summary

Dr. Burton is an Environmental Sciences Professor of Research and Director of the Institute for Environmental Quality at Wright State University. He obtained a Ph.D. degree in Environmental Science from the University of Texas at Dallas in 1984. From 1980 until 1985 he was a Life Scientist with the U.S. Environmental Protection Agency. He was a Postdoctoral Fellow at the National Oceanic and Atmospheric Administration's Cooperative Institute for Research in Environmental Sciences at the University of Colorado. Since then he has had positions as a NATO Senior Research Fellow in Portugal and Visiting Senior Scientist in Italy and New Zealand. Dr. Burton has served on numerous national and international scientific committees and review panels, has had approx. $4.8 million in grants and contracts, and over 150 publications dealing with aquatic system responses to stressors.

See also: http://www.wright.edu/~allen.burton/burton