Friends of the Chicago River

Monitoring the Chicago River:

Assessing a Tool for River Improvement

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Executive Summary

A new vision of the Chicago River is emerging now that the waterway, once terribly polluted and regarded simply as a commercial canal, takes its place in the Chicago region as a centerpiece of urban life. More and more people see the River as a resource that offers abundant recreational opportunities, complements the neighborhoods it passes, and beautifies the metropolitan area.

The City of Chicago embraces and promotes these new uses and the new relationship that is developing between the River and the Chicago community. With the support of numerous organizations, including Friends of the Chicago River, the City has established specific goals against which progress can be measured.

Improvement goals for the River are:

1. A connected greenway along the River, with continuous multi-use paths along at least one side of the River;
2. Increased public access to the River through the creation of overlooks and public parks;
3. Restoration and protection of landscaping and natural habitats along the River, particularly fish habitat;
4. Development of the River as a recreational amenity, including twelve new canoe or boat launches and ten new fishing areas (some of which have already been built); and,
5. Increased economic development compatible with the River as an environmental and recreational amenity, such as streamside cafes and restaurants

This report explores one specific, but very important, tool for achieving these goals for the river: River monitoring. Friends asserts that to achieve the City's goals and the River's potential, further reductions in pollution and improved understanding of watershed function are needed. Enhanced water quality monitoring can help in both of these areas.

Friends created the Urban River Monitoring and Recovery Initiative (URMRI) to specifically assess the potential gains of improved monitoring of the River. To assist with the URMRI effort, Friends engaged the assistance of regional monitoring experts to develop an accurate description of recent and current River monitoring.

This report documents numerous monitoring activities in the Chicago region, specifically, within the Chicago River watershed. It does not provide the data from these monitoring activities or data analyses associated with them. It does characterize the more significant monitoring efforts and describe what types of data they provide. In doing so, it provides a comprehensive inventory of monitoring that can be used for the purpose of analyzing monitoring programs and processes.

The URMRI has determined that seven agencies have collected data from over 30 monitoring efforts, some of which are ongoing. These data come from nearly 300 locations throughout the watershed. The areas of focus of these monitoring activities include water chemistry, biological conditions, sediment chemistry, physical habitat, and water quantity. The periodicity of specific monitoring activities varies from hourly to a five-year cycle, or they may be triggered by an event, depending on the objective. Just as the range of what is, or has been, monitored is broad, the reason for the data collection is also. The purpose of monitoring activities ranges from regulatory compliance, basic assessment and data collection, to gathering input for model-making, providing public health advisories, and assessing the impact of pollution control practices.

Current monitoring efforts primarily support regulatory compliance. Secondary objectives include long-term data collection and basic assessment, to increase the understanding of specific conditions or to evaluate pollution control efforts. Short term impacts, such as the impacts of wet weather events or unpermitted discharges, are not the main focus of current monitoring efforts.

After reviewing the extensive monitoring efforts, Friends concludes that:

1. In numerous cases more monitoring is done than is required for either determining compliance with NPDES permits or assessing attainment of state water quality standards.
2. Data is typically interpreted only with respect to regulations; that is, in terms of compliance with NPDES requirements and attainment of water quality standards.
3. There is not a uniform baseline level of monitoring in the watershed. For example, minimal monitoring in the Lake County portion of the watershed impedes accurate or clear identification and understanding of the causes and sources of pollution.
4. There is insufficient communication and coordination between various levels of government and private entities to integrate the various monitoring programs. Guidance that would result in an integrated approach to monitoring is lacking.
5. Public health monitoring related to the River includes only monthly bacteriological samples and annual fish advisories.
6. Even though monitoring activities by different agencies have frequently occurred at common locations, the efforts were not, for the most part, linked or coordinated. The result is that there is extensive data and information for some locations. For other locations, the same volume and variety of information is not available.

With this perspective of monitoring in hand, the URMRI has pursued the question: *Can changes to the existing monitoring programs be useful in further improving the Chicago River?* In short, Friends responds, "Yes."

The existing monitoring efforts provide an essential core of information for improving the River. However, new expectations for the River beg new questions, which require responses. The recommendations that follow supplement and leverage current monitoring. During the writing of this report, projects to address some of the following recommendations have been initiated.

Friends of the Chicago River recommends:

1. A multi-entity partnership should be established to oversee and coordinate the use of monitoring efforts as a means to improve the River. Formal guidance from this partnership will help integrate and improve monitoring programs.
2. There should be a broader effort to better characterize sources of pollution to the River. Both the concentration and total load of pollutants should be considered.
3. Monitoring should be tailored to better identify sources of pollutants, including suspected unpermitted discharges. Monitoring should help the MWRD and other agencies become more effective in their ongoing efforts to detect unpermitted discharges.
4. A broad effort should be made to make monitoring data easily accessible, timely, and understandable to the public.
5. Better coordination should take place between public health agencies, stream regulatory agencies, and user groups to understand and communicate public health risks associated with River use.
6. A scientifically sound "report card" to measure progress against River improvement goals should be developed, regularly updated, and publicly distributed.
7. A dynamic model of the River should be available to appropriate agencies and institutions in order improve understanding of the River, measure the impact of input sources, and help guide decision making for River improvements. Such a model is under development by the MWRD.
8. During wet weather, the River itself should be monitored to supplement newly required monitoring of CSO discharges.
9. River monitoring should be expanded to include monitoring for narrative standards.
10. Assessment and monitoring of the River's riparian area should be increased.
11. A minimum (baseline) level of monitoring should be established throughout the watershed.
12. Ongoing identification and assessment of stressors limiting to aquatic biota should be incorporated into River monitoring.
13. The foregoing recommendations should be incorporated into the Use Attainability Analysis

Friends is committed to pursuing the implementation of these recommendations. They represent significant progress towards making a healthier, more enjoyable River a reality.

Section I - Background and Introduction

1.1 BACKGROUND

The Chicago River, (River; see Figure 1) once terribly polluted and regarded as a commercial canal and open sewer, is taking a new place in the Chicago region as a centerpiece of urban life. More and more people see the River as a resource that offers abundant recreational opportunities, complements the neighborhoods it passes, and beautifies the metropolitan area. Friends of the Chicago River (Friends) supports these changes.

Friend is not alone in promoting a healthier and more enjoyable River. The City of Chicago's 1999 Chicago River Corridor Development Plan and Development Guidelines, the 2000 Northeastern Illinois Water Trails Plan, the Tunnel and Reservoir Plan (TARP), the North Branch Watershed plan, and a variety of local river improvement projects each describe elements of an improved River. In particular, the City of Chicago River Corridor plan enumerates five overarching goals for the River in the city, which make up the most comprehensive list of articulated goals. The five goals are:

1. A connected greenway along the River, with continuous multi-use paths along at least one side of the River;
2. Increased public access to the River through the creation of overlooks and public parks;
3. Restoration and protection of landscaping and natural habitats along the River, particularly fish habitat;
4. Development of the River as a recreational amenity, including twelve new canoe or boat launches and ten new fishing areas (some of which have already been built); and,
5. Increased economic development compatible with the River as an environmental and recreational amenity, such as streamside cafes and restaurants.

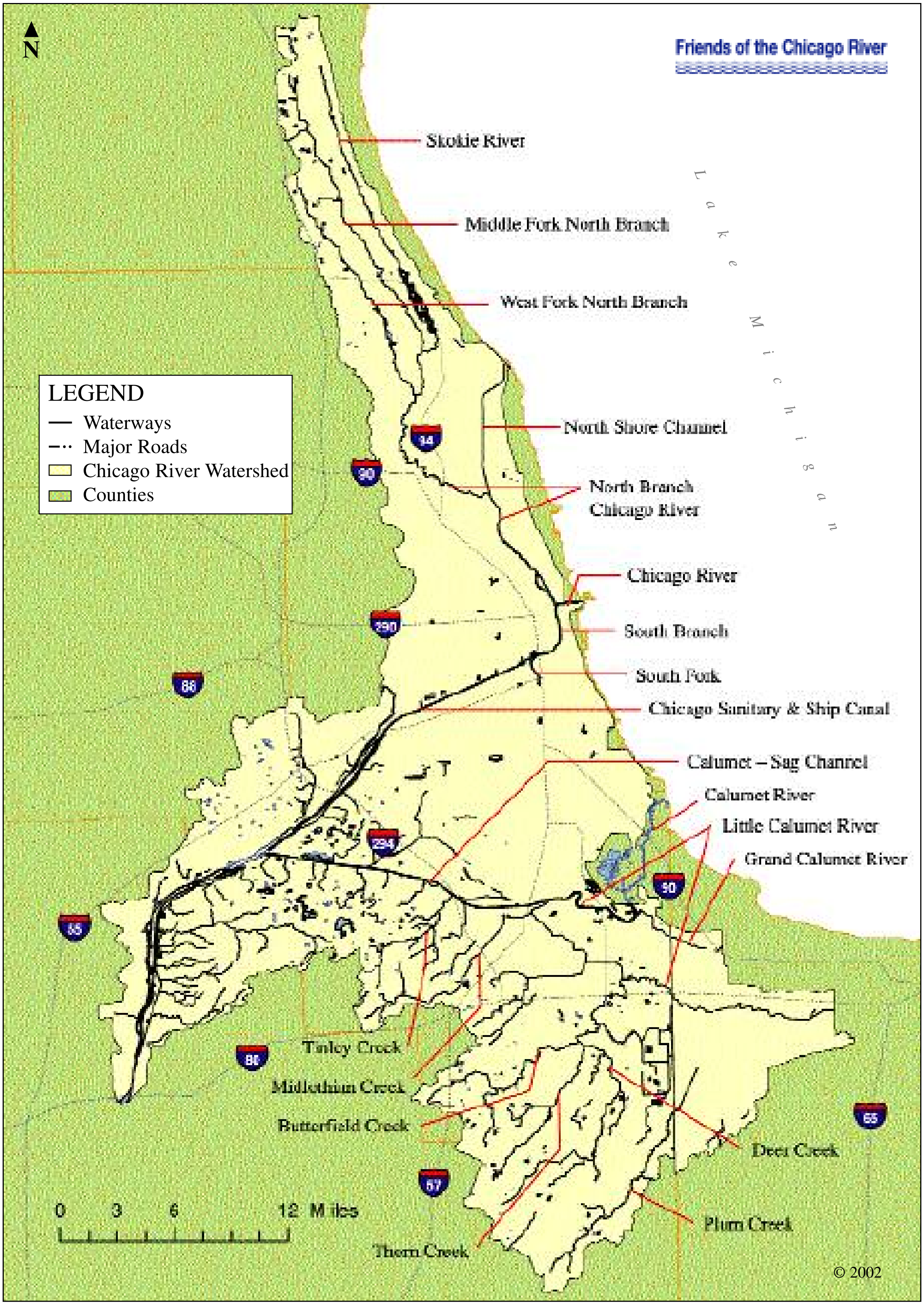
These five goals are in some ways prospective, anticipating future demands. In other ways, they encourage uses and activities that are not yet widespread but that the City would like to encourage. In yet other ways, these goals simply respond to demands that are already well demonstrated.

People are already paddling, rowing, and fishing without the aid of the formal designs proposed in the River plans. Commercial river bikes are already available in the downtown area. Friends inaugurated two years ago a widely popular River canoe race. The River has even played host in 2000 to a major professional B.A.S.S. fishing tournament. Local fishing enthusiasts have received an advisory from the Illinois Department of Public Health that limited River fish consumption is acceptable.

Friends believes that achieving the City's five goals minimally requires that:

- the River is aesthetically attractive (free of odor and visible pollution) and conveys the image of a River that is healthy and cared for;
- the River meets a water quality standard for the type of contact that is inherent in recreational uses such as paddling and rowing. Such a standard would be the equivalent of a "boating standard" currently in place in other states;
- the public is informed and able to evaluate the safety of recreational activities;
- the causes and sources of pollutants are well characterized and scientifically understood so that improvements can be achieved logically and efficiently and so that improvement projects can be evaluated for the actual benefits they provide;
- the public has ready access to current information describing and interpreting river conditions for the purposes of science, education, and general public interest;
- the quantity, diversity, and health of fish populations (game fish populations in particular) increase. Fish consumption by the public, though not encouraged at this time, is acknowledged and public education on fish advisories is widespread;
- the native plant and riparian animal species increase; and,
- River projects including restoration, landscaping, and public access (removal of fences, bank slope regrading, overlooks trails and rowing access) are numerous and widespread.

FIGURE 1: URMRI Study Area



The "traditional" services of the River — commercial navigation, transportation, wastewater conveyance, storm — and flood-water management — must still serve the region. Balancing the many uses of the River will be an ongoing challenge.

This report explores one specific, but very important, tool for achieving the new goals for the River: River monitoring. Monitoring is important because it gauges the condition of the River, allows people to assess trends in the River's condition, and ultimately provides the data used in policy decisions for the waterway. In short, monitoring is the way we find our facts and provides the base for our formal understanding of the River.

Friends asserts that improving the River requires new understandings of the River that can be gained by monitoring. Therefore, Friends created the Urban River Monitoring and Recovery Initiative (URMRI). This project specifically assesses the potential gains of increased monitoring of the River (See Figure 1, URMRI Study Area). To assist with the URMRI effort, Friends has engaged the assistance of regional monitoring experts to develop an accurate description of current River monitoring. With that picture of the existing monitoring in hand, the URMRI has pursued the question:

Can changes to the existing monitoring programs be useful in further improving the Chicago River?

Friends responds, "Yes." This report details our response, as well as our summary of the existing monitoring programs.

This report primarily explores the potential gaps in the existing monitoring regime with regards to an emerging vision of the River. The report first catalogues what information is already being gathered by current monitoring. It concludes with recommendations based upon what existing gaps can be filled. **It is important to recognize that all of the monitoring programs detailed in the report (Section II), and summarized in Appendix A, satisfy and in some cases exceed the current regulations bearing on any of the monitoring agencies. Much of the monitoring that is carried out on the Chicago River is performed by the agencies described in the absence of a specific mandate to do so.** Friends applauds this good work. It is because of the work of agencies responsible for the Chicago River that new goals for the River have emerged at all.

1.2 PROJECT PARTICIPANTS

To provide an accurate representation of regular sampling and monitoring efforts on the Chicago River in Section II, Friends assembled a Technical Advisory Committee to assist in the gathering of relevant information. David Ullrich, Deputy Regional Administrator of US Environmental Protection Agency, Region 5, chaired the Committee. Participating members of the Technical Advisory Committee also included:

- Paul Anderson, Illinois Institute of Technology
- Kathy Baskin, Charles River Watershed Association
- Dennis Dreher, Northeastern Illinois Planning Commission
- Jim Filippini, US Environmental Protection Agency, Region 5
- Tom Fogarty, US Army Corps of Engineers, Chicago Division
- Toby Frevert, Illinois Environmental Protection Agency
- Gregg Good, Illinois Environmental Protection Agency
- George Groschen, United States Geological Survey
- Donald Hey, The Wetlands Initiative
- Mardi Klevs, US Environmental Protection Agency, Region 5
- Richard Lanyon, Metropolitan Water Reclamation District of Greater Chicago
- Gail Merritt, independent consultant
- Laurene von Klan, Friends of the Chicago River
- Todd Wildermuth, independent consultant

The Committee members provided excellent guidance to the project, helped verify the accuracy of Section II, and helped develop the recommendations in Section III. **However, this written report is strictly the work product of Friends of the Chicago River and does not necessarily represent the view of all Committee members or the agencies they represent. This report is not officially endorsed by any of the agencies represented by members of the Technical Advisory Committee.**

1.3 REPORT OBJECTIVES AND OUTLINE

Friends received a grant from the Joyce Foundation to develop Phase One of URMRI. In accordance with the grant agreement, Friends:

- summarized all of the existing monitoring efforts on the River,
- evaluated whether existing monitoring programs are appropriate for meeting the high expectations for an improved River,
- recommended a series of enhancements to existing monitoring efforts,
- provided a written summary of conclusions (this report), and
- will disseminate the report to other urban watersheds in the Great Lakes drainage.

This report is organized into three parts following the introduction. Section II describes all of the significant and ongoing monitoring efforts on the River. Section II is a largely objective summary of clear facts that have been verified by agencies responsible for collecting data. Section II provides the necessary factual basis for Section III. Section III introduces Friends' recommendations for making monitoring more consistent with the emerging goals for the Chicago River. Section IV briefly concludes the report and summarizes Friends' list of recommended actions.

Friends has not attempted to provide an exhaustive recapitulation of all existing data and data analysis in Section II. Instead, we have tried to characterize in some detail the more significant existing monitoring efforts and describe what types of data they provide. This approach allows the reader to determine what kinds of data do and do not exist, without having to wade through large amounts of raw data or technical analysis. Readers who are interested in raw data and formal data analysis may consult the references provided (See Bibliography).

Section II - Monitoring Agencies and Programs

2.1. INTRODUCTION

Section II primarily describes the most regular monitoring efforts on the River as carried out by two agencies, the Metropolitan Water Reclamation District of Greater Chicago (MWRD or the District) and the Illinois Environmental Protection Agency (IEPA or the Agency). These two agencies provide nearly all of the annual monitoring data for the River and, accordingly, the programs they carry out are explored thoroughly in Sections 2.2 and 2.3.

Sections 2.4 through 2.7 describe significant one-time or occasional sampling efforts by agencies other than the IEPA or MWRD. Though these efforts by additional agencies are not assured to continue, they represent some of the important special-needs monitoring efforts that have taken place recently on the River and are therefore included here.

Section 2.8 describes the efforts of the US Geological Survey (USGS) in the Chicago River watershed. Though the USGS collects few water quality data on the River, the agency is the most significant source of water *quantity* data for the River. Ultimately, water quantity data are just as necessary as water quality data to evaluate the condition of the River, so a description of the USGS stream gage network on the River is provided.

All monitoring activities discussed in Section II are summarized in Appendix A.

2.2 THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO (MWRD)

2.2.1 Water Chemistry Sampling Programs

Ambient Water Quality Monitoring Program

What:	62 parameters (see Table 1)
Where:	39 locations (see Figure 2 and Table 2)
When:	Once a month for most (see Table 1)
Why:	To evaluate waterway compliance with IPCB water quality standards
How:	Grab samples collected from bridges
Data Form:	Annual print reports; digital database dates to 1970
Data Archive:	1970 to current

To evaluate compliance with Illinois Pollution Control Board (IPCB) water quality standards in the Chicago River (35 Ill. Adm. Code ß 301 et seq.), the MWRD has performed water quality monitoring since 1970. Since 1972, the MWRD has maintained an extensive ambient water quality monitoring (AWQM) program to provide most of the data on the condition of the waterway. In 2001, the IEPA approved the District's AWQM Quality Assurance Project Plan (MWRD 2001c) certifying that the District's data are of high enough quality to be used in the state's Clean Water Act reporting. With this recent approval, the MWRD explains its current AWQM goals as follows:

> The Primary objective of the chemical water quality monitoring program is to provide current data to the Illinois Environmental Protection Agency (IEPA) for assessing chemical waterway impairment in the District's service area through the 305 (b) use assessment and the 303 (d) listing process. Secondary objectives are to expand and enhance the long-term database of ambient chemical water quality in the Chicago metropolitan area, and to determine effects of pollution control activities on water quality (Tata 2001b, 1).

The AWQM program has remained largely constant during the period 1972-2001 with respect to monitoring station locations and measured parameters. Presently, the District's AWQM system consists of 39 locations on the Chicago River program (see Figure 2 and Table 2). The locations of these monitoring stations were primarily selected to ensure that at least one monitoring station was at the lower end of an IEPA 303 (d) waterway segment. Other criteria used to select station locations were above and below MWRD wastewater treatment plants (WWTPs), above the junction of two major waterways, below municipal boundaries, below Lake Michigan diversion points, and in areas of environmental concern (Tata 2001a).

As shown in Table 1, 58 water quality parameters are measured monthly at each of the stations, and E. coli and benzene, ethyl benzene, toluene, and xylene (BETX) are measured quarterly. Volatile organic compounds and organic priority pollutants are analyzed twice a year at each station. All parameters for which there are IPCB standards in General Use waters are measured by the District.

FIGURE 2: MWRD Ambient Water Quality Monitoring Locations

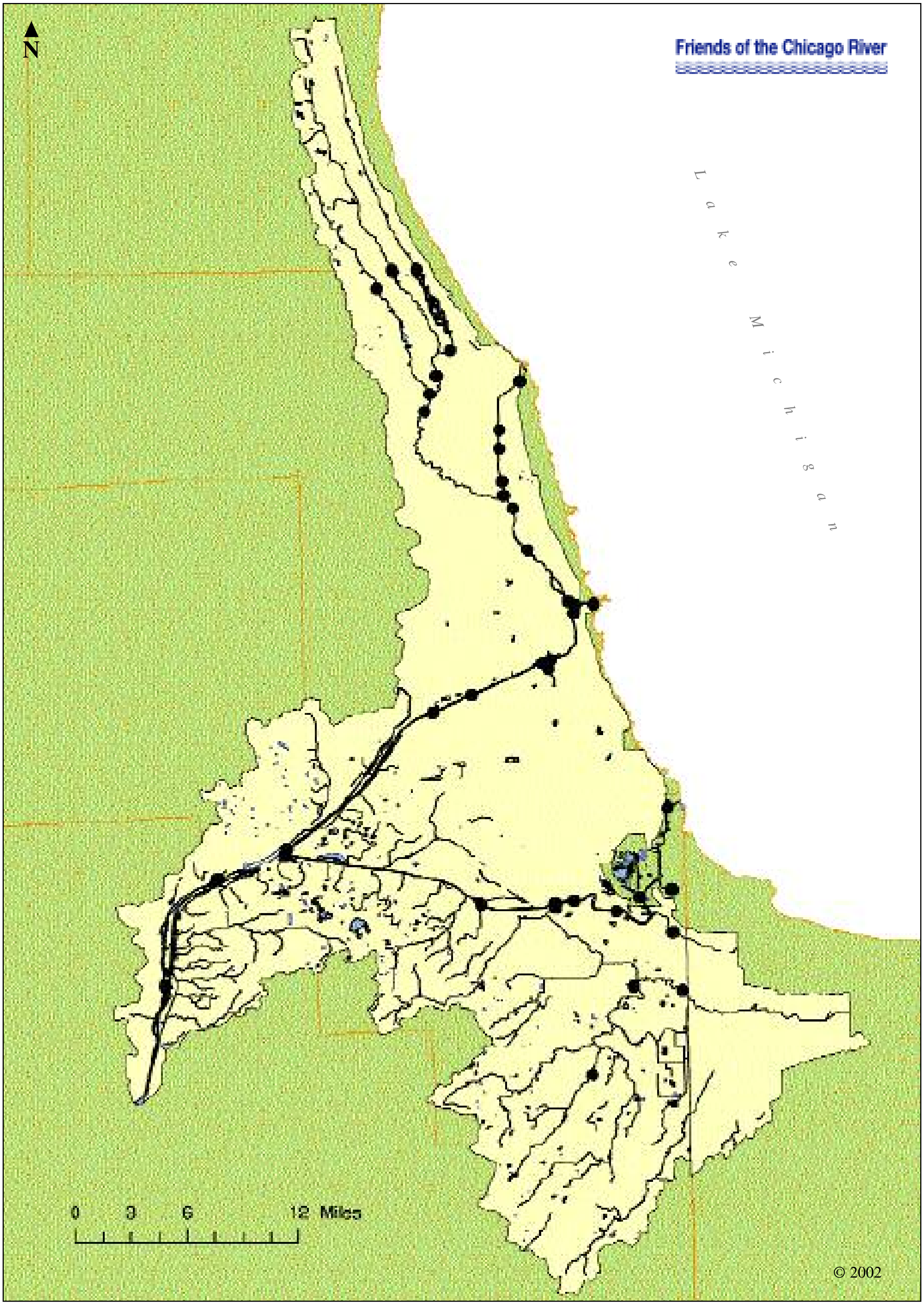


Table 1 – MWRD AWQM Analytes and Sampling Frequency (Tata 2001a)

Constituent	Sampling Frequency
Water Temperature	Monthly
pH	Monthly
Dissolved Oxygen	Monthly
5-Day Carbonaceous BOD	Monthly
5-Day Total BOD	Monthly
Total Organic Carbon	Monthly
Phenols	Monthly
BETX	Quarterly
Volatile Organic Compounds	Semi-Annually
Organic Priority Pollutants	Semi-Annually
Total Dissolved Solids	Monthly
Total Suspended Solids	Monthly
Total Kjeldahl Nitrogen	Monthly
Ammonia Nitrogen	Monthly
Nitrite + Nitrate Nitrogen	Monthly
Total Phosphorus	Monthly
Soluble Phosphorus	Monthly
Sulfate	Monthly
Alkalinity	Monthly
Chloride	Monthly
Turbidity	Monthly
Fluoride	Monthly
Oil and Grease	Monthly
Total Cyanide	Monthly
WAD Cyanide	Monthly
Total Arsenic	Monthly
Total Barium	Monthly
Total Boron	Monthly
Total Cadmium	Monthly
Total Calcium	Monthly
Total Chromium	Monthly

Constituent	Sampling Frequency
Total Copper	Monthly
Total Iron	Monthly
Total Lead	Monthly
Total Magnesium	Monthly
Total Manganese	Monthly
Total Mercury	Monthly
Total Nickel	Monthly
Total Selenium	Monthly
Total Silver	Monthly
Total Zinc	Monthly
Dissolved Arsenic	Monthly
Dissolved Barium	Monthly
Dissolved Boron	Monthly
Dissolved Cadmium	Monthly
Dissolved Calcium	Monthly
Dissolved Chromium	Monthly
Dissolved Copper	Monthly
Dissolved Iron	Monthly
Dissolved Lead	Monthly
Dissolved Magnesium	Monthly
Dissolved Manganese	Monthly
Dissolved Mercury	Monthly
Dissolved Nickel	Monthly
Dissolved Selenium	Monthly
Dissolved Silver	Monthly
Dissolved Zinc	Monthly
Gross Alpha Radioactivity	Monthly
Gross Beta Radioactivity	Monthly
Fecal Coliform	Monthly
E. Coli	Quarterly
Chlorophyll a	Monthly

Table 2 – MWRD AWQM Stations and Locations (Tata 2001a)

Station Location	Station Number	Waterway
Dundee Road	106	West Fork North Branch Chicago River
Golf Road	103	West Fork North Branch Chicago River
Lake-Cook Road	31	Middle Fork North Branch Chicago River
Lake-Cook Road	32	Skokie River
Frontage Road	105	Skokie River
Glenview Road	104	North Branch Chicago River
Dempster Street	34	North Branch Chicago River
Albany Avenue	96	North Branch Chicago River
Central Street	35	North Shore Channel
Oakton Street	102	North Shore Channel
Touhy Avenue	36	North Shore Channel
Foster Avenue	101	North Shore Channel
Wilson Avenue	37	North Branch Chicago River

Table 2 – continued

Station Location	Station Number	Waterway
Diversey Parkway	73	North Branch Chicago River
Grand Avenue	46	North Branch Chicago River
Lake Shore Drive	74	Chicago River
Wells Street	100	Chicago River
Madison Street	39	South Branch Chicago River
Loomis Street	108	South Branch Chicago River
Archer Avenue	99	South Fork South Branch Chicago River
Damen Avenue	40	Chicago Sanitary and Ship Canal
Cicero Avenue	75	Chicago Sanitary and Ship Canal
Harlem Avenue	41	Chicago Sanitary and Ship Canal
Route 83	42	Chicago Sanitary and Ship Canal
Stephen Street	48	Chicago Sanitary and Ship Canal
Lockport	92	Chicago Sanitary and Ship Canal
Ewing Avenue	49	Calumet River
Burnham Avenue	50	Wolf Lake
130th Street	55	Calumet River
Burnham Avenue	86	Grand Calumet River
Indiana Avenue	56	Little Calumet River
Halsted Street	76	Little Calumet River
Wentworth Avenue	52	Little Calumet River
Joe Orr Road	54	Thorn Creek
170th Street	97	Thorn Creek
Ashland Avenue	57	Little Calumet River
Ashland Avenue	58	Cal-Sag Channel
Cicero Avenue	59	Cal-Sag Channel
Route 83	43	Cal-Sag Channel

District sampling teams collect water quality samples from the North Branch of the Chicago River on the second Monday of each month, from the South Branch and Chicago Sanitary and Ship waterways on the third Monday, and from the Calumet waterways on the fourth Monday, always between 7 a.m. and 2 p.m. (Tata 2001a). At the Lockport Powerhouse, where the Chicago River flows into the Des Plaines River and through which all of the River flow passes, the District currently collects a grab sample of the same 58 parameters typically measured each month at other AWQM stations. From 1974 through 1995 the MWRD collected daily composites at Lockport; from 1996 through 1997 the MWRD collected weekly composites at Lockport.

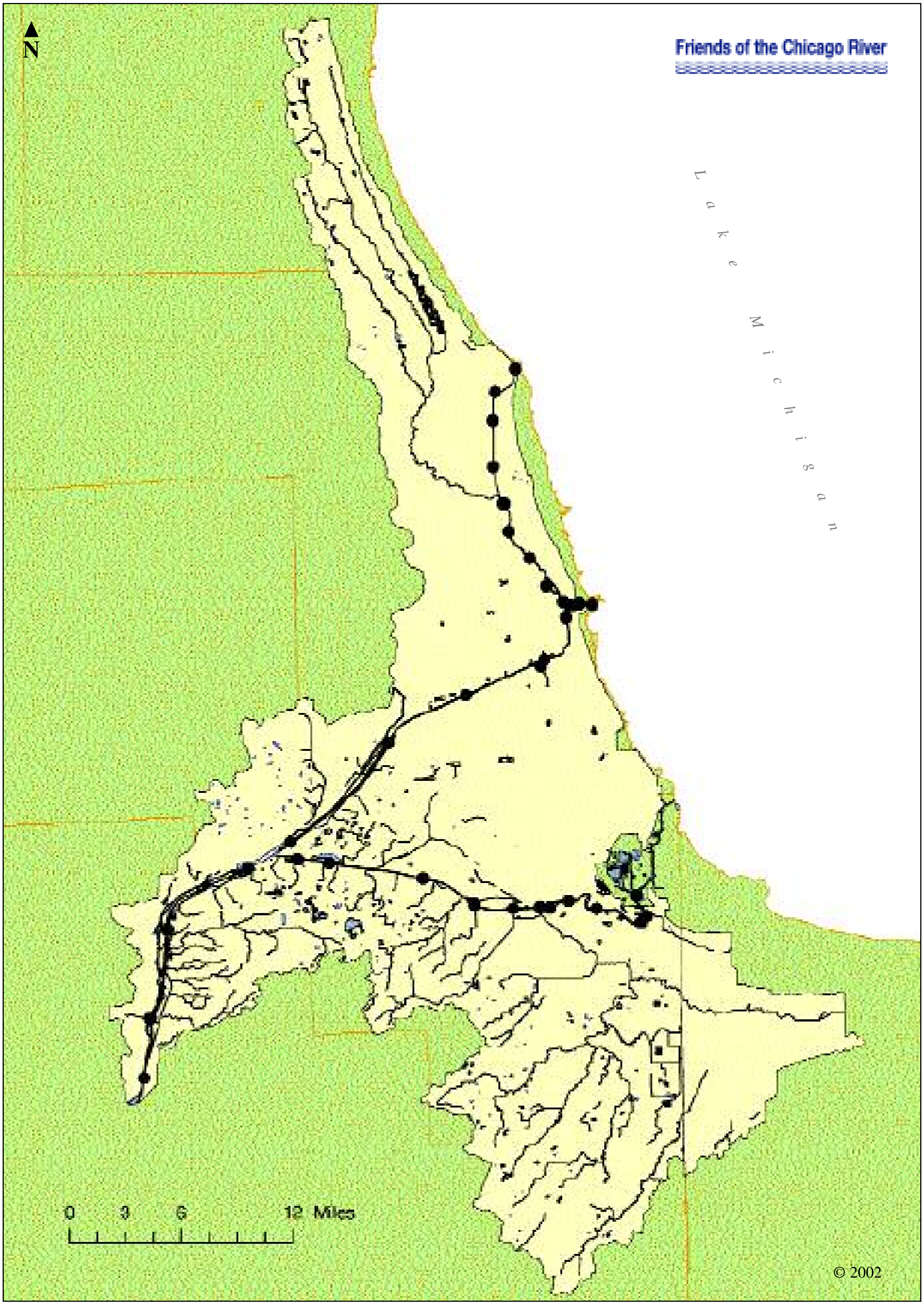
All current AWQM samples on the River are grab samples gathered manually from bridges, using plastic and stainless steel buckets. All grab samples are collected from the center of the stream on the upstream side of the bridge; the District claims that the River is well mixed and that a sample from the center of the stream is representative of the station's cross-section. Grab samples are chilled and delivered to the District's analytical laboratory at Stickney the same day the samples are collected. The only parameters measured directly in the field are pH and temperature (*MWRD 2001b*).

The District has published annual water quality summaries for the AWQM data collected between 1970 and 1998. Raw data are available electronically for 1970 to the present.

Dissolved Oxygen (DO) Monitoring

What:	Dissolved Oxygen
Where:	34 locations (see Figure 3)
When:	Hourly, 24 hours a day
Why:	To locate and identify reaches not meeting IPCB standard
How:	Continuous monitor in protective piping
Data Form:	Occasional print reports
Data Archive:	August 1998 to current

FIGURE 3: MWRD Dissolved Oxygen Monitoring Locations



In addition to monthly dissolved oxygen (DO) monitoring through the AWQM program, the MWRD operates a series of continuous DO monitors on the River to evaluate compliance with applicable Pollution Control Board standards. In the General Use portions of the River, the Board requires a DO concentration no less than 6.0 mg/l for 16 hours a day and no less than 5.0 mg/l at any time (35 Ill. Adm. Code ß 302.206). In the Secondary Contact portions of the River, the DO must be at least 4.0 mg/l at all times in Secondary Contact waters (35 Ill. Adm. Code ß 302.405) except for the navigable portion of the Little Calumet River and the Cal-Sag Channel where the DO must be at least 3.0 mg/l at all times (Ibid.).

The high organic loadings to the River, in combination with the slow velocity throughout much of the deep-draft portions of the waterway, has contributed to low DO concentrations in the River for decades. In the 1970s the MWRD installed instream diffuser systems and in the 1990s built sidestream elevated pool aeration stations, both in an attempt to increase the concentration of DO to the levels required by Board standards. From October 1994 through May 1996, weekly DO monitoring on the River showed that certain portions of the waterway still exhibited DO concentrations less than the applicable standards. To better understand these conditions with more than once-per-month grab samples, the MWRD began a two-year continuous monitoring program along the deep draft portions of the River. This more detailed data will allow the MWRD to determine if additional supplemental aeration is needed to comply with the IPCB standards for DO.

The continuous DO monitoring program began in August 1998 and has now been extended through 2003. The current program consists of 34 stations (see Figure 3) that were selected based on (a) a history of low DO concentrations at a location, (b) a location above or below a waterway confluence, (c) a proximity to instream aeration stations, (d) a near proximity to wastewater pumping stations, or (e) a location above or below the Calumet, North Side, and Stickney WWTPs.

DO data are collected using automatic monitors housed in protective stainless steel pipes. The monitoring device used for data collection is a YSI Model 6920 continuous water quality monitor and is protected in one of two different ways. Some monitors are placed in a three-foot pipe suspended 1 foot off the River bottom and oriented so that the flow passes through the pipe. Alternatively, other monitors are deployed using a 12- to 15-foot pipe with multiple 2-inch openings, which is vertically mounted on the side of a bridge abutment, dock wall, or pier.

An MWRD team services the monitors weekly by boat. On each trip, the team draws an independent grab sample at the monitoring location for lab verification, retrieves the monitor from the field, and replaces the monitor with one that has been previously calibrated in the laboratory. Retrieved monitors are returned to the lab to have their 7-day data downloaded and are cleaned, serviced, calibrated, and stored in the lab before they are returned to the field. Downloaded DO data are quality assured by checking (1) the last DO value of the data set against the grab sample analytical result, (2) the last DO value of the data set against the first DO value of the next week's data set, and (3) a DO value measured in the holding tank by a retrieved monitor against the lab analysis of DO value in the holding tank.

The District has published a preliminary report describing the data collected from August 1998 through July 1999 (MWRD 2001c). A second report will follow that will "include DO data from the second year of monitoring (August 1999 through July 2000) and discuss the impact of the operation of the instream aeration stations, discretionary diversion from Lake Michigan, and the combined sewer overflows on DO levels in the waterways." (Ibid., ix). The District will also use this continuous data in the development of a water quality model as described below.

High Flow Water Quality Monitoring

What:	13 parameters (see Table 3)
Where:	Little Calumet River at Albany Avenue (MWRD AWQM #57) North Branch at Albany Avenue (MWRD AWQM #96)
When:	High flow periods, up to 150 times in 2001
Why:	Development of an unsteady-state model of the River
How:	Grab samples collected from bridges over 8-hour intervals
Data Form:	Spreadsheet
Data Archive:	2001

Beginning in 2000, the MWRD contracted with the Institute for Urban Environmental Risk Management at Marquette University to develop an unsteady-state hydraulic and water quality mathematical model of the Chicago River waterway system. This monitoring effort is not an ongoing one and will be continued only until the necessary data for the River model are collected.

To develop the water quality portion of the model, the Institute needs pollutant loading data for nonpoint sources during storm runoff periods. Thus, the District has undertaken, or will undertake, short-term sampling programs for tributaries and pumping stations. In the first program, the District will obtain samples for high flow water quality data on two tributaries to the River, the North Branch and the Little Calumet River. The water quality data together with USGS flow data will provide loading quantities for storm events. The District has developed a sampling protocol to acquire these data at 8-hour intervals whenever the waterways are above a certain stage - 3.0 feet or higher at the USGS gage at Albany Avenue for station #57 and 8.0 feet or higher at the USGS gage at Cottage Grove Avenue for station #96. MWRD estimates that approximately 150 samples were collected for this program in 2001 (Lanyon 2001).

The District does not plan to publish the water quality data separately, but the data will be available in spreadsheet format. The Institute will combine the water quality data with USGS flow data and include the loadings in their report.

Combined Sewer Overflow (CSO) Discharge at Three Pumping Stations

What:	13 parameters (see Table 3)
Where:	Racine Avenue Pumping Station North Branch Pumping Station 125th Street Pumping Station
When:	July-November 2001
Why:	Development of an unsteady-state model of the River
How:	Automatic samplers (Racine Ave., North Branch), Manual Samples (125th St.)
Data Form:	Spreadsheet
Data Archive:	July-November 2001

As part of the effort to model unsteady-state conditions in the River, the MWRD has conducted a one-season effort to collect samples during discharge events at three major CSO pumping stations (Kukielka 2001). At each pumping station, three sampling events will take place, each beginning at the onset of pumping and for at least six hours thereafter. Pumping commences at each pumping station under different conditions so the samples may not be collected simultaneously.

At each station, one-gallon aliquots have been collected from pumped discharge every 15 minutes for the first three hours of the event, every 30 minutes for the next three hours, and then every 60 minutes until pumping to the River ceases, or until 12 total hours have passed. All samples were immediately tested in the field for temperature, pH, and DO. The remaining ten constituents in Table 3 were analyzed in the laboratory.

The District does not plan to publish the water quality data separately, but the data will be available in spreadsheet format. The Institute will combine the water quality data with USGS flow data and include the loadings in their report.

Table 3 – MWRD High Flow and CSO Pumping Station Discharge Monitoring Analytes

Temperature
pH
Chloride
Specific Conductance
Total Kjeldahl Nitrogen as Nitrogen
Organic Nitrogen as Nitrogen
Ammonia as Nitrogen
Nitrite + Nitrate as Nitrogen
Total Phosphorus
Soluble Phosphorus
5-Day Carbonaceous BOD
Dissolved Oxygen
Total Suspended Solids

Discharge from IDOT Expressway Pumping Stations

What:	13 parameters (See Table 3)
Where:	IDOT Pumping Stations 3, 5, 27, and 29
When:	2002
Why:	Development of an unsteady-state model of the River
How:	Automatic samplers
Data Form:	Spreadsheet
Data Archive:	2002

The Illinois Department of Transportation (IDOT) maintains four major storm lift pumping stations that discharge to the River. These stations pump storm water runoff that drains from major regional roads during significant rain events. The four major IDOT pumping stations that drain to the River are:

- Lift Station #3: Edens Expressway (I-94) at Forest Glen Avenue
- Lift Station #5: Eisenhower Expressway (I-290) at Des Plaines Street
- Lift Station #29: Dan Ryan Expressway (I-90/94) at 24th Street
- Lift Station #27: Bishop Ford Freeway (I-94) at 110th Street

To assess the impact of discharges from storm lift pumping stations, the MWRD has received permission from IDOT to install automatic sampling devices at the outlets of the pumping stations and has developed a sampling protocol for the sites (Renaud, 2001). The District will continue to sample these sites for an indefinite period of time.

MWRD automatic samplers at these locations will either be programmed for a 24-hour composite or for program start via a float switch. Samplers will be programmed to obtain four samples composited into a single bottle at fifteen minute intervals. The samplers will be serviced daily on Monday through Friday by MWRD staff.

Discharge events will be defined for this monitoring effort as runoff events lasting four hours or more; discharge events shorter in duration than four hours are considered insufficient to provide an adequate composite. Each composite sample will be analyzed for the 13 parameters in Table 3.

NPDES Discharge Monitoring Reports for Wastewater Treatment Plants

What:	Over 100 parameters (See Table 4)
Where:	North Side WWTP Stickney WWTP Calumet WWTP
When:	Continuous, daily and occasionally (See Table 4)
Why:	NPDES requirements of Clean Water Act
How:	Grab and composite samples (See Table 4)
Data Form:	DMRs to IEPA
Data Archive:	1978-present

The Clean Water Act National Pollutant Discharge Elimination System (NPDES) requirements mandate that direct dischargers to a stream receive a permit from the state. Accordingly, the MWRD has NPDES permits for all of its wastewater treatment plants (WWTPs) on the River: North Side, Stickney, Calumet, and Lemont. Given that approximately 70% of the total annual flow passing through the outlet control facilities at Lockport is treated effluent from MWRD treatment plants, the makeup of that effluent is extremely influential on the water quality of the River. Thus, the monthly discharge monitoring reports (DMRs) for these treatment plants offer a substantial data set for the study of the quality of River water.

Table 4 provides the constituents, sampling frequency, and sampling type reported to the IEPA by the MWRD to fulfill the requirements of the MWRD largest WWTP permit (IEPA 1987b, 2001). Note that the table lists the monitoring requirements of the District's current permit at the Stickney facility, as well as the proposed monitoring requirements under the draft permit of 2000.

Table 4 – NPDES Monitoring at the primary discharge point of the MWRD Stickney WWTP under current and proposed permits (IEPA 1987, 2001)

Constituent	Sample Frequency	Sample Type
Flow Rate	Continuous	—
$CBOD_5$	Daily	Composite
Suspended Solids	Daily	Composite
pH	Daily	Grab
Ammonia Nitrogen	Daily	Composite
Dissolved Oxygen	Daily	Grab
Cyanide*	Daily	Composite
Ammonia Nitrogen, un-ionized*	Daily	Composite
Lead*	Daily	Composite
Total Antimony	Weekly	Composite
Total Arsenic	Weekly	Composite
Total Barium	Weekly	Composite
Total Beryllium	Weekly	Composite
Total Cadmium	Weekly	Composite
WAD Cyanide**	Weekly	Composite
Total Chromium	Weekly	Composite
Hexavalent Chromium	Weekly	Composite/Grab†
Total Copper	Weekly	Composite
Total Cyanide	Weekly	Composite
Total Fluoride**	Weekly	Composite
Total Iron	Weekly	Composite
Dissolved Iron**	Weekly	Composite
Total Lead	Weekly	Composite
Total Manganese	Weekly	Composite

Table 4 – continued

Constituent	Sample Frequency	Sample Type
Total Mercury	Weekly	Composite
Total Nickel	Weekly	Composite
Total Selenium	Weekly	Composite
Total Silver	Weekly	Composite
Total Thallium	Weekly	Composite
Total Zinc	Weekly	Composite
Phenols	Weekly	Composite
Hexane-soluble Oils	Weekly	Grab
111 Organic Priority Pollutants	Annually	Composite

* *Constituent in existing permit not present in proposed permit*
** *Constituent in proposed permit not present in existing permit*
† *Composite sample in existing permit, grab sample in proposed permit*

2.2.2 Biological Sampling Programs

Fish Population Monitoring

What:	Fish
Where:	Various locations on River, 1974-1996 (see Figure 4) North Branch, 1996-7 (see Figure 5)
When:	July and August 1974-1997
Why:	To characterize water quality by inference and assess effects of pollution control activities by the MWRD
How:	Boat-mounted and backpack electrofishers, bag seine nets
Data Form:	Occasional printed reports
Data Archive:	1974-1997

From 1974 through 1996, the MWRD conducted between one and five fish sampling events per year at approximately twenty stations along the River, excluding the North Branch (see Figure 4). Most stations were sampled once or twice per year from 1974 through 1977, three or four times per year from 1985 through 1991, and twice per year from 1992 through 1996.

At each station, the District typically used a 230-volt boat-mounted electrofisher to sample fish populations along both sides of a 400-meter section of the waterway. The MWRD then calculated from the 1974-1996 data the following parameters:

- The number of fish species;
- The species composition of the sampled population;
- The relative abundance of fish or "catch per unit effort";
- The Bluegill Toxicity Index; and,
- The Index of Biotic Integrity (IBI).

In July and August of 1996 and 1997, the MWRD sampled fish populations at nine sampling stations on the shallow stream portion of the North Branch (i.e., upstream of the confluence of the upper North Branch with the North Shore Channel). Four stations were located on the North Branch proper, two stations on the Skokie River, two stations on West Fork, and one station on the Middle Fork (see Figure 5). Using either a backpack electrofisher or a 25-foot bag seine, MWRD staff would typically sample a segment approximately 40 meters in length along both banks. All fish were identified to species, weighed, measured for length, and examined for anomalies (e.g., parasites). Large fishes were evaluated in the field and returned alive to the River. From this fish data, the District calculated species composition, abundance, and an IBI for each station.

Two MWRD documents summarize the fish monitoring programs and results on the River through 1997 (MWRD 1998, 2001a).

FIGURE 4: MWRD Fish Population Monitoring (1974-1996)

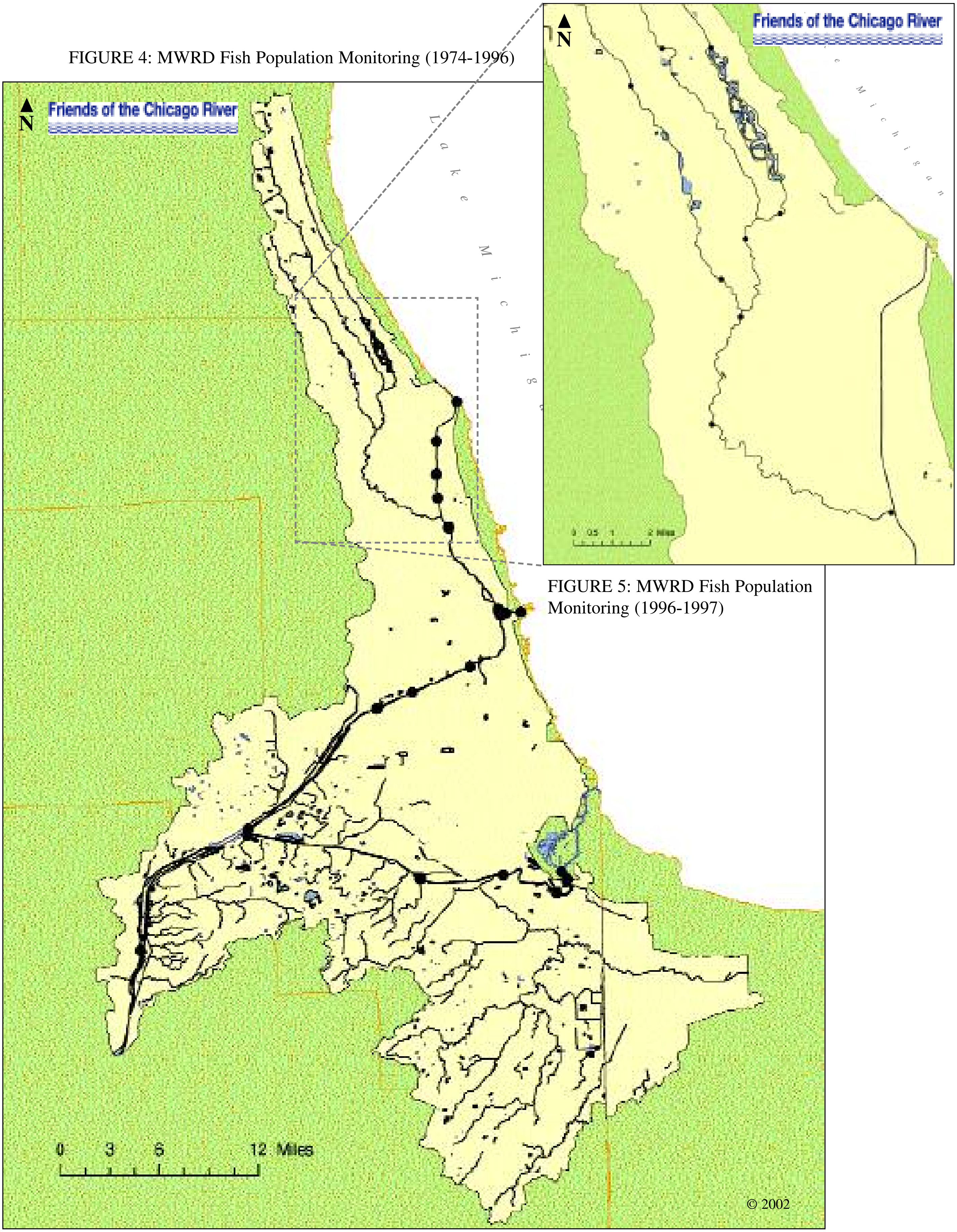


FIGURE 5: MWRD Fish Population Monitoring (1996-1997)

Biological Conditions Monitoring

What:	Fish, Benthic Invertebrates
Where:	39 stations (same as AWQM stations - see Figure 2)
When:	July and August starting in 2001
Why:	Part of an integrated monitoring program to provide data to IEPA for state's Clean Water Act reporting and listing requirements
How:	Fish: boat-mounted and backpack electrofishers, bag seine net Benthic Invertebrates: petite Ponar Grab sampler, artificial substrates
Data Form:	Undecided
Data Archive:	None available yet

In 2001, the MWRD initiated an integrated River monitoring program encompassing regular biological, sediment, and physical habitat monitoring. (See sections 2.2.3 and 2.2.4, respectively, for descriptions of the new sediment and physical habitat monitoring programs.) As with the District's AWQM program, the primary purpose of these expanded monitoring programs is to provide data to the IEPA for use in the state's Clean Water Act reporting and listing requirements (Tata 2001b).

Using the same 39 stations as the AWQM program (Figure 2), the MWRD will conduct summer sampling of both fish and benthic invertebrate populations. Nine stations were selected, primarily due to their proximity to District WWTPs, for annual sampling to describe the biological conditions in the Chicago area waterways. Starting in 2001, the stations sampled annually on the River are:

- North Branch at Albany Avenue (96)
- North Shore Channel at Touhy Avenue (36)
- North Branch at Grand Avenue (46)
- Sanitary and Ship Canal at Cicero Avenue (75)
- Sanitary and Ship Canal at Harlem Avenue (41)
- Sanitary and Ship Canal at Lockport (92)
- Calumet River at 130th Street (55)
- Little Calumet River at Halsted Street (76)
- Cal-Sag Channel at Cicero Avenue (59)

The remaining thirty stations will be sampled as follows:

- In year one of the cycle (North Branch watershed):
  West Fork North Branch at Dundee (106)
  West Fork North Branch at Golf Road (103)
  Middle Fork North Branch at Lake-Cook Road (31)
  Skokie River at Lake-Cook Road (32)
  Skokie River at Frontage Road (105)
  North Branch at Glenview Road (104)
  North Branch at Dempster Street (34)
  North Shore Channel at Central Street (35)
  North Shore Channel at Oakton Street (102)
  North Shore Channel at Foster Avenue (101)
  North Branch at Wilson Avenue (37)
  North Branch at Diversey Parkway (46)
- In year two of the cycle (South Branch and Sanitary & Ship watersheds):
  Chicago River at Lake Shore Drive (74)
  Chicago River at Wells Street (100)
  South Branch Chicago River at Madison Street (39)
  South Branch Chicago River at Loomis Street (108)
  South Fork South Branch Chicago River at Archer Avenue (99)
  Chicago Sanitary & Ship Canal at Damen Avenue (40)
  Chicago Sanitary & Ship Canal at Route 83 (42)
  Chicago Sanitary & Ship Canal at Stephen Street (48)
- In year three of the cycle (Calumet watershed):
  Calumet River at Ewing Avenue (49)
  Wolf Lake at Burnham Avenue (50)
  Grand Calumet River at Burnham Avenue (86)
  Little Calumet River at Indiana Avenue (56)
  Little Calumet River at Wentworth Avenue (52)
  Thorn Creek at Joe Orr Road (54)
  Thorn Creek at 170th Street (97)
  Little Calumet River at Ashland Avenue (57)
  Cal-Sag Channel at Ashland Avenue (58)
  Cal-Sag Channel at Route 83 (43)

In the fourth year of the cycle, the District will sample the Des Plaines River watershed. Sampling crews return to the North Branch watershed in the fifth year, starting the cycle over.

Crews will collect two benthic invertebrate samples along a transect at each station using a Ponar Grab device. The team will take one sample from the center of the stream, and second from either side of the stream. The District will use triplicate Hester-Dendy artificial substrates to quantitatively sample the benthic community. To sample fish, the MWRD crews will use a boat-mounted electrofishing gear in the deep-draft portions of the River, and either backpack electrofishers or seine nets in the wadeable portions of the stream.

Seven parameters will be evaluated for both the benthic invertebrate and fish samples. For invertebrates, those parameters are:

- Total number benthic species
- Percent composition major benthic groups
- Total number Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa
- Percent tolerant benthic species
- Total number intolerant benthic taxa
- Percent midge subfamilies
- Percent midge larvae head capsule deformities

For fish, the parameters to be developed are:

- Total number fish species
- Percent diseased fish
- Percent lithophiles (gravel spawners)
- Total number sucker species
- Total number tolerant fish taxa
- Total number intolerant fish taxa
- Percent trophic fish guilds

There are no data yet available for this monitoring program and the MWRD's report format for the material is yet to be determined.

Fish Contaminant Monitoring

The MWRD participates in the Illinois Fish Contaminant Monitoring Program with the Illinois EPA (see "Fish Contaminant Monitoring" in section 2.3.2).

2.2.3 Sediment Chemistry Sampling Programs

Sediment Quality Monitoring

What:	111 parameters
Where:	21 locations (see Figure 6)
When:	1992-1993
Why:	Internal inquiry
How:	Ponar Grab sample of surface sediment
Data Form:	R&D Departmental Annual Report
Data Archive:	1992-1993

In 1992 and 1993, the District collected Ponar Grab samples of River sediment to provide baseline information on sediment quality for future comparison. During June of 1992, the MWRD collected samples from 19 locations on the North Shore Channel, the North Branch, the South Branch, the Sanitary and Ship Canal, the Calumet River, the Little Calumet River, and the Cal-Sag Channel. In 1993, the District collected samples from two stations on the Grand Calumet River (see Figure 6 for all sampling locations). Samples were analyzed for the 111 USEPA priority pollutants; MWRD found the 17 parameters in Table 5 at detectable levels (MWRD 1992, 1993). The 1992 and 1993 sampling efforts were a one-time project, but will be extended by the sediment chemistry and toxicity monitoring described immediately below.

FIGURE 6: MWRD Sediment Quality Monitoring Locations

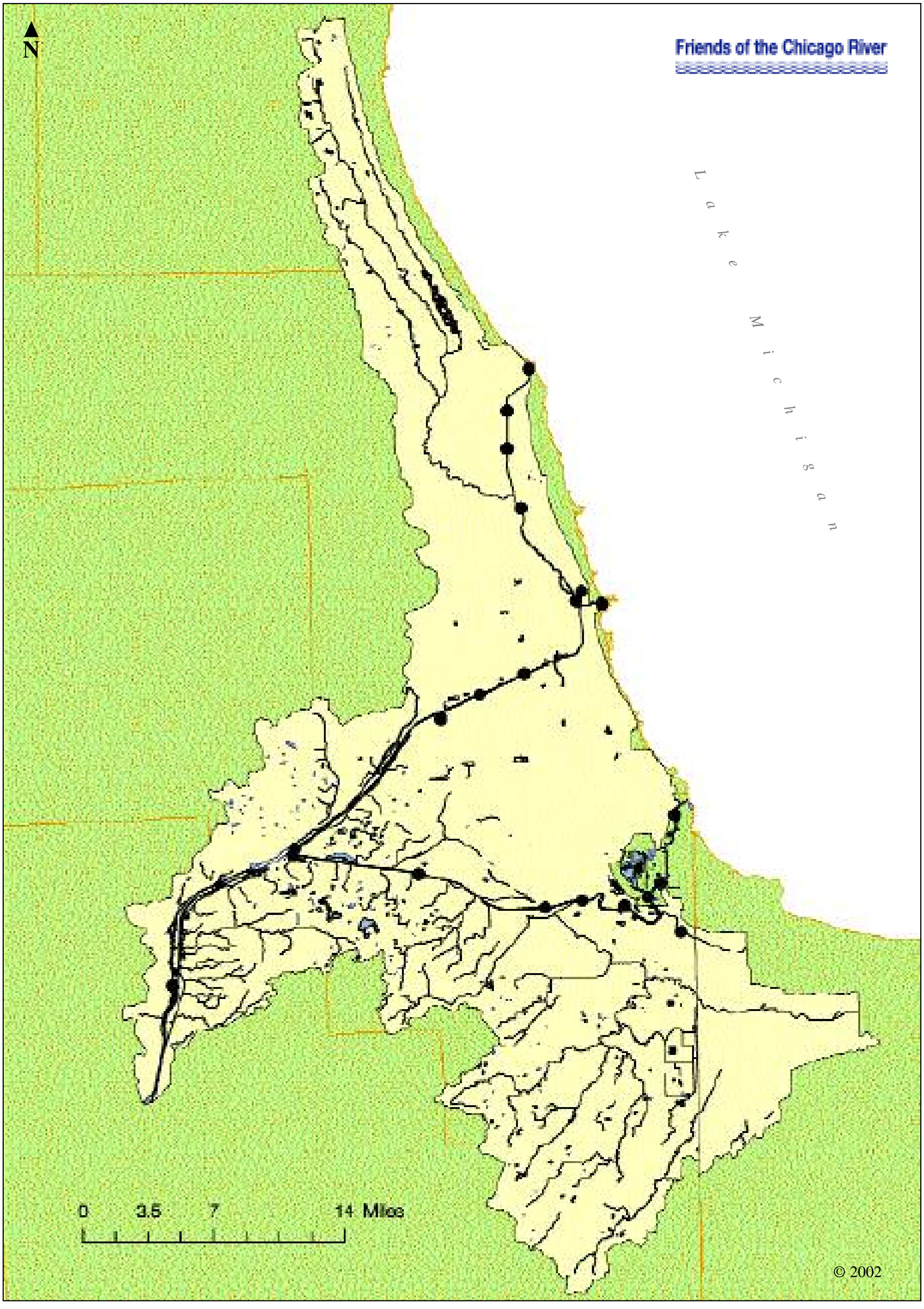


Table 5 – Detectable Sediment Chemistry Parameters from MWRD 1992-1993 Sediment Surveys

Total solids	Total copper
Total volatile solids	Total iron
Chemical oxygen demand	Total lead
Ammonium nitrogen	Total manganese
Total phosphorus	Total nickel
Phenol	Total mercury
Total cyanides	Total silver
Total cadmium	Total zinc
Total chromium	

Sediment Chemistry and Toxicity Monitoring

What: 14 types of chemical parameters, 4 toxicity tests
Where: 39 locations (same as AWQM stations - see Figure 2)
When: July and August starting in 2002
Why: Part of an integrated monitoring program to provide data to IEPA for state's Clean Water Act reporting and listing requirements
How: Ponar Grab samples of sediment
Data Form: Undecided
Data Archive: None available yet

As stated in section 2.2.2, the MWRD has initiated an integrated River monitoring program encompassing regular biological, sediment, and physical habitat monitoring. (See also section 2.2.4 for a description of the new physical habitat monitoring program.) The primary purpose of these expanded monitoring programs is to provide data to the Illinois EPA for use in the state's Clean Water Act reporting and listing requirements.

Starting in 2002, the MWRD will begin sampling all 39 AWQM stations on the River to determine sediment chemistry and toxicity, following the same four-year cycle as for the biological and physical habitat monitoring: the North Branch watershed in year 1, the South Branch and Sanitary & Ship watersheds in year 2, the Calumet watershed in year 3, and the Des Plaines watershed (an "off" year for the Chicago River watershed) in year 4. The District will begin this new sediment monitoring program with the South Branch and Sanitary & Ship phase of the four-year cycle, since that phase corresponds with the year 2002.

Sediment chemistry and toxicity monitoring efforts will be exactly coordinated with four-year benthic invertebrate collection efforts. For the most efficient collection, the same Ponar Grab sample taken to gather benthic invertebrates will be used for analysis of sediment chemistry and toxicity.

The MWRD will analyze the sediment samples for the following chemical parameters:

- Percent total solids
- Percent volatile solids
- Ammonia
- Total Kjeldahl nitrogen
- Total phosphorous
- Cyanide
- Phenols
- Volatile organic compounds
- Polynuclear aromatic hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Organochlorine pesticides
- Simultaneously extractable metals
- Acid volatile sulfide
- Total metals

Additionally, the District will perform the following sediment toxicity tests:

- 10-day growth of Chironomus tentans
- 10-day survival of Chironomus tentans
- 10-day growth of Hyalella azteca
- 10-day survival of Hyalella azteca

There are no data yet available for this monitoring program and the MWRD's report format for the material is yet to be determined.

2.2.4 Physical Habitat Sampling Programs

What: 10 physical parameters
Where: 39 locations (same as AWQM stations - see Figure 2)
When: July and August starting in 2002
Why: Part of an integrated monitoring program to provide data to IEPA for state's Clean Water Act reporting and listing requirements
How: Survey of river reach
Data Form: Undecided
Data Archive: None available yet

Regular physical habitat monitoring is the third element of the MWRD's integrated River monitoring program encompassing regular biological, sediment, and physical habitat monitoring (Tata 2001b). See sections 2.2.2 and 2.2.3, respectively, for descriptions of the physical biological and sediment monitoring programs.

In 2002, physical habitat monitoring will begin with the

South Branch and Sanitary & Ship Canal watersheds phase in the four-year monitoring cycle. Once every four years, concurrent with biological and sediment sampling, MWRD sampling teams will perform a physical habitat assessment at each AWQM station on the River. The District will evaluate the following physical parameters at those 39 stations:

- Bank stability
- Canopy cover
- Channel alteration
- Channel sinuosity
- Channel width
- Channel depth
- Embeddedness
- Riparian vegetation
- Sediment deposition
- Sediment particle size

There are no data yet available for this monitoring program and the MWRD's report format for the material is yet to be determined.

2.3 THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

2.3.1 Water Chemistry Sampling Programs

Ambient Water Quality Monitoring Network (AWQMN)

What:	Up to 65 parameters, depending on station (see Table 6)
Where:	6 on the Chicago River system (see Figure 7)
When:	Nine times per year, six week frequency
Why:	To fulfill the state's Clean Water Act reporting and listing requirements
How:	Depth- and width-integrated grab samples
Data Form:	Electronic, available through STORET database on the Internet
Data Archive:	1977-present

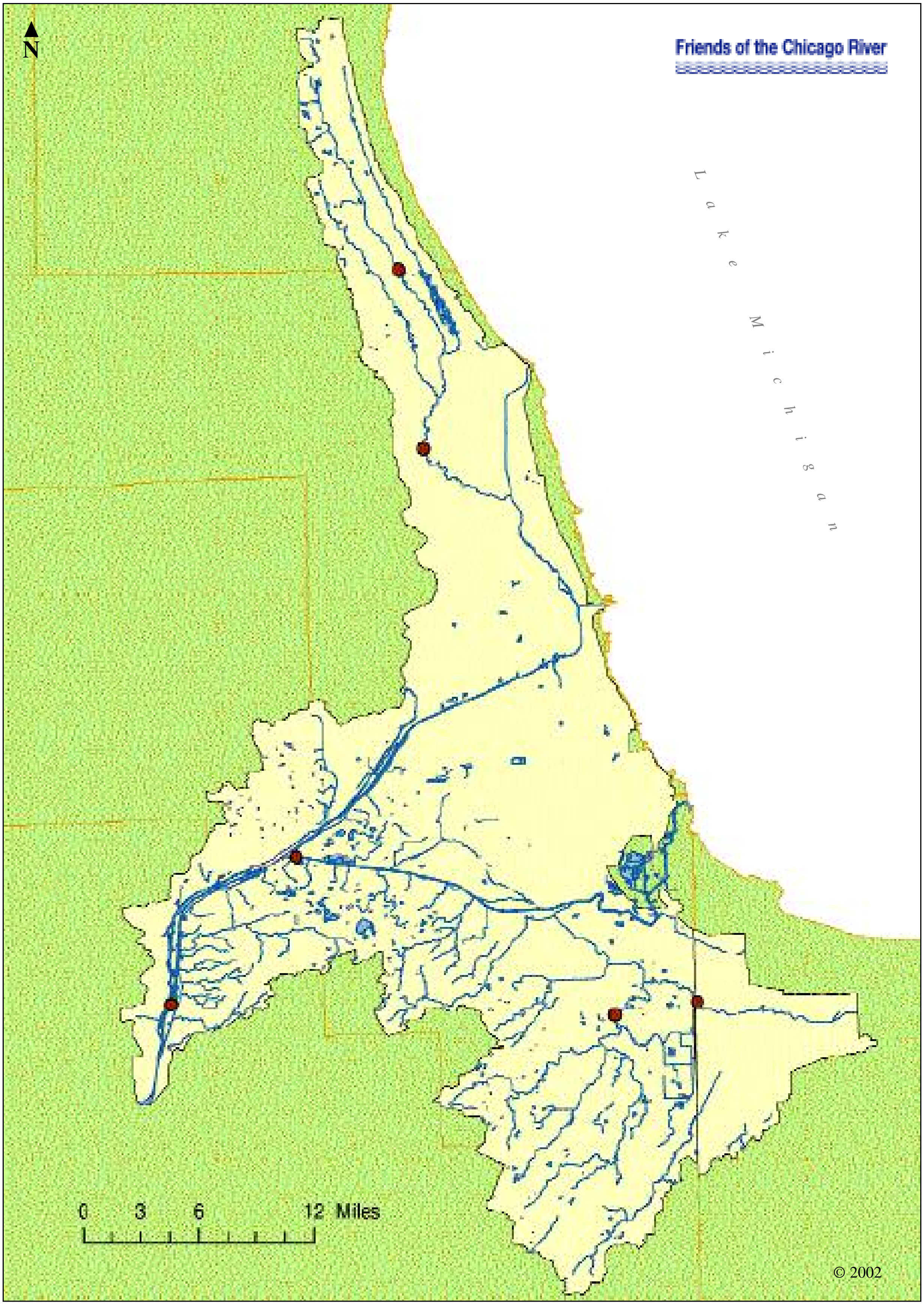
Since 1977, the Illinois Environmental Protection Agency (IEPA or the Agency) has collected ambient stream water quality data on the waters of the state through its Ambient Water Quality Monitoring Network (AWQMN). This network currently consists of 203 AWQMN stations distributed so as to provide a general picture of the water quality status and trends across the state (Short 2001). The six AWQMN stations on the River are shown in Figure 7.

The primary directive for the state's water quality monitoring efforts come from sections 305(b) and 303(d) of the Clean Water Act and associated guidance issued by the USEPA (USEPA 1997 a, b). Section 305(b) of the CWA requires the state to report to Congress the condition of the state's waterways in terms of compliance with state water quality standards and designated use support. Section 303(d) requires the state to list impaired streams, rank those streams, and target watersheds for Total Maximum Daily Load (TMDL) development.

IEPA further describes (Short 2001) the purposes and uses of the AWQMN as:

- Identifying causes and sources of surface water impairments;
- Determining the overall effectiveness of pollution control programs;
- Identifying long term water quality trends;
- Providing baseline water quality information;
- Acting as a triggering mechanism for special studies; and,
- Establishing water-quality based effluent limits for NPDES permits.

FIGURE 7: IEPA Ambient Water Quality Monitoring



Each AWQMN station is sampled nine times per water year (October 1 to September 30) or approximately every six weeks. Using methods developed by the USGS, IEPA teams collect water samples at pre-set widths and various depths in the stream. The samples are composited in a churn splitter and then transferred to bottles used for lab analysis. Air temperature, water temperature, DO, conductivity, and pH are all measured in the field; the remainder of the constituents are evaluated in a laboratory (see Table 6). All collection and analysis are performed in accordance with a quality assurance program.

Historically, raw data were available within four to eight months of collection through the USEPA STORET database, accessible on the internet at http://www.epa.gov/storet. However, since 1998 — when the STORET database underwent major revision — IEPA AWQMN data have not been available through the Internet-based STORET. Current AWQMN data can be acquired from the IEPA in hardcopy within approximately three months of sampling (Lesnak personal communication).

IEPA formally publishes a printed Section 305(b) water quality report every two years, and a Section 303(d) list approximately every four years. These documents do not report raw data, but rather the degree of use support attained and the potential causes and sources of impairment.

Table 6 – IEPA AWQMN Analytes (Short 2001)

Constituent	STORET Code
Total Aluminum	1105
Total Barium	1007
Total Boron	1022
Total Beryllium	1012
Total Cadmium	1027
Total Calcium	916
Total Chromium	1034
Total Copper	1042
Total Cobalt	1037
Total Iron	1045
Total Lead	1051
Total Magnesium	927
Total Manganese	1055
Total Nickel	1067
Total Potassium	937
Total Silver	1077
Total Sodium	929
Total Strontium	1082
Total Vanadium	1087
Total Zinc	1092
Dissolved Aluminum	1106
Dissolved Barium	1005
Dissolved Boron	1020
Dissolved Beryllium	1010
Dissolved Cadmium	1025
Dissolved Calcium	915
Dissolved Chromium	1030
Dissolved Copper	1040
Dissolved Cobalt	1035
Dissolved Iron	1046
Dissolved Lead	1049
Dissolved Magnesium	925
Dissolved Manganese	1056

Constituent	STORET Code
Dissolved Nickel	1065
Dissolved Potassium	935
Dissolved Silver	1075
Dissolved Sodium	930
Dissolved Strontium	1080
Dissolved Vanadium	1085
Dissolved Zinc	1090
Air Temperature	20
Water Temperature	10
Field Dissolved Oxygen	299
Field pH	400
Field Conductivity	94
Volatile Suspended Solids	535
Total Suspended Solids	530
Total Ammonia Nitrogen	610
Total Nitrite + Nitrate Nitrogen	630
Turbidity	76
Total Phosphorus	665
Dissolved Phosphorus	666
Fecal Coliform	31616
Hardness	900
Total Organic Carbon*	680
Total Kjeldahl Nitrogen*	625
Total Chloride*	940
Total Sulfate*	945
Total Arsenic*	1002
Phenol*	32730
Total Fluoride*	951
Total Cyanide*	720
Total Alkalinity*	410
Total Acidity*	70508
Total Mercury*	71900
* not collected at all stations	

Intensive River Basin Surveys

What:	Water chemistry, fish population, macroinvertebrate population, physical habitat, sediment chemistry, and stream flow at all sites; Fish tissue at some sites
Where:	Stations where intensive data are lacking or out-of-date (see Figure 8)
When:	On a five-year rotational basis
Why:	To complement AWQMN data for state's Clean Water Act reporting and listing requirements
How:	Various field protocols (IEPA 1987c)
Data Form:	Water chemistry in STORET; All other data in departmental tabulations or short reports
Data Archive:	1981-present

To complement the ambient data provided by the AWQMN for development of the state's 305(b) assessments, IEPA conducts intensive river basin surveys (IRBSs). IEPA divides the state into 33 major river basins and stations in each basin qualify for an IRBS once every five years. The Chicago River as defined for this study falls primarily into the Great Lakes/Calumet River Basin, which was eligible for and included in an IRBS in 2001 and was previously surveyed in 1996. Prior to 1996, an IRBS was conducted on a nearly 15-year cycle and the River was last surveyed in 1983-4. In 1983-4, sixteen stations on the River received an IRBS (see Figure 8). Nine of the sixteen stations were surveyed for water quality, sediment chemistry, fish population, macroinvertebrate population, and habitat. The remaining seven stations were all surveyed for water and sediment chemistry, and variably for the other metrics (see Table 7). In 2001 nineteen stations on the River were subject to an IRBS (see Table 8).

Table 7 – IEPA Intensive River Basin Survey (IRSB) Locations of the Chicago River in 1983-1984

Used in 2001	Station	Stream	Location	Year	WQ	Sed	Fish	Mac	Hab
	H-01	Cal-Sag Channel	Rt. 83, near Lemont	1983	X	X		X	
X	H-04	Little Calumet River	Halsted Ave., Calumet Park	1983	X	X	X		
X	HB-01	Little Calumet River	Ashland Ave., Blue Island	1983	X	X	X		
X	HB-42	Little Calumet River	Hohman Ave., near IN line	1983	X	X	X	X	X
	HBA-01	Midlothian Creek	Dixie Hwy., Blue Island	1983	X	X	X	X	
X	HBD-04	Thorn Creek	Thornton-Lansing Rd., Thornton	1983	X	X		X	
X	HBD-05	Thorn Creek	Rt. 30 near, Chicago Heights	1983	X	X	X	X	X
X	HBDA-01	North Creek	Cottage Grove Ave. near Sweets Woods	1983	X	X	X	X	X
X	HBDB-03	Butterfield Creek	Chicago Rd., Homewood	1983	X	X	X	X	X
X	HBDC-02	Deer Creek	Cottage Grove Ave., Glenwood	1984	X	X	X	X	X
	HBE-02	Plum Creek	County Rd., Crete	1984	X	X	X	X	X
X	HCC-07	North Branch of the Chicago River	Touhy Ave.,	1984	X	X		X	
X	HCCB-05	West Fork of the North Branch	Dundee Rd., Northbrook	1984	X	X	X	X	X
X	HCCC-04	Middle Fork of the North Branch	Golf Rd., Glenview	1984	X	X	X	X	X
X	HCCD-09	Skokie River	Willow Rd., Northfield	1984	X	X	X	X	X
X	HF-01	Tinley Creek	135th St.	1984	X	X	X	X	X

FIGURE 8: IEPA Intensive River Basin Survey (IRBS) Locations, 1983-1984 and 2001

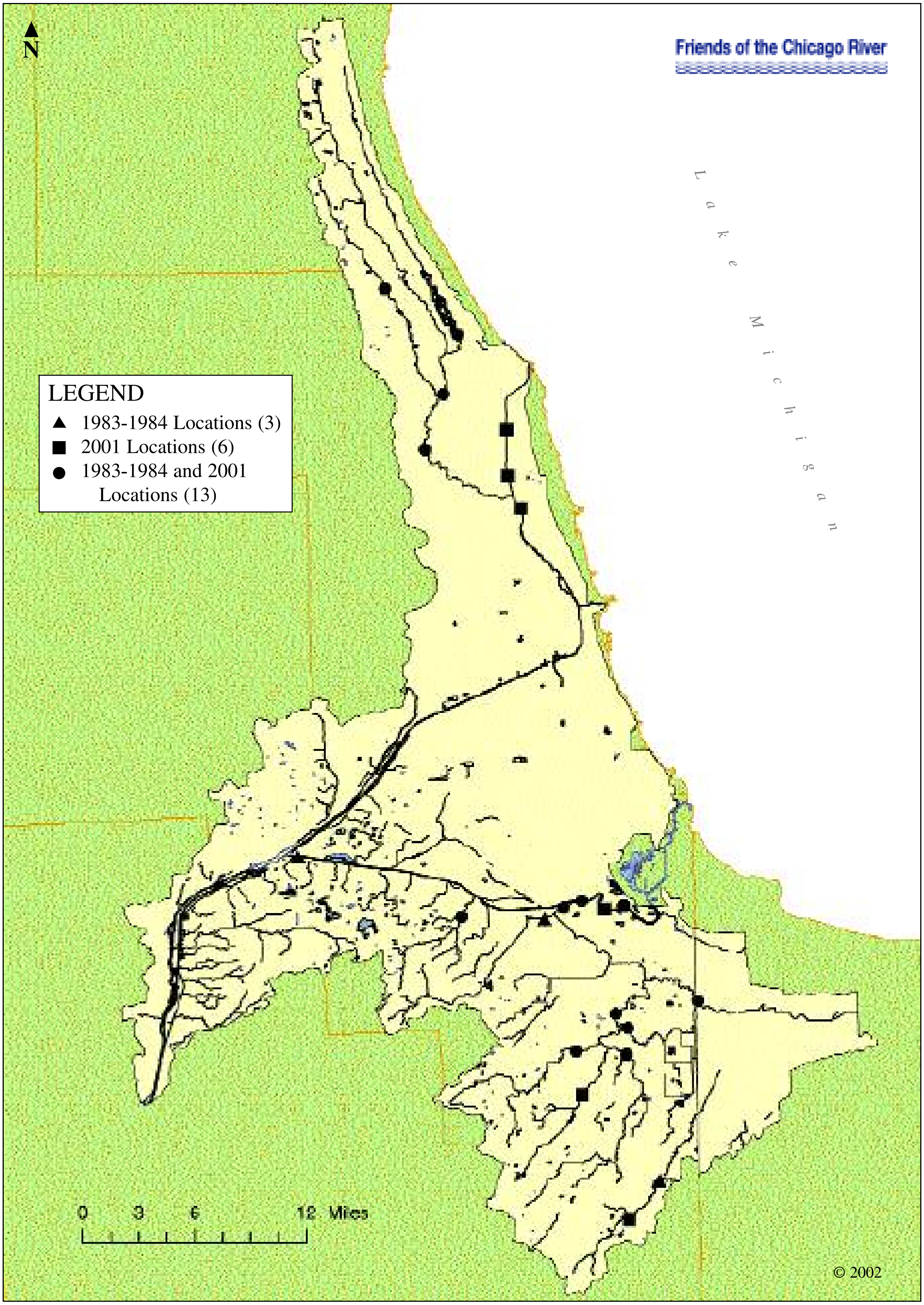


Table 8 – IEPA Intensive River Basin Survey (IRSB) Locations in 2001

Used in '83-'84	Station	Stream	Location	Year	WQ	Sed	Fish	Mac	Hab
	HCC-02	North Branch	Wilson Ave.	2001	X	X	X	X	X
X	HCC-07	North Branch	Touhy Ave.	2001	X	X	X	X	X
	HCCA-04	North Shore Channel	Peterson Ave.	2001	X	X	X	X	X
X	HCCC-04	Middle Fork of the North Branch	Upstream of Chick Evans Golf Course	2001	X	X	X	X	X
X	HCCB-05	West Fork of the North Branch	Dundee Rd., Northbrook	2001	X	X	X	X	X
X	HCCD-09	Skokie River	Below dam at Skokie Lagoons	2001	X	X	X	X	X
	HCCA-02	North Shore Channel	Oakton Ave.	2001	X	X		X	X
	HBE-03	Plum Creek	Bemes Rd.	2001	X	X	X	X	X
X	HBD-05	Thorn Creek	Rt. 30, Chicago Heights	2001	X	X	X	X	X
X	HBD-04	Thorn Creek	Ridge Rd., Thornton	2001	X	X		X	
	HBD-06	Thorn Creek	Forest Ave.	2001	X	X	X	X	X
X	HBDB-03	Butterfield Creek	Halsted St.	2001	X	X	X	X	X
X	HBDA-01	North Creek	Cottage Grove Ave. near Sweet Woods	2001	X	X	X	X	X
X	HBDC-02	Deer Creek	Cottage Grove Ave.	2001	X	X	X	X	X
X	HB-01	Little Calumet River	Ashland Ave./Jackson	2001	X	X	X	X	X
X	HA-04	Little Calumet River	Halsted St., Calumet Pk.	2001	X	X	X	X	X
X	HB-42	Little Calumet River	Hohman near IN line	2001	X	X	X	X	X
	HA-05	Little Calumet River	Indiana Ave.	2001	X	X		X	X
X	HF-01	Tinley Creek	135th St.	2001	X	X	X	X	X

Current IRBS surveys include water chemistry sampling, biological population and fish tissue sampling (see section 2.3.2), sediment chemistry sampling (see section 2.3.3), and instream habitat characterization (see 2.3.4). The fish population, water and sediment chemistry, macroinvertebrate population, physical habitat, and flow data are collected at every IRBS site, whereas fish tissue data are collected only at selected sites. All protocols except those for fish collection are described in a field and quality assurance guide provided to IEPA sampling crews (*IEPA 1997c*). Fish are typically collected for an IRBS by Illinois Department of Natural Resources (IDNR) staff or, on the River, MWRD personnel.

IRBS data are not formally reported on a regular basis. Water chemistry data are sent to the STORET database, but the remainder of the data is only tabulated for internal development of 305(b) reports or summarized in an informal report. Any collected data or informal reports can be requested through the IEPA in Springfield by a Freedom of Information Act request.

Facility-Related Stream Surveys

What	Water chemistry, macroinvertebrates, physical habitat, and stream flow
Where:	In the vicinity of municipal and industrial wastewater treatment discharges
When:	As need arises based on input from IEPA Field Operations, Permits, or Surface Water Monitoring Sections
Why:	To evaluate the impacts of specific wastewater treatment discharges
How:	Upstream/downstream water and invertebrate samples; one effluent sample
Data Form:	Short IEPA reports
Data Archive:	1979-present

Data collected from a Facility-Related Stream Survey (FRSS) are used to assess the need for additional wastewater controls at the permitted facility. If an FRSS shows that there is significant biological impact on the receiving stream, IEPA may adjust the facility's NPDES permit to more fully protect designated uses of the receiving stream. Selection of sites for FRSSs is an ad hoc process based on recommendations and professional opinion from the IEPA Field Operations, Permits, Compliance, and Surface Water Quality Monitoring sections.

Sampling protocols for an FRSS are approximately the same as those for an IRBS (IEPA 1997c). For an FRSS, both a water chemistry and a macroinvertebrate sample are taken upstream of the facility to be used as "background" values. The sampling crew then collects water chemistry and macroinvertebrate samples within approximately 200 yards of the facility discharge for comparison with the upstream sample. If the first downstream samples indicate the stream is affected, then another set of samples are collected approximately 400 yards downstream of the first downstream sample. This pattern is continued, with downstream sample spacing being about doubled each iteration, until the downstream sample approximately matches the upstream "background" sample. Additionally, one sample of the pure effluent is taken from the discharge point at the time of the FRSS.

Any collected FRSS data or reports can be requested through the IEPA in Springfield by a Freedom of Information Act request.

Industrial Solvents Subnetwork

The IEPA formerly sampled 31 stations in the state as part of an industrial solvents subnetwork (see Table 9 for parameters analyzed). At present, the program has been discontinued due to the low number of selected parameters detected at the subnetwork stations. Two of the 31 stations were located on the River system. One was located on the North Branch (Station HCC-07) and the other on the Middle Fork of the North Branch (Station HCCC-02).

Table 9 – IEPA Industrial Solvents Monitoring Subnetwork Parameters

Constituent	STORET Code
Chloroform	31206
Dichlorobromomethane	32101
Chlorodibromomethane	32105
Bromoform	32104
Methylene Chloride	34423
1,1-Dichloroethylene	34501
1,1-Dichloroethane	34496
Trans-1,2-Dichloroethylene	34546
1,2-Dichloroethane	34531
1,1,1-Trichloroethane	34506
Carbon Tetrachloride	32102
Trichloroethylene	39180
Tetrachloroethylene	34475
Chlorobenzene	34301
Dichlorobenzene (total)	34716
Benzene	78124
Toluene	78131
Ethylbenzene	78113
Xylenes	81551
Cis-1,2-Dichloroethylene	77093

Pesticide Monitoring Network

What:	36 chemical parameters (see Table 10)
Where:	30 AWQMN stations pre-1996, 30 rotational sites post-1996
When:	Three of the nine annual AWQMN sampling events
Why:	To detect agricultural pesticides in the water
How:	Using the same protocol as AWQMN sampling
Data Form:	Reported to the STORET database
Data Archive:	1985-current; since 1996 on the River

Prior to 1996, IEPA maintained a fixed pesticide monitoring subnetwork annually at 30 of the state's AWQMN stations. At each station, 36 chemical parameters, primarily agricultural pesticides, are monitored three times a year (see Table 10). Prior to 1996, no AWQMN stations on the River were monitored as part of this network. Since that time, IEPA pesticides are monitored at 30 AWQMN sites as selected on a rotational basis. The following stations were sampled three times in 2001 as part of this network:

- AWQMN Station HBD-04: Thorn Creek at Thornton-Lansing Road, Thornton;
- AWQMN Station HCC-07: North Branch at Touhy Avenue, Niles; and,
- AWQMN Station HCCC-02: Middle Fork of the North Branch at Lake-Cook Road, Deerfield.

Table 10 – IEPA Pesticide Monitoring Subnetwork Parameters

Constituent	STORET Code	Constituent	STORET Code
Alachlor	77825	Total DDT	39370
Atrazine	39630	O, p DDE	39327
Butylate	81410	P, pí DDE	39320
Captan	39640	O, p DDD	39315
Chloropyrifos	81403	P,p’ DDD	39310
Cyanazine	81757	O,p DDT	39305
Diazinon	39570	P,p’ DDT	39300
Fonofos	81294	Total Chlordane	39350
Malathion	39530	Chlordane trans isomer	39065
Methyl Parathion	39600	Nonachlor cis isomer	39068
Metolachlor	39356	Nonachlor trans isomer	39071
Metribuzin	81408	Endrin	39390
Phorate	46314	Methoxychlor	39480
Terbufos	82088	Hexachlorocyclorhexane	39337
Trifluralin	81284	Gamma BHC-Lindane	39340
PCBs	39516	Hexachlorobenzene	39700
Aldrin	39330	Pentachlorophenol	39032
Dieldrin	39380	Chloradane cis isomer	39062

NPDES Discharge Monitoring Reports

What: Flow and chemical constituents actually or potentially in facility discharge that might impact that receiving stream
Where: Discharge points of permitted facilities
When: Varies by facility and permit
Why: To comply with NPDES requirements of the Clean Water Act
How: Varies by facility and permit
Data Form: Printed monthly DMRs
Data Archive: Five years for most dischargers

The Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) with the original goal of eliminating all effluent discharge to the waters of the United States. As the agency that implements the Clean Water Act for Illinois, IEPA administers the state’s NPDES permitting system.

The constituents regulated in a permit, as well as effluent sampling methods, vary with each facility. Permits are issued on a five-year basis and amended as necessary to better support the designated uses of the receiving waterway. New and re-issued permits must take into account the existing water quality conditions in the receiving waters.

Each permittee must submit a monthly Discharge Monitoring Report (DMR) to the IEPA. This report lists the discharger’s regulated effluent parameters and their concentrations as measured in the past month. Electronic or printed DMRs for any facility are available from the IEPA upon request through the IEPA Compliance Assurance Section.

2.3.2 Biological Sampling Programs

Intensive River Basin Surveys
The IEPA performs macroinvertebrate and fish monitoring as part of its IRBS protocols (see section 2.3.1).

Facility-Related Stream Surveys
The IEPA performs macroinvertebrate and fish monitoring as part of its FRSS protocols (see section 2.3.1).

Fish Contaminant Monitoring

What: 15 chemical parameters in five-fish composite samples (see Table 11)
Where: Chicago River main stem, North Branch, North Shore Channel
When: Summer prior to spring advisory issue
Why: To issue fish consumption advisories
How: Boat-mounted and backpack electrofishers, seines
Data Form: Printed annual advisories; Printed lab analysis sheets
Data Archive: 1988-present

IEPA participates in a joint state-wide fish consumption advisory effort with the Illinois Departments of Natural Resources, Public Health, and Agriculture. Generally, IDNR collects the fish samples, IEPA analyzes the fish for toxics, and IDPH issues the final consumption advisories. In the MWRD service area, the District collects the fish samples and funds the analysis of the samples at the IEPA laboratory in Springfield.

IEPA and IDPH use a four-tier ranking system to advise the frequency of consumption for fish caught in state waterways: one meal per week, one meal per month, six meals per year, and “do not eat.” These advisory categories are developed using the wet weight concentrations of PCBs, chlordane, and mercury in the fish fillets submitted to the IEPA. Fish advisories are for consumption of trimmed and skinned fish and are developed to protect infants, children, and women of child bearing age (IDPH 1999).

Table 11 – IEPA Fish Contaminant Monitoring Parameters

Aldrin
Total Chlordane
Total DDT and analogs
Dieldrin
Total PCBs
Heptachlor
Heptachlor epoxide
Toxaphene
Methoxychlor
Hexachlorobenzene
Gamma-BHC (Lindane)
Alpha-BHC
Mirex
Endrin
Mercury (top predators only)
— all reported as ug of contaminant per g of wet sample weight
Sample depth
Sample lipid content
Number of individual filets in composite sample
Fish species
Fish length
Anatomy

Fish Population Monitoring

Fish population monitoring is conducted at all IEPA IRBS stations and at some AWQMN stations. Fish populations are sampled jointly by IDNR and IEPA in their Cooperative Basin Survey Program. Various types of collection gear are utilized depending on site location, including electric seine, boat electrofishing, and minnow seine. A standardized sampling time of 30 minutes is generally employed when using boat or electric seine collection methods. However, because variability of physical conditions at each station often dictates the sampling time required to obtain a representative fish population sample, collection durations may vary. Collected fishes are identified to species, counted and returned to the stream alive when possible. When field identifications are not practical, specimens are preserved in ten percent formalin. Identification of preserved specimens is accomplished by IDNR Streams Program staff or under contract with private firms. Fisheries data are analyzed by assessment of community structure and the Index of Biotic Integrity (IBI). The IBI is calculated on the basis of a number of community metrics (see metrics below). These individual metrics are assigned values of 1, 3, or 5 that are subsequently summed to produce an IBI score with a range of 12-60. The assignment of values to each metric is influenced by community expectations and inherent differences based on stream size and biogeography.

Category	Metric
Species Richness and Composition	1. Total number of fish species 2. Number and identity of darter species 3. Number and identity of sunfish species 4. Number and identity of sucker species 5. Number and identity of intolerant species 6. Proportion of individuals as green sunfish
Trophic Composition	7. Proportion of individuals as omnivores 8. Proportion of individuals as insectivorous cyprinids 9. Proportion of individuals as piscivores (top carnivores)
Fish Abundance and Condition	10. Number of individuals in sample 11. Proportion of individuals as hybrids 12. Proportion of individuals with disease, tumors, fin damage, and skeletal anomalies

Macroinvertebrate Monitoring

Macroinvertebrate monitoring is conducted at all IEPA IRBS and FRSS stations and at some AWQMN stations. Macroinvertebrate communities are sampled qualitatively by means of forceps, hand-held sieve (standard 30-mesh), and/or D-net from all available habitats. Comparable sampling effort at each site yields a single sample reflecting relative abundance of each taxon found in the aquatic community. Samples are preserved in 95 percent ethyl alcohol and are identified by qualified IEPA staff or under contract with private firms. Macroinvertebrate data are interpreted using the Macroinvertebrate Biotic Index (MBI). Pollution tolerance ratings for each taxon (species, genus, etc.) are assigned on a scale of 0 to 11, based on information from reference documents, observations and professional judgment. A rating of 0 is assigned to taxa known to live only in high-quality water, while a rating of 11 is assigned to taxa known to live in severely polluted water. The MBI is the mean tolerance rating for each macroinvertebrate community; it is weighted by the tolerance rating and the relative abundance of each taxon present.

2.3.3 Sediment Chemistry Sampling Programs

Sediment chemistry samples are taken at all IEPA IRBS and some AWQMN stations. At each sampling site a quality of the uppermost layer of recently deposited sediment is collected from two or more areas of deposition. This material is composited in a large stainless steel pan, and a subsample of the sediment is passed through a 63-micron stainless steel sieve by a wet-sieving process at the site. This method of sediment collection yields a sample of known maximum particle size, eliminates subjectivity of field personnel in finding "sediment," and decreases variability between replicate samples. An aqueous suspension of sieved sediment is poured into a glass quart jar and allowed to settle. Supernatant is poured off and into separate bottles for metals and organics analysis.

2.3.4 Physical Habitat Monitoring Programs

Physical habitat monitoring is conducted at all IEPA IRBS and FRSS stations and at some AWQMN stations. The Agency uses two methods concurrently to evaluate stream habitat quality. To determine whether the physical component of streams is a factor limiting biotic integrity of aquatic communities, a methodology for assessing habitat quality using a transect approach is used. This procedure characterizes stream habitat based on width, depth, bottom substrate, and other metrics. Specifically, depth, velocity and substrate are recorded along 11 equally-spaced transects throughout wadeable stream segments. At un-wadeable segments, parameters are recorded from a boat along two to three transects. Other habitat metrics routinely collected include percentages of shade, in-stream cover, and pool area. In 1993, the Agency augmented the transect approach with a multi-metric procedure for evaluating stream habitat quality based on instream and riparian features. The Stream Habitat Assessment Procedure (SHAP) is a qualitative approach to evaluate stream habitat quality using features considered important to biotic integrity. Data on 15 metrics associated with bottom substrate type, channel morphology, hydrology, and riparian features are collected. Each metric is assessed and assigned to one of four habitat quality categories. The total score of points assigned to each metric form the basis of the overall habitat quality rating for the stream reach assessed.

2.4 THE US ENVIRONMENTAL PROTECTION AGENCY

What:	Collection of sediment chemistry data for the Chicago River
Where:	North and South Branches of the Chicago River
When:	1999 -present
Why:	To estimate the volume of heavily polluted sediments in the River
How:	Ponar Grab samples or sediment coring
Data Form:	FIELDS database and hard copy lab sheet from Central Regional Lab
Data Archive:	1999-present

The U.S. Environmental Protection Agency (USEPA Region 5), Chicago and Water Division FIELDS Teams have initiated a study of the River to determine the extent of contamination in sediments with assistance from Superfund Division and the Great Lakes National Program Office. At the end of 2001, about 100 sediment locations on the North and South Branches of the River had been sampled by Ponar grabs and/or coring.

Over 500 sediment thickness probings have been collected on the North and South Branches. Additional sampling has also been performed downstream on the Cal-Sag Channel, the Sanitary & Ship Canal and the Lower Des Plaines River. Further sampling will continue in 2002 on the remaining portions of the Sanitary and Ship Canal, the Cal-Sag Channel, and Calumet River. All of these data are being entered into the FIELDS database and will be analyzed using a Geographic Information System.

The USEPA will produce maps that show trends of major organic and inorganic contaminant concentrations, as well as estimates of sediment volumes for use by planning agencies contemplating remediation of these sediments.

Additional work is also being undertaken by the USEPA Region 5 Toxics Team to assess the water and sediment concentrations of endocrine disrupting compounds (alkylphenols, ethoxylates, and carboxylates).

No publication of this information is yet available and work is continuing on collections, analyses, and future summary documents.

2.5 THE US FISH AND WILDLIFE SERVICE

What:	Fish and benthic invertebrate populations
Where:	17 stations on the upper North Branch (see Figure 9)
When:	July through September 1993
Why:	To provide data for the Chicago Rivers Demonstration Project
How:	Fish - ¼" bar minnow seine; Invertebrates - dip nets and hand picking from submerged rocks, logs, and other debris
Data Form:	Printed in Nature and the River
Data Archive:	1993

What:	8 physical habitat parameters
Where:	37 stations on the River (see Figure 10)
When:	July through September 1993
Why:	To provide data for the Chicago Rivers Demonstration Project
How:	Visual observation, petite Ponar grab sampler, and depth pole or boat-mounted electric depth finder
Data Form:	Printed in Nature and the River
Data Archive:	1993

FIGURE 9: US Fish and Wildlife Service Fish and Benthic Invertebrate Population Sampling Locations

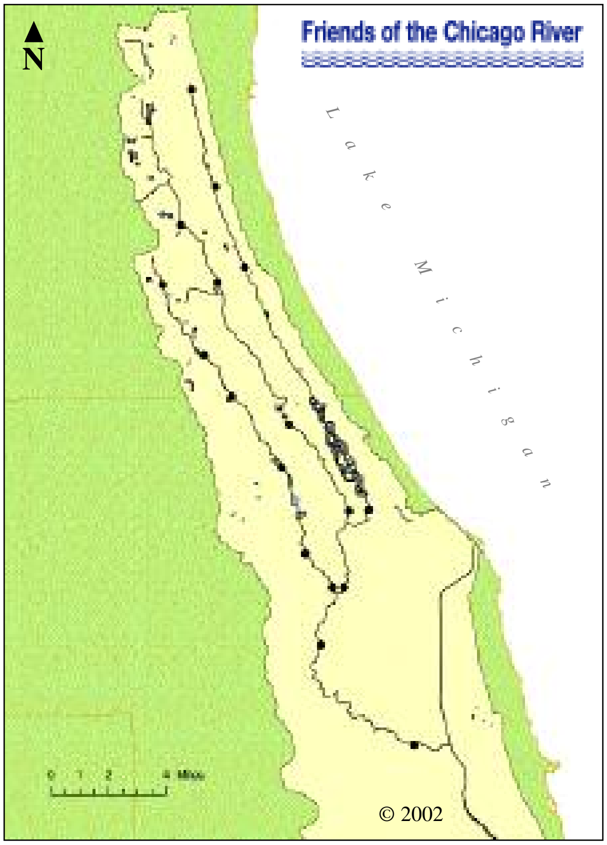
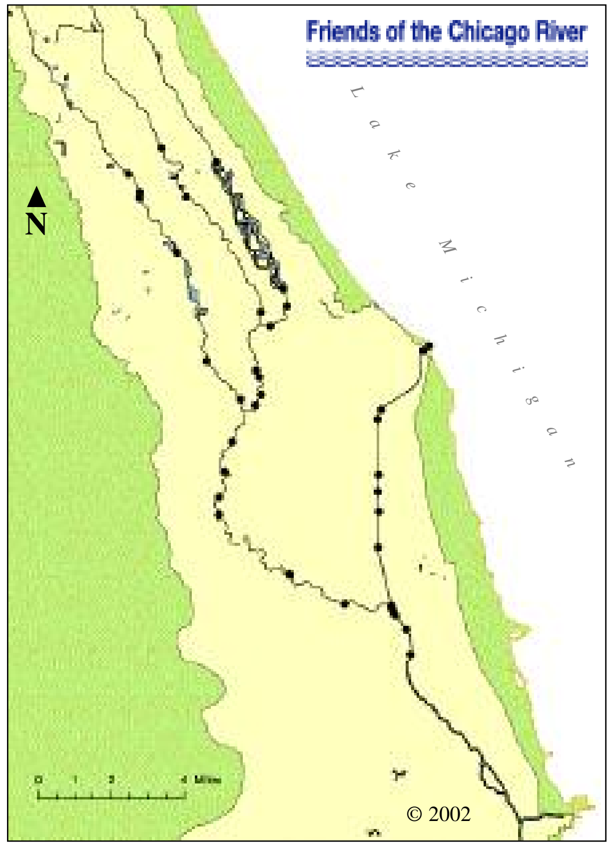


FIGURE 10: US Fish and Wildlife Service Physical Habitat Monitoring Locations



In 1993, the US Congress initiated the Chicago Rivers Demonstration Project in an attempt to provide a national model for revitalizing degraded urban rivers. Out of that project came the 1998 United States Fish and Wildlife Service (USFWS) publication Nature and the River: A Natural Resources Report of the Chicago and Calumet Waterways (Moore et al. 1998).

The USFWS report relied primarily on published accounts for data on fish and invertebrates in the lower reaches of the River, but the agency collected a small amount of new biological data on the upper North Branch for the 1998 report. In that portion of the River, the USFWS conducted new sampling efforts at 17 stations (see Figure 9). USFWS sampling crews performed one-time, thirty-minute sampling for fish and invertebrates at each of the 17 stations. During these 1993 sampling events, fish were collected with a seine net and invertebrates were collected by use of dip nets and hand picking from submerged substrate.

During the same summer of 1993 that the biological data were collected, the USFWS characterized and assessed the physical habitat of the stream and stream banks at 37 stations (see Figure 10). At each station, the following parameters were evaluated:

- Channel modification
- Bank height
- Bank slope
- Bank stabilization
- Bank composition
- Channel substrate
- In-stream cover
- Percent canopy cover

Channel substrate material was collected by hand in shallow waters and by a petite Ponar grab sampler in deeper water. Likewise, channel depth was measured to the inch in wadeable stream segments using a six-foot pole and using a boat-mounted electric depth finder in deeper waters.

The USFWS summarized all available biological data up to 1993 in its report and provides an excellent list of biological reference material on the River in its bibliography.

2.6 THE NORTH SHORE SANITARY DISTRICT (NSSD)

2.6.1 Water Chemistry Sampling Programs

What:	40 chemical parameters (see Table 12)
Where:	Upstream and downstream of each of the three outfalls at the NSSD Clavey Road WWTP (4 locations)
When:	Once per quarter
Why:	To perform NPDES local limits evaluation; to assess the impact of the Clavey Road WWTP on the River
How:	Stainless steel bucket samples collected from bridges or in wadeable reaches
Data Form:	Departmental reports

The North Shore Sanitary District (NSSD) samples the Skokie River near its Clavey Road wastewater treatment plant (WWTP) to (a) provide data used in local limits evaluation required by NPDES permit every five years and (b) to assess the impact of the Clavey Road WWTP on the receiving streams.

NSSD collects a quarterly grab at four locations on the Skokie River and Edens drainage ditch using a stainless steel bucket: Dundee Road, Tower Road, Willow Road, and Winnetka Road. The grab sample is transferred from the bucket by NSSD field personnel into:

- two one-gallon bottles for analysis of conventional and general parameters;
- one BacT bottle for bacteriological samples;
- one 2000 ml preserved bottle for cyanide; and,
- one 1800 ml preserved bottle for phenol.

Grab samples are also collected from the WWTP outfalls at the time of sampling. All field samples are analyzed for the 40 chemical parameters listed in Table 12. NSSD does not publish water quality data and reviews it internally to evaluate plant performance.

Table 12 – Chemical parameters sampled by the NSSD

Conventional pollutants	
$CBOD^5$	
Total solids	
Total suspended solids	
Total volume suspended solids	
Dissolved solids	
Ammonia nitrogen	
Un-ionized ammonia nitrogen	
Nitrite nitrogen	
Nitrate plus nitrite nitrogen	
Phosphorus	
Metal pollutants	
Arsenic	Manganese
Barium	Mercury
Beryllium	Nickel
Cadmium	Potassium
Calcium	Selenium
Chromium	Silver
Copper	Sodium
Iron	Thallium
Lead	Zinc
Magnesium	
In-situ measurements	
pH	Water temperature
Dissolved oxygen	
Bacteriological analyses	
Fecal coliform	Turbidity
Miscellaneous parameters	
Boron	Fluoride
Chloride	Phenol
Cyanide	Sulfate

2.6.2 Biological Sampling Programs

What:	Collection of habitat, macroinvertebrate, and fish data
Where:	Willow Road Dam at the confluence of the Edens drainage ditch and Skokie River
When:	Every three to five years
Why:	To assess the impact of the Clavey Road WWTP final effluent on the biotic resources of the Skokie River
How:	Dip nets and artificial substrates for invertebrates; Backpack electrofisher for fish
Data Form:	Departmental report; fish data submitted

In the summer of 2000, NSSD performed one of a series of occasional biological monitoring efforts on the Skokie River. NSSD samples the biological resources at the confluence of the Edens drainage ditch, into which the NSSD effluent discharges, and the Skokie River just south of the Skokie Lagoons at the Willow Road dam.

Benthic macroinvertebrates were sampled upstream of the WWTP discharge, within the discharge plume, and downstream of the discharge. Substrate and dip net collection were performed twice, while multi-plate artificial substrate collection was performed once. The NSSD analyzed the benthic community using the USEPA Rapid Bioassessment Protocol II; individual specimens were identified to the family level.

NSSD collected fish population samples twice at locations upstream, within, and downstream of the WWTP discharge plume. A backpack electroshocker was used to gather at least 100 individuals at each location.

Identifiable fish were weighed and returned to the stream; others were taken to the NSSD lab for analysis.

A general habitat evaluation was performed at each station measuring stream depth, stream width, substrate composition, instream features, and riparian composition.

NSSD reports the results of the fish collection to the IDNR and a departmental report is available upon request.

2.7 THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES

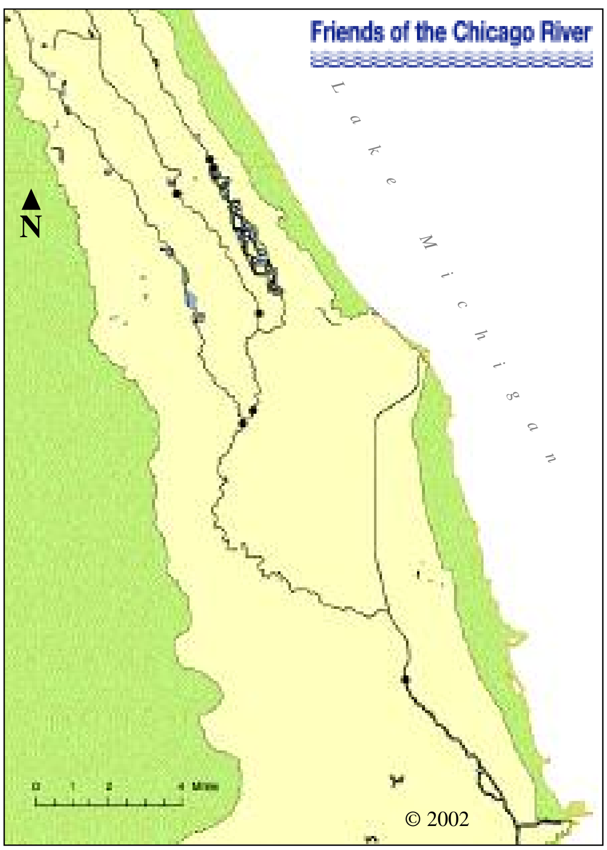
Since 1996, the fisheries section of the Illinois Department of Natural Resources (IDNR) has conducted studies on the upper North Branch of the River. These studies provide useful biological data on the same portion of the River that the USFWS found undersampled relative to the rest of the River in 1993. Separate sampling events between 1996 and 2001 have provided data for seven sites on the upper North Branch (see Figure 11).

What:	Fish and invertebrates
Where:	7 locations on the North Branch (see Figure 11)
When:	1996 -2001
Why:	To complement the North Branch Watershed Partnership's planning efforts
How:	Fish - backpack and boat-mounted electrofishers; Invertebrates - RiverWatch protocol (dipnets and hand picking from debris)
Data Form:	Occasional Reports

The IDNR fisheries personnel establish approximately 150-foot stations at each site, sampling for both fish and invertebrates along the selected stream segment. Fish are sampled using either backpack or boat-mounted electrofishers; invertebrates are sampled with dip nets and by hand picking from submerged rocks, logs, and other debris.

Results from the IDNR sampling events are published in occasional reports, which provide IBI and MBI scores with an accompanying narrative.

FIGURE 11: Illinois Department of Natural Resources Fish and Invertebrates Population Sampling



2.8 THE US GEOLOGICAL SURVEY

What:	Stream discharge; Occasional records for water temperature, suspended sediments; one instance of 35 chemical parameters (UIRB NAWQA site, see Table 13)
Where:	18 active stations, 11 discontinued stations (see Figure 12)
When:	Varies by station - oldest data from 1916, oldest active station from 1947
Why:	To maintain a long-term database of water quantity data for the state and to assure compliance with international Great Lakes water allotments
How:	Varies by station - stage recorders, crest-stage recorders, acoustical flowmeters, and raingages
Data Form:	Annual reports on CD and at http://il.water.usgs.gov/, with limited paper copies available
Data Archive:	Print reports for 1935-1998, CD and print reports for 1998-current

In conjunction with federal, state, and local agencies, the Illinois District of the US Geological Survey (USGS) maintains a monitoring network of 18 active stations on the River (see Figure 12). The general purpose of the USGS network is to provide a long-term database on water quantity in Illinois. However, the network on the River serves the additional purpose of monitoring the state's compliance with international agreements limiting the permissible diversion of water from the Great Lakes. By order of the US Supreme Court, Illinois may only divert an average of 3,200 ft^3/s from Lake Michigan. As explained by the USGS annual reports, "Illinois' diversion includes water diverted from the lake for domestic water supply, for navigation and water-quality improvement in the Chicago Sanitary and Ship Canal system, and the storm water runoff from a 673 mi^2 diverted watershed area." (LaTour et al. 2001).

Four monitoring stations — Columbus Drive on the Chicago River, the O'Brien Lock on the Calumet River, Maple Street on the North Shore Channel in Wilmette, and Romeoville on the Sanitary and Ship Canal — monitor River discharge using advanced acoustical flowmeters. These highly accurate flowmeters are intended to track the flow through the River system to assure compliance with the Supreme Court decree. At the remaining 14 active stations, the USGS uses a stage recorder to measure River stage and, by reference to a calibrated stage-to-discharge relationship, stream discharge. All acoustical flowmeters and 13 of the stage recorders are connected to phone telemeters, allowing the USGS to post real-time stream discharge on its website at http://il.water.usgs.gov/. At the two stations without phone telemeters, USGS personnel visit the site and manually download the recorded data, which are subsequently posted on the website. In addition to stage recorders or acoustical flowmeters, five active stations feature crest-stage recorders and five stations feature raingages.

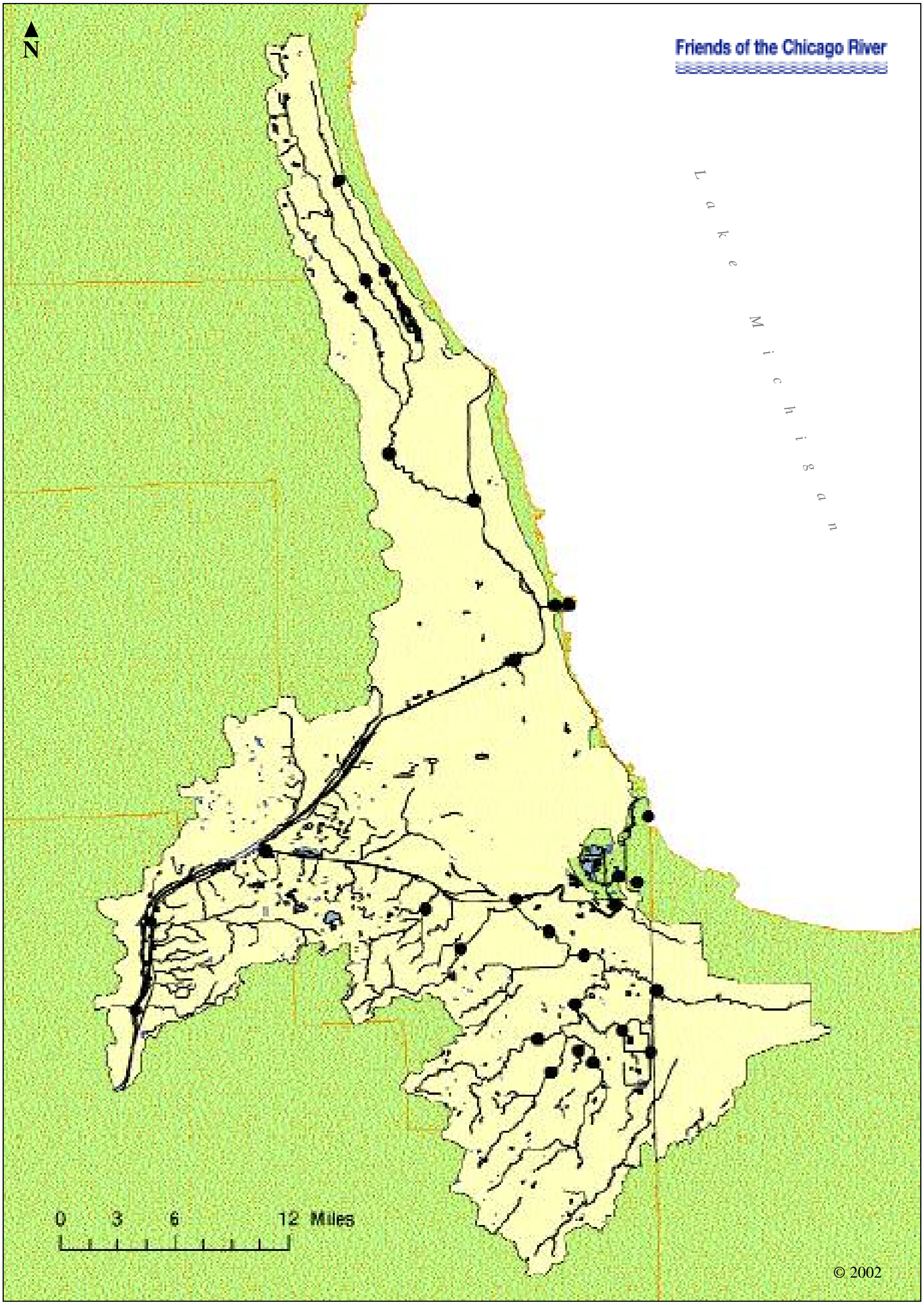


FIGURE 12: US Geological Survey Stream Discharge Gaging Locations

In addition to many current stations with discharge data, the USGS has historic records, sometimes quite lengthy, of five discontinued stations. The following sites are listed as discontinued USGS monitoring stations on the River with at least three years of discharge data*:

- # 05536105, N Branch Chicago River at Albany Avenue at Chicago (1990-98)
- # 05536210, Thorn Creek near Chicago Heights (1964-79)
- # 05536270, North Creek near Lansing (1948-79)
- # 05536325, Little Calumet River at Harvey (1917-33)
- # 05537000, Chicago Sanitary and Ship Canal at Lockport (1900-84)

One active station, at Romeoville on the Sanitary and Ship Canal, has been recently sampled for water quality data as part of the USGS Upper Illinois River Basin National Water Quality Assessment Program (UIRB NAWQA). At this station, 34 physical and chemical parameters (see Table 13) were collected approximately once per month from March 1999 to September 2000.

Parameter	Reported Units
Gage height	feet
Instantaneous discharge	cfs
Barometric pressure	mm Hg
Dissolved Oxygen	mg/l
pH	standard units
Specific conductance	us/cm
Air temperature	degrees C
Water temperature	degrees C
Calcium, dissolved	mg/l as Ca
Magnesium, dissolved	mg/l as Mg
Potassium, dissolved	mg/l as K
Sodium, dissolved	mg/l as Na
Alkalinity, field total	mg/l as CaCO3
Bicarbonate, field dissolved	mg/l as HCO3
Chloride, dissolved	mg/l as Cl
Fluoride, dissolved	mg/l as F
Silica, dissolved	mg/l as SiO2
Sulfate, dissolved	mg/l as SO4
Nitrogen, Ammonia dissolved	mg/l as N
Nitrogen, Ammonia + organic dissolved	mg/l as N
Nitrogen, Ammonia + organic total	mg/l as N
Nitrogen, dissolved	mg/l as N
Nitrogen, total	mg/l as N
Nitrogen, Nitrate dissolved	mg/l as N
Nitrogen, Nitrite dissolved	mg/l as N
Nitrogen, NO2 +N03 dissolved	mg/l as N
Nitrogen, organic dissolved	mg/l as N
Nitrogen, organic total	mg/l as N
Orthophosphate, dissolved	mg/l as P
Orthophosphate, dissolved	mg/l as PO4
Phosphorus, dissolved	mg/l as P
Phosphorus, total	mg/l as P
Solids residue at 180 deg C, dissolved	mg/l
Iron, dissolved	ug/l as Fe
Manganese, dissolved	ug/l as Mn
Suspended sediment	mg/l
Suspended sediment sieved, diameter finer than 0.062 mm	% diam < 0.062 mm

* Station #05536105 was resumed in 2000 with sponsorship by the MWRD, though listed as discontinued in the USGS water year 2000 water resources data. Station #05537000 was an MWRD station with data verified by the US Corps of Engineers.

Table 13 – USGS UIRB NAWQA Parameters

In addition to the single UIRB NAWQA site with extensive water chemistry data, the USGS historically collected water quality data on seven River stations. The following sites are USGS monitoring stations on the River with discontinued water chemistry and microbiological data collected not less than quarterly:

- # 05534500, North Branch Chicago River at Deerfield (1978-91)
- # 05536000, North Branch Chicago River at Niles (1978-91)
- # 05536195, Little Calumet River at Munster, Ind. (1978-91)
- # 05536275, Thorn Creek at Thornton (1979-91)
- # 05536700, Calumet Sag Channel at Sag Bridge (1978-87)
- # 05536995, Chicago Sanitary and Ship Canal at Romeoville (1986-92)
- # 05537000, Chicago Sanitary and Ship Canal at Lockport (1978-91)

During the 1970s, the USGS collected daily water temperature data for five stations on the River. The following sites are USGS monitoring stations on the River with discontinued daily water temperature data:

- # 04092490, Calumet River at Chicago (1974-77)
- # 04092550, Lake Michigan at Calumet Park at Chicago (1974-77)
- # 05536135, Chicago Sanitary and Ship Canal at Ashland Avenue at Chicago (1975-77)
- # 05536368, Calumet Sag Channel at Blue Island (1975-77)
- # 05536995, Chicago Sanitary and Ship Canal at Romeoville (1974-77)

Recent annual USGS water resources data for Illinois are available from the USGS on CD and printed 2-volume reports (e.g. LaTour et al. 2001). The USGS switched to this format in 1998 after receiving increased requests for electronic hydrologic data and adding both precipitation and biological data to the annual report. From 1965 to 1997, the USGS provided annual water resources report in printed volumes. Water resources data for Illinois were published primarily in USGS Water-Supply Papers in the years prior to 1965.

2.9 SOME SIGNIFICANT OBSERVATIONS FROM SECTION II

As stated in Section 1.1, an improved River entails the following features:

1. A connected greenway along the River, with continuous multi-use paths along at least one side of the River;
2. Increased public access to the River through the creation of overlooks and public parks;
3. Restoration and protection of landscaping and natural habitats along the River, particularly fish habitat;
4. Development of the River as a recreational amenity, including twelve new canoe or boat launches and ten new fishing areas (some of which have already been built); and,
5. Increased economic development compatible with the River as an environmental and recreational amenity, such as streamside cafes and restaurants.

Fulfilling these goals for the River (and Friends' interpretation of them on page 5) requires further understanding of the River's condition and, hence, new monitoring or new applications of existing monitoring data. This section describes the changes in River monitoring that Friends believes are necessary to satisfy the demands of emerging River uses.

In many cases, Friends' suggested changes might seem to put the cart before the horse. That is, some proposed changes in monitoring only appear to make sense if they are preceded by new regulations or policy. However, current monitoring already exceeds regulatory requirements and there is no reason to believe it could not continue to do so. Monitoring can be thought of as simply a required response to regulation or, more broadly, as a desirable inquiry to gain better understanding for improving conditions. Friends adopts this latter perspective and looks to redoubled monitoring efforts by agencies, universities, and even citizen scientists to realize a healthier, more enjoyable River. Abundant and targeted information is perhaps the most powerful guide to meeting River goals.

The list of recommendations that follows supplements and leverages the current monitoring already underway described in Section II. Indeed, the existing monitoring efforts provide an essential core of information for attaining the new River goals. The existing monitoring regimes are well designed for assessing long-term trends on the whole River. However, the emerging expectations for the River beg new questions that require monitoring at more discerning scales of time and space, and monitoring tailored to much more interactive River uses.

Section III - Recommendations and Discussion

As stated in Section 1.1, an improved River entails the following features:

1. A connected greenway along the River, with continuous multi-use paths along at least one side of the River;
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RECOMMENDATION #1

A multi-entity partnership should be established to oversee and coordinate the use of monitoring efforts as a means to improve the River.

As evident in this section, many extended or new monitoring efforts are possible and recommended. Some monitoring is best carried out by agencies, some by universities, and some by citizen scientists. A multi-entity partnership could coordinate monitoring efforts and data, as well as promote the filling of monitoring gaps. This partnership could likewise prioritize monitoring needs, providing clear justification to funding entities that a proposed monitoring activity is perceived as needed and its results would be used.

One of the first tasks of the partnership would be to explore the designation of IEPA waterbody segments (or "assessment units"). Use impairments for the River and all streams in the state are decided on the basis of IEPA waterway segments. With increased use expectations for the River, it is important that its regulated waterway segments accurately reflect the condition of the River. It is unclear whether the present waterway segments represent reaches of the stream that are in fact relatively homogeneous with respect to water chemistry. Existing data or additional monitoring should be used to determine if IEPA waterway segments could be made more consistent with actual breaks in water quality.

The partnership should also consider new chemicals and chemicals of emerging concern (e.g., pharmaceuticals) for addition to River monitoring efforts. It is presently unclear what protocol is followed to determine whether new additions should be made to the chemical water quality monitoring efforts on the River. New chemicals are, of course, being developed all the time and not all may be removed by good wastewater treatment. A more formal and open procedure should be used to determine and justify new additions to the monitoring regime. This process would openly explore the efficacy of adding new pharmaceutical chemicals and endocrine disrupters to the list of constituents monitored.

The partnership should be open to all parties interested in the future of the River.

RECOMMENDATION #2

There should be a broader effort to better characterize sources of pollution to the River. Both the concentration and total load of pollutants should be considered.

In order to manage adequately the River for its proposed new uses, managers must have a relatively complete picture of all inputs to the River and their relative contributions to its water quality. Two regulatory activities anticipated by the IEPA — a Total Maximum Daily Load (TMDL) analysis and Use Attainability Analysis (UAA) — could serve as vehicles to develop this relatively complete picture of inputs to the River.

Currently, IEPA makes the most thorough attempt to identify the sources of pollution to the River through NPDES reporting and the agency's 305 (b) water quality reports. IEPA uses what sampling teams see in the field, what the Agency knows about land use, and what data are reported in NPDES DMRs to infer what the likely sources of pollutants are to a segment of the River. However, these sources given by IEPA should be treated only as best estimates; most data are derived from the ambient program designed only to measure the condition of the River in general.

Like the two ambient water quality monitoring programs, the following physio-chemical sampling efforts are designed to generally measure the River's condition:

- MWRD Continuous DO Monitoring
- MWRD High Flow Monitoring
- IEPA Pesticides Subnetwork
- IEPA Toxicity Testing
- NSSD Stream Chemistry Monitoring
- USGS NAWQA Data

Similarly, all fish monitoring can be treated as demonstrating, in part, whether adverse input sources exist, but not where they come from. Fish monitoring cannot solely distinguish input sources primarily due to the high mobility of fish.

Unlike fish, benthic invertebrates are relatively immobile, making them more representative of the average conditions where they are collected. Still, benthic sampling can only show the effects of pollutants and not the specific sources thereof, so it should be considered primarily a detection method as well.

More appropriate than ambient, fish, or invertebrate monitoring for actually locating sources are "special needs" sampling programs. For example, the IEPA Facility-Related Stream Surveys closely examine a stream segment near a permitted facility to separate the influences of the point source from the background or upstream condition. This type of sampling is purposely designed to distinguish, not just detect, pollutant sources.

* MWRD does operate a hotline for the report of actual or potential illegal discharge to the River. Incidences reported to the 312/332-DUMP hotline are pursued immediately in the field by trained staff from the MWRD Industrial Waste Division.

The IEPA Intensive River Basin Surveys take a similar approach and attempt to distinguish sources as well.

Another group of sampling activities distinguishes input sources by definition: discharge monitoring programs. The facility DMRs, available from IEPA, provide an abundant and nearly complete record of all legitimate point source discharges to the River. Also providing data on sources of direct discharge to the River are the CSO Discharge Monitoring program and IDOT Pumping Station Discharge effort, both carried out by the MWRD on a temporary basis.

The Sediment Chemistry and Toxicity Monitoring of the MWRD and the sediment chemistry study by the USEPA directly measure pollutant migration to the River from the local sediment. Those programs therefore both detect and distinguish sources of pollutants.

In sum:

- Only one type of source is completely monitored - discharges from permitted point sources;
- Four stormwater discharges - the IDOT Pumping Stations - in the entire watershed are monitored;
- Only the three major CSO pump stations out of at least 260 permitted CSOs in the watershed are monitored, although this is changing under the 2002 NPDES permits; and,
- There are no monitoring efforts at all specifically designed to distinguish unpermitted discharges to the River from other, legitimate sources.*

Finally, some segments of the River receive higher levels of discharge than others and may feature higher concentrations of chemical constituents. These areas would, more significantly than average, limit new recreational, aesthetic, and biological expectations for the River. Hot spots, once detected, might return the biggest marginal yield on investments made on River improvement. Monitoring should be designed to discover hot spots in both wet and dry weather.

RECOMMENDATION #3

Monitoring should be tailored to better identify sources of pollution, including suspected unpermitted discharges. Monitoring should help the MWRD and other agencies become more effective in the ongoing efforts to detect unpermitted discharges.

New uses of the River will require that unpermitted discharges be actively sought out and eliminated. All emerging uses, whether recreational, biological, or simply aesthetic, are potentially threatened by unpermitted discharges. Moreover, unpermitted discharges are illegal by definition and should be vigorously pursued under any vision for the River.

Currently, detection of unpermitted discharges is limited to informal observation by MWRD field personnel and responses to citizen complaints through the MWRD's illegal dumping telephone hotline. These surveillance efforts should be continued and augmented by a more formal, regular surveillance effort conducted by field professionals or trained citizen scientists.

RECOMMENDATION #4

A broad effort should be made to render monitoring data easily accessible and understandable to the public.

All people, from the general public to a scientific specialist, should be able to locate, access, and use data from the sampling programs on the River to gauge progress toward an improved River.

(a) A summary of all monitoring programs, including descriptions of those programs, should be provided in one location in a publicly accessible form. In most cases, only a very basic outline of any given monitoring program is provided to the public. Relatively complete descriptions of each monitoring program should be accessible so an interested River user could assess how data is gathered. Presently the data is spread out over various reports and web sites. There is no central summary of monitoring programs (other than this report).

(b) Raw data and meaningfully interpreted data should be accessible to the public as quickly as this can accurately be achieved. Though vast data are potentially available to a user, the time between sample collection and data reporting can be limiting. The USGS reports real-time water quantity data, but is unique in that aspect. The USGS specifies that real-time data are yet subject to quality assurance and it is indeed quality assurance that substantially delays the reporting of data in the cases of water quality monitoring.

The ambient programs of the IEPA and, with the recent approval of a Quality Assurance Program Plan (QAPP), the MWRD, target a few months between collection and reporting of water chemistry data. Because these programs are so regular and follow well-established protocols, they can reasonably upload quality-assured data to the national STORET database in this time frame. Prior to QAPP approval, MWRD AWQM data were released only in more delayed publications, the most recent of which is the annual report for 1999 released in October of 2001. Therefore, it is expected that the STORET database will be a publicly accessible repository of data that is only a few months old or less.

NPDES Discharge Monitoring Reports (DMRs) can be requested from the IEPA as soon as they are received from a permitted facility. However, given that DMRs include data from throughout the prior month, the delay between collection and reporting (to the user) is at least a month.

For many biological studies, the period between data collection and reporting is often in years. (An important exception is IEPA fish contaminant monitoring program, which reports summer samples the following spring). In biological sampling efforts, some of the organisms are recorded in the field and returned directly, but many more are typically preserved and taken to a lab for further analysis. Obviously, the larger the sampling effort, the more analysis needed in the lab, and the longer the delay in reporting. One example of this is the FWS *Nature and the River* report issued in 1998, with 17 benthic samples collected in 1993. In a similar example on the nearby Des Plaines River, the MWRD collected benthic, fish, and bacterial samples at seven different stations in 1992 and 1993, publishing extensive results in an April 2000 report.

RECOMMENDATION #6

A scientifically sound "report card" that measures progress against River goals should be developed, regularly updated, and publicly distributed.

The potential audience for a River report card is broad — scientists, agencies, and regular citizens all have a stake in a healthier, more enjoyable River. A River report card should be firmly based in science and provide information accessible to a broad audience. The report card could be part of a larger public relations campaign targeted to improve the public visibility of the River and alert citizens to the steadily improving quality of the River.

A wide range of measurable parameters (including, among other potential categories, biology, water chemistry, and public health) should be incorporated into the report card.

To summarize the information in the report card, it may be useful to develop a single composite index that describes the condition of the River. This index could be updated annually and, like the report card itself, should be based on scientifically sound monitoring data. Such an indicator has utility as both a guide for monitoring and as an accessible way to report progress. Various River protection efforts are measured by such a report card.

The Chesapeake Bay Foundation (CBF) has had good success with the indicator approach. CBF developed their indicator with the assistance of technical agency experts and universities to ensure that its scientific basis was sound. The indicator uses regular monitoring data to gauge the Bay's progress toward a defined target value by a defined date. CBF's indicator can be viewed at the organization's web address (www.cbf.org). To both present the index and show how it can be usefully conveyed to the public, a CBF press release is included as Appendix B to this report.

RECOMMENDATION #7

A dynamic model of the River should be available to appropriate agencies and institutions in order improve understanding of the River, measure the impact of input sources, and help guide decision making for River improvements. Such a model is under development by the MWRD.

Not all aspects of the River can be directly monitored, so a dynamic model of water quality on the River should be developed. This model will need to account for the unsteady state conditions of the River due primarily to diversions from Lake Michigan and wet weather CSO discharges. As mentioned in Section II, the MWRD is currently developing such a model with the Institute for Urban Environmental Risk Management at Marquette University. This effort should be continued and regularly updated with the changing conditions of the watershed.

This model should be used to explore the probability that applicable water quality standards are being met at all times on the River. Only 39 (MWRD) to 45 (MWRD + IEPA) instantaneous snapshots are taken of the River over a month; it is unclear if these samples can be extrapolated to adequately represent the whole month. River managers should establish, consistent with new River uses, a target confidence level for statistical analysis of monthly ambient water quality data.

RECOMMENDATION #8

River monitoring should be expanded to include monitoring for narrative standards.

Not all standards on the River are stated as acceptable concentrations of chemical constituents. Most notably, even in the less stringent regulations for secondary contact reaches, the River "shall be free from unnatural sludge or bottom deposits, floating debris, visible oil, odor, unnatural plant or algal growth, or unnatural color or turbidity" (35 Ill. Adm. Code ß 302.403). These narrative conditions must be monitored on par with chemical constituents on the Chicago River to ensure that new River uses can be achieved.

RECOMMENDATION #10

Assessment and monitoring of the River's riparian area should be increased.

A high quality riparian area, from the banks themselves to a minimum distance on the order of 30 feet from the banks, is essential to a healthier River environment. Improved River ecology will require some critical mass of instream vegetation and bankside vegetation for both forage and habitat purposes. Whether of much ecological value or not, improved vegetation will be necessary to achieve the aesthetic goals for the River such as scenic overlooks and streamside cafés. A continuous recreational River trail should be visually pleasing as well as functional. For many citizens, an improved River will be experienced only visually and the riparian area alone will form the bulk of their impressions.

Exploration and improvement of the riparian area should be a three-step process. First, the important elements to be assessed should be determined. These elements may be habitat quality for riparian animals (such as beaver and mink), floristic quality, recreational accessibility, or others. Second, after the important elements have been determined, an initial assessment of each element should be performed. This process may take a few years and will provide the baseline information for riparian monitoring. Finally, regular monitoring (once yearly in many cases) of the riparian area should be conducted to measure progress toward a improved River with a vibrant, healthy streamside.

RECOMMENDATION #11

A minimum (baseline) level of monitoring should be established throughout the watershed. To meet this baseline level, more River monitoring should be conducted in some areas, such as Lake County.

There is a surprising dearth of data collected in the Lake County portion of the watershed compared to the Cook County portion of the watershed. The MWRD's extensive ambient water quality monitoring program does not extend into Lake County, which falls outside of the District's jurisdictional boundaries. Likewise, none of the IEPA ambient water quality or intensive river basin survey sampling sites falls in Lake County.

The Lake County portion of the watershed represents the headwaters of the Chicago River. These Lake County headwaters are distinct from the lower portions of the River in that the headwaters run largely free of permitted dischargers, are generally wadeable, and receive drainage from a less urban landscape. As such, the Lake County headwaters offer different opportunities for recreational, biological, and aesthetic uses than the lower portions of the River. Additionally, the headwaters provide significant flow to lower portions of the River and influence the water quality of Cook County's more northern segments.

Increased monitoring of water quality, biology, habitat, and sediment chemistry on the upper North Branch in Lake County should be carried out at a level at least comparable to the recently expanded MWRD AWQM program. This data from the Lake County headwaters should be coordinated and reported in conjunction with the equivalent Cook County data (see Recommendation #4).

Having a better understanding of the impacts of upstream activities will help guide improvements closer to the Chicago portions of the River.

RECOMMENDATION #12

Ongoing identification and assessment of stressors limiting to aquatic biota should be incorporated into River monitoring.

Whether aquatic biota are analyzed as a surrogate for improved River health or for the more specific purpose of fishery management, monitoring should be designed to help managers determine the factors that are limiting to aquatic biota. These factors might be constant disruption of habitat, acute toxicity from wet weather, insufficiency of macroinvertebrates — all of which can be monitored — or other factors. The upper North Branch in particular would benefit from expanded biomonitoring.

RECOMMENDATION #13

The foregoing recommendations should be incorporated into the Use Attainability Analysis (UAA) wherever possible and appropriate.

The IEPA is about to let out a contract to perform a Use Attainability Analysis (UAA) to determine the best use designation for the Chicago Waterway System. Since the success of a UAA is largely dependent upon reliable monitoring data, it is recommended that these findings and foregoing recommendations be carefully considered and included wherever practical in planning and performing the Chicago Waterway System UAA.

Section IV - Conclusion and Summary of Recommendations

A new vision for the Chicago River is emerging that will place new demands on the River. These new demands will require extension of existing monitoring programs and the creation of new ones. The current monitoring programs are exemplary and typically exist in the absence of any mandate to carry them out. Nonetheless, Friends believes the following improvements to River monitoring will be required to realize the high expectations that have been set for the future River:

1. **A multi-entity partnership should be established to oversee and coordinate the use of monitoring efforts as a means to improve the River.**
2. **There should be a broader effort to better characterize sources of pollution to the River. Both the concentration and total load of pollutants should be considered.**
3. **Monitoring should be tailored to better identify sources of pollutants, including suspected unpermitted discharges. Monitoring should help the MWRD and other agencies become more effective in their ongoing efforts to detect unpermitted discharges.**
4. **A broad effort should be made to make monitoring data easily accessible, timely, and understandable to the public.**
5. **Better coordination should take place between public health agencies, stream regulatory agencies, and user groups to understand and communicate public health risks associated with River use.**
6. **A scientifically sound “report card” to measure progress against River improvement goals should be developed, regularly updated, and publicly distributed.**
7. **A dynamic model of the River should be available to appropriate agencies and institutions in order improve understanding of the River, measure the impact of input sources, and help guide decision making for River improvements. Such a model is under development by the MWRD.**
8. **During wet weather, the River itself should be monitored to supplement newly required monitoring of CSO discharges.**
9. **River monitoring should be expanded to include monitoring for narrative standards.**
10. **Assessment and monitoring of the River’s riparian area should be increased.**
11. **A minimum (baseline) level of monitoring should be established throughout the watershed. To meet this baseline level, more River monitoring should be conducted in the Lake County portion of the watershed.**
12. **Ongoing identification and assessment of stressors limiting to aquatic biota should be incorporated into River monitoring.**
13. **The foregoing recommendations should be incorporated into the Use Attainability Analysis (UAA) wherever possible and appropriate.**

It is our hope that this report will bring to light many of the challenges facing the River and River monitoring over the coming years. Friends is committed to this exciting new future for the River and will continue to work toward making it a reality.

APPENDIX A: ALL MONITORING ACTIVITIES, BY AGENCY

Type Key: WC=Water Chemistry; BS=Biological Sampling; SC=Sediment Chemistry; PH=Physical Habitat; WQ=Water Quantity

Ref #	Agency	Type	Monitoring Activity	Start	Ongoing	End	Periodicity	# of locations	Pg #
1	MWRD	WC	Ambient Water Quality	1970	X		monthly	39	7
2	MWRD	WC	Dissolved Oxygen	1998	X		hourly, 24/7	31	10
3	MWRD	WC	High Flow Water Quality	2001		2001	hi-flow periods	2	12
4	MWRD	WC	Combined Sewer Overflow	2001		2001	per discharge event	3	13
5	MWRD	WC	IL Dept of Transportation; Interstate Highway	2002	X		per discharge event	4	13
6	MWRD	WC	NPDES	1978	X		various, by constituent	3	14
7	MWRD	BS	Fish Population	1974		1996	1-5x/yr	20	15
8	MWRD	BS	Fish Population	1996		1997	1-5x/yr	10	15
9	MWRD	BS	Biological Conditions	2001	X		by site, annual or 1x/4yr	39	17
10	MWRD	BS	Fish Contaminant	see #23					18
11	MWRD	SC	Sediment Quality	1992		1993	1x	28	18
12	MWRD	SC	Sediment Chemistry & Toxicity	2002	X		4 yr	39	20
13	MWRD	PH	Physical Habitat	2002	X		4 yr	39	20
14	IEPA	WC	Ambient Water Quality	1977	X		every 6 wks/9x	8	21
15	IEPA	WC	Intensive River Basin Surveys	1983		1984	15 yr	16	24
16	IEPA	WC	Intensive River Basin Surveys	2001		2001	5 yr	21	24
17	IEPA	WC	Facility-Related Stream Surveys	1981	X		occasional		27
18	IEPA	WC	Industrial Solvents Subnetwork			n/a	n/a	2	27
19	IEPA	WC	Pesticide Monitoring	1996	X			3	27
20	IEPA	WC	NPDES Discharge		X		monthly	by permit	28
21	IEPA	BS	Intensive River Basin Surveys	part of #15					–
22	IEPA	BS	Facility-Related Stream Surveys	part of #17					–
23	IEPA	BS	Fish Contaminant	1988	X		annual	3	28
24	IEPA	BS	Fish Population		X		n/a		29
25	IEPA	BS	Macroinvertebrate sampling		X		n/a		29
26	IEPA	SC	Sediment Chemistry		X		n/a		30
27	IEPA	PH	Physical Habitat		X		n/a		30
28	USEPA	SC	Sediment Chemistry	1999	X		1x	100	30
29	USFWS	BS	Fish & Benthic Invertebrate	1993		1993	1x	17	30
30	USFWS	PH	Physical Habitat	1993		1993	1x	38	30
31	NSSD	WC	Water Chemistry		x		quarterly	4	32
32	NSSD	BS	Biological Sampling		x		occasional	1	32
33	IDNR	BS	Fish & Invertebrates sampling	1996		2001	occasional	10	33
34	USGS	WQ	Water Quantity Gaging	1916/ 1947	x		continuous	18 active 11 discontinued	34

APPENDIX B: CHESAPEAKE BAY FOUNDATION PRESS RELEASE

Pollution, sprawl, and crabs drive Bay's first decline in recent years;

Chesapeake health drops to 27 out of 100, according to State of the Bay Report†

October 23, 2001

Contact: Geoff Oxnam 410.268.8816

FOR IMMEDIATE RELEASE

Download the Complete 2001 State of the Bay Report (High Bandwidth Version with color images 2.4MB) or (Low Bandwidth Version, text only 126KB).

(ANNAPOLIS, Md.)—The Chesapeake Bay's health declined for the first time in recent years according to the 2001 State of the Bay Report released today by the Chesapeake Bay Foundation. Two indicators, forest buffers and shad, showed modest improvement. But continued damage from excessive levels of water pollution, accelerated loss of land to sprawl, and problems in the crab fishery created a 1-point decline in the Bay's overall health between 2000 and 2001. The Bay's health remains barely more than one quarter of historic levels at 27 out of 100 and still far short of the 40 needed by 2010 for the Bay to be removed from the U.S. Environmental Protection Agency's list of impaired waters. This year's decline marked the first since CBF began issuing the annual report in 1998.

"The most alarming trend in this year's report is not what has changed, but what hasn't," said William C. Baker, president of the Chesapeake Bay Foundation. "Water pollution—primarily from excess nitrogen and phosphorus—has mired the Bay's health in the 20 percent range. We need to cut this pollution in half before underwater grasses, crabs, oysters, and other life will thrive and restore the Bay system."

The State of the Bay Report is an annual snapshot of the health of North America's largest estuary. Based on analysis of data from a variety of sources, CBF scores the health of 13 key Bay indicators between 0 and 100 (the Bay before European settlement). The average of these scores represents the overall health of the Bay. CBF estimates that the Bay's health bottomed out in the early 1980s when it would have scored a 23 and that a "saved Bay" would score a 70.

"We'll never see a Bay that is as pristine as that which John Smith saw in the beginning of the Seventeenth Century," added Baker. "But when we restore clean water with healthy levels of oxygen, we can expect a great awakening—an upward spiral driven by rebounding underwater grass beds and oyster bars."

The decline in this year's health rating is not only troubling for the Chesapeake, but also for all coastal waterways. The Chesapeake Bay and the multi-state, voluntary partnership that oversees the recovery are models for coastal waterway restoration around the world. Experts estimate that the Chesapeake Bay is anywhere from 10 to 15 years ahead of any other estuary in this recovery effort.

Gains in 2001

Shad: A new fish ladder at the York Haven Dam in June 2000 that opened the Susquehanna River to Binghamton, N.Y., for the first time since 1904 and other management strategies are signs of progress. Shad counts around the watershed increased in 2001. American shad, migratory fish that travel up Chesapeake Bay tributaries each year to spawn, have declined dramatically over the past century due to fishing pressure, poor water quality, dams and other blockages that closed 98 percent of spawning grounds. Significant recovery may take many years, however, and the indicator remains one of the Bay's lowest at 6 out of 100.

Forested buffers: Shores lined by trees and shrubs showed a 1-point increase due to a tremendous amount of restoration work throughout the watershed. Federal, state, local and private programs are restoring this vital resource that reduces erosion, filters pollution, and provides essential habitat. The Conservation Reserve Enhancement Program, for example, offers financial incentives for farmers and property owners to restore buffers and wetlands and has grown to more than 5,200 acres in Virginia, 20,000 acres in Pennsylvania, and 30,000 acres in Maryland. However, the Bay has barely more than 50 percent of its historic levels of forest buffers, and pressure from land development continues to eliminate them.

Losses in 2001

Blue Crabs: The biggest decline in this year's report came in blue crabs, the bay's most valuable commercial catch and a cultural icon. Decades of habitat loss (primarily underwater grasses) and intensive commercial and recreational pressure on the fishery have led to significant declines both in the crab population and, more importantly, its reproductive capacity. In 2000, the Bi-State Blue Crab Advisory Committee, composed of scientists, watermen, conservationists and others, came to consensus on a strategy to shore up the population and fishery problems. In 2001, Maryland and Virginia began a three-year effort to implement the strategy. Reductions in water pollution that allow underwater grasses to rebound are essential to long-term improvements.

Resource Lands: Updated estimates on the annual rate of resource-land (farms, fields, forests and open spaces) loss led to a 3-point decline. Resource lands filter water, reduce erosion, and serve as habitat throughout the watershed. Prior to 2001, estimates held that about 90,000 acres are lost annually to development. Current estimates say that that figure is too low. Although the U.S. Department of Agriculture pegs the number at 128,000 acres, CBF and other experts believe it is less. Due to the lack of consensus, CBF reduced the index only slightly.

Water Pollution: No real improvement was made toward reducing the Bay's top pollution problem—excess nitrogen and phosphorus. Along with sediment pollution, nitrogen and phosphorus pollution lead to low levels of water clarity that prohibits sunlight from reaching underwater grasses, chokes fish, and smothers shellfish. Water pollution also contributes to low levels of dissolved oxygen, creating "dead zones" in large parts of the Bay.

"Clean water is the foundation of a healthy Bay and our top priority," said Baker. "There are two ways to control water pollution—produce less and filter more. While reducing pollution from its sources, we must also restore natural filters such as forest buffers and wetlands and improve manmade filters, particularly sewage treatment plants."

In order to reach a level where the water is healthy enough for restoration efforts to sustain a healthy system, the Bay's health score must improve to a 40. That effort is at the heart of the multi-state partnership to restore the Bay's health and sights are set on 2010. Chesapeake 2000, the new Chesapeake Bay Agreement signed in June 2000, provides a strong blueprint to achieve those improvements. CBF is building coalitions and working with federal, state, and local officials to raise the estimated $8.5 billion needed over the next decade to reduce water pollution.

Chesapeake Bay Foundation's 2001 State of the Bay Report		
Habitat	**Pollution**	**Fisheries**
Wetlands 42	Toxics 30	Crabs 42
Forested Buffers 54	Water Clarity 15	Rockfish 75
Underwater Grasses 12	Phosphorus 15	Oysters 2
Resource Lands 30	Nitrogen 15	Shad 6
	Dissolved Oxygen 15	
	Overall: 27	

Note: All scores out of 100—the Bay as it was before European settlement

For more information, contact Geoff Oxnam, Media Relations Manager, 443/482-2033 or goxnam@cbf.org.

Download the Complete 2001 State of the Bay Report (High Bandwidth Version with color images 2.4MB) or (Low Bandwidth Version, text only 126KB).

APPENDIX C: ACRONYM GUIDE

AWQM	Ambient Water Quality Monitoring
AWQMN	Ambient Water Quality Monitoring Network
BETX	benzene, ethyl benzene, toluene, and xylene
CBF	Chesapeake Bay Foundation
CSO	combined sewer overflow
CWA	Clean Water Act
DMR	discharge monitoring report
DO	dissolved oxygen
FRSS	Facility-related Stream Survey
GIS	Geographic Information System
IBI	Index of Biotic Integrity
IDNR	Illinois Department of Natural Resources
IDOT	Illinois Department of Transportation
IDPH	Illinois Department of Public Health
IEPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
IRBS	Intensive River Basin Survey
MBI	Macroinvertebrate Biotic Index
MWRD	Metropolitan Water Reclamation District of Greater Chicago
NPDES	National Pollutant Discharge Elimination System
NSSD	North Shore Sanitary District
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated byphenyls
TARP	Tunnel and Reservoir Plan
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
UIRB NAWQA	Upper Illinois River Basin National Water Quality Assessment
URMRI	Urban River Monitoring and Recovery Initiative
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WWTPs	wastewater treatment plants

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