OHIO RIVER VALLEY WATER SANITATION COMMISSION

WATER QUALITY MONITORING STRATEGY

for

the Ohio River

and

Lower Reaches of

Major Tributaries

A recommended regional monitoring program to satisfy the needs of Federal, State and Interstate Agencies

developed by the
ORSANCO Ohio River Monitoring Strategy Study Team

DECEMBER 1973

An interstate agency representing: Illinois • Indiana • Kentucky • New York • Ohio • Pennsylvania • Virginia • West Virginia

A RECOMMENDED WATER QUALITY MONITORING STRATEGY FOR THE OHIO RIVER AND LOWER REACHES OF MAJOR TRIBUTARIES

developed by the

ORSANCO
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OHIO RIVER VALLEY WATER SANITATION COMMISSION
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FOREWARD

In May 1973 the Commission directed that a study team be formed to prepare a monitoring strategy for the Ohio River and mouths of major tributaries that would satisfy the needs of state, interstate and federal agencies for appraisal of water quality.

This document, submitted to the commissioners of ORSANCO, addresses itself to: 1) the statutory requirements of various agencies, and in particular PL 92-500; 2) monitoring stragegy; 3) water quality needs; 4) existing monitoring network; 5) recommended monitoring network; and 6) recommendations for implementing the proposed strategy.

The report represents the combined thinking of the study team in attempting to arrive at a program that will satisfy the needs of the various agencies in a cost effective manner.

The study team wishes to acknowledge with appreciation the efforts of many persons who contributed to the formulation of the report, and in particular Messrs. David Rockwell, Curtis Ross, William West and Robert Zeller of U. S. Environmental Protection Agency, Region V.

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I

INTRODUCTION

The Engineering Committee in September 1972 requested the ORSANCO staff to conduct an appraisal of the basic ORSANCO, State and Federal agencies' water quality monitoring strategies and programs. A draft report of its findings titled "Monitoring and Evaluation of River Quality Conditions in the Compact District" was issued in March 1973. In view of the comprehensive monitoring requirements contained in PL 92-500, the Commission directed a reappraisal, based on the Policy Committee recommendation to develop a recommended water quality monitoring strategy for the main stem of the Ohio River and the lower reaches of the major tributaries (Appendix 1). This area shall later be referred to as the study area. The study team consists of representatives from the U. S. EPA, U. S. Corps of Engineers, USGS, the signatory states (as appropriate) and the ORSANCO staff.

II

PROJECTED PROGRAMS

Statutory Requirements

Each of the member agencies was requested to identify the applicable section(s) of statutes or regulation(s) requiring monitoring. Appendix 2 is a summary listing of the applicable provisions. Monitoring is called for in the authorizing legislation for each state by giving the appropriate control agencies responsibility to protect state waters. Furthermore, PL 92-500 delegates to state as well as federal agencies the responsibility for carrying out monitoring programs.

Summary of Agency Monitoring Needs

The member agencies were requested to identify their projected monitoring needs. The following is a synopsis of the indicated needs.

U. S. Corps of Engineers -- Water management activities related to reservoirs, planning (PL 87-88) and navigation operations require water-quality intelligence on specific river conditions and trends. Specific needs are:

1. Priority access to timely (real time) temperature, dissolved oxygen, pH and conductivity data in the study area during the summer and early fall low-flow periods on a several-times-a-day basis.

2. Information on long and short-term trends in water quality at the same locations over the entire calendar year for the above listed parameters, plus an expanded list of chemical and biological parameters.

3. Continuation of the 1957-1962 and 1968-1970 fish surveys on the Ohio River.

4. Initiation of biological surveys using biological indicators other than fish.

Thirteen stations and associated parameters are itemized for the recent Ohio River main stem pools and on 14 tributaries. These sites are of present concern or may become important in the future.

U. S. Environmental Protection Agency -- A monitoring strategy for the study area was identified, including specific monitoring needs. The strategy, responsive to PL 92-500, addressed three basic monitoring regimes:

1. Intensive basin/segment surveys, including water quality and point and non-point sources.

2. Primary In-Stream Monitoring Network.

3. Compliance monitoring (point sources).

In addition, strategies were presented for laboratory support and quality assurance, and data handling, storage and reporting.

An overview and identification of the monitoring needs for intensive surveys for each water quality limiting segment was presented, based on information compiled by the applicable U. S. EPA regional offices. However, the specific monitoring needs were not identified due to the many conflicts in segment classifications.

The specific monitoring needs to support a primary in-stream monitoring network in the study area, were identified. A total of 38 monitoring locations were selected. Water quality parameters were selected based on the needs under Sections 104(a), 106(e), and 502(13). Sampling frequencies were based on agency requests. Man power, cost, and statistical considerations were not considered.

Specific point source compliance monitoring needs were not identified.

U. S. Geological Survey -- The Survey expresses a need for water quality information relating to the planned Level 1 accounting network (OMB Circular A-67). This is a part of the national water data network to provide for periodic accounting of water supply needs, both quantity and quality, and water usage throughout the United States. Needs expressed by the Survey are:

1. Data on the variability of stream flow and water quality at selected accounting sites for a sufficient number of parameters, at suitable frequencies, to provide reasonable estimates of dissolved inorganic, organic, biologic, bacteriologic and sediment loads.

U. S. Geological Survey (continued)

2. An interagency committee, coordinated by the USGS, selected 22 tentative sites for the national stream quality accounting network in the study area along with associated parameters and frequency of measurement.

ORSANCO -- The Commission's basic data need is to appraise river quality conditions to implement Articles VI and VIII of the compact. Other purposes served are: 1) to aid in establishing stream-quality criteria; 2) to provide information to determine water discharge requirements; 3) to determine whether or not stream-quality criteria are being met; and 4) to measure trends in water quality.

A network of 58 locations on the Ohio River and major tributaries is proposed, along with selected physical, chemical and biological parameters, and their frequency of sampling.

The stations are located, insofar as possible, to satisfy the following objectives: 1) to measure conditions at points where waste discharges have a major impact on water quality; 2) to measure the water quality at points of usage (i.e. water treatment plants and in recreational areas); and 3) to measure water quality at points of interstate concern (i.e. state boundaries).

Additional recommendations related to the needs are:

1. Water and wastewater treatment plant laboratories might be utilized to provide water quality data, including bacteriological data.

2. Intensification of laboratory quality-control programs to improve the reliability of data from cooperating laboratories.

3. Reactivate U. S. Geological Survey-ORSANCO cooperative agreement to supplement unavailable data through water users, robot monitors and cooperating agencies.

Illinois -- Projected needs, recommendation and comments are:

1. ORSANCO should assume a portion of the water quality monitoring programs in the Illinois section of the Ohio River, particularly at locations where a record has been established, with emphasis on temperature and heavy metals at significant points.

2. Initiate an integrated basin-wide biological survey program.

3. Assist in application of modeling techniques to predict water-quality conditions.

Indiana -- Monitoring recommendations to meet the monitoring requirements of PL 92-500 are:

1. Initiate a periodic sampling program (monthly or semi-monthly) upstream and downstream from five major communites in the Indiana section of the Ohio River for biological and chemical parameters.

2. ORSANCO should conduct or coordinate a 24-hour intensive type field survey of the Ohio River and major tributaries (including biological parameters and benthic deposits).

3. Prepare an annual report integrating survey and stream monitoring results on river conditions for use by states in complying with PL 92-500.

4. Continue the existing robot monitor network.

The interstate considerations involved with the Ohio River indicate water quality monitoring will be best coordinated on a comprehensive interstate basis.

Kentucky -- The strategy position developed by the Commonwealth of Kentucky is summarized to indicate the following projected needs:

1. A water quality monitoring strategy has already been implemented by ORSANCO which meets the requirements of the Section 106 regulations as of the October 5, 1973, draft. This is demonstrated by ORSANCO's monthly reports of robot and water user monitoring activity.

2. This system constitutes a basic and primary network. It should be reinforced, particularly below Cincinnati and Louisville, for better definition of the DO profile.

3. Bacteriological monitoring should be part of the above reinforcement, particularly below major complexes with combined sewers.

4. Intensive stream surveys, performed by U. S. EPA, should be conducted for 303(e) and long-range planning on the Ohio River only. (U. S. EPA has already published two water quality reports for the Louisville-Evansville reach of the Ohio River). This program should be in operation in time to be useful in permit issuance.

5. Laboratory support and quality assurance should be increased by the use of reference sample programs, inventorying laboratory equipment and establishing uniform analytical methods.

Ohio -- Recommendations and comments on projected needs for physical, chemical and biological water-quality data are:

1. Continue the automatic monitoring program at existing locations, plus one additional station in the Maysville, Kentucky, area. Periodic review was recommended to insure a location consistent with data collection needs.

2. Install automatic composite samplers at the automatic monitoring stations to permit collection of water samples for laboratory analysis of parameters not measured by the monitors.

3. Implement an aerial photogrametric program (two to three times) during the hot, low-flow periods to increase the understanding of thermal loads and their distribution in the Ohio River.

4. Develop a program for collection of biological data including continuous biological (bioassay) monitoring in-plant and in-stream.

5. Develop an ORSANCO full-time, mobile field sampling team to routinely collect water-quality data in

critical areas. Primary effort should be data collection for chemical and biological parameters in the Ohio River. Priority development should be given in-stream surveys for dissolved oxygen in areas downstream from Pittsburgh, Pa.; downstream from East Liverpool, Ohio; area of Benwood, W. Va.; area downstream from Parkersburg, W. Va.; area of Huntington, W. Va.-Ironton, Ohio-Portsmouth, Ohio; and area downstream from Cincinnati, Ohio.

Pennsylvania -- The current ORSANCO-State-Federal Primary Monitoring Network on the Ohio River and its major tributaries is considered satisfactory, and no major changes are recommended at this time.

Pennsylvania's monitoring needs are placed in the three categories outlined in this report; primary monitoring should be confined principally to the sampling of discharges. As a part of the discharge surveillance system, the use of visual surveillance for spills and the usual conditions is an additional valuable tool. Observers include the Pennsylvania Fish Commission, the Corps of Engineers' Lock Masters, and the Coast Guard.

A network of eight locations on the Ohio River and major tributaries, along with selected physical, chemical and biological parameters and their frequency of sampling, is proposed to satisfy the program needs.

West Virginia -- The projected needs for water quality data are tabulated for nine locations on the Ohio River main stem and seven locations on lower reaches of major tributaries, along with selected physical, chemical and biological parameters and the required frequency of sampling.

Tabulation of Monitoring Needs

The indicated monitoring needs fall into three groupings: Primary in-stream monitoring network (fixed stations), intensive surveys, and compliance monitoring.

Primary In-Stream Monitoring Network -- Three federal agencies, ORSANCO, and five states designated over one hundred locations where fixed station data from a primary in-stream monitoring network is needed. Appendix 3 and Map 1 are tabulations of these locations and the parameters and frequencies needed. The parameters and frequencies generally fell into three sampling technique categories. These are automated, manual and water user type stations. Some of these stations are in existence and have significant periods of record and others will not be practical until a future date such as when new high level navigation dams are completed. Most of the needs were for data at a point where at least future sampling would be possible. All stations were considered, regardless of location redundancy.

Intensive Surveys -- All agencies recognized that intensive surveys will remain a most important feature of basin-wide water quality measurements (Appendix 4). Since such surveys are oriented very specifically to highly varied objectives, they are difficult to classify. Numerous activities including planning, enforcement, construction, verification, evaluation, modeling, and operation will continue to generate many specific requirements for detailed investigations. PL 92-500 is an example of a legal requirement for intensive surveys. The scope of these studies will vary in time from a few hours for a spot check to several years for comprehensive efforts. The area may be limited to one effluent, one segment, or may include the entire main stem. Regardless of the mechanism by which each agency may meet future intensive survey requirements, the need for coordination of such efforts is recognized.

Compliance Monitoring (point source) -- The requirement to conduct compliance monitoring is recognized as it is defined in Section 106 of the 1972 Amendments. The specific needs associated with fulfilling this requirement are not thoroughly defined in this document. This is, in part, due to the state's being in the early stages of NPDES permits issuance process.

III

A MONITORING PROGRAM TO SATISFY INDICATED NEEDS

A monitoring program for the study area must be responsive to the needs identified under applicable Federal, State and Interstate Agency statutes, compact and directives, etc. These are:

- The 1972 Federal Water Pollution Control Act, as amended (PL 92-500)
- The 1970 National Environmental Policy Act (PL 87-88)
- The ORSANCO Compact and Directives
- OMB Circular A-67
- State legislation.

In essence, the monitoring needs encompass the measurement of and securement of data attendant to the physical (including thermal), chemical, and biological integrity of water quality in the study area, inclusive of point sources and non-point sources.

Further, the objective of the state, interstate, federal, and other recognized agencies, but not limited to monitoring and surveillance programs, is: to identify each point and non-point discharge to determine its effect on water quality; to determine existing quality and quality trends in all waters; and to monitor the progress toward meeting the water quality standards.

STRATEGY

A monitoring strategy* is presented for the study area, which is responsive to the monitoring requirements identified earlier by statutes, compact and directives, using a cooperative, multi-purpose, interdisciplinary monitoring and surveillance program based on the following entities:

* The strategy was based on October 5, 1973, draft of the Section 106 regulations.

1. Intensive Basin/Segment Surveys, including water quality and point and non-point sources.

2. Primary In-Stream Monitoring Network.

3. Compliance Monitoring (point sources) by:

   a. Discharger

   b. Regulatory Agency

Intensive Basin/Segment Surveys

Intensive surveys and reports shall address one or more of the following:

1. Set priorities for establishing or improving pollution controls;

2. Determine quantitative cause and effect relationships of water quality including measuring and evaluating the contribution of pollutants to the Ohio River from point and non-point sources;

3. Obtain data for updating water quality management plans, set effluent limits, determine compliance with water quality standards, and where appropriate, verify the classifications of segments;

4. Determine the effectiveness of pollution control actions taken; and

5. Determine any additional required water quality management actions.

ORSANCO will coordinate the development of an annual projected schedule of surveys to be conducted in the study area contingent on mutual agreement between the parties involved in execution of surveys. The annual projected schedule of surveys will be submitted to the Regional Administrator with each state's program submission consistent with their respective proposed involvements. The work devoted to a given monitoring survey should depend upon the difficulty of the pollution problem in the survey area. The surveys should provide the basis for analyzing water quality conditions, and for evaluating the adequacy of the design and operation of the treatment facilities for all significant municipal and industrial dischargers affecting the survey area. Station locations, parameter coverage, and sampling frequencies for intensive surveys should be consistent with the particular objectives of the study and known or suspected forms and variability of pollution occurring in the survey area. The following factors should be considered:

1. Station locations -- Surface water monitoring stations should measure inputs, transformations, movements, and outputs of pollutants within, to and from the survey area. Stations should be located:

   a. In wastewater outfalls or at representative sites for measuring pollutant contributions from point and non-point sources;

   b. In receiving waters for determining mass balances of pollutants, including stations to define mixing and stratification characteristics and profiles or gradients of water quality with respect to distance;

   c. At study area boundaries for measuring flow and water quality entering and leaving the study area;

   d. At locations particularly selected for biological monitoring;

   e. In sediment deposits for measuring benthic demands, concentrations of pollutants in sediments, and the extent to which sediments act as sinks or sources for the various constituents of the water, and for investigating, where needed, sediment transport of pollutants; and

   f. In locations as may be required to define other pollutant sources, factors and sinks for completing determinations of mass balances of pollutants.

2. Parameter coverage -- The physical, chemical, biological, microbiological, hydraulic, hydrologic, climatic, and geometric parameters to be measured during monitoring surveys will depend upon the survey purpose and local conditions, and tailored to the specific pollution problems of the area. However, all surveys should include, at representative sites, measurements of dissolved oxygen, temperature, pH, and pollutants known or suspected to be entering the surface waters of the survey area from specific point sources of pollution. All surveys of flowing streams should include measurements of stream flow or estimates where measurement is not possible or practical.

   Depending upon the survey purpose and localized conditions within the study area, the following parameters should be measured where needed to satisfy objectives of the particular study and to fulfill requirements set by the Regional Administrator:

a. Water quality and related parameters to measure intermediate forms or final effects of pollutants to determine balances of materials affecting water quality;

b. Biological parameters to evaluate the balance and condition of indigenous communities of aquatic organisms and eutrophic conditions, including standing crop, diversity of indigenous aquatic communities, and indicator organisms, in accordance with but not limited to, parameters listed in Appendix 5.

c. Biologically related chemical and physical measurements, analyses, and observations, including necessary chemical analyses of tissue of aquatic organisms to determine the presence and extent of toxic materials;

d. Microbiological parameters (both indicator organisms and specific pathogens where appropriate) in water, sediments, and aquatic biota; and

e. Hydraulic and geometric parameters of the streams and bodies of waters in the study area if such data are not otherwise available at representative sites. Such parameters include cross-sectional area and depth, or mean width and depth; and stream velocities, or times of travel.

3. Sampling frequencies -- Sampling frequencies must be determined on the basis of the variability of each of the parameters associated with the pollution problem, and must be adequate to define the pollution problem within statistically determined confidence intervals. The sampling frequencies during intensive surveys must be adequate to determine mass balances of pollutants and to define fluctuations of water quality and related parameters in receiving waters and pollutant sources.

In complex problem areas monitoring surveys should be conducted to reflect seasonal water quality variations.

Water Quality Standards must be reviewed at least every three years [PL 92-500, Section 303(c)(1)]. NPDES permits must be reviewed at least every five years [PL 92-500, Section 303(b)(1)(C)]. Other prevailing conditions like hydrology changes, new major discharges coming on stream, and results from fixed stream monitoring may require repeated intensive surveys. In no case should the time interval between intensive surveys or appropriate verification exceed five years.

The memorandum of September 7, 1973, from an Ad Hoc Committee on 303(e) Continuous Planning Process indicate the water quality segments for the Ohio River main stem identified pursuant to Section 303 by the States of Ohio, Kentucky, Illinois, Indiana, West Virginia and Pennsylvania. Indiana has not identified water quality limited segments for the Ohio River. There are conflicting segment classifications by adjoining states.

It is beyond the charge to the study team to resolve the conflicts in the states' 303 planning process. Consequently, the study team has not identified specific intensive segment surveys.

Primary In-Stream Monitoring Network

The national goal is to achieve by July 1, 1983, water quality which will provide for water recreational activities, the protection and propagation of fish and wildlife, and the withdrawal of such waters for public water supply, agricultural, industrial and other purposes. This network should assess progress toward this goal, establish baselines of water quality, maintain cognizance of water quality conditions throughout the Ohio River main stem, assess compliance with Water Quality Standards and obtain basic information needed for reports required by Section 305(b) and 516(a) of PL 92-500, the ORSANCO compact and directives, and OMB Circular A-67. The Regional Administrator and the Director in each state, in cooperation with ORSANCO and other federal agencies should establish and maintain a network of primary surface water monitoring stations for use in obtaining physical, chemical, and biological data concerning seasonal and other variations.

The primary monitoring network consists of selected, fixed-point stations which are sampled at regular intervals for a defined set of parameters and for which accompanying flow measurements are available. The stations are designed and operated to provide information, which when taken in combination with information from intensive surveys, permit compliance monitoring, and permittee self-monitoring, will adequately represent the quality of surface water at each location and the general conditions in the study area.

The State-Interstate-Federal primary in-stream monitoring network should be designed and operated to provide the necessary information. This system, together with information from intensive surveys, permit compliance monitoring and permittee self-monitoring, should show whether or not the water quality management activities are protecting the quality of the Ohio River. The number and location of monitoring stations, parametric coverage, and sampling frequencies must be adequate to represent the quality of the Ohio River in the annual inventory report required under Section 305(b)

and 516(a) of PL 92-500, the ORSANCO compact and directives, and OMB Circular A-67. Station locations, parameter coverage, and sampling frequencies shall be as follows:

1. Station locations -- Various types of surface water stations, including stations for monitoring river quality, biological conditions, hydrologic conditions, and sediment conditions, are required in the primary network. Primary station location should be located in the study area on basis of the following criteria:

   a. At a point located within intensive survey areas, which on the basis of information from such surveys to represent reaches, have the most critical water quality problems.

   b. At stations upstream and downstream of major population and/or industrial centers where it is possible to measure differences resulting from usage and discharges.

   c. At points within pools to measure water quality, eutrophic condition, bioaccumulation, and accumulation of pollutants in water and sediments.

   d. In major high quality water use areas, such as public water supply intakes, and recreational areas.

   e. In stream-bed sediments where applicable.

   f. To meet the accounting requirement of OMB Circular A-67.

2. Parameter Coverage and Sampling Frequencies -- Water quality samples and measurements must be representative of variations in water quality. Continuous stream flow data should be determinable for all primary stations. Flow measurements may be accomplished either by direct measurement or by estimation using nearby stream gages or measurements at representative sites. Parametric coverage for the primary network should include, where relevant:

   a. Parameters known or suspected to be associated with major upstream pollution sources such as areas of high population, industrial centers, agricultural and urban run-off, and mine drainage; and parameters specifically mentioned in the state's and ORSANCO's water quality standards relating to the sampling area;

   b. At sediment stations heavy metals and other toxic materials, oil and grease, chemical oxygen demand, total kjeldahl nitrogen, and pesticides in sediments;

c. Continuous dissolved oxygen, temperature, and conductivity;

d. Total phosphorus, total kjeldahl nitrogen, NO_2, NO_3, total organic carbon, COD and BODs;

e. Biological parameters at selected stations, including chlorophyll, and other parameters sufficient to evaluate the balances and conditions of indigenous communities of aquatic organisms, including standing crop, species diversity and the presence or absence of indicator organisms in accordance with, but not limited to, parameters shown in Appendix 5;

f. Biologically related chemical and physical analyses, and observations at selected stations, including chemical analyses of tissue as necessary to determine presence, extent, and impact of toxic pollutants; and

g. Microbiological parameters, indicator organisms, and where appropriate, specific pathogens.

Frequencies for the above parameters should be based on best available knowledge and need. Frequencies for biological parameters should be keyed to the dynamics of the biological community [Section 502(15)].

Compliance Monitoring (point source)

The states and/or other appropriate agencies should carry out monitoring activities to determine compliance with their permits and applicable water quality standards, to validate self-monitoring reports, and as necessary to provide support for enforcement actions. Procedures for carrying out such activities should be mutually agreed upon by the appropriate states and the U. S. EPA Regional Administrators. Specifically, the following monitoring activities should be required:

1. Facility inspections -- The states and/or U. S. EPA should inspect the facilities of dischargers, described in subparagraphs (a), (b) and (c) below, including where appropriate, effluent sampling and examination of monitoring records, reports, equipment and methods. Inspections are required as follows:

   a. Significant dischargers -- Each state should identify and designate significant dischargers. The agencies should conduct inspections, including effluent sampling, at least once each year at the facilities of all dischargers designated as significant.

b. Selected dischargers -- Appropriate inspections, with or without effluent sampling should be conducted at the facilities of selected dischargers not included in subparagraph (1)(a) above. Other dischargers to be inspected shall be based upon random selection each year, or as mutually agreed upon by the states and U. S. EPA Regional Administrators.

c. Follow-up inspections -- The states and/or U. S. EPA shall review self-monitoring data, reports obtained from permittees, complaints, data obtained from activities described in subparagraph (1)(a) and (1)(b) above, and any other available data sources for the purposes of identifying permit violations and permittee report errors. When violations are indicated, the states and/or U. S. EPA should schedule and conduct inspections and/or sampling at the facilities of permittees in a manner, and when needed, to support legal action.

2. Permittee self-monitoring -- Compliance monitoring (point sources) by dischargers will provide the basic data on all discharges in order to check compliance or violation of effluent limitations and/or loading allocations. Potential violations identified through the NPDES compliance monitoring program may necessitate the appropriate regulatory agency to undertake a point source(s) sampling program to confirm the violation(s).

   In view of the aforementioned point source compliance monitoring strategy, and the clear delineation of state, U. S. EPA, and permittee responsibility for implementation, the study team did not identify a specific point source compliance monitoring program.

Laboratory Support and Quality Assurance

Monitoring programs should produce data and information to describe the water quality in the study area in an accurate and consistent manner. Therefore, laboratories (or combinations of laboratories) supporting the subject water quality monitoring program should provide physical, professional, and analytical capabilities and quality assurance as follows:

1. Physical and professional capabilities should be adequate to perform analysis, in compliance with Items 2-7 for each of the water quality measurements listed in regulations published pursuant to Section 304(g) of the Act, and biological measurements listed in Appendix 5.

2. Sample collection, handling, and preservation shall be conducted according to the U. S. EPA manuals entitled Methods for Chemical Analysis of Water and Wastes, as revised, and Biological Field and Laboratory Methods for Measuring the Quality of Water and Wastes, as revised. Additional or alternative methods and procedures may be used as approved by the Regional Administrator.

3. Time-sensitive samples shall be delivered from the field and analyzed within specified holding times. Until superseded by designation in published U. S. EPA analytical reference methods, maximum holding times for sensitive samples will be as specified in the U. S. EPA manuals identified in subparagraph (2).

4. Procedures should be instituted for assuring sample integrity during sampling, transport, storage and analysis.

5. The appropriate entities must be prepared to provide, as needed, documentation for a legal chain of custody for any samples collected for the purpose of providing evidence in enforcement actions.

6. Physical and chemical analyses should be conducted by the use of analytical methods as specified in regulations published pursuant to Section 304(g) of PL 92-500. It includes selected methods from Standard Methods for the Examination of Water and Wastewater, (APHA), Annual Book of Standards, Par 23, Water; Atmospheric Analysis, (ASTM), and Methods for Chemical Analysis of Water and Wastes, (U. S. EPA). Biological analyses shall be conducted according to the U. S. EPA manual entitled Biological Field and Laboratory Methods for Measuring the Quality of Water and Wastes, as revised. Alternative test procedures including methods cited in Recommended Methods for Water Data Acquisition, (USGS), and Methods for Chemical Analysis of Water and Waste, (U. S. EPA), may be used provided that stipulations set forth in regulations published pursuant to Section 304(g) of PL 92-500, have been satisfied.

7. All participating laboratories should routinely utilize and document intralaboratory analytical quality control procedures including a combination of techniques such as: spiked sample recovery, replicate sample analyses, and reference sample analyses in a manner mutually agreed upon by the agencies.

   The operation of such an intralaboratory analytical quality control program should conform to practices recommended in the U. S. EPA manual Handbook for Analytical Quality Control in Water and Wastewater Laboratories, as revised, and other guidelines, procedures, and revisions published by the U. S. EPA. The laboratories should participate in interlaboratory

testing programs, including sample splitting between state monitoring support laboratories and U. S. EPA and other federal laboratories as needed.

Data Handling, Storage and Reporting

Water quality and related data should be validated and made available to the agencies in a timely manner. Intensive survey data should be made available to the agencies as soon as practical after completion of each survey. Data from the Primary In-Stream Monitoring Network should be made available to the agencies within ninety days after it is collected or as soon as practical thereafter.

The participating agencies should utilize an information system capable of preparing, screening, validating, and transmitting to the U. S. EPA or STORET all water monitoring data collected. The data should be made available in a format suitable for entry into the U. S. EPA water quality information system (STORET) and should specifically include the following:

1. All data collected from stations particularly identified as intensive survey stations, primary monitoring stations, beginning with data collected in FY 1974, including accurate latitude and longitude coordinates, station type codes, and other station descriptors for each station;

2. Pertinent hydraulic and geometric data obtained in connection with intensive surveys and primary monitoring network activities;

3. All compliance monitoring data collected by the state and other entities;

4. A listing each fiscal year of the stations to be monitored in the primary in-stream monitoring network in the following year, highlighting changes from the current year, and including for each station, descriptions of station location, station type, parametric coverage and sampling frequencies.

MONITORING NEEDS
PRIMARY IN-STREAM MONITORING NETWORK

Appendix 6 identifies the monitoring locations for the Primary In-Stream Monitoring Network, which represent a composite of the indicated needs of the participating agencies. A total of 86 locations were selected. In addition, Appendix 6 identifies the requisite needs satisfied by each monitoring station. In the absence of detailed site information, we recommend final location selection be based on an on-site inspection of each suggested sampling point, and evaluation of historical data.

Recognizing the requisite water quality parameter regime needs identified under Sections 104(a), 106(e)(1), and 502(13) of PL 92-500, state statutes, the ORSANCO compact and directives, and OMB Circular A-67; a comprehensive listing of physical, chemical, biological, and microbiological parameters and corresponding sampling frequencies for each recommended station was prepared. The sampling frequency for a given parameter at a given station was determined using the most frequent frequency identified by the respective agencies. Sampling frequencies were not based on best statistical knowledge, man power or cost and will need to be adjusted to reflect these considerations.

The team recognizes the importance of sediment studies to detect the build-up of materials in bottom sediments, but due to the wide variations in flow and the gravelly bottom of the Ohio River, no specific program has been recommended.

Costs

The cost criteria (Appendix 7) were applied to the indicated monitoring needs for the Primary In-Stream Monitoring Network.

		%
Sample Collection	$ 390,930	22
Laboratory	1,383,429	76
Data Handling	39,787 +	2
Total	$ 1,814,146	

The total annual cost per station ranged from $1,217 to $50,509. The average cost per station was $21,095.

+ See note at end of Appendix 7.

IV

EXISTING MONITORING PROGRAMS

Introduction

A survey of the existing monitoring programs of the member agencies was begun in October 1972. Some of this information was included in the ORSANCO staff report, "Monitoring and Evaluation of River Quality Conditions in the Compact District," issued in draft form in March 1973. This information has been updated to reflect additional and inaccurate information that has been brought to the attention of the committee.

Primary In-Stream Monitoring Network

The information received, almost without exception, dealt with the primary (fixed station) monitoring networks of the agencies. Five states, ORSANCO, and three federal agencies operate 125 fixed stations in the study area. These stations are listed by location (Appendix 8) and by frequency and parameter (Appendix 9). Most of these programs and the attendant stations were instituted prior to the passage of PL 92-500 and do not reflect its influence.

The stations fell into three classes:

1. Automated instrumentation;
2. Grab samples by member agency personnel, or;
3. "Water User" sampling.

The automated instruments generally gave continuous or hourly data, while the grab samples by agency personnel represented monthly or quarterly samples. The "Water Users" sampling provided an interim frequency, generally daily to weekly.

Data Handling

The processing and storage of data in the existing systems involves several systems. The Federal Government has the STORET system, which is presently receiving federal as well as most of the state data. Storage of data is accomplished by medium-speed terminals in the U. S. EPA regional offices, while low-speed terminals and magnetic

tapes are generally used by the states. Most of the states have extensive internal capacity for data handling and are developing systems dedicated to water and environmental quality. ORSANCO has a data processing and storage system, which is currently handling its own data as well as the robot monitor data from the States of Kentucky and Indiana. A method for interfacing the ORSANCO data handling system with the STORET system is being developed. Implementation has been delayed by a lack of adequate funding.

Costs

In order to determine the "value" of the existing monitoring systems of the member agencies, the committee decided to assign certain uniform cost values to each item. Appendix 7 details how the costs were determined and includes the unit costs. In some cases, such as the ORSANCO Water Users network, the member agency receiving the information incurs no cost. A cost "value" was still applied as a cost is involved for collection and analyses of the sample, regardless of who furnished the information.

Appendix 10 is a cost "value" listing by agency. This reveals a total cost value of $558,420 for the 125-station-existing system through the data processing phase and up to but not including the data storage phase. The same cost analysis was performed on the "monitoring program" to satisfy needs and will be performed on the recommended program.

			%
Sample Collection	$	182,735	33
Laboratory		357,343	64
Data Handling		18,342 +	3
Total annual cost	$	558,420	

The total annual cost per station ranged from $583 to $38,591. The average cost was $4,467.

+ See note at end of Appendix 7.

COMPARISON OF EXISTING NETWORK WITH THE MONITORING PROGRAM TO SATISFY INDICATED NEEDS

The existing network includes 121 sites (Appendix 8) for nine agencies. Four of these stations are cooperative relationships between two agencies. The cost value of the existing network is $558,420.

The monitoring network to satisfy the indicated needs of nine agencies included 109 different sites (Appendix 3), which were grouped into 86 stations. Forty-three of these stations reflect needs of more than one agency. The minimum cost value of this network is $1,814,000, since part of the robot data handling costs is not included.

The economies obtained by combining station sites are overshadowed by the expanded information desired. However, collection costs would be reduced at sites where several agencies' existing data needs are comparable to indicated needs. A comparison of indicated need vs. existing collection, laboratory, and data handling costs shows a two to one increase in collection and data handling costs, but a four to one increase in analyses costs. This latter increase highlights the chief difference between the two monitoring program networks, namely, information desired greatly exceeds the present data being collected.

The comparison illustrates that many agencies are not currently collecting sufficient data to satisfy their present and projected needs. The requirements of PL 92-500 can be assumed to be a primary factor in explaining this difference. The comparison of the existing programs indicates a substantial difference in the amounts and depth of the existing programs of the participating agencies; e.g., existing station cost values ranging from $583 to $38,591. Compilations of the stations to satisfy the needs would again appear to have a wide range ($1,217 to $50,509). The cost of the program to satisfy the needs could exceed the apparent "cost value," (proportionate increase of 2-1/2 times) if a great number of new water users are not pressed into service, because almost $300,000 of the existing $558,420 is in "cost value" donated by these users.

A greatly increased laboratory facility need appears to exist over present laboratory work loads in the study area. It would be doubtful that existing laboratories could increase their output fourfold. Data collection system facilities would appear to require less of an increase to satisfy the needs as only a twofold increase is indicated. With respect to data handling the need would probably increase in proportion to laboratory output. In addition, there are indicated needs for 2-1/2 times as many automated stations as in the existing network, which would also require proportionately more data handling.

VI

RECOMMENDED PRIMARY IN-STREAM MONITORING NETWORK

The recommended basic primary in-stream monitoring network consists of 37 stations, of which 22 are located on the Ohio River and 15 in lower reaches of major tributaries (TABLE I and Map 3). This network represents a nucleus of key locations above and below major population and industrial areas, and in critical water quality sections of the new high level pools on the Ohio River. The stations were selected from a compendium of locations recommended by the participating agencies for satisfying their needs with regard to statutory requirements. By carefully limiting the number of stations, the study team believes that implmentation would be possible within a reasonable time through cooperative arrangements. This is not to say that additional station locations may be needed in the future, or that locations will have to be changed on the basis of experience and intensive surveys. In other words, the network represents the best judgment of the study team at the present time. Final station location will have to be made by the operating agency, taking into account local conditions and facilities, sampling access points, costs, etc.

The parameters selected and the periodicity of sampling (TABLE II) are designed to provide sufficient information on which to appraise water quality conditions at each location, and to provide for comparisons of quality with other sections of the river. Again, experience may indicate that changes are needed. Where indicated, they can be selectively made on a station-by-station basis to achieve maximum cost effective operation. However, the team believes that until adequate information is available from the recommended network on which to make individual judgments, that the stations be operated in the manner set forth.

The estimated annual cost value for the recommended network is approximately $670,000, which covers the cost of collection, analysis and data handling.

TABLE I

RECOMMENDED PRIMARY MONITORING NETWORK
BASIC MONITORING LOCATIONS, PARAMETERS, FREQUENCY AND JUSTIFICATION

Parameter/ Frequency		A	A	A	A	A	A	A	B	B
Applicable Justifications	River Mile	Mon. 5.5	All. 13	Oh. 6	Beaver 5	Oh. 40	Oh. 87	Oh. 126	Oh. 162	Musk. 6
Section	101(e)	x	x	x	x	x	x	x	x	x
1972 FWPCA	102(a)	x	x	x	x	x	x	x	x	x
Amendments	104(a)(1)	x	x	x	x	x	x	x	x	x
"	104(a)(2)	x	x	x	x	x	x	x	x	x
"	104(a)(5)	x	x	x	x	x	x	x	x	x
"	105(d)(3)	x	x	x	x	x	x	x	x	x
"	106(e)(1)	x	x	x	x	x	x	x	x	x
"	115	x	x	x	x	x	x	x	x	x
"	208(a)(2)(3)	x	x	x		x	x	x		
"	302(a)	x	x	x	x	x	x	x	x	x
"	303(a)(b)(c)	x	x	x	x	x	x	x	x	x
"	303(d)(1)(A)	x	x	x	x	x	x	x	x	x
"	303(d)(1)(B)	x	x	x	x	x	x	x	x	x
"	303(d)(1)(C)	x	x	x	x	x	x	x	x	x
"	303(d)(2)(D)	x	x	x	x	x	x	x	x	x
"	303(d)(2)	x	x	x	x	x	x	x	x	x
"	303(d)(3)									
"	303(e)	x	x	x	x	x	x	x	x	x
"	304(a)	x	x	x	x	x	x	x	x	x
"	305(a)	x	x	x	x	x	x	x	x	x
"	305(b)	x	x	x	x	x	x	x	x	x
"	309(a)(1)(2)	x	x	x	x	x	x	x	x	x
"	401	x	x	x	x	x	x	x	x	x
"	402(a)(2)	x	x	x	x	x	x	x	x	x
"	516(a)	x	x	x	x	x	x	x	x	x
USGS	OMB Circular A-67	x	x		x		x			x
USCE	NEPA - 1970	x	x	x	x	x	x	x	x	x
ORSANCO	Compact & Directives	x	x	x	x	x	x	x	x	x
Illinois										
Indiana										
Kentucky										
Ohio						x	x	x	x	x
Penna.		x	x	x	x	x	x	x	x	
W. Va.						x	x	x	x	x

A - Monitor & Manual Sampling
B - Manual Sampling Only
C - Monitor Only

TABLE I (continued)

Parameter/ Frequency		B	A	C	A	A	A	B	A		A	B
River Mile		Oh. 192	Oh. 260	Kanawha 2	Kanawha 31	Oh. 279	Oh. 304	Oh. 316	Big Sandy 20		Oh. 341	Scioto 15
Applicable Justifications												
Section 1972 FWPCA Amendments	101(e)	x	x	x	x	x	x	x	x		x	x
	102(a)	x	x	x	x	x	x	x	x		x	x
	104(a)(1)	x	x	x	x	x	x	x	x		x	x
"	104(a)(2)	x	x	x	x	x	x	x	x		x	x
"	104(a)(5)	x	x	x	x	x	x	x	x		x	x
"	105(d)(3)	x	x	x	x	x	x	x	x		x	x
"	106(e)(1)	x	x	x	x	x	x	x	x		x	x
"	115	x	x	x	x	x	x	x	x		x	x
"	208(a)(2)(3)		x			x	x	x			x	
"	302(a)	x	x	x	x	x	x	x	x		x	x
"	303(a)(b)(c)	x	x	x	x	x	x	x	x		x	x
"	303(d)(1)(A)	x	x	x	x	x	x	x			x	x
"	303(d)(1)(B)	x	x	x	x	x	x	x	x		x	x
"	303(d)(1)(C)	x	x	x	x	x	x	x	x		x	x
"	303(d)(2)(D)	x	x	x	x	x	x	x	x		x	x
"	303(d)(2)	x	x	x	x	x	x	x	x		x	x
"	303(d)(3)											
"	303(e)	x	x	x	x	x	x	x	x		x	x
"	304(a)	x	x	x	x	x	x	x	x		x	x
"	305(a)	x	x	x	x	x	x	x	x		x	x
"	305(b)	x	x	x	x	x	x	x	x		x	x
"	309(a)(1)(2)	x	x	x	x	x	x	x	x		x	x
"	401	x	x	x	x	x	x	x	x		x	x
"	402(a)(2)	x	x	x	x	x	x	x	x		x	x
"	516(a)	x	x	x	x	x	x	x	x		x	x
USGS	OMB Circular A-67	x		x					x		x	x
USCE	NEPA - 1970		x	x	x	x	x	x	x		x	x
ORSANCO	Compact & Directives	x	x	x	x	x	x	x	x		x	x
Illinois												
Indiana									x	x	x	x
Kentucky												
Ohio		x	x	x	x	x	x	x			x	x
Penna.												
W. Va.		x	x	x	x	x	x	x	x			

A - Monitor & Manual Sampling
B - Manual Sampling Only
C - Monitor Only

TABLE I (Continued)

Parameter / Frequency		B	A	B	A	A	A	B
River Mile		Oh. 436	Oh. 463	Little Miami 4	Licking 5	Oh. 490	Great Miami 6	Oh. 532
Applicable Justifications								
Section	101(e)	x	x	x	x	x	x	x
1972 FWPCA	102(a)	x	x	x	x	x	x	x
Amendments	104(a)(1)	x	x	x	x	x	x	x
"	104(a)(2)	x	x	x	x	x	x	x
"	104(a)(5)	x	x	x	x	x	x	x
"	105(d)(3)	x	x	x	x	x	x	x
"	106(e)(1)	x	x	x	x	x	x	x
"	115	x	x	x	x	x	x	
"	208(a)(2)(3)		x			x		
"	302(a)	x	x	x	x	x	x	x
"	303(a)(b)(c)	x	x	x	x	x	x	x
"	303(d)(1)(A)		x	x	x	x	x	
"	303(d)(1)(B)	x	x	x	x	x	x	x
"	303(d)(1)(C)		x	x	x	x	x	
"	303(d)(2)(D)	x	x	x	x	x	x	x
"	303(d)(2)	x	x	x	x	x	x	x
"	303(d)(3)							
"	303(e)	x	x	x	x	x	x	x
"	304(a)	x	x	x	x	x	x	x
"	305(a)	x	x	x	x	x	x	x
"	305(b)	x	x	x	x	x	x	x
"	309(a)(1)(2)	x	x	x	x	x	x	x
"	401	x	x	x	x	x	x	x
"	402(a)(2)	x	x	x	x	x	x	x
"	516(a)	x	x	x	x	x	x	x
USGS	OMB Circular A-67				x		x	x
USCE	NEPA - 1970	x	x	x	x	x		x
ORSANCO	Compact & Directives	x	x	x	x	x	x	x
Illinois								
Indiana						x	x	x
Kentucky		x	x	x	x	x		x
Ohio		x	x	x	x	x	x	
Penna.								
W. Va.								

A - Monitor & Manual Sampling
B - Manual Sampling Only
C - Monitor Only

TABLE I (Continued)

Parameter/ Frequency		A	A	C	A	B	A	A	A
River Mile		Oh. 601	Oh. 626	Oh. 721	Oh. 725	Green 9	Oh. 789	Oh. 846	Wabash 30
Applicable Justifications									
Section	101(e)	x	x	x	x	x	x	x	x
1972 FWPCA	102(a)	x	x	x	x	x	x	x	x
Amendments	104(a)(1)	x	x	x	x	x	x	x	x
"	104(a)(2)	x	x	x	x	x	x	x	x
"	104(a)(5)	x	x	x	x	x	x	x	x
"	105(d)(3)	x	x	x	x	x	x	x	x
"	106(e)(1)	x	x	x	x	x	x	x	x
"	115	x	x		x	x	x	x	x
"	208(a)(2)(3)	x	x					x	
"	302(a)	x	x	x	x	x	x	x	x
"	303(a)(b)(c)	x	x	x	x	x	x	x	x
"	303(d)(1)(A)	x	x		x			x	x
"	303(d)(1)(B)	x	x	x	x	x	x	x	x
"	303(d)(1)(C)	x	x		x			x	x
"	303(d)(2)(D)	x	x		x	x	x	x	x
"	303(d)(2)	x	x	x	x	x	x	x	x
"	303(d)(3)								
"	303(e)	x	x	x	x	x	x	x	x
"	304(a)	x	x	x	x	x	x	x	x
"	305(a)	x	x	x	x	x	x	x	x
"	305(b)	x	x	x	x	x	x	x	x
"	309(a)(1)(2)	x	x	x	x	x	x	x	x
"	401	x	x	x	x	x	x	x	x
"	402(a)(2)	x	x	x	x	x	x	x	x
"	516(a)	x	x	x	x	x	x	x	x
USGS	OMB Circular A-67			x					x
USCE	NEPA - 1970	x	x	x	x	x	x	x	x
ORSANCO	Compact & Directives	x	x	x	x	x	x	x	x
Illinois									x
Indiana		x	x	x	x		x	x	x
Kentucky		x	x	x	x	x	x	x	x
Ohio									
Penna.									
W. Va.									

A - Monitor & Manual Sampling
B - Manual Sampling Only
C - Monitor Only

TABLE I (Continued)

Parameter/ Frequency / River Mile / Applicable Justifications		B Cumberland 30	A Tennessee 18	A Oh. 963
Section 1972 FWPCA Amendments	101(e)	x	x	x
	102(a)	x	x	x
	104(a)(1)	x	x	x
"	104(a)(2)	x	x	x
"	104(a)(5)	x	x	x
"	105(d)(3)	x	x	x
"	106(e)(1)	x	x	x
"	115	x	x	x
"	208(a)(2)(3)		x	x
"	302(a)	x	x	x
"	303(a)(b)(c)	x	x	x
"	303(d)(1)(A)		x	x
"	303(d)(1)(B)	x	x	x
"	303(d)(1)(C)		x	x
"	303(d)(2)(D)	x	x	x
"	303(d)(2)	x	x	x
"	303(d)(3)			
"	303(e)	x	x	x
"	304(a)	x	x	x
"	305(a)	x	x	x
"	305(b)	x	x	x
"	309(a)(1)(2)	x	x	x
"	401	x	x	x
"	402(a)(2)	x	x	x
"	516(a)	x	x	x
USGS	OMB Circular A-67	x	x	x
USCE	NEPA - 1970	x		x
ORSANCO	Compact & Directives	x	x	x
Illinois Indiana Kentucky Ohio Penna. W. Va.		x	x	x

A - Monitor & Manual Sampling
B - Manual Sampling Only
C - Monitor Only

TABLE II

RECOMMENDED PRIMARY MONITORING NETWORK
PARAMETERS AND FREQUENCIES

Parameter	Parameter Frequency Code		
	A Automatic Monitor & Manual Sampling	B Manual Sampling Only	C Automatic Monitoring only
Basic Physical & Chemical			
Temperature	H	D @ Users W @ Non Users	H
pH	H	D @ Users W @ Non Users	H
Dissolved Oxygen	H	D @ Users W @ Non Users	H
Conductivity	H	D @ Users W @ Non Users	H
Turbidity	As Needed	As needed	
Flow	D (See Recommendation 7)	D (See Recommendation 7)	D
General Chemical			
Acidity	W	W	
Alkalinity	W	W	
BOD_5	M	M	
Chloride	W	W	H
Cyanide	W	W	
Fluoride	W	W	
Total Hardness	W	W	
NH_3N	W	W	
NO_3N	W	W	
TKN	W	W	
Phenolics	W	W	
Total Dissolved Phosphorus	W	W	
Total Phosphorus-P	W	W	
Solids, Dissolved	W	W	
Solids, Suspended	W	W	

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly;
Q-quarterly; S-semiannually; Y-yearly

TABLE II (Continued)

Parameter	Parameter Frequency Code		
	A Automatic Monitor & Manual Sampling	B Manual Sampling Only	C Automatic Monitoring Only
General Chemical			
Sulfate	W	W	
Sodium	W	W	
Potassium	W	W	
Silica	W	W	
Calcium	W	W	
Magnesium	W	W	
TOC	W	W	
Trace Metals			
Arsenic	Q	Q	
Barium	M	M	
Cadmium	M	M	
Chromium, Total	M	M	
Chromium, Hexavalent	As needed by total chrome	A needed by total chrome	
Copper	M	M	
Iron	M	M	
Lead	M	M	
Manganese	M	M	
Mercury	M	M	
Nickel	M	M	
Selenium	Q	Q	
Silver	M	M	
Zinc	M	M	
Others			
Radioactivity	M/Q Comp.	M/Q Comp.	
Pesticides	As needed	As needed	
PCB	As needed	As needed	
Bacterial			
Coliform, Fecal	D @ Users W @ Non Users	D @ Users W @ Non Users	
Coliform, Total	D @ Users W @ Non Users	D @ Users W @ Non Users	

TABLE II (Continued)

Parameter	Parameter Frequency Code		
	A Automatic Monitor & Manual Sampling	B Manual Sampling Only	C Automatic Monitoring Only
Biological*	As Needed	As Needed	

* See Section 502-15, PL 92-500

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

VII

CONCLUSIONS AND RECOMMENDATIONS

The efforts of this study team in reviewing and revising monitoring strategy for the Ohio River have involved considerable discussion, soul-searching, and compromise. The discussions, some highly volatile, have exposed opposing viewpoints and differences of opinion pertaining to every facet of water quality measurement and monitoring. The strategy, presented herein to the Commission, is a consensus aimed at meeting present water quality data needs of all agencies. This application of the strategy is considered practical, and should be regularly reviewed, modified, and upgraded in the light of experience, and in accordance with accomplishments and needs. In addition, the success of any monitoring strategy evolved will be more directly related to the coordination and extent of the efforts of all the agencies involved than to strategy, per se.

The Ohio River is viewed by this group as a series of reaches including complicated mixtures of navigation pools, SMSA's, tributaries, point and non-point sources. All of these have been inadequately defined in spite of considerable past attention. While there is some agreement among us pertaining to priorities, the scope and the detail of everyone's specific data needs completely defies available funding and man power.

We believe automatic monitoring must be continued because of data acquisition constraints and needs for frequent definitive data for certain basic parameters from many stations in relation to general conditions and trends along the river as in the USCE management of water quality control. To acquire the necessary data from so many stations by other means is impracticable. Present manual sampling must be continued and expanded to the fullest extent possible. In addition, intensive surveys must be carefully designed and implemented. The team believes these surveys must be carried out in such a way as to meet multiple demands including modification of monitoring strategy application.

Because of recognized multiple data needs, man power limitations, costs and technical complexities, the need for all agencies to participate to fullest possible extent must be stressed. No single agency can provide the overall expertise or man power nor can one laboratory meet all the analytical requirements. Funding is a problem more easily resolved than man power limitations. The complexity of river conditions requires carefully coordinated attention by multi-disciplinary teams. We suggest all of these factors can be resolved by pooling agency resources on a continuing basis under the coordination of a single body.

Detailed recommendations are as follows:

Primary In-Stream Monitoring Network

1. The initial network should consist of the 37 suggested stations and the data collected should generally coincide with the enclosed guidelines for parameters and frequencies. This network should be made operational July 1, 1974.

2. Exact station locations should be determined by the operating agency in cooperation with ORSANCO. The operating agency should be responsible for eventual entry of the data into STORET.

3. ORSANCO should operate the automatic monitoring network and undertake whatever steps are necessary to strengthen and eventually expand the present ORSANCO Water Users Monitoring Newwork. User is intended here to include all permit holders.

4. ORSANCO should prepare an annual appraisal of water quality in the study area which will be incorporated into the state water quality inventory reports to Congress.

5. ORSANCO should implement established procedures to assure adequate quality control of collecting and analytical procedures by operating agencies and water users.

6. ORSANCO should establish a continuing program for appraisal and modification of the primary in-stream monitoring network in cooperation with member agencies. A report should be submitted annually.

7. Flow measurements or estimates of flow must be utilized at each monitoring station. In the absence of a stream flow guage, National Weather Service estimates can be applied.

Intensive Surveys

1. ORSANCO should coordinate the development and implementation of intensive surveys in the study area. The intent of this recommendation is to facilitate the planning and design on the part of the agency or agencies involved, achieve essential integration of overall activities, and generate pooling of available expertise. Such coordination should not delay emergency type surveys nor subvert the original objectives of any survey.

2. The participating agencies should notify ORSANCO as early as possible about survey needs and contemplated surveys. Initial survey plans for a given fiscal year should be submitted to ORSANCO by January 1 or earlier if possible.

3. The annual projected schedule should be submitted to the EPA Regional Administrator with each state's program submissions, consistent with their respective proposed involvements.

4. Participating agencies should be responsible for implementing necessary quality control procedures in regard to surveys and be responsible for entering data into STORET.

5. The U. S. EPA field offices are considered a critical resource in this basin in terms of helping to collect field data and provide laboratory analysis. Without these offices, a formidable task seems impossible. In addition, the continued services of the USGS on a contractual basis is essential and the Corps of Engineers should be requested to provide expertise, man power, and funding. Other federal agencies should be asked to participate as needed.

6. ORSANCO should evaluate basin-wide survey needs and survey effectiveness, providing critiques to participating agencies and, where pertinent, determine optimal frequencies for repeated studies. ORSANCO should maintain an inventory of qualified personnel who might provide specialized expertise or consultation.

Compliance Monitoring

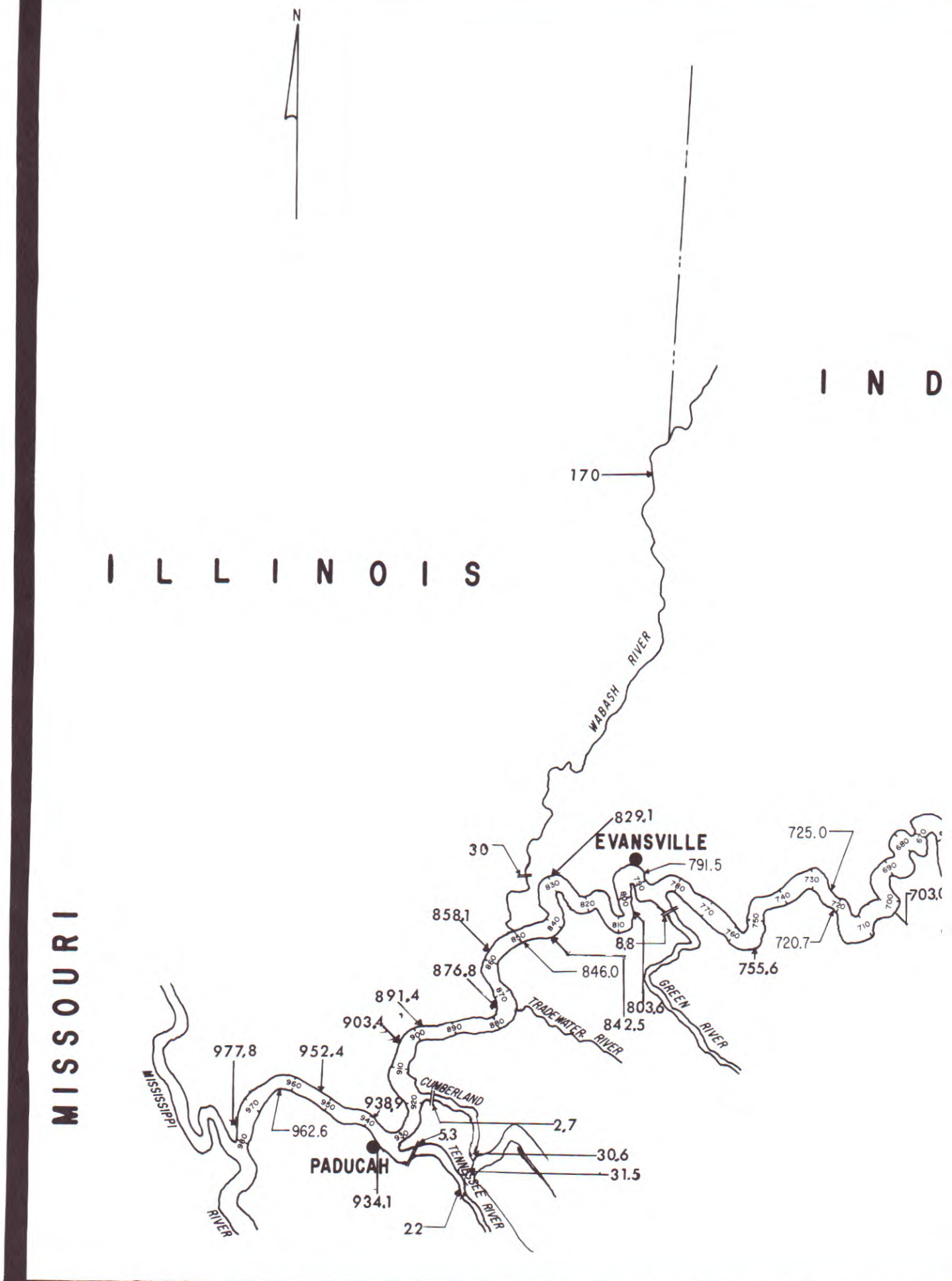
The states and/or U. S. EPA should be responsible for the conduct of the point source compliance monitoring program consistent with the Section 106 regulations.

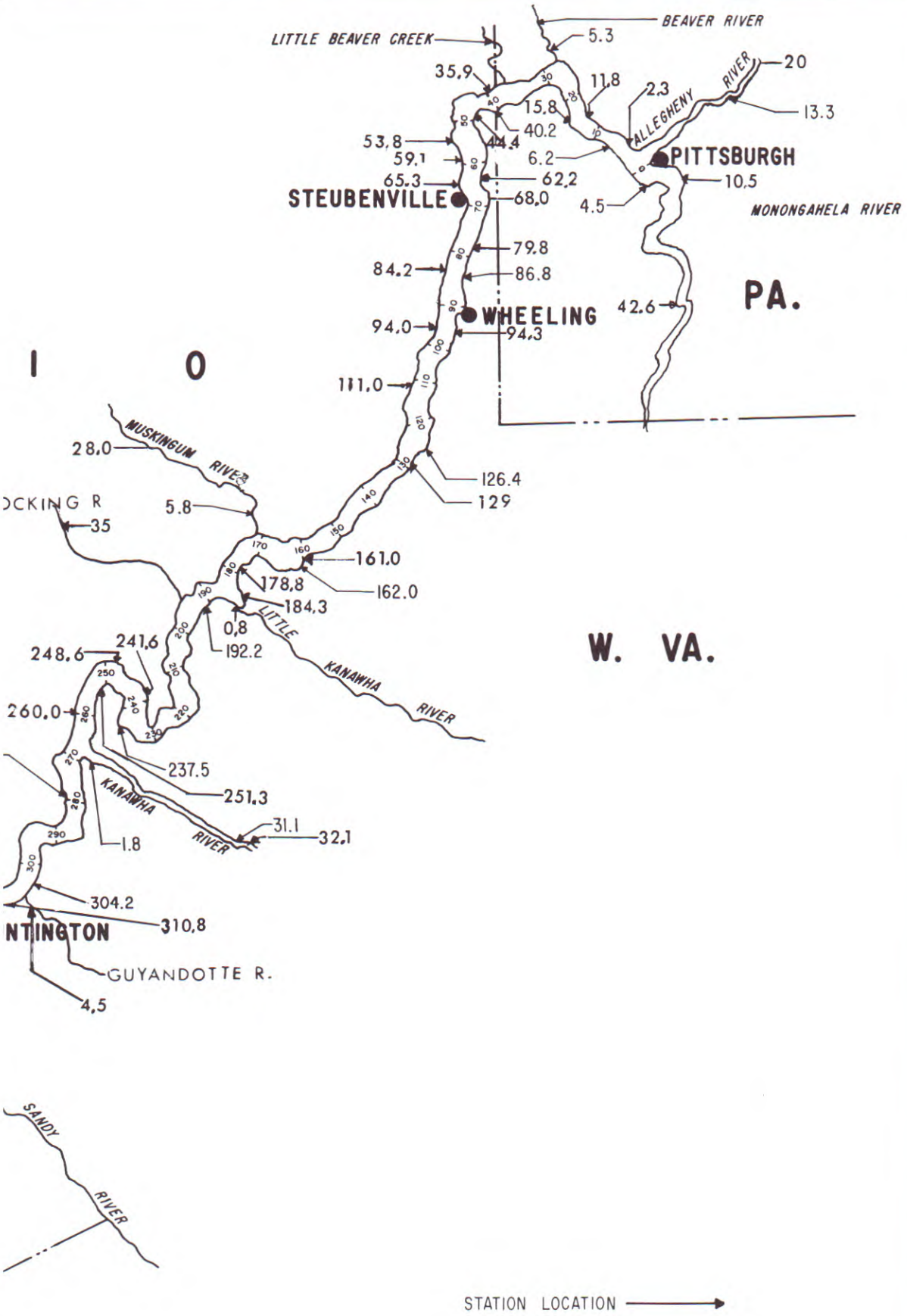
General

The U. S. EPA and the USGS should enter into an agreement with respect to implementing OMB Circular A-67 in relation to PL 92-500.

Policy Considerations Requiring Attention

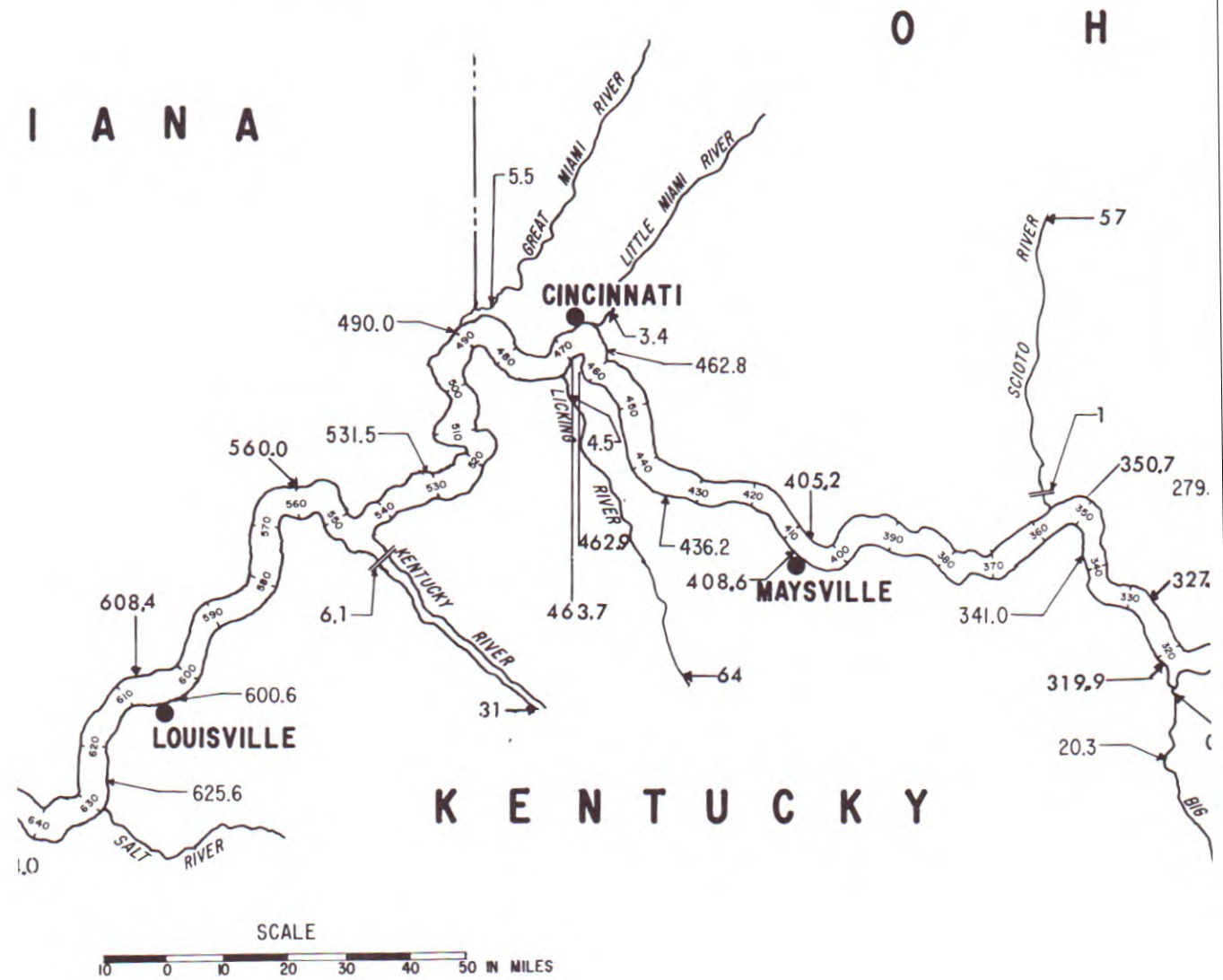
The success of the monitoring program recommended by the study team will require a commitment of man power, resources, and funds. Most members of the study team do not have the authority to commit their agencies resources. This is particularly true for the manually-collected in-stream primary network and the intensive surveys. The team suggests that the Commission and its Engineering Committee are the appropriate forum for working out appropriate arrangements and commitments from the respective agencies for implementation of the recommended program. There should also be recognition and some provision for additional commitments if they are required as experience is gained with operation. Effective and progressive implementation of the recommended program cannot proceed until these institutional arrangements have been promulgated.

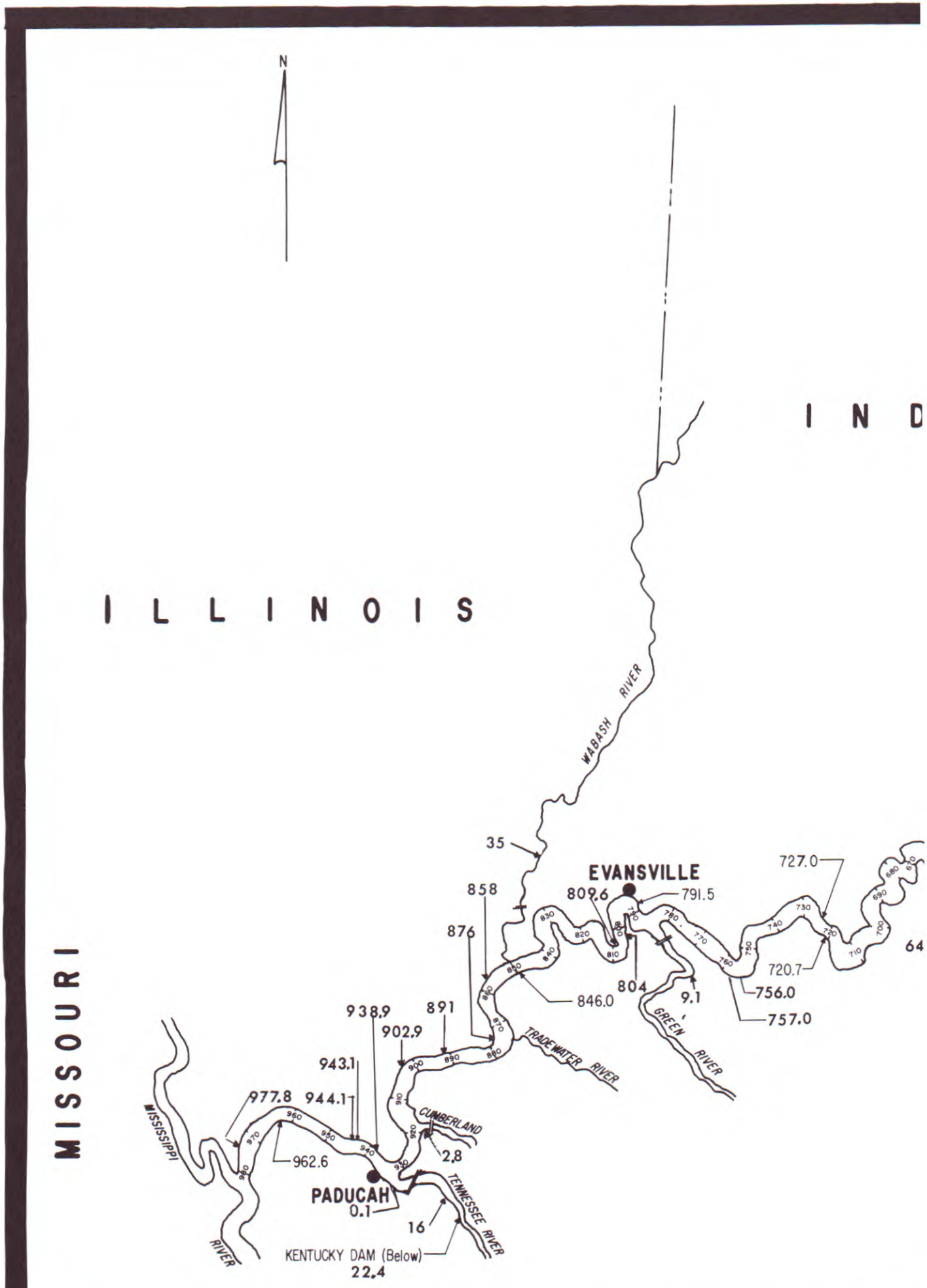

N
I N D
I L L I N O I S
MISSOURI
170
WABASH RIVER
829.1
EVANSVILLE
30
791.5
725.0
858.1
8.8
720.7
846.0
755.6
876.8
891.4
803.6
842.5
GREEN RIVER
903.4
TRADEWATER RIVER
977.8
952.4
CUMBERLAND
938.9
2.7
962.6
5.3
30.6
PADUCAH
31.5
934.1
TENNESSEE RIVER
22
MISSISSIPPI
RIVER


BEAVER RIVER
LITTLE BEAVER CREEK
5.3
35.9
11.8
2.3
ALLEGHENY RIVER
20
13.3
15.8
40.2
44.4
53.8
59.1
65.3
6.2
62.2
PITTSBURGH
10.5
STEUBENVILLE
68.0
4.5
MONONGAHELA RIVER
79.8
84.2
86.8
PA.
42.6
WHEELING
94.0
94.3
I O
111.0
MUSKINGUM RIVER
28.0
126.4
129
OCKING R
5.8
35
161.0
178.8
162.0
184.3
LITTLE KANAWHA RIVER
0.8
192.2
W. VA.
248.6
241.6
260.0
237.5
251.3
KANAWHA RIVER
31.1
32.1
1.8
304.2
NTINGTON
310.8
GUYANDOTTE R.
4.5
SANDY RIVER
STATION LOCATION

MAP 1

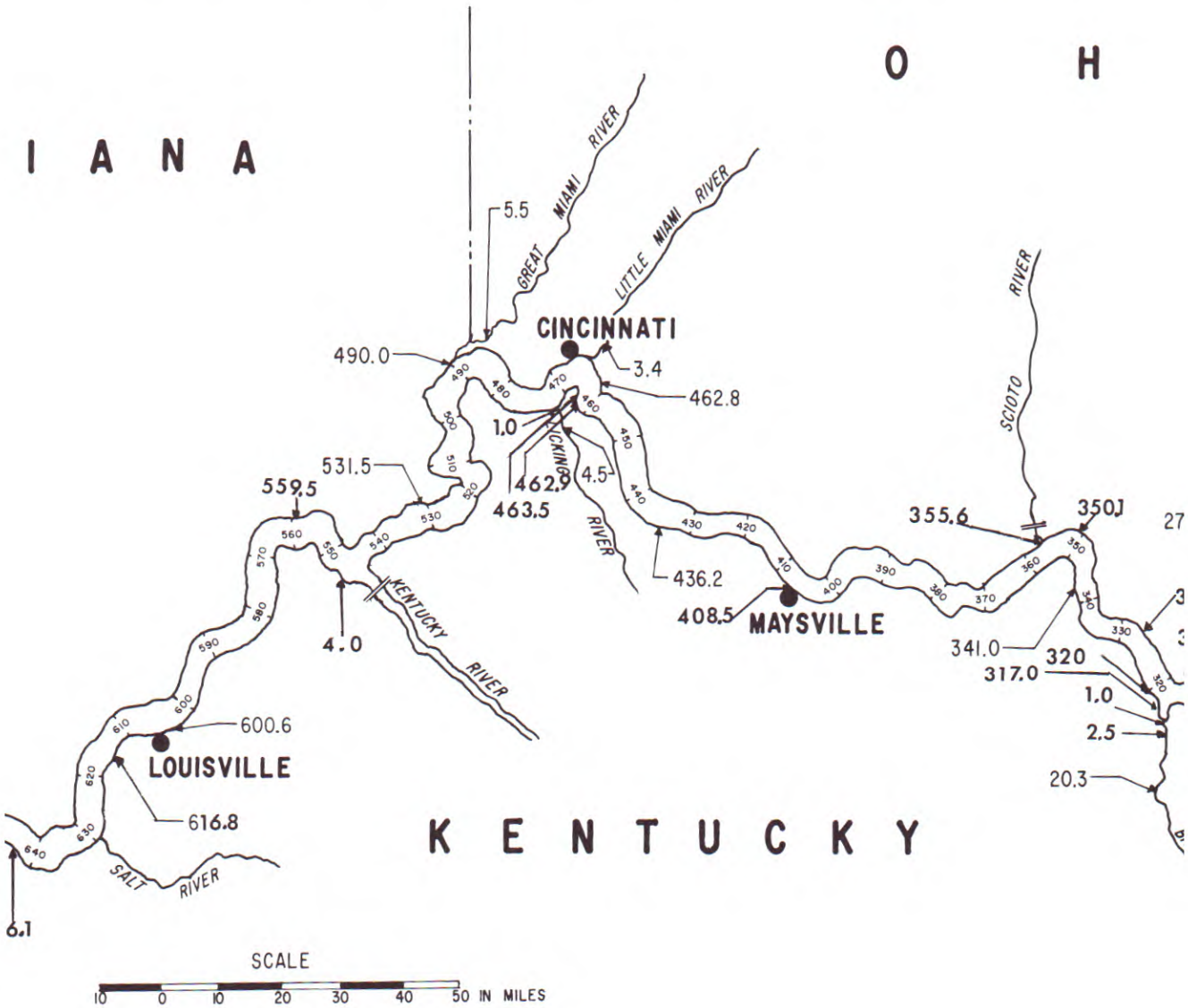
MONITORING STATIONS RECOMMENDED BY THE INDIVIDUAL AGENCIES

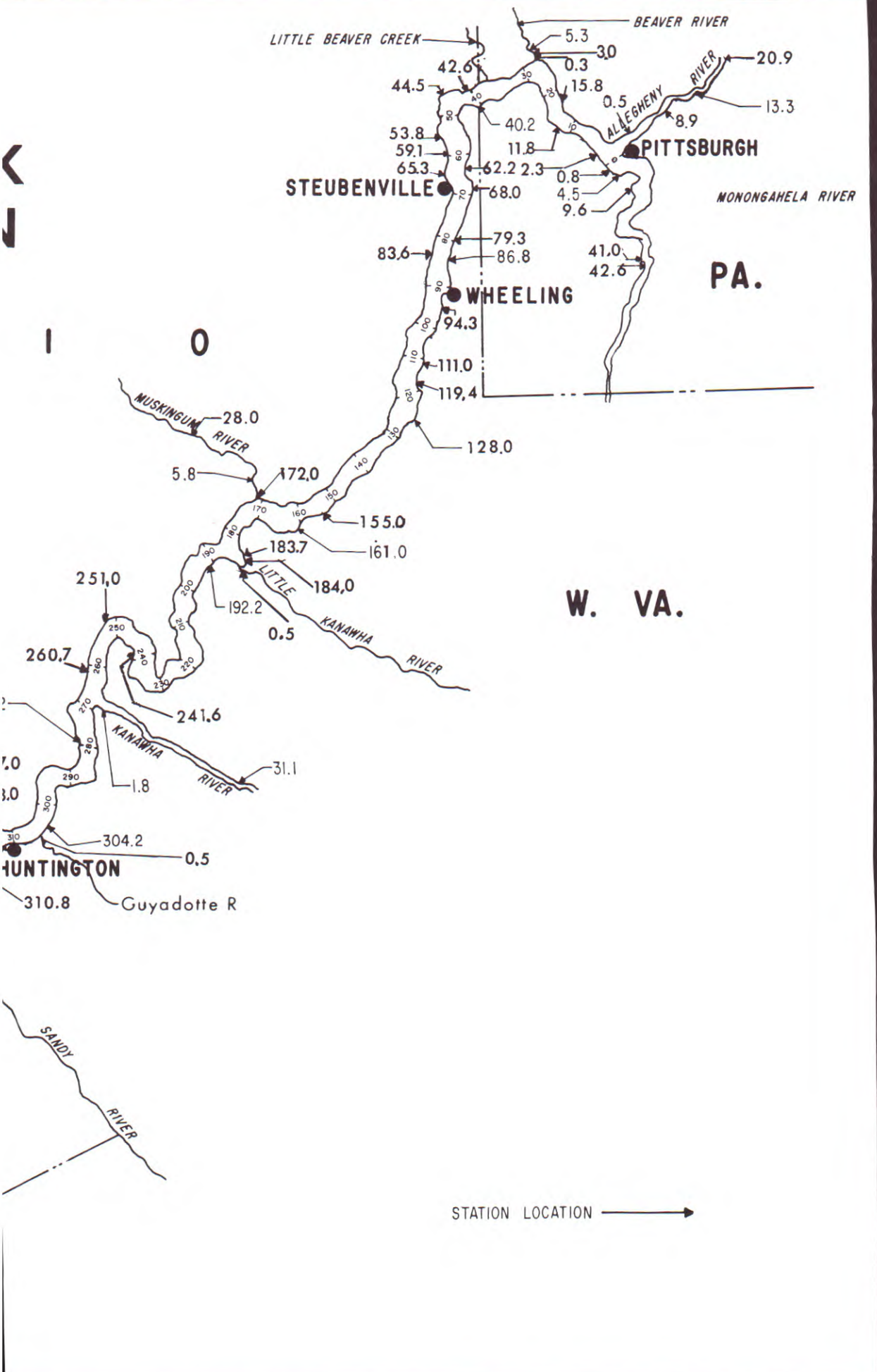


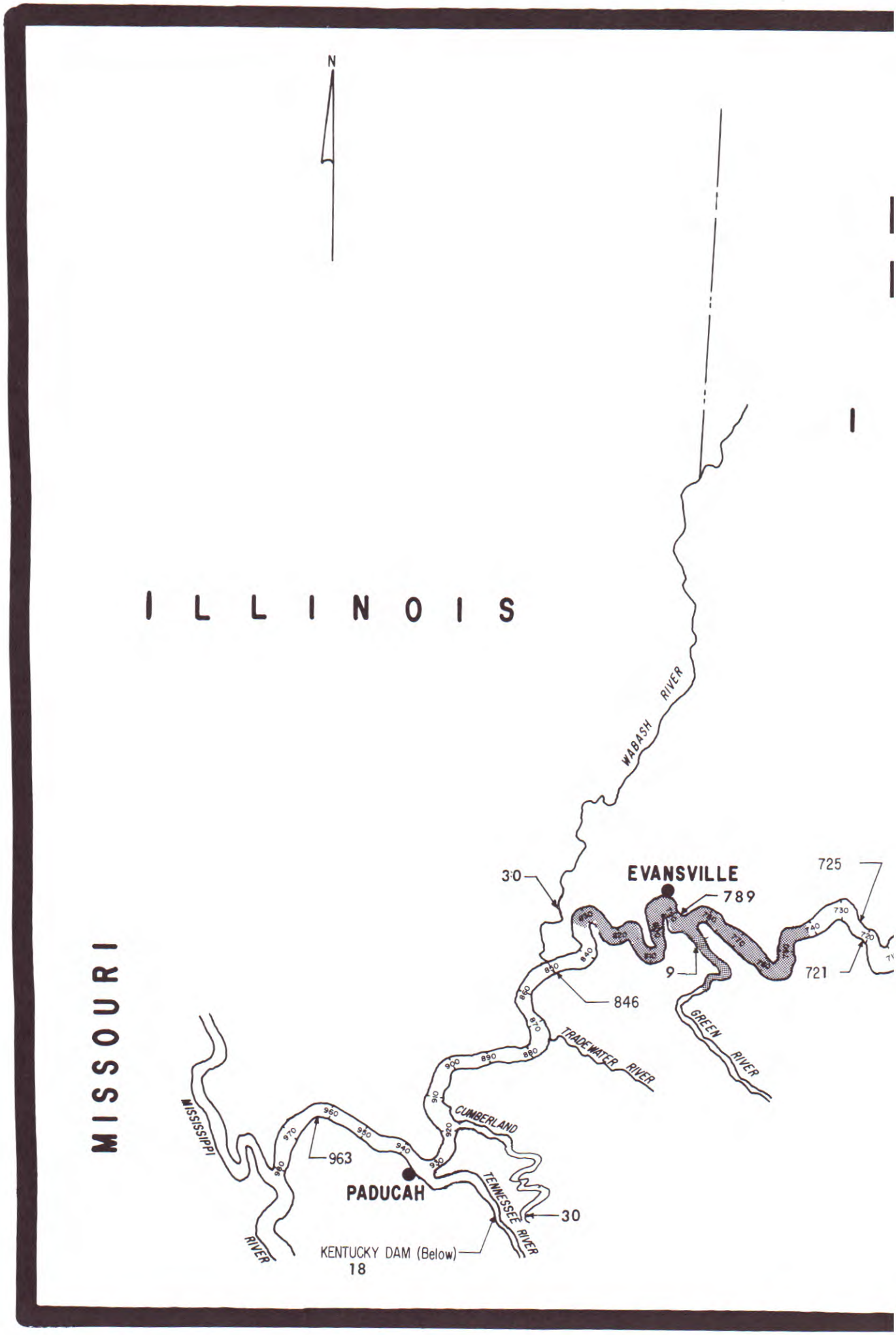

N
I N D
I L L I N O I S
MISSOURI
WABASH RIVER
35
858
876
938.9
891
902.9
943.1
977.8
944.1
962.6
846.0
EVANSVILLE
809.6
791.5
727.0
720.7
804
9.1
756.0
757.0
64
TRADEWATER RIVER
GREEN RIVER
CUMBERLAND
2.8
PADUCAH
0.1
16
TENNESSEE RIVER
KENTUCKY DAM (Below)
22.4
MISSISSIPPI
RIVER

MAP 2

EXISTING MONITORING NETWOR
SHOWING STATION LOCATIO

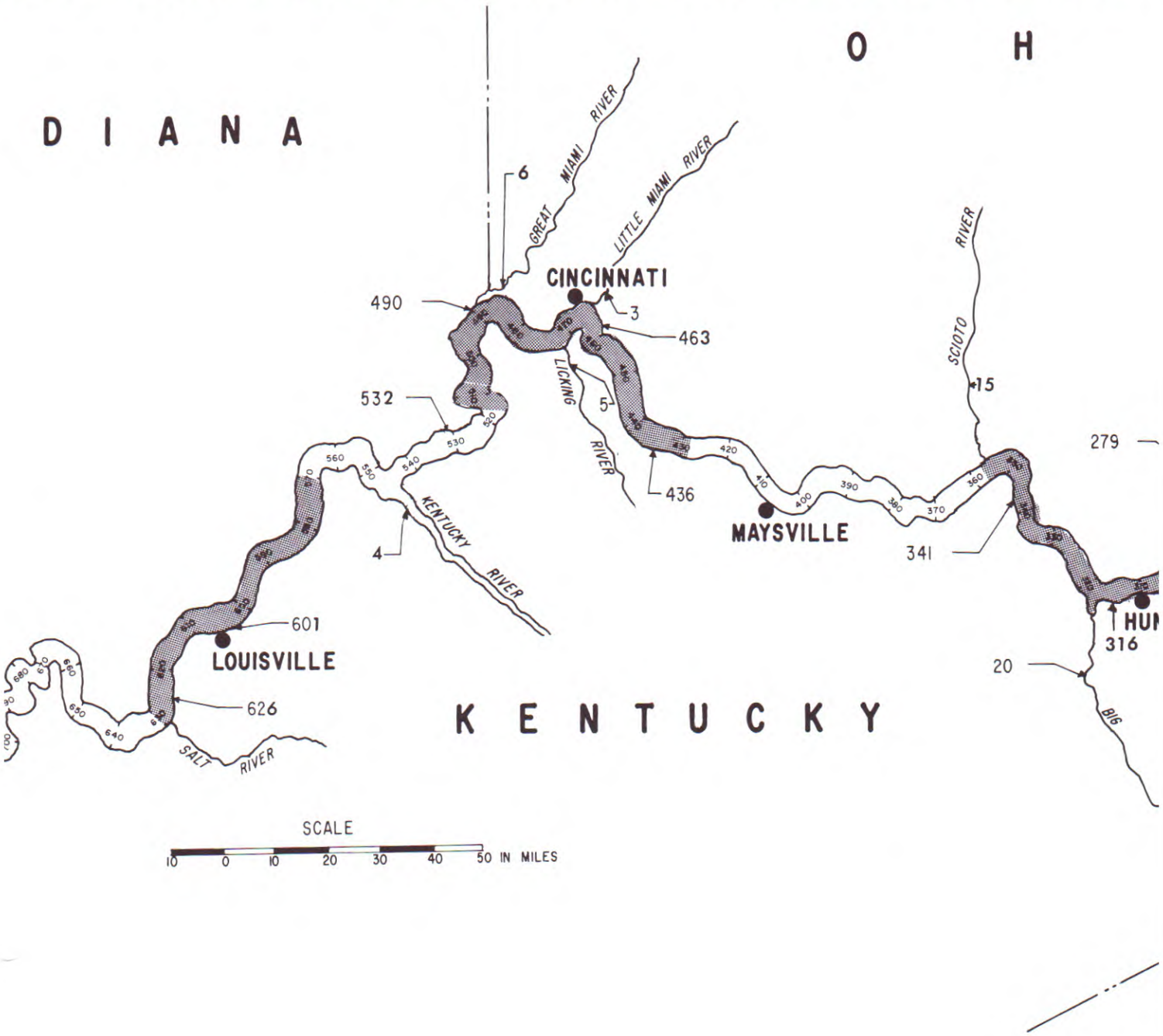


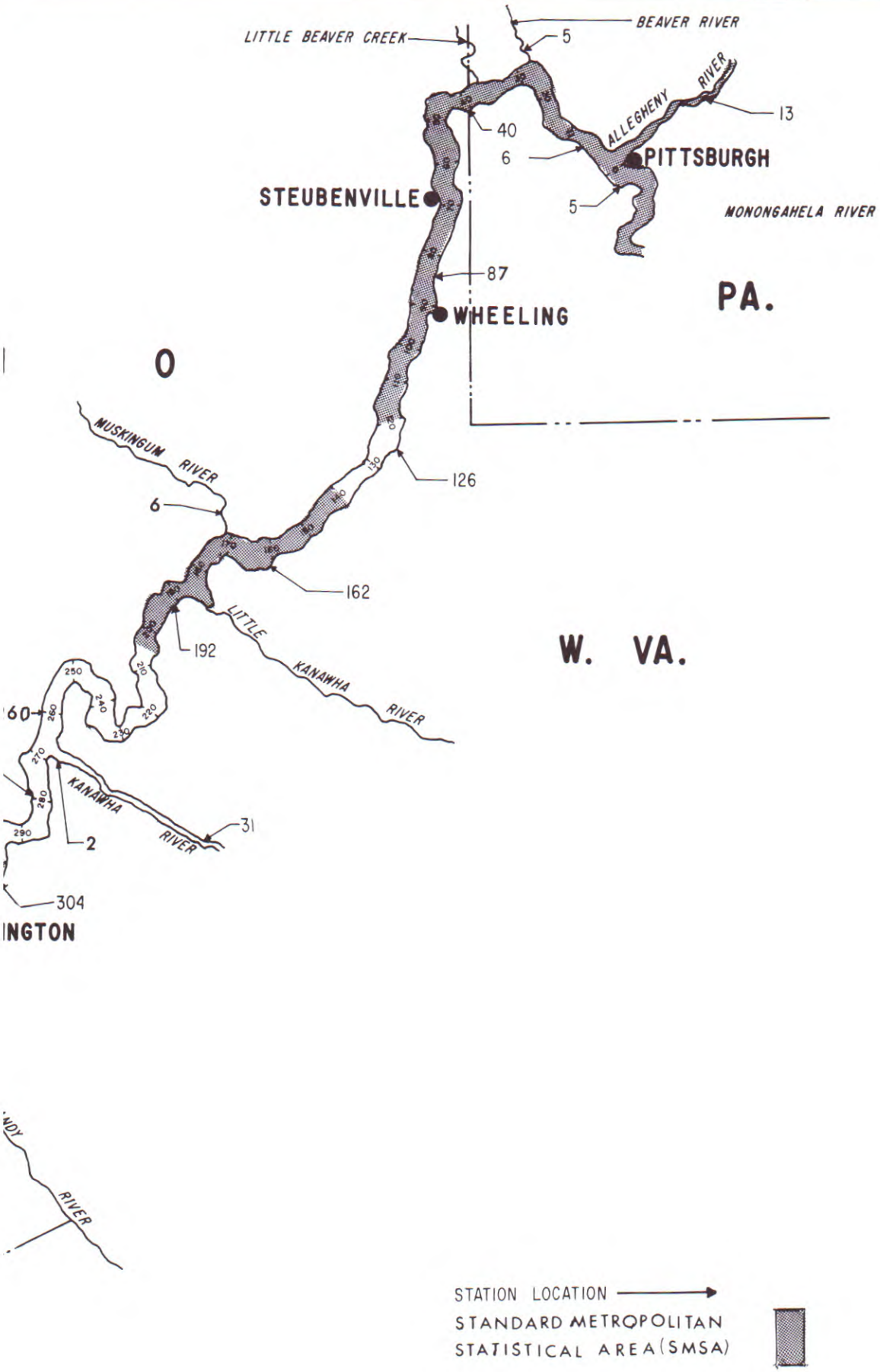

BEAVER RIVER
LITTLE BEAVER CREEK
5.3
3.0
0.3
42.6
44.5
15.8
20.9
RIVER
ALLEGHENY
0.5
13.3
8.9
40.2
53.8
59.1
65.3
11.8
PITTSBURGH
62.2
2.3
0.8
4.5
9.6
STEUBENVILLE
68.0
MONONGAHELA RIVER
79.3
83.6
86.8
41.0
42.6
PA.
WHEELING
94.3
111.0
119.4
MUSKINGUM
RIVER
28.0
128.0
5.8
172.0
155.0
183.7
161.0
184.0
251.0
192.2
LITTLE
KANAWHA
RIVER
0.5
W. VA.
260.7
241.6
KANAWHA
RIVER
31.1
1.8
304.2
0.5
HUNTINGTON
310.8
Guyadotte R
SANDY
RIVER
STATION LOCATION


N
ILLINOIS
MISSOURI
WABASH RIVER
EVANSVILLE
789
725
730
740
720
721
9
846
GREEN RIVER
TRADEWATER RIVER
CUMBERLAND
TENNESSEE RIVER
30
963
PADUCAH
MISSISSIPPI
RIVER
KENTUCKY DAM (Below)
18

MAP 3

PRIMARY
N STREAM MONITORING NETWORK
ECOMMENDED STATION LOCATIONS




LITTLE BEAVER CREEK
BEAVER RIVER
5
ALLEGHENY RIVER
13
40
6
PITTSBURGH
STEUBENVILLE
5
MONONGAHELA RIVER
87
PA.
WHEELING
O
MUSKINGUM RIVER
6
126
162
LITTLE KANAWHA RIVER
192
W. VA.
60
KANAWHA RIVER
31
2
304
NGTON
NDY RIVER
STATION LOCATION
STANDARD METROPOLITAN
STATISTICAL AREA (SMSA)

APPENDIX 1

Directive to the
Ohio River Monitoring Strategy Study Team

The Study Team is hereby directed to develop a recommended water quality monitoring strategy for the Ohio River main stem and lower reaches of major tributaries. Therein the Study Team will:

1. Tabulate projected federal, state, and interstate agency program needs for physical, biological and chemical water quality; point and non-point pollution source, and hydrologic information. This information will relate to water quality management planning, water resource planning, flow regulation, permit issuance, water quality standards compliance monitoring, enforcement activities, and the reporting requirements of the several participating agencies. Also, the program needs will be specific as to station location, parameters, and periodicity of sampling.

2. Evaluate and recommend cost effective means for collecting the needed information. Available monitoring alternatives include intensive stream surveys; point and non-point source surveys; automatic monitoring at fixed and mobile locations, and manual sampling at fixed and mobile locations. Recommendations will include sampling station locations, parameters, methods, periodicity and data handling consistent with the identified program needs. The recommendations will also include estimated associated costs.

3. Tabulate existing monitoring programs and projected available resources of the several participating agencies. Available resource projections should include fiscal and manpower allocations to support implementation of this monitoring strategy.

4. Compare the recommended monitoring program in (2) above with the existing programs and available resources tabulated in (3) above.

5. Recommend the priority decisions and associated responsibilities of participating agencies to implement an efficient, comprehensive monitoring strategy for the Ohio River main stem and lower reaches of major tributaries. Document identified program needs which will be satisfied by the recommended monitoring strategy.

6. Have a draft of its recommendations for presentation at the September 1973 meeting of ORSANCO.

ORSANCO:slb

June 12, 1973

APPENDIX 2

STATUTORY REQUIREMENTS OF PARTICIPATING AGENCIES

The following is a compilation of applicable sections of federal, interstate and state statutes that require water quality monitoring by the participating agencies.

FEDERAL

FWPCA Amendments of 1972 (PL 92-500)	Description
Sec. 101(e)	Public participation in the development, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program.
Sec. 102(a)	The Administrator shall prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters. Joint investigations are authorized.
Sec. 104(a)(1)	Promote the coordination and acceleration of, research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of pollution.
Sec. 104(a)(2)	Encourage, cooperate with, and render technical services.
Sec. 104(a)(5)	The Administrator shall establish, equip, and maintain a water quality surveillance system for the purpose of monitoring the quality of the navigable waters and ground waters and the contiguous zone and the oceans, and shall report on such quality in the report under subsection (a) of Section 516.

Sec. 105(d)(3)	The Administrator shall develop, refine, and achieve practical application of improved methods and procedures to identify and measure the effects of pollutants on the chemical, physical, and biological integrity of water, including those pollutants created by new technological developments.
Sec. 106(e)(1)	No grants shall be made to any State which has not provided or is not carrying out as a part of its program the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, to compile, and analyze data on the quality of navigable waters, including biological monitoring; and annually updating such data and including it in the report required under Section 305.
Sec. 115	Administrator to identify the location of in-place pollutants with emphasis on toxic pollutants in harbors and navigable waterways.
Sec. 208(a)(2),(3)	The State(s) shall identify each area which as a result of urban-industrial concentrations or other factors, has substantial water quality control problems.
Sec. 210	The Administrator shall annually make a survey to determine the efficiency of the operation and maintenance of treatment works constructed with grants under the Act. The results are to be included in the report required under Section 516(a).
Sec. 301(b)(1)(C)	Achieve not later than July 1, 1977, any more stringent limitation, including those necessary to meet water quality standards, etc.
Sec. 302(a)	The Administrator, if effluent limitations required under Section 301(b)(2) interfere with the attainment or maintenance of water quality standards, shall establish effluent limitations which can reasonably be expected to contribute to the attainment or maintenance of such water quality.

Sec. 303 (a),(b),(c)	Set water quality standards.
Sec. 303(d)(1)(A)	State to identify those waters for which effluent limitations required by Sec. 301(b)(1)(A) and Sec. 301(b)(1)(B) are not stringent enough to meet water quality standards.
Sec. 303(d)(1)(B)	State to identify those waters for which controls on thermal discharges under Sec. 301 are not stringent enough to assure protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife.
Sec. 303(d)(1)(C)	States shall establish the total maximum daily load, for those pollutants identified under Sec. 304(a)(2), at a level necessary to implement the applicable water quality standards.
Sec. 303(d)(1)(D)	States shall estimate the total maximum daily thermal load required to assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife.
Sec. 303(d)(2)	Each State to submit to the Administrator for his approval, the waters identified and the loads established under paragraphs (1)(A), (1)(B), (1)(C), and (1)(D) of this subsection. If disapproved, the Administrator shall establish.
Sec. 303(d)(3)	Each State to submit to the Administrator for his approval the identity of all waters not identified under paragraph (1)(A) and (1)(B) of this subsection and an estimate of the total maximum daily loads for pollutants identified under Sec. 304(a)(2), including thermal discharges.
Sec. 303(e)	Each State shall have a continuing planning process.
Sec. 304(a)	The Administrator shall develop and publish water quality criteria and information.

APPENDIX 2 (continued)

Sec. 305(a)	The Administrator is to prepare the 1973 Water Quality Inventory for submittal to Congress.
Sec. 305(b)	Each State, thereafter, shall annually submit to the Administrator a Water Quality Inventory.
Sec. 305(b)(1)(E)	Each State to submit to the Administrator a description of the nature and extent of non-point sources, recommend control programs including an estimate of costs.
Sec. 308	Provides for inspections, monitoring and entry.
Sec. 309(a)(1),(2)	Federal Enforcement.
Sec. 401	Provides for Certification.
Sec. 402(a)(2)	The Administrator shall prescribe conditions for NPDES permits.
Sec. 516(a)	Reports to Congress -- Contains among other things a summary of the results of the survey required under Sec. 210.

National Environmental Policy Act	Description
Sec. 2	Declares a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological system and natural resources important to the nation.
Sec. 102(g)	All agencies of the federal government shall initiate and utilize ecological information in the planning and development of resource-oriented projects.

Circular A-67
1964
OMB

Description

1. Provides guidelines for coordination of acquisition by Federal agencies of quantitative and qualitative data from streams, lakes, reservoirs, estuaries, and ground waters; among those activities excluded are soil related water studies. USGS acquires basic water data on the water resources of the Nation, and a number of other agencies acquire special water data to support their missions; both activities must be coordinated to assure effective and economical management of resources in meeting essential needs. The guidelines contemplate that the Department of the Interior will operate a national network for data acquisition; user agencies will arrange for specialized data that cannot be provided through the National network; the Department of the Interior will follow procedures to facilitate coordination of data acquisition, and will conduct a systematic continuing review directed toward efficient coordination of data acquisition activities. Agencies needing particular water data will, in general, provide funding for the data acquisition.

2. The national network to be designed and operated by the Department of the Interior will meet the water quantity needs of all Federal agencies and the water quality needs common to two or more agencies. Determination of the need for specialized data that cannot be met through the national network will be entirely the responsibility of the user agencies.

3. In operating the national network, the Department of the Interior will utilize services of other agencies whenever such an arrangement would result in a more effective and economical operation. User agencies will determine availability of services by the Department of the Interior before performing data acquisition activities on their own. Each agency will coordinate its activities with appropriate state and local agencies. The Department of the Interior will maintain a central catalog of information on water data and on plans for acquiring such data.

4. The Department of the Interior will prepare and keep current a Federal plan for the efficient utilization of data acquisition activities. The plan will be periodically reviewed, and common needs will be identified. Advice and assistance of the principal agencies providing or utilizing data will be obtained when the plan is being prepared and revised.

APPENDIX 2 (continued)

INTERSTATE

ORSANCO Compact	Description
Art. I	Pledges signatory states to pollution control and outlines uses to be protected for public and industry: water supply, recreational usage, maintaining fish and other aquatic life, freedom from unsightly or malodorous nuisances due to floating solids or sludge deposits.
Art. VI	Recognizes variation of size, flow, location, character, self purification and usage of water within the district. The guiding principle is that wastewaters from one state shall not injuriously affect the various uses of interstate waters. Wastewaters must be treated to protect health or preserve the waters for other legitimate purposes. Tributary streams within a state shall be maintained in such condition that quality is at least equal to the interstate stream immediately above the confluence. Rules, regulations and standards may be promulgated.
Art. VIII	Commission shall conduct a survey, study the pollution problems and make report for prevention or reduction of stream pollution. Commission shall confer with agencies of the federal government, and regional planning bodies as well as consultation and advice with various states, communities, corporations, personnel or other entities with regard to waste disposal.
Art. IX	Authorizes the issuance of enforcement orders and prescribes the methods of compliance.

APPENDIX 2 (continued)

STATE

ILLINOIS
Environmental Protection Act
July 1, 1970

	Description
Sec. 4b	The Agency shall have the duty to collect and disseminate such information, acquire such technical data and conduct such experiments as may be required to carry out the duties of this Act including ascertainment of the quantity and nature of discharges from any contaminant source and data on those sources, and to operate and arrange for the operation of devices for the monitoring of environmental quality.
Sec. 4c	The Agency shall have authority to conduct a program of continuing surveillance and/or regular or periodic inspection of actual or potential contaminants or noise sources, or public water supplies, and of refuse disposal.
Sec. 13	The Board, pursuant to procedures prescribed in Title 7 of this Act may adopt regulations to promote purposes of this type (water pollution). Without limiting the generalities of this authority, such regulations may, among other things, prescribe: (i) Requirements and Standards for equipment and procedures for monitoring contaminant discharges and their sources, the collection of samples and the collection, reporting, and retention of data resulting from such monitoring.
Sec. 27 (in part)	The Board may adopt substantial requirements .... including the nature of .... the receiving body of water .... .

APPENDIX 2 (continued)

INDIANA Stream Pollution Control Law	Description
(IC 13-1-3) Sec. 3	The Technical Secretary of the Stream Pollution Control Board "shall...make or arrange for such investigations and surveys and obtain, assemble or prepare such reports and data as the Board may direct or authorize".
Environmental Management Law	
(IC 13-7) Chapter 3 Sec. 1(c)	It shall be the duty of the (Environmental Management) Board to conduct a program of continuing surveillance ... of actual or threatened sources of environmental pollution by contamination... .
Chapter 5, Sec. 1(b)	...the Board shall have the power to: (b) Have a designated agent enter, at any reasonable time, upon any private or public property to inspect for and investigate possible violations of this article or regulations promulgated by the Board.
KENTUCKY Environmental Protection Law	
Sec. 224.033(4)	Develop and conduct a comprehensive program for the management of water, land, and air resources to assure their protection and balance utilization consistent with the environmental policy of the Commonwealth.
Sec. 224.033(7)	Secure necessary scientific, technical, administrative, and operational services, including laboratory facilities, by contract or otherwise.
Sec. 224.033(16)	Monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems and to warn of emergency conditions.

APPENDIX 2 (continued)

PENNSYLVANIA The Clean Streams Law of 1970	Description
Sec. 4(5)	The achievement of the objective herein set forth requires a comprehensive program of watershed management and control.
Sec. 5(b)(2)(4)	Establish policies for effective water quality control and water quality management in the Commonwealth of Pennsylvania and coordinate and be responsible for the development and implementation of comprehensive public water supply, waste management and other water quality plans. Report from time to time to the Legislature and to the Governor on the Commonwealth's public water supply and water quality control program.
Sec. 5(d)(4)	Make such inspections of public or private property as are necessary to determine compliance with the provisions of this act, and the rules, regulations, orders or permits issued hereunder.
Sec. 304	The board shall have power to make a complete survey of the waters of the Commonwealth in order to ascertain the extent of pollution in each of said waters, and the remedies to be employed to purify said waters. It shall have power to adopt, prescribe, and enforce such rules and regulations, not inconsistent with this act, as may be deemed necessary for the protection of the purity of the waters of the Commonwealth, or parts thereof, and to purify those now polluted, and to assure the proper and practical operation and maintenance of treatment works approved by it. A violation of which rules and regulations, after notice, shall also constitute a nuisance under this act.

APPENDIX 2 (continued)

WEST VIRGINIA Water Pollution Control Act as amended 1969	Description
Chapter 20 Article 5A-3	To encourage, participate in, or conduct or cause to be conducted studies, scientific or other investigations, research, experiments and demonstrations relating to water pollution, and the causes, control and reduction thereof, and to collect data with respect thereto, all as may be deemed advisable and necessary to carry out the purposes of this article; To collect and disseminate information relating to water pollution and the control and reduction thereof; To sample ground and surface water with sufficient frequency to ascertain the standards of purity or quality from time to time of the waters of the State.
OHIO Amended Substitute Senate Bill No. 80	To amend Chapter 6111 of the Ohio Revised Code to comply with the FWPCA Amendments of 1972.

APPENDIX 3

Tabulation List of Monitoring Locations
Recommended by Individual Agencies

River	Location	ORSANCO	EPA	USGS	USCE	Pa.	W.Va.	Ohio
Allegheny	New Kensington, Pa.					20		
"	Oakmont Water Intake	13.3	13.3	13.3	NP			
Monongahela	South Pittsburgh, Pa.		4.5		NP			
"	Braddock, Pa.			10.5		10.5		
"	Charleroi Water Intake	42.6				42.6		
Ohio	Reed Power Station (abandoned)	2.3						
"	Emsworth Dam Pool				NP			
"	Emsworth Dam		6.2					
Ohio	Sewickley					11.8		
"	Phillips Power Station, South Heights, Pa.	15.8						
Beaver	Beaver Falls Water Intake (Eastvale)	5.3	5.3	5.3	NP	5.3		
Ohio	Crucible Steel Co. Intake	35.9						
Ohio	E. Liverpool, O. Water Intake	40.2	40.2			40.2		
"	Newell, W. Va. Bridge						44.4	
Ohio	Sammis Power Plant Intake	53.8						
Ohio	Toronto Water Intake	59.1						
Ohio	National Steel Intake (Weirton)	62.2						
Ohio	Steubenville Water Intake	65.3						
"	East Steubenville, W. Va.						68.0	
Ohio	Ohio Power Company Intake	79.8						
Ohio	Pike Island Pool - Dam		84.2		NP			
Ohio	Wheeling Water Intake	86.8						

NP -- No preference

River	Location	ORSANCO	EPA	USGS	USCE	W.Va.	Ohio	Ky.
Ohio	Bellaire Water Intake	94.0						
"	Benwood, W. Va. Bridge					94.3		
Ohio	Ormet Power Station	111.0						
Ohio	Hannibal Dam	126.4	126.4			126.4		
"	New Martinsville			129				
Ohio	Monongahela Power Intake	161.0						
"	Willow Island Dam		161.9	NP				
Muskingum	Lock & Dam No. 2		5.8	NP	NP			
"	Beverly Power Station Intake	28.0						
Ohio	Williams Town, W. Va.					178.8		
"	Parkersburg, W.Va., Rt. 50 Bridge					184.3		
Little Kanawha	Near Mouth			NP	NP	0.8		
Ohio	Old Lock & Dam No. 19		192.2					
Hocking	Below Athens			35				
Ohio	Racine Dam		237.5					
"	Sporn Power Plant Intake	241.6						
Ohio	Meigs Co., O., Water Intake	248.6						
"	Mason, W. Va., Bridge					251.3		
Ohio	CVEC Kyger Creek Intake	260.0						
Kanawha	U.S. Coast Guard Station (Pt. Pleasant)	1.8	1.8	1.8	NP	1.8		
"	Winfield Dam	31.1	31.1					
"	Winfield Bridge					32.1		
Ohio	Gallipolis Pool				NP			
"	Gallipolis Dam		279.2			279.2		
Ohio	Huntington (40th St.)Water Intake	304.2	304.2					304.2
"	Huntington, Rt. 52 Bridge					310.8		

NP -- No preference

River	Location	ORSANCO	EPA	USGS	USCE	W.Va.	Ohio	Ky.
Guyandot	Mouth			NP		4.5		
Big Sandy	Mouth			NP		0.8		
"	Louisa, Ky. - Ky. Power Co. Intake	20.3	20.3		NP			20.3
Ohio	Ashland, Ky., Water Intake	319.9						319.9
Ohio	Ironton, Ohio Water Intake	327.0						
Ohio	Greenup Dam Pool				NP			
Ohio	Portsmouth, Ohio, Water Intake	350.7		NP				350.7
Scioto	Route 239		1					
"	Higby, Ohio			57				
Ohio	Aberdeen, O. - DP&L Co. Stuart Plant Intake	405.2					405.2	405.2
Ohio	Maysville,Ky., Water Intake	408.6						
Ohio	Meldahl Pool				NP			
"	Meldahl Dam	436.2	436.2					
Ohio	Cincinnati, Ohio, Water Intake	462.8	462.8					462.8
"	Covington, Ky., Water Intake	462.9						
"	Newport, Ky., Water Intake	463.7						
Little Miami	Near Beechmont Levee		3.4		NP			
Licking	Kenton County, Ky., Water Intake	4.5	4.5		NP			4.5
"	McKinneysburg, Ky.			64.0				
Ohio	North Bend, O. - CG&E Miami Fort Plant Intake	490.0	490.0					490.0
Great Miami	Elizabethtown, O., Bridge	5.5	5.5	5.5	NP			
Ohio	Markland Pool				NP			
"	Markland Lock & Dam	531.5	531.5	531.5				531.5

NP -- No preference

River	Location	ORSANCO	EPA	USGS	USCE	Ky.	Ill.	
Kentucky	Rte. 71 Bridge, near Carrollton,Ky.		6.1			NP		
"	Lock & Dam No.2,Lockport, Ky.			31.0				
Ohio	Madison, Ind. - Ind.-Ky. Electric Clifty Creek Intake	560.0				560.0		
Ohio	Louisville, Ky., Water Intake	600.6	600.6			600.6		
"	McAlpin Pool				NP			
Ohio	New Albany, Ind., Water Intake	608.4						
"	West Point, Ky. - LG&E Mill Creek Plant Intake	625.6	625.6			625.6		
"	Brandenburg, Ky.-Olin Corp. Intake	644.0				644.0		
Ohio	Old Lock & Dam No. 45			703.0				
Ohio	Cannelton Pool				NP			
"	Cannelton Lock & Dam	720.7	720.7			720.7		
"	Below Cannelton Dam		725					
Ohio	Owensboro, Ky. - Municipal Power Company Intake					755.6		
Ohio	Newburgh Pool				NP			
Green	At Route 60 Bridge		8.8					
Ohio	Evansville, Ind., Water Intake	791.5	791.5			791.5		
Ohio	Henderson, Ky. - Electric Power Intake	803.6						
Ohio	Mt. Vernon, Ind., Water Intake	829.1				829.1		
Ohio	Uniontown Pool				NP			
"	Uniontown, Ky., Water Intake	842.5				842.5		
"	Uniontown Lock & Dam		846.0					
Wabash	New Harmony, Ind.@ Rte 62 Bridge		30	30	NP			
"	Hutsonville, Ill.-Public Service Company of Ill. Intake	170						

NP -- No preference

River	Location	ORSANCO	EPA	USGS	USCE	Ky.	Ill.	
Ohio	Shawneetown, Ill.						858.1	
Ohio	Lock & Dam No. 50						876.8	
Ohio	Rosiclare, Ill., Water Intake	891.4						
Ohio	Golconda, Ill., Water Intake	902.3				902.3	902.3	
Ohio	Smithland Pool				NP			
Cumberland	Rte. 60 Lucy Jefferson Bridge		2.7					
"	Barkley Dam					30.6		
"	Grand Rivers			31.5				
Tennessee	At Rte 60 (George Rogers Clark Bridge)		5.3					
"	Kentucky Dam(Below)	22	22	22		22		
Ohio	Paducah, Ky., Water Intake	934.1				934.1		
Ohio	Lock & Dam No. 52						938.9	
Ohio	Joppa, Ill., Joppa Steam Plant Intake	952.4				952.4		
Ohio	Lock & Dam No. 53		962.6	962.6				
Ohio	Cairo, Ill., Water Intake	977.8				977.8	977.8	

NP -- No preference

APPENDIX 4

INTENSIVE SURVEY NEEDS

Agency	Description	Location	Remarks
Illinois	Integrated basin-wide biological survey	N.I.	B
Indiana	Comprehensive 24-hour type survey	Ohio River, significant point sources, major tributaries	B, including benthics, P, C
Kentucky	Dissolved oxygen survey	Below Cincinnati and Louisville	N.I.
	Bacteriological survey	Below major complexes with combined sewers	N.I.
Ohio	Aerial photogrammetry	Ohio River	Temperature
	Full-time, mobile field sampling team to collect data on critical areas routinely	Downstream from Pittsburgh Upstream of East Liverpool In area of Benwood, W. Va. Downstream from Parkersburg, W. Va. Huntington-Portsmouth Downstream from Cincinnati	DO DO DO DO DO DO
ORSANCO	N.I.	N.I.	N.I.
Pennsylvania	Biological surveys of pollution problem areas. Update previous modeling and load allocation work.	N.I.	N.I.

N.I. -- not indicated

P -- Physical; C -- Chemical; B -- Biological

INTENSIVE SURVEY NEEDS

Agency	Description	Location	Remarks
U. S. Corps of Engineers	N.I.	N.I.	N.I.
U. S. Environmental Protection Agency	Water Quality Segments (Water Quality and Point Source Surveys)	MP 0 - 29 Allegheny River (Pa.)	Water quality & point source
		MP 0 - 25 Monongahela River (Pa.)	"
		MP 0 - 40 Ohio River (Pa.)	"
		MP 40 - 325 Ohio River (W. Va.)	"
		MP 51 - 96 Ohio River (Ohio)	12 water quality stations & 49 point sources
		MP 304 - 341 Ohio River (Ohio)	8 water quality stations & 43 point sources
		MP 463 - 491 Ohio River (Ohio)	7 water quality stations & 22 point sources
		MP 317 - 336 Ohio River (Ky.)	Water quality & point source
		MP 0.0 - 2.6 Big Sandy (Ky.)	"
		MP 460 - 531 Ohio River (Ky.)	Adequate water quality data, point source data needed
		MP 606 - 720 Ohio River (Ky.)	Adequate data exists
		MP 846 - 980 Ohio River (Ill.)	"
		MP 15 - 18 Tennessee River (Ky.)	Water quality & point source
U. S. Geological Survey	N.I.	N.I.	N.I.
West Virginia	N.I.	N.I.	N.I.

N.I. -- not indicated

P -- Physical; C -- Chemical; B -- Biological

APPENDIX 5

BIOLOGICAL MONITORING

Community	Parameter	Priority*	Collection & Analysis Method**
Plankton	Counts and identification;+	1	Grab samples
	Chlorophyll a;	2	
	Biomass as ash free weight		
Periphyton	Counts and identification;	1	Artificial
	Chlorophyll a;	2	substrates
	Biomass as ash free weight	2	
Macrophyton	Areal coverage;	1	As circumstances
	Identification;	1	prescribe
	Biomass as ash free weight	1	
Macroin-	Counts and identification;	1	Artificial and
vertebrate	Biomass as ash free weight;	2	natural substrates
	Flesh tainting;	2	
	Toxic substances in tissue***	2	
Fish	Toxic substances in tissue;***	1	Electrofishing or
	Counts and identification;	2	netting
	Biomass as wet weight	2	
	Condition factor;	2	
	Flesh tainting;	2	
	Age and growth	2	

* Priority
1 - Minimum Program
2 - Add as soon as capability can be developed.
** See EPA Biological Methods Manual
*** Keyed to dynamics of community.
\+ To taxonomic level required for significant interpretation.

APPENDIX 6

Primary In-Stream Monitoring Network Station Locations and Justification
Ohio River Main Stem and Lower Reaches of Major Tributaries

Applicable Justifications \ River Mile		All 20.0	All 13.3	Mon 42.6	Mon 10.5	Mon 4.5	OH 2.3	OH 6.2	OH 15.8	Beaver 5.3	OH 35.9	OH 40.2	OH 53.8	OH 59.1	OH 62.2
Sections	101(e)	x	x	x	x	x		x	x	x		x			
1972 FWPCA	102(a)	x	x	x	x	x		x	x	x		x			
Amendments	104(a)(1)	x	x	x	x	x		x	x	x		x			
"	104(a)(2)	x	x	x	x	x		x	x	x		x			
"	104(a)(5)	x	x	x	x	x		x	x	x		x			
"	105(d)(3)	x	x	x	x	x		x	x	x		x			
"	106(e)(1)	x	x	x	x	x		x	x	x		x			
"	115	x	x	x	x	x		x	x	x		x			
"	208(a)(2)(3)	x	x	x	x	x		x	x	x		x			
"	302(a)	x	x	x	x	x		x	x	x		x			
"	303(a)(b)(c)	x	x	x	x	x		x	x	x		x			
"	303(d)(1)(A)	x	x	x	x	x		x	x	x		x			
"	303(d)(1)(B)	x	x	x	x	x		x	x	x		x			
"	303(d)(1)(C)	x	x	x	x	x		x	x	x		x			
"	303(d)(2)(D)	x	x	x	x	x		x	x	x		x			
"	303(d)(2)	x	x	x	x	x		x	x	x		x			
"	303(e)	x	x	x	x	x		x	x	x		x			
"	304(a)	x	x	x	x	x		x	x	x		x			
"	305(a)	x	x	x	x	x		x	x	x		x			
"	305(b)	x	x	x	x	x		x	x	x		x			
"	309(a)(1)(2)	x	x	x	x	x		x	x	x		x			
"	401	x	x	x	x	x		x	x	x		x			
"	402(a)(2)	x	x	x	x	x		x	x	x		x			
"	516(a)	x	x	x	x	x		x	x	x		x			
ORSANCO	Compact & Directives		x	x			x		x	x	x	x	x	x	x
USGS	OMB Circular A-67		x		x					x					
USCE	NEPA - 1970	x				x		x		x					
Ill.															
Ind.															
Ky.															
Ohio												x	x	x	x
Pa.		x	x	x	x	x	x	x	x	x	x	x			
W. Va.												x	x	x	x

Primary In-Stream Monitoring Network Station Locations and Justification
Ohio River Main Stem and Lower Reaches of Major Tributaries

Applicable Justifications	River Mile	OH 65.3	OH 79.8	OH 84.2	OH 86.8	OH 94.0	OH 111.0	OH 126.4	OH 161.9	Musk 5.8	Musk 28.0	OH 178.8	L.Kanawha 0.8	OH 192.0	Hock 35
Sections	101(e)	x		x		x		x	x	x		x	x	x	
1972 FWPCA	102(a)	x		x		x		x	x	x		x	x	x	
Amendments	104(a)(1)	x		x		x		x	x	x		x	x	x	
"	104(a)(2)	x		x		x		x	x	x		x	x	x	
"	104(a)(5)	x		x		x		x	x	x		x	x	x	
"	105(d)(3)	x		x		x		x	x	x		x	x	x	
"	106(e)(1)	x		x		x		x	x	x		x	x	x	
"	115	x		x		x		x	x	x		x	x	x	
"	208(a)(2)(3)	x		x		x									
"	302(a)	x		x		x		x	x	x		x	x	x	
"	303(a)(b)(c)	x		x		x		x	x	x		x	x	x	
"	303(d)(1)(A)	x		x		x		x	x	x		x	x	x	
"	303(d)(1)(B)	x		x		x		x	x	x		x	x	x	
"	303(d)(1)(C)	x		x		x		x	x	x		x	x	x	
"	303(d)(2)(D)	x		x		x		x	x	x		x	x	x	
"	303(d)(2)	x		x		x		x	x	x		x	x	x	
"	303(e)	x		x		x		x	x	x		x	x	x	
"	304(a)	x		x		x		x	x	x		x	x	x	
"	305(a)	x		x		x		x	x	x		x	x	x	
"	305(b)	x		x		x		x	x	x		x	x	x	
"	309(a)(1)(2)	x		x		x		x	x	x		x	x	x	
"	401	x		x		x		x	x	x		x	x	x	
"	402(a)(2)	x		x		x		x	x	x		x	x	x	
"	516(a)	x		x		x		x	x	x		x	x	x	
ORSANCO	Compact & Directives	x	x		x		x	x			x				
USGS	OMB Circular A-67							x		x			x		x
USCE	NEPA - 1970			x					x	x			x	x	
Ill.															
Ind.															
Ky.															
Ohio		x	x	x	x	x	x	x	x	x	x	x		x	x
Pa.															
W. Va.		x	x	x	x	x	x	x	x			x	x	x	

Primary In-Stream Monitoring Network Station Locations and Justification
Ohio River Main Stem and Lower Reaches of Major Tributaries

Applicable Justifications	River Mile	OH 237.5	OH 248.6	OH 251.3	OH 260.0	Kanawha 31.1	Kanawha 1.8	OH 279.2	OH 304.2	Guyandot 4.5	B.Sandy 20.3	B.Sandy 0.8	OH 319.9	OH 327.0
Sections	101(e)	x		x		x	x	x	x	x	x	x		x
1972 FWPCA	102(a)	x		x		x	x	x	x	x	x	x		x
Amendments	104(a)(1)	x		x		x	x	x	x	x	x	x		x
"	104(a)(2)	x		x		x	x	x	x	x	x	x		x
"	104(a)(5)	x		x		x	x	x	x	x	x	x		x
"	105(d)(3)	x		x		x	x	x	x		x	x		x
"	106(e)(1)	x		x		x	x	x	x	x	x	x		x
"	115	x		x		x	x	x	x	x	x	x		x
"	208(a)(2)(3)							x	x		x	x		x
"	302(a)	x		x		x	x	x	x	x	x	x		x
"	303(a)(b)(c)	x		x		x	x	x	x	x	x	x		x
"	303(d)(1)(A)	x		x		x	x	x	x	x	x	x		x
"	303(d)(1)(B)	x		x		x	x	x	x	x	x	x		x
"	303(d)(1)(C)	x		x		x	x	x	x	x	x	x		x
"	303(d)(2)(D)	x		x		x	x	x	x	x	x	x		x
"	303(d)(2)	x		x		x	x	x	x	x	x	x		x
"	303(e)	x		x		x	x	x	x	x	x	x		x
"	304(a)	x		x		x	x	x	x	x	x	x		x
"	305(a)	x		x		x	x	x	x	x	x	x		x
"	305(b)	x		x		x	x	x	x	x	x	x		x
"	309(a)(1)(2)	x		x		x	x	x	x	x	x	x		x
"	401	x		x		x	x	x	x	x	x	x		x
"	402(a)(2)	x		x		x	x	x	x	x	x	x		x
"	516(a)	x		x		x	x	x	x	x	x	x		x
ORSANCO	Compact & Directives	x	x		x	x	x		x	x	x		x	x
USGS	OMB Circular A-67						x					x		
USCE	NEPA - 1970						x	x				x		
Ill.														
Ind.														
Ky.											x	x	x	x
Ohio		x	x	x	x			x	x	x			x	x
Pa.														
W. Va.		x	x	x	x	x	x	x	x	x	x	x	x	

Primary In-Stream Monitoring Network Station Locations and Justification
Ohio River Main Stem and Lower Reaches of Major Tributaries

Applicable Justifications	River Mile	OH 341.0	OH 350.7	Scioto 1	Scioto 57	OH 405.2	OH 408.6	OH 436.2	OH 462.8	OH 463.7	L.Miami 3.4	Lick 4.5	Lick 64	OH 490.0	G.Miami 5.5
Sections	101(e)	x	x	x		x		x	x		x	x		x	x
1972 FWPCA	102(a)	x	x	x		x		x	x		x	x		x	x
Amendments	104(a)(1)	x	x	x		x		x	x		x	x		x	x
"	104(a)(2)	x	x	x		x		x	x		x	x		x	x
"	104(a)(5)	x	x	x		x		x	x		x	x		x	x
"	105(d)(3)	x	x	x		x		x	x		x	x		x	x
"	106(e)(1)	x	x	x		x		x	x		x	x		x	x
"	115	x	x	x		x		x	x		x	x		x	x
"	208(a)(2)(3)	x	x	x					x		x	x		x	
"	302(a)	x	x	x		x		x	x		x	x		x	x
"	303(a)(b)(c)	x	x	x		x		x	x		x	x		x	x
"	303(d)(1)(A)	x	x	x		x		x	x		x	x		x	x
"	303(d)(1)(B)	x	x	x		x		x	x		x	x		x	x
"	303(d)(1)(C)	x	x	x		x		x	x		x	x		x	x
"	303(d)(2)(D)	x	x	x		x		x	x		x	x		x	x
"	303(d)(2)	x	x	x		x		x	x		x	x		x	x
"	303(e)	x	x	x		x		x	x		x	x		x	x
"	304(a)	x	x	x		x		x	x		x	x		x	x
"	305(a)	x	x	x		x		x	x		x	x		x	x
"	305(b)	x	x	x		x		x	x		x	x		x	x
"	309(a)(1)(2)	x	x	x		x		x	x		x	x		x	x
"	401	x	x	x		x		x	x		x	x		x	x
"	402(a)(2)	x	x	x		x		x	x		x	x		x	x
"	516(a)	x	x	x		x		x	x		x	x		x	x
ORSANCO	Compact & Directives					x	x			x				x	
USGS	OMB Circular A-67		x		x								x		
USCE	NEPA - 1970	x									x	x			
Ill.															
Ind.															
Ky.		x	x			x	x	x	x	x		x	x	x	
Ohio		x	x	x	x	x	x	x	x	x	x			x	x
Pa.															
W. Va.															

Primary In-Stream Monitoring Network Station Locations and Justification
Ohio River Main Stem and Lower Reaches of Major Tributaries

Applicable Justifications		River Mile: OH 531.5	Ky 31.0	Ky 6.1	OH 560.0	OH 600.6	OH 608.4	OH 625.6	OH 644.0	OH 703.0	OH 720.7	OH 725.0	OH 755.6	Green 8.8	OH 791.5
Sections	101(e)	x		x	x	x		x	x		x	x	x	x	x
1972 FWPCA	102(a)	x		x	x	x		x	x		x	x	x	x	x
Amendments	104(a)(1)	x		x	x	x		x	x		x	x	x	x	x
"	104(a)(2)	x		x	x	x		x	x		x	x	x	x	x
"	104(a)(5)	x		x	x	x		x	x		x	x	x	x	x
"	105(d)(3)	x		x	x	x		x	x		x	x	x	x	x
"	106(e)(1)	x		x	x	x		x	x		x	x	x	x	x
"	115			x	x	x		x	x		x	x	x	x	x
"	208(a)(2)(3)					x		x	x				x	x	x
"	302(a)	x		x	x	x		x	x		x	x	x	x	x
"	303(a)(b)(c)	x		x	x	x		x	x		x	x	x	x	x
"	303(d)(1)(A)			x	x	x		x	x		x	x	x	x	x
"	303(d)(1)(B)	x		x	x	x		x	x		x	x	x	x	x
"	303(d)(1)(C)			x	x	x		x	x		x	x	x	x	x
"	303(d)(2)(D)			x	x	x		x	x		x	x	x	x	x
"	303(d)(2)	x		x	x	x		x	x		x	x	x	x	x
"	303(e)	x		x	x	x		x	x		x	x	x	x	x
"	304(a)	x		x	x	x		x	x		x	x	x	x	x
"	305(a)	x		x	x	x		x	x		x	x	x	x	x
"	305(b)	x		x	x	x		x	x		x	x	x	x	x
"	309(a)(1)(2)	x		x	x	x		x	x		x	x	x	x	x
"	401	x		x	x	x		x	x		x	x	x	x	x
"	402(a)(2)	x		x	x	x		x	x		x	x	x	x	x
"	516(a)	x		x	x	x		x	x		x	x	x	x	x
ORSANCO	Compact & Directives	x				x	x	x	x		x	x			
USGS	OMB Circular A-67	x	x							x					
USCE	NEPA - 1970	x											x		
Ill.															
Ind.		x			x	x	x	x	x	x	x	x	x		x
Ky.		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ohio															
Pa.															
W. Va.															

Primary In-Stream Monitoring Network Station Locations and Justification
Ohio River Main Stem and Lower Reaches of Major Tributaries

Applicable Justifications \ River Mile		OH 803.6	OH 829.1	OH 842.5	Wabash OH 30.0	OH 858.1	Tradewater 30	OH 876.8	OH 891.4	OH 902.3	Cumber 31.5	Cumber 2.7	Tenn 22.0	Tenn 5.3
Sections	101(e)		x	x	x	x	x	x		x	x	x	x	x
1972 FWPCA	102(a)		x	x	x	x	x	x		x	x	x	x	x
Amendments	104(a)(1)		x	x	x	x	x	x		x	x	x	x	x
"	104(a)(2)		x	x	x	x	x	x		x	x	x	x	x
"	104(a)(5)		x	x	x	x	x	x		x	x	x	x	x
"	105(d)(3)		x	x	x	x	x	x		x	x	x	x	x
"	106(a)(1)		x	x	x	x	x	x		x	x	x	x	x
"	115		x	x	x	x	x	x		x	x	x	x	x
"	208(a)(2)(3)		x											
"	302(a)		x	x	x	x	x	x		x	x	x	x	x
"	303(a)(b)(c)		x	x	x	x	x	x		x	x	x	x	x
"	303(d)(1)(A)		x	x	x	x	x	x		x	x	x	x	x
"	303(d)(1)(B)		x	x	x	x	x	x		x	x	x	x	x
"	303(d)(1)(C)		x	x	x	x	x	x		x	x	x	x	x
"	303(d)(2)(D)		x	x	x	x	x	x		x	x	x	x	x
"	303(d)(2)		x	x	x	x	x	x		x	x	x	x	x
"	303(e)		x	x	x	x	x	x		x	x	x	x	x
"	304(a)		x	x	x	x	x	x		x	x	x	x	x
"	305(a)		x	x	x	x	x	x		x	x	x	x	x
"	305(b)		x	x	x	x	x	x		x	x	x	x	x
"	309(a)(1)(2)		x	x	x	x	x	x		x	x	x	x	x
"	401		x	x	x	x	x	x		x	x	x	x	x
"	402(a)(2)		x	x	x	x	x	x		x	x	x	x	x
"	516(a)		x	x	x	x	x	x		x	x	x	x	x
ORSANCO	Compact & Directives	x	x	x	x		x		x	x				
USGS	OMB Circular A-67				x						x		x	
USCE	NEPA - 1970			x	x									
Ill.					x	x			x	x				
Ind.		x	x	x	x									
Ky.		x	x	x		x	x	x	x	x	x	x	x	x
Ohio														
Pa.														
W. Va.														

Primary In-Stream Monitoring Network Station Locations and Justification
Ohio River Main Stem and Lower Reaches of Major Tributaries

Applicable Justifications \ River Mile		OH 934.1	OH 938.9	OH 952.4	OH 962.6	OH 977.8
Sections	101(e)	x	x	x	x	x
1972 FWPCA	102(a)	x	x	x	x	x
Amendments	104(a)(1)	x	x	x	x	x
"	104(a)(2)	x	x	x	x	x
"	104(a)(5)	x	x	x	x	x
"	105(d)(3)	x	x	x	x	x
"	106(e)(1)	x	x	x	x	x
"	115	x	x	x	x	x
"	208(a)(2)(3)					
"	302(a)	x	x	x	x	x
"	303(a)(b)(c)	x	x	x	x	x
"	303(d)(1)(A)	x	x	x	x	x
"	303(d)(1)(B)	x	x	x	x	x
"	303(d)(1)(C)	x	x	x	x	x
"	303(d)(2)(D)	x	x	x	x	x
"	303(d)(2)	x	x	x	x	x
"	303(e)	x	x	x	x	x
"	304(a)	x	x	x	x	x
"	305(a)	x	x	x	x	x
"	305(b)	x	x	x	x	x
"	309(a)(1)(2)	x	x	x	x	x
"	401	x	x	x	x	x
"	402(a)(2)	x	x	x	x	x
"	516(a)	x	x	x	x	x
ORSANCO	Compact & Directives	x			x	x
USGS	OMB Circular A-67					
USCE	NEPA - 1970					
Ill.		x	x	x	x	x
Ind.						
Ky.		x	x	x	x	x
Ohio						
Pa.						
W. Va.						

APPENDIX 7

COST CRITERIA

The cost figures used to determine the "value" of the data were extrapolated on the basis of the following:

1. Laboratory analysis costs were obtained from quotations from the U. S. Geological Survey for such work. Comparisons with quotes from commercial laboratories for these analyses indicate concurrence.

2. Sampling costs were estimated by the U. S. EPA as per sample cost for a man to travel to the field, collect samples over the period of a day and return the samples to the laboratory for analysis in accordance with the time frame required.

3. Robot monitor costs reflect the operating costs per station of the 20-station ORSANCO system. These costs include field station maintenance, leased line costs for telemetry, and central receiving station costs, but do not include capital considerations or data handling costs (see 4 below). These costs also reflect that the instrument would be housed in an existing municipal or industrial intake facility where no housing, pumping or intake maintenance costs would be incurred as exemplified by the ORSANCO system.

4. Data handling costs were estimated by the U. S. EPA as their costs for preparation of the data for historical storage in a system such as STORET, but do not include the storage or retrieval costs for evaluation purposes. Costs are included for both manual samples, including necessary key-punching or tape preparation, and automated instrument samples, where data is assumed to be in a form suitable for processing.

ANALYTICAL COSTS -- WATER SAMPLES

Silicon Dioxide	$ 4.80
Aluminum (dissolved)	5.60
Iron (dissolved)	5.60
Manganese	5.60
Calcium	5.60
Magnesium	5.60
Sodium	5.60
Potassium	5.60
Alkalinity	3.95
Sulfate	8.00
Chloride	3.95
Fluorine	4.80
Ammonia-Nitrogen (total)	8.00
Nitrite-Nitrogen (total)	4.80
Nitrate-Nitrogen (total)	8.00
Organic-Nitrogen (kjeldahl)	8.00
Phosphorus (dissolved)	7.15
Phosphorus (total)	8.00
Dissolved Solids	8.00
Carbon Dioxide	1.60
Orthophosphate	4.80
Lithium (dissolved)	6.40
Chromium (dissolved)	6.40
Nickel (dissolved)	6.40
Copper (dissolved)	6.40

Analytical Costs (continued)

Lead (dissolved)	$ 6.40
Zinc (dissolved)	6.40
Cobalt (dissolved)	6.40
Barium (dissolved)	8.00
Cyanide	16.00
Strontium (dissolved)	6.40
Arsenic (dissolved)	8.00
Boron (dissolved)	8.00
Cadmium (dissolved)	6.40
Selenium (dissolved)	9.60
Silver (dissolved)	6.40
Vanadium (dissolved)	32.00
Beryllium (dissolved)	8.00
Molybdenum (dissolved)	32.00
Mercury (dissolved)	9.60
Mercury (total)	9.60
Threshold Odor	4.80
Pesticides	(See separate list)
T.O.C.	9.20
Suspended Solids	1.60
Total Solids	8.00
Hardness	1.60 (calculated) 5.60 (analyzed)
Acidity	4.80
Specific Conductance	1.60

Analytical Costs (continued

pH	$ 1.60
Temperature	--
D.O.	8.00
D.O. (% sat.)	--
B.O.D.	12.00
C.O.D. (.25 N)	12.00
C.O.D. (.025 N)	12.00
Phenols	16.00
MBAS	8.00
Turbidity	2.45
Color (color units)	1.60
Sulfide (dissolved)	8.00
Coliform (fecal)	8.00
Coliform (MF Imm.)	8.00
Streptococci	8.00

COSTS FOR CHEMICAL ANALYSES OF BOTTOM MATERIALS

Cadmium	$ 10.50
Chromium (total)	10.50
Copper	10.50
Lead	10.50
Manganese	6.95
Kjeldahl Nitrogen	5.90
Selenium	18.15
Arsenic	10.60
Organic Carbon	11.00
Cobalt	10.50
Iron	6.65
Mercury	7.00
Nitrogen (nitrite & nitrate)	3.35
Phosphorus (total)	6.20
Zinc	6.95

SERVICES AND COSTS

Phytoplankton	
Type I (3 co-dominant forms)	$ 27.50
Type II	16.50
Periphyton	
Type I	22.00
Biomass (dry and ash weights)	11.00
Biomass-Pigment Ratio	11.00
Seston (dry and ash weights)	11.00
Plant Pigments (chlorophylls a and b)	11.00
Macroinvertebrates	
ID and Species Diversity	137.00
ID only	111.00
Biomass (wet weight)	5.50
Multiplate Samplers	5.50
Dip Net	7.15
Forceps	0.65
Media Kits (each kit will prepare 30 plates)	
MFC agar	5.50
M-endo agar	5.50
M-enterococcus agar	5.50
MFC broth	5.50
M-endo broth	5.50

COSTS FOR SPECIAL ANALYSES

Insecticides in:

Water	$ 38.50

Insecticides determined include the chlorinated hydrocarbons and phosphorothioates. PCBs are analyzed without additional charge.

Insecticides in:

Sediment	$ 82.50
Plant Material	110.00
Animal and Fish	110.00

Insecticides determined include only the chlorinated hydrocarbons. PCBs are analyzed at no additional charge. Phosphorothioate analysis in sediment costs an additional amount of $20.00.

Herbicides in:

Water	$ 49.50
Sediment	88.00

Phosphorothioates as separate analysis in

Water	$ 27.50
Sediment	71.50

Petrochemicals in

Water	$ 27.50
Sediment	49.50

Analysis of chlorinated hydrocarbon insecticides, herbicides, phosphorothioates, and PCBs in water costs $77.00.

Radiochemical analyses $ 77.00

(Includes dissolved and suspended gross alpha, gross beta and solids; and strontium and strontium/90).

OTHER ASSOCIATED COSTS

Grab Sample Cost	$ 15.00/sample
Robot Monitor Operating Cost*	$ 2,000.00/year
Data Handling Cost+	
(Prior to Storage)	
Robot Monitor Data	$ 0.0125/item
Manual Monitoring Data#	$ 0.07585/item

* Includes maintenance and telemetering line costs

\+ Cost for transferring data from agency to STORET. Not included are data handling costs incurred by agency prior to transfer. ORSANCO estimates its data handling costs as an additional $0.03/item for robot monitor data. This cost was not reflected in appendices 10 and 13 and the figures on pages 27 and 30.

\# ORSANCO's current cost for data handling of manual samples is about $0.17/data item.

APPENDIX 8

Tabulation List of Existing Station Locations

River	Location	ORSANCO	EPA	USGS	USCE	Pa.	Ohio	W.Va.
Allegheny	6th St. Bridge, Pittsburgh		0.5					
"	Wilkinsburg-Penn Water Intake	8.9						
"	Oakmont Water Intake	13.3						
"	New Kensington Water Intake				20.9			
Monongahela	Smithfield St. Bridge, Pittsburgh		0.8					
"	So. Pittsburgh Water Intake	4.5						
"	Braddock, Pa.			9.6				
"	Charleroi, Pa.					41.0		
"	Charleroi, Pa. Water Intake	42.6						
Ohio	Reed Power Station (abandoned)	2.3						
"	Sewickley, Pa.			11.8				
"	South Heights, Pa.	15.8						
Beaver	Rochester, Pa.					0.3		
"	New Brighton, Fa.		3.0					
"	Beaver Falls (Eastvale)	5.3				5.3		
Ohio	Pa./Ohio/W.Va. State Line		40.0					
"	East Liverpool, Ohio		42.6			42.6	42.6	
"	Newell, W. Va.							44.5
"	Stratton, Ohio	53.8						
"	Toronto, Ohio	59.1						
"	Weirton (Steel), W. Va.	62.2						
"	Steubenville, Ohio	65.3						
"	East Stubenville, W. Va.							68.0
"	Power, W. Va.	79.3						
"	Yorkville, Ohio	83.6						

NP -- No preference

Tabulation List of
Existing Station Locations

River	Location	ORSANCO	EPA	USGS	USCE	Ohio	W.Va.	Ky
Ohio	Wheeling Water Intake	86.8	86.8					
"	Benwood, W. Va.						94.3	
"	Moundsville, W. Va.	111.0						
"	Natrium, W. Va.	119.4						
"	New Martinsville, W. Va.		128					
"	St. Marys, W. Va.						155	
"	Willow Island, W. Va.	161.0						
"	Marietta, Ohio		172.0					
Muskingum	Lock & Dam No. 2		5.7					
"	Beverly, Ohio	28.0						
Little Kanawha	Parkersburg, W. Va.						0.5	
Ohio	Parkersburg, W. Va.	183.7					184.0	
"	Old Lock & Dam 19		192.2					
Hocking	Athens, Ohio			--				
Ohio	New Haven, W.Va. (Sporn Power Pl.)	241.6						
"	Pomeroy, Ohio						251	
"	Addison, O.(Kyger Creek Power Pl.)	260.7	260.7					
Kanawha	Point Pleasant, W. Va.		1.8				1.8	
"	Winfield Dam, W. Va.	31.1						
Ohio	Gallipolis Lock & Dam		279.2				279.2	
"	Huntington Water Intake	304.2						
Guyandot	Huntington, W. Va.		0.5					
O Ohio	Huntington, W. Va.						310.8	
Big Sandy	Catlettsburg, Ky.						1.0	1.0
"			2.5					
"	Louisa, Ky.	20.3						

NP -- No preference

Tabulation List of Existing Station Locations

River	Location	ORSANCO	EPA	USGS	USCE	Ky.	Ohio
Ohio	Catlettsburg, Ky.		317				
"	South Point, Ohio	318					
"	Ashland, Ky.					320	
"	Ironton, Ohio		327				
"	Greenup Dam		341				
"	Portsmouth, O. Water Intake	350.1					
"	Portsmouth, Ohio		355.6				
Scioto	Lucasville, Ohio			--			
Ohio	Maysville, Ky.		408.5			408.5	
"	Meldahl Dam		436.2				
"	Cincinnati Water Intake	462.8					
"	Covington Water Intake					462.9	
"	Newport, Ky. Water Intake					463.5	
Little Miami	Cincinnati, O. (Beechmont Ave.)		3.4				
Licking	Covington, Ky.		1.0				
"	Kenton Co. Water Intake	4.5				4.5	
Ohio	N. Bend, O. (Miami Ft. Power Pl.)	490.0	490.0				
Great Miami	Cleves, Ohio	5.5		5.5			
Ohio	Markland Dam	531.5	531.5				
Kentucky	Lock & Dam No. 1		4.0				
Ohio	Madison, Ind. (Clifty Cr. Pow.Pl.)	559.5					
"	Louisville Water Intake	600.6	600.6			600.6	
"	Louisville (Cane Run Power Plant)	616.8	616.8				
"	Brandenburg, Ky.		646.1				
"	Brandenburg, Ky.		647.8				
"	Cannelton Dam		720.7				
"	Hawesville, Ky.					727	

NP -- No preference

Tabulation List of
Existing Station Locations

River	Location	ORSANCO	EPA	USGS	USCE	Ky.	Ill.	
Ohio	Lock & Dam No. 46		756					
"	" "		757					
Green	Lock & Dam No. 1		9.1					
Ohio	Evansville, Ind.	791.5						
"	Henderson, Ky.		804			804		
"	Lock & Dam No. 48		809.6					
"	Uniontown Lock & Dam		846.0					
Wabash	New Haven, Ill.						35	
Ohio	Shawneetown, Ill.						858	
"	Dam No. 50						876	
"	Rosiclaire, Ill.		891				891	
"	Golconda, Ill.						902.9	
Cumberland	Smithland, Ky.			2.8				
Tennessee	Paducah, Ky.					0.1		
"	Calvert City, Ky.					16		
"	Kentucky Dam			22.4				
Ohio	Lock & Dam No. 52		938.9					
"	Brookport (Dam No. 52)		938.9					
"	Metropolis, Ill.		943.1					
"	" "			944.1				
"	Olmstead, Ill. (Dam No. 53)			962.8			962.8	
"	Cairo Water Intake		977.8				977.8	

NP -- No preference

TABULATION LIST OF MONITORING PARAMETERS AND FREQUENCIES AT EXISTING STATIONS

APPENDIX 9

Stream / Milepoint	Allegheny 0.5	Allegheny 8.9	Allegheny 13.3	Allegheny 19	Allegheny 20.9	
Agency	8	5	5	6/9	7	
Analyses						
Temperature	M	D	H	M	H	
pH	M	D	H	M	H	
D.O.	M		H	M	H	
Conductivity	M		H	M	H	
Turbidity	M	D	D	Q		
Flow	M		D			
Acidity	M		D	Q		
Alkalinity Phenol & Total	M		D			
BOD	M					
Chloride	M	W		Q	H	
Cyanide	M					
Fluoride	M	D				
Total Hardness	M		2/W	Q		
NH_3-N	M	D		Q		
NO_3-N	M			Q		
TKN	M					
Phenolics	M					
Total Dissolved Phosphorus				Q		
Total Phosphorus-P						
Solids, Dissolved	M					
Solids, Suspended	M			Q		
Sulfate	M			Q		
Sodium	M	W				
Potassium						
Silica						
Calcium				M		
Magnesium				M		
Cobalt						
TOC	M			M		
Arsenic	M			Y		
Barium						
Beryllium						
Cadmium				Y		
Chromium				Y		
Chromium, Hexavalent	M					
Copper				Y		
Iron	M	W	3/W	Q		
Lead				Y		
Manganese	M	D	3/W	Q		
Mercury	M			Y		
Nickel				Y		
Selenium						
Silver						
Zinc				Y		
Radioactivity				M		
Pesticides						
PCB						
Coliform, Fecal	M	D		M		
Coliform, Total	M			M		
Fecal Streptococci	M					
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Threshold Odor		D				
Aluminum	M			Y		
Color	M					
No. of Data Items (Manual)	384	3,076	1,876	173		
No. of Data Items (Robot)			35,040		43,800	

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Monongahela	Monongahela	Monongahela	Monongahela	Monongahela	
Milepoint	0.8	4.5	9.6	41.0	42.6	
Agency	8	5	6/9	6	5	
Analyses						
Temperature	M	D	D	Q	H	
pH	M	D		Q	H	
D.O.	M		Q	Q	H	
Conductivity	M		D	Q	H	
Turbidity	M	D		Q	D	
Flow	M				D	
Acidity	M	M		Q	D	
Alkalinity Phenol & Total	M	D		Q	D	
BOD	M					
Chloride	M			Q		
Cyanide	M					
Fluoride	M					
Total Hardness	M	D		Q	D	
NH_3-N	M			Q		
NO_3-N	M			Q		
TKN	M					
Phenolics	M					
Total Dissolved Phosphorus						
Total Phosphorus-P	M		M	Q		
Solids, Dissolved	M			Q		
Solids, Suspended	M					
Sulfate	M			Q		
Sodium						
Potassium						
Silica						
Calcium				Q		
Magnesium				Q		
Cobalt						
TOC	M		Q	Q		
Arsenic	M		Q	Y		
Barium						
Beryllium						
Cadmium			Q	Y		
Chromium			Q	Y		
Chromium, Hexavalent	M					
Copper			Q	Y	D	
Iron	M		Q	Q		
Lead			Q	Y	D	
Manganese	M		Q	Q		
Mercury	M		Q	Y		
Nickel				Y		
Selenium			Q			
Silver						
Zinc			Q	Y		
Radioactivity						
Pesticides						
PCB						
Coliform, Fecal	M	D	M	Q		
Coliform, Total	M		M	Q		
Fecal Streptococci	M					
Zooplankton						
Phytoplankton			M			
Periphyton			Q			
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Aluminum	M		Q	Y		
Threshold Odor				Q		
Color	M					
No. of Data Items (Manual)	384	1,837	834	96	2,555	
No. of Data Items (Robot)					35,040	

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream / Milepoint	Ohio 2.3	Ohio 11.8	Ohio 15.8		Beaver 0.3	Beaver 3.0	Beaver 5.3	
Agency	5	6/9	5	8	6	8	5	6
Analyses								
Temperature		M	H	M	Q	M	H	Q
pH	D	M	H	M	Q	M	H	Q
D.O.		M	H	M	Q	M	H	Q
Conductivity		M	H	M	Q	M	H	Q
Turbidity	D	Q	D	M	Q	M	D	Q
Flow			D	M		M	D	
Acidity		Q		M	Q	M		Q
Alkalinity Phenol & Total				M	Q	M	D	Q
BOD				M		M		
Chloride	D	Q	D	M	Q	M	2/W	Q
Cyanide				M		M		
Fluoride				M		M		
Total Hardness	D	Q	D	M	Q	M	2/W	Q
NH_3-N		Q		M	Q	M		Q
NO_3-N		Q		M	Q	M		Q
TKN				M		M		
Phenolics				M		M		
Total Dissolved Phosphorus		Q						
Total Phosphorus-P				M	Q	M		Q
Solids, Dissolved				M	Q	M		Q
Solids, Suspended		Q		M		M		
Sulfate		Q		M	Q	M	W	Q
Sodium								
Potassium								
Silica								
Calcium		M			Q			Q
Magnesium		M			Q			Q
Cobalt								
TOC		M		M	Q	M		Q
Arsenic		Y		M	Y	M		Y
Barium								
Beryllium								
Cadmium		Y			Y			Y
Chromium		Y			Y			Y
Chromium, Hexavalent				M		M		
Copper		Y			Y			Y
Iron		Q			Q			Q
Lead		Y			Y			Y
Manganese		Q		M	Q	M		Q
Mercury		Y		M	Y	M		Y
Nickel		Y			Y			Y
Selenium								
Silver								
Zinc		Y			Y			Y
Radioactivity		M			Q			Q
Pesticides								
PCB								
Coliform, Fecal		M		M	Q	M	D	Q
Coliform, Total		M		M	Q	M		Q
Fecal Streptococci				M		M		
Zooplankton								
Phytoplankton								
Periphyton								
Chlorophyll (a & b)								
Chlorophyll Phaeophyton								
Artificial Substrates								
Alga Assays								
Nektonic Forms								
In place toxic pollutants								
Organic extracts(GC&IR)								
Aquatic organisms tissue constituents								
Threshold Odor								
Aluminum				M		M		
Color				M	Q	M		Q
No. of Data Items (Manual)	1,460	172	1,460	384	100	384	1,981	100
No. of Data Items (Robot)			35,040					

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio
Milepoint	40.0	42.6	44.5	53.8	59.1	62.2
Agency	8	6 4	10	5	5	5
Analyses						
Temperature	M	Q	2/Q	H		
pH	M	Q	2/Q	H	D	
D.O.	M	Q	2/Q	H		
Conductivity	M	Q	2/Q	H		
Turbidity	M	Q	2/Q			
Flow	M			D		
Acidity	M	Q	2/Q			
Alkalinity Phenol & Total	M	Q	2/Q		D	
BOD	M					
Chloride	M	Q	2/Q	H		
Cyanide	M					
Fluoride	M		2/Q			
Total Hardness	M	Q	2/Q		W	
NH_3-N	M	Q				
NO_3-N	M	Q	2/Q			
TKN	M					
Phenolics	M		2/Q			
Total Dissolved Phosphorus		Q				
Total Phosphorus-P	M					
Solids, Dissolved	M	Q	2/Q			
Solids, Suspended	M	Q	2/Q			
Sulfate	M	Q	2/Q			
Sodium			2/Q			
Potassium			2/Q			
Silica						
Calcium		Q				
Magnesium		Q				
Cobalt						
TOC	M					
Arsenic	M	Y	S			
Barium						
Beryllium						
Cadmium		Y	S			
Chromium		Y				
Chromium, Hexavalent	M		2/Q			
Copper		Y	S			
Iron	M	Q	2/Q			
Lead		Y	2/Q			
Manganese	M	Q	2/Q			
Mercury	M	Y				
Nickel		Y				
Selenium			S			
Silver			S			
Zinc		Y	S			
Radioactivity		Q M				
Pesticides						
PCB						
Coliform, Fecal	M	Q	2/Q			
Coliform, Total	M	Q	2/Q			D
Fecal Streptococci	M		2/Q			
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Aluminum	M	Y	2/Q			
Threshold Odor			2/Q			
Color	M					
No. of Data Items (Manual)	384	95 12	218	365	782	365
No. of Data Items (Robot)				43,800		

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Ohio	Ohio	Ohio	Ohio	Ohio		Ohio
Milepoint	65.3	68.0	79.3	83.6	86.8		94.3
Agency / Analyses	5	10	5	5	5	8	10
Temperature		2/Q			D	M	2/Q
pH	2/Q		D	2/W	D	M	2/Q
D.O.		2/Q				M	2/Q
Conductivity		2/Q	D			M	2/Q
Turbidity	D	2/Q		2/W		M	2/Q
Flow						M	
Acidity		2/Q		2/W		M	2/Q
Alkalinity Phenol & Total		2/Q	D	2/W	D	M	2/Q
BOD						M	
Chloride	W	2/Q		2/W	D	M	2/Q
Cyanide							
Fluoride		2/Q			D	M	2/Q
Total Hardness	D	2/Q	D	2/W	D	M	2/Q
NH_3-N						M	
NO_3-N		2/Q				M	2/Q
TKN						M	
Phenolics		2/Q			D	M	2/Q
Total Dissolved Phosphorus							
Total Phosphorus-P						M	
Solids, Dissolved		2/Q				M	2/Q
Solids, Suspended		2/Q				M	2/Q
Sulfate	W	2/Q	D	2/W		M	2/Q
Sodium		2/Q					2/Q
Potassium		2/Q					2/Q
Silica							
Calcium							
Magnesium							
Cobalt							
TOC						M	
Arsenic		S				M	S
Barium							
Beryllium							
Cadmium		S					S
Chromium							
Chromium, Hexavalent		2/Q				M	2/Q
Copper		S					S
Iron		2/Q			D	M	2/Q
Lead		2/Q					2/Q
Manganese	D	2/Q			D	M	2/Q
Mercury						M	
Nickel							
Selenium		S					S
Silver		S					S
Zinc		S					S
Radioactivity							
Pesticides							
PCB							
Coliform, Fecal	D	2/Q			D	M	2/Q
Coliform, Total	D	2/Q			D	M	2/Q
Fecal Streptococci		2/Q				M	2/Q
Zooplankton							
Phytoplankton							
Periphyton							
Chlorophyll (a & b)							
Chlorophyll Phaeophyton							
Artificial Substrates							
Alga Assays							
Nektonic Forms							
In place toxic pollutants							
Organic extracts(GC&IR)							
Aquatic organisms tissue constituents							
Threshold Odor		2/Q				M	2/Q
Aluminum		2/Q					2/Q
Color						M	
No. of Data Items (Manual)	1,929	218	1,825	728	4,015	384	218

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio
Milepoint	111.0	119.4	128	155	161.0	172.0
Agency	5	5	8	10	5	8
Analyses						
Temperature	D	W	M	2/Q	H	M
pH	D	W	M	2/Q	H	M
D.O.			M	2/Q	H	M
Conductivity	D		M	2/Q	H	M
Turbidity		W	M	2/Q		M
Flow			M		D	M
Acidity			M	2/Q		M
Alkalinity Phenol & Total		W	M	2/Q	2/M	M
BOD						M
Chloride	2/M	W	M	2/Q	H	M
Cyanide			M			M
Fluoride			M	2/Q		M
Total Hardness	D	W	M	2/Q	2/M	M
NH_3-N			M			M
NO_3-N			M	2/Q		M
TKN			M			M
Phenolics			M	2/Q		M
Total Dissolved Phosphorus						
Total Phosphorus-P			M			M
Solids, Dissolved			M	2/Q		M
Solids, Suspended			M	2/Q		M
Sulfate	2/M	W	M	2/Q	2/M	M
Sodium				2/Q		
Potassium				2/Q		
Silica	2/M					
Calcium						
Magnesium						
Cobalt						
TOC			M			M
Arsenic			M	S		M
Barium						
Beryllium						
Cadmium				S		
Chromium						
Chromium, Hexavalent			M	2/Q		M
Copper				S		
Iron	2/M	2/M	M	2/Q		M
Lead				2/Q		
Manganese			M	2/Q		M
Mercury			M			M
Nickel						
Selenium				S		
Silver				S		
Zinc				S		
Radioactivity						
Pesticides						
PCB						
Coliform, Fecal			M	2/Q	2/M	M
Coliform, Total			M	2/Q		M
Fecal Streptococci			M	2/Q		M
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Threshold Odor		W		2/Q		
Aluminum			M	2/Q		M
Color			M			M
No. of Data Items (Manual)	1,556	388	384	218	413	384
No. of Data Items (Robot)					43,800	

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream / Milepoint	Muskingum 5.7	Muskingum 28.0	Little Kanawha 0.5	Ohio 184		Ohio 192	Hocking
Agency	8	5	10	5	10	8	9
Analyses							
Temperature	M	H	2/Q	W	2/Q	M	H
pH	M	H	2/Q	W	2/Q	M	H
D.O.	M	H	2/Q	W	2/Q	M	H
Conductivity	M	H	2/Q	W	2/Q	M	H
Turbidity	M		2/Q	W	2/Q	M	
Flow	M	D				M	
Acidity	M		2/Q		2/Q	M	
Alkalinity Phenol & Total	M	3/W	2/Q	W	2/Q	M	2/M
BOD	M					M	
Chloride	M	H	2/Q	W	2/Q	M	2/M
Cyanide	M					M	
Fluoride	M		2/Q		2/Q	M	
Total Hardness	M	D	2/Q	W	2/Q	M	2/M
NH_3-N	M	S				M	
NO_3-N	M		2/Q		2/Q	M	2/M
TKN	M					M	
Phenolics	M		2/Q		2/Q	M	
Total Dissolved Phosphorus							
Total Phosphorus-P	M					M	
Solids, Dissolved	M	M	2/Q		2/Q	M	2/M
Solids, Suspended	M		2/Q		2/Q	M	
Sulfate	M	M	2/Q		2/Q	M	2/M
Sodium			2/Q		2/Q		
Potassium			2/Q		2/Q		
Silica							
Calcium							
Magnesium							
Cobalt							
TOC	M					M	S
Arsenic	M		S		S	M	S
Barium							
Beryllium							
Cadmium			S		S		
Chromium							
Chromium, Hexavalent	M		2/Q		2/Q	M	
Copper			S		S		
Iron	M	M	2/Q	W	2/Q	M	
Lead			2/Q		2/Q		
Manganese	M	M	2/Q	W	2/Q	M	
Mercury	M					M	S
Nickel							
Selenium			S		S		
Silver			S		S		
Zinc			S		S		
Radioactivity							
Pesticides							
PCB							
Coliform, Fecal	M		2/Q		2/Q	M	
Coliform, Total	M		2/Q		2/Q	M	
Fecal Streptococci	M		2/Q		2/Q	M	
Zooplankton							
Phytoplankton							
Periphyton							
Chlorophyll (a & b)							
Chlorophyll Phaeophyton							
Artificial Substrates							
Alga Assays							
Nektonic Forms							
In place toxic pollutants							
Organic extracts(GC&IR)							
Aquatic organisms tissue constituents							
Threshold Odor			2/Q		2/Q		
Aluminum	M		2/Q		2/Q	M	
Color	M					M	
No. of Data Items (Manual)	384	946	218	520	218	384	150
No. of Data Items (Robot)		43,800					35,040

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream / Milepoint	Ohio 241.6	Ohio 251	Ohio 260.7		Kanawha 1.8		Kanawha 31.1		Ohio 279.2	
Agency	5	10	5	8	8	10	5	10	8	10
Analyses										
Temperature	H	2/Q	D	M	M	2/Q	H	2/Q	M	2/Q
pH	H	2/Q		M	M	2/Q	H	2/Q	M	2/Q
D.O.	H	2/Q		M	M	2/Q	H	2/Q	M	2/Q
Conductivity	H	2/Q	D	M	M	2/Q	H	2/Q	M	2/Q
Turbidity		2/Q	D	M	M	2/Q		2/Q	M	2/Q
Flow	D			M	M		D		M	
Acidity		2/Q		M	M	2/Q		2/Q	M	2/Q
Alkalinity Phenol & Total		2/Q	D	M	M	2/Q		2/Q	M	2/Q
BOD				M	M				M	
Chloride	H	2/Q	D	M	M	2/Q	H	2/Q	M	2/Q
Cyanide				M	M				M	
Fluoride		2/Q		M	M	2/Q		2/Q	M	2/Q
Total Hardness	W	2/Q	D	M	M	2/Q		2/Q	M	2/Q
NH_3-N	M		M	M	M				M	
NO_3-N		2/Q		M	M	2/Q		2/Q	M	2/Q
TKN				M	M				M	
Phenolics		2/Q		M	M	2/Q		2/Q	M	2/Q
Total Dissolved Phosphorus										
Total Phosphorus-P				M	M				M	
Solids, Dissolved		2/Q		M	M	2/Q		2/Q	M	2/Q
Solids, Suspended		2/Q		M	M	2/Q		2/Q	M	2/Q
Sulfate	W	2/Q	W	M	M	2/Q		2/Q	M	2/Q
Sodium		2/Q				2/Q		2/Q		2/Q
Potassium		2/Q				2/Q		2/Q		2/Q
Silica										
Calcium										
Magnesium										
Cobalt										
TOC				M	M				M	
Arsenic		S		M	M	S		S	M	S
Barium										
Beryllium										
Cadmium		S				S		S		S
Chromium										
Chromium, Hexavalent		2/Q		M	M	2/Q		2/Q	M	2/Q
Copper		S				S		S		S
Iron		2/Q		M	M	2/Q		2/Q	M	2/Q
Lead		2/Q				2/Q		2/Q		2/Q
Manganese		2/Q		M	M	2/Q		2/Q	M	2/Q
Mercury				M	M				M	
Nickel										
Selenium		S				S		S		S
Silver						S		S		S
Zinc						S		S		S
Radioactivity										
Pesticides										
PCB										
Coliform, Fecal		2/Q		M	M	2/Q		2/Q		2/Q
Coliform, Total		2/Q		M	M	2/Q		2/Q	M	2/Q
Fecal Streptococci		2/Q		M	M	2/Q		2/Q	M	2/Q
Zooplankton										
Phytoplankton										
Periphyton										
Chlorophyll (a & b)										
Chlorophyll Phaeophyton										
Artificial Substrates										
Alga Assays										
Nektonic Forms										
In place toxic pollutants										
Organic extracts(GC&IR)										
Aquatic organisms tissue constituents										
Threshold Odor		2/Q				2/Q		2/Q		2/Q
Aluminum		2/Q		M	M	2/Q		2/Q	M	2/Q
Color				M	M				M	
No. of Data Items (Manual)	481	218	2,254	384	384	218	365	218	384	218
No. of Data Items (Robot)	43,800						43,800			

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream / Milepoint	Ohio 304.2	Guyandot 0.5	Ohio 310.8	Big Sandy 1	Big Sandy 2.5	Big Sandy 20.3
Agency	5	8	10	3 10	8	3/5
Analyses						
Temperature	H	M	2/Q	2/Q	M	H
pH	H	M	2/Q	2/Q	M	H
D.O.	H	M	2/Q	2/Q	M	H
Conductivity	H	M	2/Q	2/Q	M	H
Turbidity	D	M	2/Q	2/Q	M	
Flow	D	M			M	D
Acidity		M	2/Q	2/Q	M	
Alkalinity Phenol & Total	D	M	2/Q	2/Q	M	M
BOD		M			M	
Chloride	H	M	2/Q	2/Q	M	M
Cyanide		M			M	
Fluoride		M	2/Q	M 2/Q	M	
Total Hardness	D	M	2/Q	2/Q	M	
NH_3-N		M			M	M
NO_3-N		M	2/Q	2/Q	M	
TKN		M			M	
Phenolics	Q	M	2/Q	2/Q	M	
Total Dissolved Phosphorus						
Total Phosphorus-P		M			M	
Solids, Dissolved		M	2/Q	2/Q	M	
Solids, Suspended		M	2/Q	2/Q	M	
Sulfate	D	M	2/Q	2/Q	M	M
Sodium			2/Q	2/Q		
Potassium			2/Q	2/Q		
Silica						
Calcium						
Magnesium						
Cobalt						
TOC		M			M	
Arsenic		M	S	Q S	M	
Barium						
Beryllium						
Cadmium			S	M S		
Chromium				M		
Chromium, Hexavalent		M	2/Q	2/Q	M	
Copper			S	S		
Iron	2/W	M	2/Q	2/Q	M	
Lead			2/Q	M 2/Q		
Manganese	D	M	2/Q	2/Q	M	
Mercury		M			M	
Nickel						
Selenium			S	S		
Silver			S	M S		
Zinc			S	S		
Radioactivity						
Pesticides						
PCB						
Coliform, Fecal	D	M	2/Q	2/Q	M	M
Coliform, Total		M	2/Q	2/Q	M	
Fecal Streptococci		M	2/Q	2/Q	M	
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Threshold Odor	D		2/Q	2/Q		
Aluminum		M	2/Q	2/Q	M	
Color		M			M	
No. of Data Items (Manual)	3,028	384	218	64 218	384	425
No. of Data Items (Robot)	43,800					35,040

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio
Milepoint	317	318	320	327	341	350.7
Agency	8	5	3	8	8	5
Analyses						
Temperature	M	W		M	M	2/W
pH	M	W		M	M	2/W
D.O.	M			M	M	
Conductivity	M			M	M	
Turbidity	M			M	M	2/W
Flow	M					
Acidity	M					
Alkalinity Phenol & Total	M			M	M	2/W
BOD	M			M	M	
Chloride	M			M	M	2/W
Cyanide	M					
Fluoride	M		M			2/W
Total Hardness	M			M	M	
NH_3-N	M			M	M	
NO_3-N	M			M	M	
TKN	M			M	M	
Phenolics	M			M	M	
Total Dissolved Phosphorus						
Total Phosphorus-P	M			M	M	
Solids, Dissolved	M			M	M	
Solids, Suspended	M			M	M	
Sulfate	M			M	M	2/W
Sodium						
Potassium						
Silica						
Calcium						
Magnesium						
Cobalt						
TOC	M		Q			
Arsenic	M			M	M	
Barium						
Beryllium						
Cadmium			M	M	M	
Chromium			M	M	M	
Chromium, Hexavalent	M			M	M	
Copper				M	M	
Iron	M			M	M	
Lead			M	M	M	
Manganese	M					
Mercury	M			M	M	
Nickel				M	M	
Selenium						
Silver			M			
Zinc				M	M	
Radioactivity						
Pesticides						
PCB						
Coliform, Fecal	M					2/W
Coliform, Total	M			M	M	
Fecal Streptococci	M					
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Threshold Odor						2/W
Aluminum	M			M	M	
Color	M			M	M	
NO_2				M	M	
No. of Data Items (Manual)	384	104	64	372	372	936

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream Milepoint	Ohio 355.6	Scioto	Ohio 408.5		Ohio 436.2	Ohio 462.8		Ohio 462.9
Analyses Agency	8	9	3	8	8	5	8	3
Temperature	M	3/M		M	M	H	M	
pH	M	3/M		M	M	H	M	
D.O.	M	3/M		M	M	H	M	
Conductivity	M	D		M	M	H	M	
Turbidity	M			M	M	D	M	
Flow						D		
Acidity								
Alkalinity Phenol & Total	M	3/M		M	M	D	M	
BOD	M	3/M						
Chloride	M	3/M		M	M	H	M	
Cyanide								
Fluoride			M			W		M
Total Hardness	M	3/M		M	M	D	M	
NH_3-N	M	3/M		M	M		M	
NO_3-N	M	3/M		M	M		M	
TKN	M	3/M		M	M		M	
Phenolics	M			M	M		M	
Total Dissolved Phosphorus		3/M						
Total Phosphorus-P	M	3/M		M	M		M	
Solids, Dissolved	M			M	M		M	
Solids, Suspended	M			M	M		M	
Sulfate	M	3/M		M	M	W	M	
Sodium		3/M						
Potassium		3/M						
Silica								
Calcium		3/M						
Magnesium		3/M						
Cobalt								
TOC								
Arsenic	M	S	Q	M	M		M	Q
Barium		S						
Beryllium		S						
Cadmium	M	S	M	M	M		M	M
Chromium	M	S	M	M	M		M	M
Chromium, Hexavalent	M	S		M	M		M	
Copper	M	S		M	M		M	
Iron	M	S		M	M		M	
Lead	M	S	M	M	M		M	M
Manganese		S						
Mercury	M	S		M	M		M	
Nickel	M	S		M	M		M	
Selenium		S						
Silver		S	M					M
Zinc	M	S		M	M		M	
Radioactivity		3/M						
Pesticides								
PCB								
Coliform, Fecal		3/M				D		
Coliform, Total	M	3/M		M	M		M	
Fecal Streptococci		3/M						
Zooplankton								
Phytoplankton								
Periphyton								
Chlorophyll (a & b)								
Chlorophyll Phaeophyton								
Artificial Substrates								
Alga Assays								
Nektonic Forms								
In place toxic pollutants								
Organic extracts(GC&IR)								
Aquatic organisms tissue constituents								
Threshold Odor						3/W		
Aluminum	M			M	M		M	
Color	M			M	M		M	
NO_2	M			M	M		M	
No. of Data Items (Manual)	372	1,151	64	372	372	1,355	372	64
No. of Data Items (Robot)						43,800		

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Ohio	Little Miami	Licking	Licking	Ohio	Great Miami
Milepoint	463.5	3.4	1.0	4.5	490.0	5.5
Agency	3	8	8	3 5	5 8	5 9
Analyses		M	M	H	H M	H D
Temperature		M	M	H	H M	H 3/M
pH		M	M	H	H M	H
D.O.		M	M	H	H M	H D
Conductivity		M	M		M	
Turbidity				D		D
Flow						
Acidity						
Alkalinity Phenol & Total		M	M		W M	3/M
BOD						
Chloride		M	M	H	H M	H 3/M
Cyanide						
Fluoride	M			M		3/M
Total Hardness		M	M		M	3/M
NH_3-N		M	M		M	
NO_3-N		M	M		M	3/M
TKN		M	M		M	3/M
Phenolics		M	M		M	
Total Dissolved Phosphorus						
Total Phosphorus-P		M	M		M	3/M
Solids, Dissolved		M	M		2/W M	3/M
Solids, Suspended		M	M		M	
Sulfate		M	M		M	3/M
Sodium						
Potassium						
Silica						
Calcium						
Magnesium						
Cobalt						
TOC						
Arsenic	Q	M	M	Q	M	
Barium						
Beryllium						
Cadmium	M	M	M	M	M	
Chromium	M	M	M	M	M	
Chromium, Hexavalent		M	M		M	
Copper		M	M		M	
Iron		M	M		M	
Lead	M	M	M	M	M	
Manganese						
Mercury		M	M		M	
Nickel		M	M		M	
Selenium						
Silver	M			M		
Zinc		M	M		M	
Radioactivity						
Pesticides						
PCB						
Coliform, Fecal						
Coliform, Total		M	M		M	
Fecal Streptococci						
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Aluminum		M	M		M	
Color		M	M		M	
NO_2		M	M		M	
No. of Data Items (Manual)	64	372	372	64 365	372	365 1,090
No. of Data Items (Robot)				43,800		43,800

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream Milepoint	Ohio 531.5		Kentucky 4.0	Ohio 559.5	Ohio 600.6			Ohio 616.8		Ohio 646.1
Agency Analyses	5	8	8	5	3	5	8	5	8	8
Temperature	H	M	M	Q		H	M	H	M	M
pH	H	M	M			H	M	H	M	M
D.O.	H	M	M			H	M	H	M	M
Conductivity	H	M	M	D		H	M	H	M	M
Turbidity		M	M	D		D	M		M	M
Flow	D					D		D		
Acidity										
Alkalinity Phenol & Total		M	M	D		D	M		M	M
BOD		M	M				M		M	M
Chloride	H	M	M	D		H	M		M	M
Cyanide										
Fluoride		M	M		M		M		M	M
Total Hardness				D		D				
NH_3-N		M	M	D			M		M	M
NO_3-N										
TKN										
Phenolics										
Total Dissolved Phosphorus		M	M				M		M	M
Total Phosphorus-P		M	M				M		M	M
Solids, Dissolved										
Solids, Suspended		M	M				M		M	M
Sulfate		M	M	W		2/W	M		M	M
Sodium										
Potassium										
Silica										
Calcium										
Magnesium										
Cobalt										
TOC										
Arsenic		M	M		Q		M		M	M
Barium										
Beryllium										
Cadmium		M	M		M		M		M	M
Chromium					M					
Chromium, Hexavalent										
Copper										
Iron										
Lead		M	M		M		M		M	M
Manganese		M	M				M		M	M
Mercury		M	M				M		M	M
Nickel										
Selenium										
Silver		Q	Q		M		Q		Q	Q
Zinc		Q	Q				Q		Q	Q
Radioactivity										
Pesticides										
PCB										
Coliform, Fecal		M	M				M		M	M
Coliform, Total		M	M				M		M	M
Fecal Streptococci										
Zooplankton										
Phytoplankton										
Periphyton										
Chlorophyll (a & b)										
Chlorophyll Phaeophyton										
Artificial Substrates										
Alga Assays										
Nektonic Forms										
In place toxic pollutants										
Organic extracts(GC&IR)										
Aquatic organisms tissue constituents										
Threshold Odor						D				
No. of Data Items (Manual)	365	260	260	2,264	64	1564	260	365	260	260
No. of Data Items (Robot)	43,800				43,800			35,040		

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream / Milepoint	Ohio 647.8	Ohio 720.7	Ohio 727	Ohio 756	Ohio 757	Green 9.1
Analyses Agency	8	8	3	8	8	8
Temperature	M	M		M	M	M
pH	M	M		M	M	M
D.O.	M	M		M	M	M
Conductivity	M	M		M	M	M
Turbidity	M	M		M	M	M
Flow						
Acidity						
Alkalinity Phenol & Total	M	M		M	M	M
BOD	M	M		M	M	M
Chloride	M	M		M	M	M
Cyanide						
Fluoride	M	M	M	M	M	M
Total Hardness						
NH_3-N	M	M		M	M	M
NO_3-N						
TKN						
Phenolics						
Total Dissolved Phosphorus	M	M		M	M	M
Total Phosphorus-P	M	M		M	M	M
Solids, Dissolved						
Solids, Suspended	M	M		M	M	M
Sulfate	M	M		M	M	M
Sodium						
Potassium						
Silica						
Calcium						
Magnesium						
Cobalt						
TOC						
Arsenic	M	M	Q	M	M	M
Barium						
Beryllium						
Cadmium	M	M	M	M	M	M
Chromium			M			
Chromium, Hexavalent						
Copper						
Iron						
Lead	M	M	M	M	M	M
Manganese	M	M		M	M	M
Mercury	M	M		M	M	M
Nickel						
Selenium	Q	Q		Q	Q	Q
Silver	Q	Q	M	Q	Q	Q
Zinc						
Radioactivity						
Pesticides						
PCB	M	M		M	M	M
Coliform, Fecal	M	M		M	M	M
Coliform, Total						
Fecal Streptococci						
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
No. of Data Items (Manual)	260	260	64	260	260	260

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream Milepoint	Ohio 791.5	Ohio 804	Ohio 809.6	Ohio 846.0	Wabash 35	Ohio 858
Analyses Agency	5	3 8	8	8	1	1
Temperature	H	M	M	M	M	M
pH	H	M	M	M	M	M
D.O.	H	M	M	M	M	M
Conductivity	H	M	M	M		
Turbidity	D	M	M	M		
Flow	D					
Acidity						
Alkalinity Phenol & Total	D	M	M	M		
BOD		M	M	M		
Chloride	H	M	M	M	Q	Q
Cyanide					Q	Q
Fluoride		M M	M	M	Q	Q
Total Hardness	D					
NH_3-N		M	M	M	M	M
NO_3-N					M	M
TKN						
Phenolics					M	M
Total Dissolved Phosphorus		M	M	M		
Total Phosphorus-P		M	M	M	M	M
Solids, Dissolved					M	M
Solids, Suspended		M	M	M		
Sulfate	D	M	M	M	Q	Q
Sodium						
Potassium						
Silica						
Calcium						
Magnesium						
Cobalt						
TOC						
Arsenic		Q M	M	M	Q	Q
Barium					Q	Q
Beryllium						
Cadmium		M M	M	M	Q	Q
Chromium		M			Q	Q
Chromium, Hexavalent					Q	Q
Copper					Q	Q
Iron					Q	Q
Lead		M M	M	M	Q	Q
Manganese	D	M	M	M	Q	Q
Mercury		M	M	M	M	M
Nickel					Q	Q
Selenium		Q	Q	Q	Q	Q
Silver		M Q	Q	Q	Q	Q
Zinc					Q	Q
Radioactivity						
Pesticides						
PCB						
Coliform, Fecal	D	M	M	M	M	M
Coliform, Total		M	M	M		
Fecal Streptococci						
Zooplankton						
Phytoplankton						
Periphyton						
Chlorophyll (a & b)						
Chlorophyll Phaeophyton						
Artificial Substrates						
Alga Assays						
Nektonic Forms						
In place toxic pollutants						
Organic extracts(GC&IR)						
Aquatic organisms tissue constituents						
Threshold Odor	D				M	M
MBAS					Q	Q
Boron						
No. of Data Items (Manual)	2,190	64 260	260	260	188	188
No. of Data Items (Robot)	43,800					

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Ohio	Ohio		Ohio	Cumberland	Tennessee	Tennessee
Milepoint	876	891.4		902.9	2.8	0.1	16
Analyses Agency	1	1	8	1	9	3	3
Temperature	M	M	M	M	H		H
pH	M	M	M	M			H
D.O.	M	M	M	M			H
Conductivity			M				H
Turbidity			M				
Flow							
Acidity							
Alkalinity Phenol & Total			M				
BOD			M				
Chloride	Q	Q	M	Q			
Cyanide	Q	Q		Q			
Fluoride	Q	Q	M	Q		M	
Total Hardness							
NH_3-N	M	M	M	M			
NO_3-N	M	M		M			
TKN							
Phenolics	M	M		M			
Total Dissolved Phosphorus			M				
Total Phosphorus-P	M	M	M	M			
Solids, Dissolved	M	M		M			
Solids, Suspended			M				
Sulfate	Q	Q	M	Q			
Sodium							
Potassium							
Silica							
Calcium							
Magnesium							
Cobalt							
TOC							
Arsenic	Q	Q	M	Q		Q	
Barium	Q	Q		Q			
Beryllium							
Cadmium	Q	Q	M	Q		M	
Chromium	Q	Q		Q		M	
Chromium, Hexavalent	Q	Q		Q			
Copper	Q	Q		Q			
Iron	Q	Q		Q			
Lead	Q	Q	M	Q		M	
Manganese	Q	Q	M	Q			
Mercury	M	M	M	M			
Nickel	Q	Q		Q			
Selenium	Q	Q		Q			
Silver	Q	Q	Q	Q		M	
Zinc	Q	Q	Q	Q			
Radioactivity							
Pesticides							
PCB							
Coliform, Fecal	M	M	M	M			
Coliform, Total			M				
Fecal Streptococci							
Zooplankton							
Phytoplankton							
Periphyton							
Chlorophyll (a & b)							
Chlorophyll Phaeophyton							
Artificial Substrates							
Alga Assays							
Nektonic Forms							
In place toxic pollutants							
Organic extracts(GC&IR)							
Aquatic organisms tissue constituents							
MBAS	M	M		M			
Boron	Q	Q		Q			
No. of Data Items (Manual)	188	188	260	188		64	
No. of Data Items (Robot)					8,760		3,504

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream Milepoint	Tennessee 22.4	Ohio 938.9	Ohio 938.9		Ohio 943.1	Ohio 944.1	Ohio 962
Analyses Agency	9	8	1	8	8	9	1
Temperature	W	M	M	M	M	H	M
pH		M	M	M	M		M
D.O.		M	M	M	M		M
Conductivity		M		M	M		
Turbidity		M		M	M		
Flow							
Acidity							
Alkalinity Phenol & Total		M		M	M		
BOD		M		M	M		
Chloride		M	Q	M	M		Q
Cyanide			Q				Q
Fluoride		M	Q	M	M		Q
Total Hardness							
NH_3-N		M	M	M	M		M
NO_3-N			M				M
TKN							
Phenolics			M				M
Total Dissolved Phosphorus		M		M	M		
Total Phosphorus-P		M	M	M	M		M
Solids, Dissolved			M				M
Solids, Suspended		M		M	M		
Sulfate		M	Q	M	M		Q
Sodium							
Potassium							
Silica							
Calcium							
Magnesium							
Cobalt							
TOC							
Arsenic		M	Q	M	M		Q
Barium			Q				Q
Beryllium							
Cadmium		M	Q	M	M		Q
Chromium			Q				Q
Chromium, Hexavalent			Q				Q
Copper			Q				Q
Iron			Q				Q
Lead		M	Q	M	M		Q
Manganese		M	Q	M	M		Q
Mercury		M	M	M	M		M
Nickel			Q				Q
Selenium			Q				Q
Silver		Q	Q	Q	Q		Q
Zinc		Q	Q	Q	Q		Q
Radioactivity							
Pesticides							
PCB							
Coliform, Fecal		M	M	M	M		M
Coliform, Total		M		M	M		
Fecal Streptococci							
Zooplankton							
Phytoplankton							
Periphyton							
Chlorophyll (a & b)							
Chlorophyll Phaeophyton							
Artificial Substrates							
Alga Assays							
Nektonic Forms							
In place toxic pollutants							
Organic extracts(GC&IR)							
Aquatic organisms tissue constituents							
MBAS			M				
Boron			Q				
No. of Data Items (Manual)	52	260	188	260	260		188
No. of Data Items (Robot)						8,760	

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

Stream	Ohio						
Milepoint	977.8						
Agency	1	8					
Analyses							
Temperature	M	M					
pH	M	M					
D.O.	M	M					
Conductivity		M					
Turbidity		M					
Flow							
Acidity							
Alkalinity Phenol & Total		M					
BOD		M					
Chloride	Q	M					
Cyanide	Q						
Fluoride	Q	M					
Total Hardness							
NH_3-N	M	M					
NO_3-N	M						
TKN							
Phenolics	M						
Total Dissolved Phosphorus		M					
Total Phosphorus-P	M	M					
Solids, Dissolved	M						
Solids, Suspended		M					
Sulfate	Q	M					
Sodium							
Potassium							
Silica							
Calcium							
Magnesium							
Cobalt							
TOC							
Arsenic	Q	M					
Barium	Q						
Beryllium							
Cadmium	Q	M					
Chromium	Q						
Chromium, Hexavalent	Q						
Copper	Q						
Iron	Q						
Lead	Q	M					
Manganese	Q	M					
Mercury	M	M					
Nickel	Q						
Selenium	Q	Q					
Silver	Q	Q					
Zinc	Q						
Radioactivity							
Pesticides							
PCB							
Coliform, Fecal	M	M					
Coliform, Total		M					
Fecal Streptococci							
Zooplankton							
Phytoplankton							
Periphyton							
Chlorophyll (a & b)							
Chlorophyll Phaeophyton							
Artificial Substrates							
Alga Assays							
Nektonic Forms							
In place toxic pollutants							
Organic extracts(GC&IR)							
Aquatic organisms tissue constituents							
MBAS	M						
Boron	Q						
No. of Data Items (Manual)	188	260					

1-Ill; 2-Ind; 3-Ky; 4-Ohio; 5-ORSANCO; 6-Pa; 7-USCE; 8-U.S.EPA; 9-USGS; 10-W. Va.

H-hourly; D-daily; W-weekly; B-biweekly; M-monthly; Q-quarterly; S-semiannually; Y-yearly

COST SUMMARY BY AGENCY
EXISTING MONITORING NETWORK

Agency	No. of Stations	Cost
Illinois	8	$ 13,832
Indiana		
Kentucky	11	8,268
Ohio	1	1,105
ORSANCO Robot. . . . . $ 36,000 Data handling. . . $ 12,882 Water Users. . . . $298,863*	34	347,745
Pennsylvania	4	2,945
U. S. Corps of Engineers	1	2,548
U. S. EPA	43	100,092
U. S. Geological Survey	7	55,964
West Virginia	12	17,061
Pa./USGS Cooperative	3	5,867
Ky./ORSANCO Cooperative	1	3,033
TOTALS	125	$558,420

* Cost value only -- no cost incurred by ORSANCO for the data.