

UPPER MISSISSIPPI RIVER BASIN PROJECT

STUDY PLAN
FOR A
COMPREHENSIVE WATER POLLUTION
CONTROL PROGRAM

November 1964

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Division of Water Supply and Pollution Control
Region V, Chicago, Illinois

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I - INTRODUCTION

Purpose

The Department of Health, Education, and Welfare, Public Health Service in cooperation with the State agencies concerned with public water supply, water pollution control, water resource development, conservation and related fields, and with other Federal and interstate agencies, is planning to undertake a detailed study of the Upper Mississippi River Basin. The study will be undertaken as a part of the Public Health Service activities to develop comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary conditions of surface and underground waters under the authority given to the Secretary of the Department of Health, Education, and Welfare in Public Law 660, 84th Congress, as amended by Public Law 87, 88th Congress.

Scope

The study area will include all of the area draining into the Mississippi River above the mouth of the Ohio River, exclusive of the areas drained by the Illinois and Missouri Rivers. This includes a total area of 160,000 square miles which has been divided into 15 planning subareas (hydrologic subbasins). The major parts or all of 246 counties in the State of Illinois, Iowa, Minnesota, Missouri, South Dakota, and Wisconsin are located within these 15 subbasins. In the development of a comprehensive program for this basin, due regard shall be given to the improvements which are necessary to conserve the surface and ground waters for public water supplies, propagation of fish and aquatic life and wildlife, recreational purposes, and agricultural, industrial and other legitimate uses. This will entail a determination of (1) the existing water uses and water-borne wastes, (2) the present quality of surface and ground waters through sampling and laboratory testing procedures,

and (3) the natural characteristics and capability of surface waters to assimilate wastes. Using the data collected, together with that supplied by other Federal agencies, mathematical projections will be made of the water needs for all beneficial uses and the flow regulation requirements for water quality control. The plan formulated as a part of the study will include an itemization of facilities and measures needed to improve, protect, and conserve the quality of both surface and ground waters for present and future beneficial uses.

Objectives

The objectives of the study are as follows:

1. To determine the causes of water pollution and the effects of such pollution on the quality of water resources and beneficial water uses.
2. To develop agreements on the desired beneficial water uses and the water quality objectives necessary to accommodate these uses.
3. To develop water quality management measures to achieve the desired objectives including the establishment of a timetable for their accomplishment.

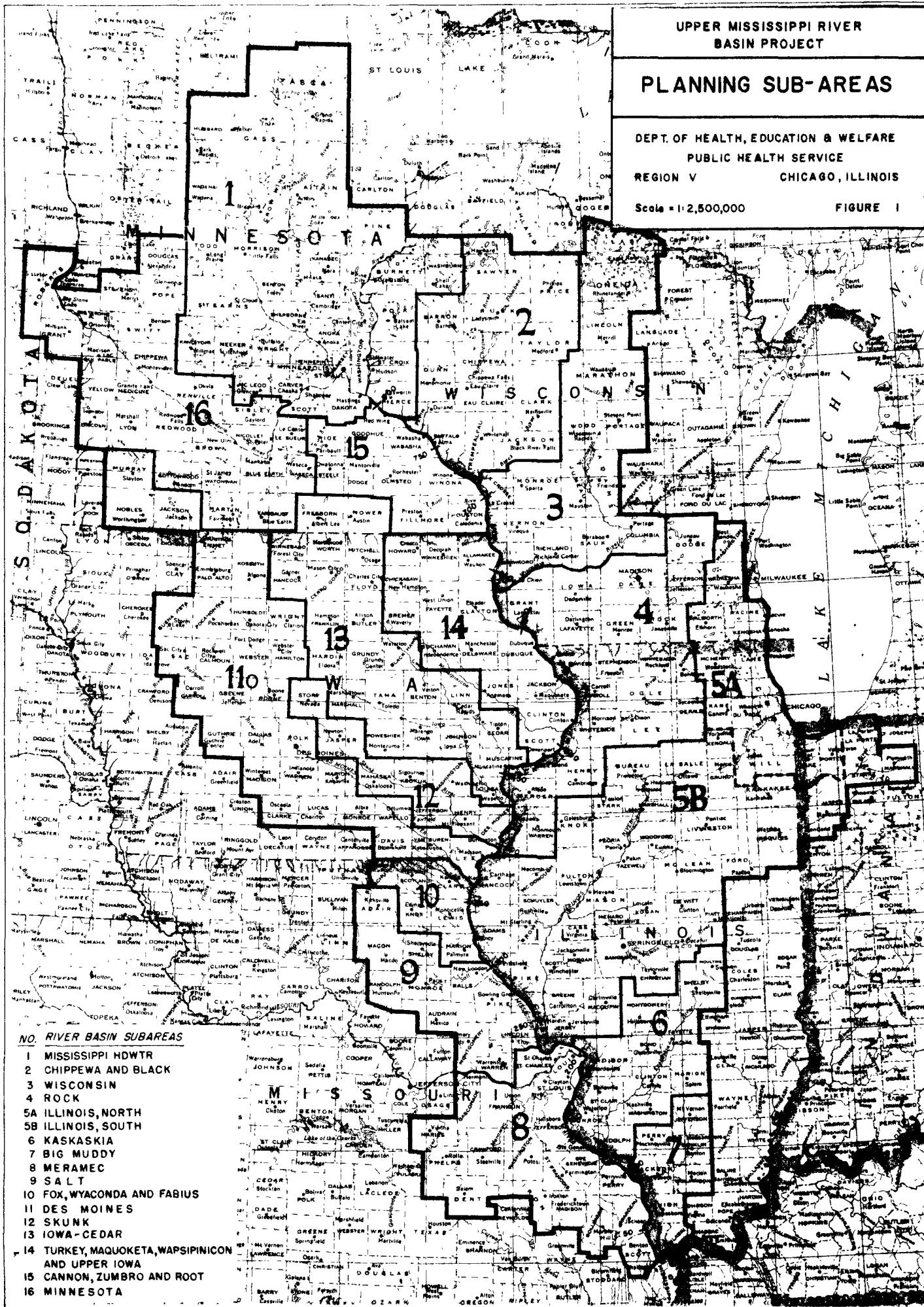
UPPER MISSISSIPPI RIVER
BASIN PROJECT

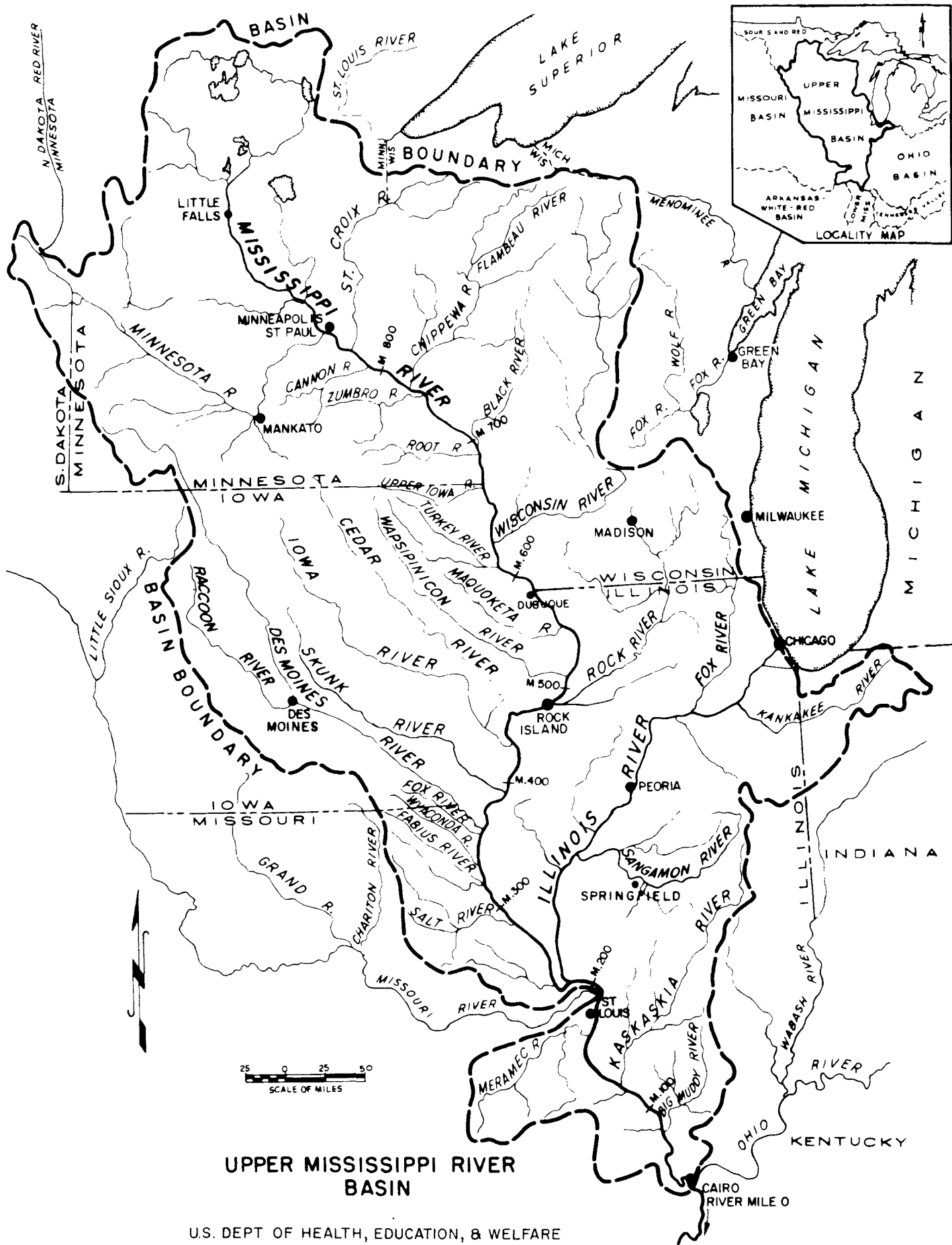
PLANNING SUB-AREAS

DEPT. OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
REGION V CHICAGO, ILLINOIS

Scale = 1:2,500,000

FIGURE 1





**UPPER MISSISSIPPI RIVER
BASIN**

U.S. DEPT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION V CHICAGO, ILLINOIS

II - OTHER FEDERAL AGENCIES PARTICIPATION

Discussions have been held with each of the Federal agencies participating in the Upper Mississippi River Comprehensive Basin Study (UMRCBS). These discussions were held at the request of the Federal agencies in order to coordinate the needs for the Framework Plan Study with the future requirements of the Public Health Service for its Comprehensive Water Pollution Control Study. Prior to the meetings with the Federal agencies an itemized listing of the Public Health Service needs was prepared. This itemized listing was reviewed by representatives of a number of Comprehensive Water Pollution Control Project staff members prior to presentation. The listing was prepared to cover only those items of data that would be used in connection with the Public Health Service Comprehensive Water Pollution Control Study. It did not include the important narrative and descriptive information and other data that will be included in the appendices to the UMRCBS Report.

The appendices to the UMRCBS Report will be prepared by the various Federal agencies that met with the Public Health Service to discuss the needs. A considerable portion of the data needs for the Public Health Service Comprehensive Water Pollution Control Study will be included in the appendices as totals for each of the 16 planning subareas. Undoubtedly it will be necessary for the other Federal agencies to make special studies in order to present the information needed by the Public Health Service for areas smaller than planning subareas. In addition, other items of information that will not be included in the Appendices Reports may be needed. It is understood, however, that most of the agencies are collecting the basic data for the UMRCBS Report by counties or groups of counties within subareas. Therefore, the work required to present information to the Public Health Service for smaller than planning subareas will be simplified.

The following Federal agencies were represented in the meetings held to coordinate the needs of the Public Health Service for its Comprehensive Water Pollution Control Study with the requirements for the UMRCBS:

Department of Agriculture

Economic Research Service

Forest Service

Soil Conservation Service

Department of the Army

Corps of Engineers

Federal Power Commission

Department of the Interior

Bureau of Mines

Geological Survey

Fish and Wildlife Service

Bureau of Outdoor Recreation

Office of Water and Power

Department of Health, Education, and Welfare

Public Health Service

In Mr. Harold C. Jordahl, Jr.'s letter of November 2, 1964 the extent of the participation of the National Park Service in river basin studies is outlined. In certain locations within the Upper Mississippi River Basin, it appears that this agency could contribute valuable information for use in connection with the Water Pollution Control Study.

No attempt has been made to indicate the agencies that will be assigned by their respective departments to contribute the information included in the following listing of items. Following completion of the UMRCBS Appendices Report, additional meetings should be held with the various departments and

agencies to discuss in detail the additional requirements of the Public Health Service. The following outline lists some of the items that will be included in the UMRCBS Appendices Report and others that will be obtained through special studies.

A. Economic and demographic studies (available from Corps of Engineers)

B. Surface water hydrology

1. Runoff - Stream gaging stations (to be selected)

(Corps will prepare two or three for each subbasin)

*a. Location

*b. Drainage area above each

*c. Mean monthly flow data for period of record

2. Stream flow characteristics (Representative stations in each subbasin)

*a. Low flow frequency graphs of annual mean stream flows

based on April-March annual means (See USGS WSP 1543A for detailed procedure).

*b. Ratio of median monthly flow to annual mean flow at representative gaging station.

*c. Time of flow between selected points for range of flows

3. Available data on existing and potential reservoirs

*a. For municipal and/or industrial uses only

*b. For power use only

*c. For flood control and/or navigation only

*d. For recreational use only

*e. For quality control regulation only

*f. For multiple purpose use (specify)

*g. Safe yield and operation schedules

*Data available from UMRCBS Report

4. Evaporation losses from free water surface

*a. In each subbasin

*b. Average for entire basin

C. Ground water hydrology and geology

1. Ground water aquifers in each subbasin

a. Areal extent, description and area of recharge watershed

b. Depth and distance below ground

c. Estimated storage capacity

d. Estimated annual recharge

e. Estimated annual discharge to streams

f. Estimated natural yield

g. Estimated present withdrawal rate

h. Drawdown per 100 gpm pumped

i. Time of recovery

j. Recommended well spacing

k. Estimated variations in discharge to stream flow during
periods of minimum and maximum withdrawal

l. Chemical contents of water

m. Recharge possibilities

(1) Through wells

(2) Through impoundments, water spreading, etc.

D. Recreation

1. Introduction

Purpose

2. The Basin

Location and extent

Climate

The Land

Geography

Land Use

Ownership patterns

3 The Water

The Mississippi River and Tributaries

Inland Lakes

Reservoirs and dams

Water quality and Pollution (general incidence)

4 3. The People and Their Requirements

Resident population

Past and present

Projected to 1980, 2000, 2020

5 The Economy

Changing Times

Mobility, work week, availability of expendable funds,
improved equipment

Visiting Populations

Present

Projected

Basic requirements of people for recreation participation

6 4. Subbasin Inventory of Recreation Areas

Name

Location

Administering Agency

Ownership

Description

Access

Acreage--Land, water, marsh

Classification

High density recreation
General recreation
Natural environment
Outstanding natural features
Primitive area
Historical and cultural site

Physical description of area

Land surface characteristics
Terrain features
Other attracting features

15. Present Subbasin Water Oriented Recreation Activities

Existing activities rated as to importance (fishing, swimming, boating, water skiing, camping, hunting, winter sports, and others including overnight users) Heavy__Medium__Light__None__

Visitation (Annual)

Number day visits
Number overnight visits
Percentage of visits by month

Fees charged

Entrance or parking
User
None

16. Future Projections of Subbasin Water Oriented Recreation

Types of facilities currently needed

Activities programmed for short term (five year) development in subbasin

Potential recreational activities in subbasin

Projected outdoor recreational use for years 1980, 2000, 2020

Percent of people, by month, using each activity

Location where recreational facilities are needed

Needed minimum facilities to meet demand 1980, 2000, 2020

98. Subbasin Water Quality as Related to Water Oriented Recreation

Water quality influence

Acceptability of water in recreation areas

Types of waste and source of pollutants

From shore facilities

From boats

Other

Selected locations where deteriorated water quality effects recreation

Specific recreation use effected

Cause

Corrective actions (date and result)

108. Summary of Recreation Activities Related to Water Quality

Existing activities under present water quality conditions

Projected activities under similar or deteriorated conditions

Projected activities under improved conditions

119. Conclusions

E. Fish and Wildlife

~~(Outline being revised)~~

1. Criteria.
 - a. species-groups
 - b. Water Quantity and quality.
2. Areas of habitat where existing water quality should be preserved, by subbasin.
 - a. cold-water sport fish.
 - b. warm-water sport fish.
 - c. commercial fish.
 - d. waterfowl
 - e. aquatic fur animals.
3. Areas of habitat where existing water quality should be up-graded,
 - a. cold-water sport fish.
 - b. warm-water sport fish.
 - c. commercial fish.
 - d. waterfowl
 - e. aquatic fur animals.
4. Areas of potential fish and wildlife habitat projected for development in the years 1980, 2000 and 2020 where water quality standards should be established and maintained, by subbasin.
 - a. cold-water sport fish.
 - b. warm-water sport fish.
 - c. commercial fish.
 - d. waterfowl.
 - e. aquatic fur animals.
5. Basin-wide summary.

F. Mining and mineral resources

1. General statement on basin
2. Discussion of hydrologic subbasin (each sub hydrologic basin to be discussed separately as outlined.)

- a. Existing development of mineral resources as related to water needs, discharges, and problems.

- (1) Oil and gas

- (a) Extent of reserves

- (b) Number and location of producing wells

- (c) Number and location of abandoned wells

- (2) Solid fuels

- (a) Strip mining

- Number, location, and extent of present operations

- Number, location, and extent of abandoned operations

- (b) Underground mining

- Number, location and extent of present operations

- Number, location and extent of abandoned operations

- (3) Metallic and nonmetallic minerals

- (a) Surface mining operations

- Number, location and extent of present operations

- Number, location and extent of abandoned operations

- (b) Underground operations

- Number, location and extent of present operations

- Number, location and extent of abandoned operations

- b. Projected development of mineral resources and problems for years ~~1980~~, 2000, 2020.

- (1) Oil and gas

- (a) Potential areas of production

- (b) Projected development

Producing wells - Number and general location

Abandoned wells - Number and general location

(2) Solid fuels

(a) Strip mining

Potential area of production

Projected course of development, abandonment, and reclamation of lands

(b) Underground mining

Potential area of production

Projected course of development and abandonment

(3) Metallic and nonmetallic minerals

(a) Surface mining

Potential area of production

Projected course of development, abandonment and reclamation of lands

(b) Underground mining

Potential area of production

Projected course of development, abandonment

(c) Summary of water needs, discharge, and problems by hydrologic subbasins

G. Climate and meterology

*1. Types and location of stations (map)

2. Precipitation

*a. Subbasins

(1) Monthly average for normal year

(2) Monthly average for minimum year

*b. Intensity, duration curves for selected stations (storms occurring during normal year)

*c. Depth of annual snowfall for normal year (subbasins)

3. Temperatures

*a. Mean annual and monthly distribution (subbasins)

*b. Maximum depth of freezing (subbasins)

- (1) Lake and reservoirs
- (2) Rivers and streams
- (3) Land areas
- (4) Duration of ice cover

H. Power

1. Existing power developments

a. Hydroelectric

- *(1) Location on map
- *(2) Capacity and production
- X(3) Extent of and specific locations of plants used for peaking (hours of day shut down)
- X(4) Possibility of re-regulating releases

b. Steam electric generating stations

- *(1) Location on map
- *(2) Capacity and production

2. Projected power developments for years 1980, 2000, 2020

a. Hydroelectric

- *(1) Location on map
- *(2) Capacity and production
- X(3) Extent of and specific location of plants to be used for peaking (hours of day shut down)
- X(4) Possibility of re-regulating releases

b. Steam electric generating stations

- *(1) Location on map (area)

X Data to be obtained through special studies

- * (2) Capacity and production
 - c. Pumped storage
 - * (1) Location on map
 - * (2) Capacity and production
 - 3. Steam electric generating stations cooling water requirements
 - * a. Average quantity per KWH used for cooling purposes
 - (1) Maximum hour
 - (2) Month of August
 - (3) Annual
 - * b. Average heat loss to condensing water
 - (1) Maximum hour
 - (2) Month of August
 - (3) Annual
 - * c. Cooling tower water losses
 - (1) Average for month of August
 - (2) Average annual

I. Agriculture

- 1. Existing development of resources (by subbasin)
 - a. Land use (acres)
 - * (1) Cultivated
 - * (2) Pasture and grass
 - * (3) Wood lots and forests
 - b. Soil erosion
 - * (1) Erodible land (acres)
 - * (2) Non-erodible land (acres)
 - * (3) Estimated annual soil loss (tons)
 - c. Drained land
 - * (1) Areas (total acres and areas outlined on map)

- * (2) Brief discussion of quality of drainage waters indicating soil leachability and effects of fertilizers used
 - *d. Farm animals (number)
 - *e. Discuss use of insecticides and herbicides, indicating the amounts used in each subbasin annually (also include a discussion of available data on the agricultural effects of radioactive fallout)
2. Projected development of resources for years 1980-2000-2020 (by subbasin)
- *a. The estimated total capacity in potential headwater reservoirs available for municipal and industrial use or that could be released for water quality control (if possible indicate the subareas on map)
 - b. Soil erosion
 - * (1) Erodible land (acres)
 - * (2) Non-erodible land (acres)
 - * (3) Estimated annual soil loss (tons)
 - c. Drained land
 - * (1) Area (total acres and potential areas outlined on map)
 - * (2) Brief description of quality of drainage waters indicating use of fertilizers and soil leachability (also, if possible, estimated quantities of drainage waters discharged into rivers and streams from specific areas)
 - *d. Farm animals (total projected number each date)
 - Xe. Upstream reservoirs with capacities sufficient to provide a

minimum of 5 cfs for stream flow regulation during dry months or to provide a minimum safe yield of 100,000 gpd for municipal or industrial use

- (1) Location (show potential reservoirs sites on map)
- (2) Capacity of each (available for above uses)
- (3) Safe yield of each

*Data available from UMRCBS Reports

X Data to be obtained through special studies

III - PARTICIPATION WITH STATE AGENCIES, INTERSTATE AGENCIES AND GROUPS, LOCAL AUTHORITIES AND PRIVATE GROUPS

Most of the basic data needs for both the Framework Water Supply and Quality Control and Comprehensive Water Pollution Control Studies will be made available through the State Departments of Health, Water Pollution Control and Water Resource Agencies. Participation of most of the other State agencies in the Upper Mississippi River Comprehensive Water Pollution Control Studies will be channeled through the various Federal agencies participating in the study. However, all of the agencies represented by membership in the Coordinating Committee for the UMRCBS and a number of the other State agencies have indicated an interest in more direct information on the extent of the Public Health Service Comprehensive Water Pollution Control Studies. In the past years the Public Health Service has participated in the activities of the Bi-State Development Agency representing the interests of Illinois and Missouri in the St. Louis District, the Upper Mississippi River Conservation Committee, and the State of Illinois Technical Advisory Committee on Water Resources. A number of local water works and industries are participating with the Public Health Service in operation of the Water Pollution Surveillance System. Participation with the State, interstate and local agencies and industries will be continued and expanded to include other groups participation, particularly at the local level. A partial list of the agencies, organizations and groups that should be contacted and kept informed of the progress of the Comprehensive Water Pollution Control Studies follows:

State Agencies

Illinois

Technical Advisory Committee on Water Resources

Board of Economic Development

State Water Survey

Department of Conservation

Department of Health

Division of Sanitary Engineering

Iowa

Natural Resources Council

Conservation Commission

Geological Survey

Department of Health

Division of Public Health Engineering

Minnesota

Department of Conservation

Division of Waters

Division of Fish and Game

Department of Health

Division of Environmental Sanitation

Missouri

Water Resources Board

Conservation Commission

Geological Survey

Water Pollution Control Board

Division of Health

South Dakota

Water Resources Commission

Department of Health

Wisconsin

Department of Resource Development

Department of Conservation

Department of Health

Water Pollution Committee

Interstate Agencies and Groups

Bi-State Development Agency

Upper Mississippi River Conservation Committee

Local Authorities and Private Groups

Area, Metropolitan and Municipal Planning Groups

Municipal and Metropolitan Water Suppliers

Municipal and Metropolitan Sewerage Authorities

State, County, Metropolitan and Municipal Industrial Organizations

State and County Clean Streams Committees

Conservation Organizations

Sportsman Clubs

Participators in Water Pollution Surveillance System

Burlington Iowa Municipal Water Department

Dubuque Iowa Water Department

East St. Louis Illinois Water Company

Minneapolis-St. Paul Sanitary District

Missouri Utilities Company Cape Girardeau

U.S. Corps of Engineers

Lock and Dam No. 11 Dubuque, Iowa

Lock and Dam No. 3 near St. Paul, Minnesota

IV - TECHNICAL COMMITTEES AND CONSULTANTS

Technical Committees

In view of the fact that the beneficial water uses and water quality parameters may vary somewhat between the subbasins in the southern and northern parts of the Upper Mississippi River Basin, it is recommended that more than one technical committee be established. A letter (see sample) will be prepared by the Project Director for the Regional Program Director's signature to each of persons being requested to serve on the committees. Activities of each of the committees for the assigned subbasins may also be somewhat variable; however, their main assistance to the Public Health Service and the Project Director should be emphasized as follows:

1. The dissemination of information on purpose, scope and status of accomplishments and problems in connection with the comprehensive program studies.
2. The determination of desired beneficial water uses for each subbasins. This determination should be based on public policy as expressed for national interest.
3. The development of water quality objectives or goals for each beneficial use.
4. The obtaining of agreement between State and interstate regulatory agencies on the water quality objectives or goals established.

Representatives of water users and Federal, State, interstate, and local agencies should be invited to serve on each of the technical committees. On the basis of location and comparable water uses, it is suggested that separate technical committees be established to serve in the following subbasins:

Committee No. 1

6 - Kaskaskia River, 7 - Big Muddy River, 8 - Meramec River, 9 - Salt River, and 10 - Fox, Wyaconda, and Fabius Rivers and southern section of the main stem of the Upper Mississippi River.

Committee No. 2

4 - Rock River, 11 - Des Moines River, 12 - Skunk River, 13 - Iowa-Cedar Rivers, 14 - Turkey, Maquoketa, Wapsipinicon and Upper Iowa Rivers, and middle section of main stem of Upper Mississippi River below the mouth of the Chippewa River.

Committee No. 3

1 - Mississippi River Headwaters, 2 - Chippewa and Black Rivers, 3 - Wisconsin River, 15 - Cannon, Zumbro and Root Rivers and 16 - Minnesota River.

Dear -----

This is to ask you if you would be willing to serve as a member of a technical committee to assist the Public Health Service in developing long term plans for the control of pollution affecting the surface and ground waters in the Upper Mississippi River Basin. Each committee will be composed of representatives of water users and Federal, State, interstate and local agencies.

The water pollution control study underway in the Upper Mississippi River Basin is designed to develop a comprehensive plan to control and prevent pollution. In an undertaking of this scope and magnitude and in consideration of the issues involved, a high degree of communication and understanding, as well as the dissemination of reliable information, is a necessity. A wide variety of experiences and viewpoints is needed to assist in developing a sound plan and in carrying out such measures as the plan may propose. Your assistance will be needed primarily in carrying out the following:

1. The dissemination of information on purpose, scope and status of accomplishments and problems in connection with the comprehensive program studies.

2. The determination of desired beneficial water uses for each sub-basin.

3. The development of water quality objectives or goals for each beneficial use.

4. The obtaining of agreement between State and interstate regulatory agencies on the water quality objectives or goals established.

We wish to carry on the study in cooperation with the States, municipalities, and industries of the areas so that we can develop a program which will protect the waters for the best uses of all concerned. The committee on which you are being asked to serve will be concerned with activities in the Kaskaskia, Big Muddy, Meramec, Salt, Fox, Wyaconda and Fabius Rivers Subbasins and that section of the Mississippi River which receives drainage from these subbasins. The service area of this committee is outlined on the enclosed map.

Acceptance of this membership will be an acknowledgement of your interest in clean water. The work required will not place heavy demands on your time, and I sincerely hope that you will be able to undertake this most important assignment.

Sincerely yours,

H. W. Poston
Regional Program Director
Region V

Consultants

From time to time experts in the fields of water supply, water pollution control, water resource development, conservation, statistical analyses and computer programming should be employed to assist the technical staff in establishing procedures, analyzing test results, evaluation of data, and preparing reports. These experts should be obtained from the Robert A. Taft Sanitary Engineering Center and other program of the Water Supply and Pollution Control Division when available for consultation. However, the use of college professors, technical experts from private organizations and other Federal, State and local agencies should be considered for definite periodic assignments.

V - FIELD INVESTIGATIONS

Inventory of Water Uses and Water-borne Wastes

In order to be in a position to make preliminary estimates of the future municipal and industrial water needs and water-borne waste loads, in FY 1967 it will be necessary to start the collection of inventory data during FY 1965 and plan for completion prior to the date when the Comprehensive Water Pollution Control Program investigation, is scheduled to be started. As some inventory data on existing water uses will be collected and the future needs will be estimated by the other Federal agencies for use in the UMRCBS Type I Report, primary consideration should be given during FYs 1965-1966 toward the collection of information on (1) the present municipal water supply use, (2) the present water use of the manufacturing and construction industries, (3) the present municipal waste loads, and (4) the present industrial waste loads.

Present Public Water Supply Use

The municipal water supply use should include that supplied through (1) public water supply systems, (2) institutional water supply systems, (3) Federal installation systems and (4) recreational area facilities.

The principal source of information for the data concerning public water supply use is the Public Health Service publication "Municipal Water Supply Facilities Inventory as of January 1, 1963." The data included in this inventory should be assembled by subbasins with a further breakdown into stream areas corresponding to the stretches on which water quality studies are to be made. It is expected that the Basic Data Branch will be able to supply the information needed on public water supply use broken down into areas as designated by the project. After the printout is received,

it should be checked with reports published by the State Departments of Health to assure that all significant water supplies have been included. In the State of Iowa an additional check should be made with the reports available in the Natural Resources Council Office in order to update the water consumption data. It is understood that the water consumption data included in the 1963 inventory was obtained from a questionnaire submitted to the municipalities in 1958. This information is not considered to represent the present use.

The States have information available in their files and/or publications covering the present use of water withdrawn directly from surface and ground water sources by institutions. The information needed should be collected and included with the data obtained from the Basic Data Branch on public water supplies.

The water withdrawn directly from surface and ground water sources by Federal installations should be included. The Public Health Service publication, "Water Disposal Practices at Federal Installations" does not include information on water consumption, type of treatment, nor source of supply; however, it does include the name of the facility and whether or not the wastes are discharged to a municipal system. It is also possible that the reports being developed by the Enforcement Branch may be helpful in determining the source of supply and water consumption for those installations withdrawing water directly from surface and ground water sources. Such information as can be collected should be included with the data assembled on public water supplies.

The information on the present withdrawal of water from surface and ground water sources by recreational facilities will be available in most cases in the State Health Department Sanitary Engineering files. Data on

supplies operated by Federal Recreational interests should be obtained from the Federal Agencies where the information obtained from the States is incomplete.

Exhibit No. 1 is a sample form to be prepared for each sub basin on which the inventory data on municipal water supply use may be assembled. If the degree of accuracy in collecting and assembling this information is sufficient, there will be no need to duplicate the table at a later date for use in the comprehensive water pollution control investigation.

Present Water Use of the Manufacturing Industries

An attempt is being made to obtain data on the water use of the manufacturing industries from the Bureau of the Census in connection with their "1963 Census of Manufactures - Industrial Water Use." Should it be possible to obtain the information requested broken down by counties and planning sub-areas, it would not be difficult to assemble the information by stream areas corresponding to that used in the breakdown for municipal water supplies. However, if the Bureau of the Census will not be able to supply the information broken down in the necessary detail, consideration should be given toward collecting this information in the following manner:

Illinois - The State Water Survey will make a breakdown of the industrial water use by counties for ground water supplies and by streams for surface supplies. The State Water Survey will expect to be paid for this service.

Iowa - The Natural Resources Council has available in its office, reports from all industries that have increased their water consumption more than 3 per cent since 1958. It may be that this means of collecting the water use data will not be sufficiently complete, and it will be necessary to visit industries in order to obtain full coverage. If necessary to visit industries, this should be handled at the same time data on industrial waste

EXHIBIT NO. 1
UPPER MISSISSIPPI RIVER BASIN
PUBLIC WATER SUPPLY SYSTEMS

Subbasin _____

(1) Community or Water District, Institution, Federal Installation, Recreational Facility	(2) Withdrawn from Name of Stream or Principal Aquifer	(3) 1960 Population	(4) Treatment	(5) Estimated Population Served	(6) Estimated Usage	(7) Remarks
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loads are obtained.

Minnesota - It is believed that information on water use by the manufacturing industry can be obtained from the Division of Waters.

Missouri - It will be necessary to visit industries in Missouri to obtain data on industrial wastes; therefore, the information on water use should be included, along with the data required on industrial wastes.

South Dakota - The method of obtaining information on industrial water use in this State has not been investigated.

Wisconsin - Information on industrial water use in this State will be collected by the Department of Resource Development upon request.

Exhibit No. 2 is a sample form for use in assembling data on the present water use of the manufacturing industries. A similar breakdown into stream areas corresponding to those used in the municipal water supply tabulation should be employed in this table.

Other Water-Using Activities

Separate appendices will be attached to the UMRCBS Type I Report which will include data on the present water use and the water supply needs of the following:

1. Agricultural
 - a. Rural domestic use
 - b. Stock watering
 - c. Irrigation
2. Power
 - a. Hydroelectric
 - b. Steam electric generating stations
3. Mineral Resources Industries

Although this information will not be available in published form until the latter part of FY 1969, it is expected that most of the infor-

Sub-basin

Number S. I. C. of Plants Code No.	Amount Withdrawn (mgd)		Purpose of Use (mgd)		Amount Discharged (mgd)		Net Consumptive Use (mgd)			
	From Surface Water Source	From Ground Water Source	Cooling Water	Process Water	Direct to Stream	To Public Sewerage System				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

mation will be available in the Corps of Engineers Division Office by the end of FY 1967.

Present Municipal Waste Loads

The Public Health Service 1962 inventory "Municipal Waste Facilities" is the best source of information for the subbasins tabulations of municipal waste loads. The information included in this publication is listed separately for each community or sanitary district sewerage system. Each State also has published data for individual sewerage systems which include information on State institutions. It is believed that some of the States have not included the information on institutional facilities with separate outlets in the data supplied for the Public Health Service inventory. Information in the Public Health Service inventory also does not include data for the Federal Installations which discharge wastes through separate outfalls. The information on waste load discharges from Federal Installations is included in the Public Health Service publication "Waste Water Disposal Practices at Federal Installations." Therefore, the information on waste loads discharged directly by State institutions and Federal Installations should be added to the data compiled from the municipal waste facilities inventory. The information included in the two Public Health Service publications is available from storage systems maintained by the Basic Data Branch and can be broken down in any manner specified by the Projects. However, it may be necessary to submit to the Basic Data Branch the list of Federal Installations in each subbasin if a direct subbasin tabulation is desired. It is believed that a further breakdown below the subbasin level can be made more easily in the Project office. Data on State institutions should be obtained from the States.

Exhibit No. 3 is a sample form for use in assembling the data on

EXHIBIT NO. 3
UPPER MISSISSIPPI RIVER BASIN
SOURCES OF SEWAGE POLLUTION

Sub-basin				
Community Sewer or Sanitary District Institution Military Installation	Receiving Stream	Mileage Code	Treatment (4)	Estimated Population Connected to Sewer (5)
(1)	(2)	(3)		
			Untreated (6)	Estimated Sewered Population Equivalent (BOD Basis) Discharged (7)

municipal waste loads. The data included in this form should be assembled by stream areas to the degree necessary to reflect waste loads needed for the water quality study.

Present Industrial Waste Loads

At the present time the information available in the State offices on industrial waste loads is entirely inadequate. Most of the States have up-to-date information on some of the larger industries such as pulp and paper mills. Wisconsin is completing industrial waste surveys in all basins and will have all areas surveyed by the spring of 1966. Copies of reports including data on industrial waste loads will be forwarded to the Regional office as soon as completed. Six of the 11 subbasin reports are now available in the Project Office files.

It is expected that visits to industries will be required in order to complete the industrial waste surveys in all States excepting Wisconsin. The number of visits required in each State will depend upon the results obtained from questionnaires which will be sent out to the industries by the States during FY 1965. Should the return of completed questionnaires be 100 per cent, it will not be necessary to make individual visits to any of the industries. However, it is not expected that a 100 per cent compliance with the State's request will be secured. Accordingly, plans are made to secure the information lacking on industrial wastes through individual visits to industries.

All the States have agreed that these visits should be made by Public Health Service employees assigned to the State Sanitary Engineers. The same form as used by the States in their questionnaires should be used in completing this industrial waste survey. Space on the back of page 2 of this form may be used to collect water use data in the case that information on

water uses is not obtainable from the Bureau of Census. The information on water use need be obtained only in connection with visits to those industries that withdraw directly from surface and ground water sources.

Completion of the industrial waste surveys is planned for FY 1966. Exhibit No. 4 is a sample form for use in assembling the data on industrial waste loads. The data included in this tabulation should be assembled by stream areas to the degree necessary to reflect waste loads needed for the water quality study.

Collection of Data on Existing Water Quality

Following are the data available from each of the States that reflect existing water quality conditions:

Illinois

Inventory of Public Water Supplies - This publication available in the Project Office files includes some chemical analyses of raw and finished waters.

Water Quality Network Stations - Bacteriological and chemical analyses are available in the State Health Department files for approximately 200 locations throughout the State.

Water Survey Reports - This State Agency has a published list of all the reports available on the quality of waters. It also has a considerable amount of unpublished data on file.

Iowa

Taste and Odor Problems on the Cedar River - This 1961 report of the Iowa Department of Public Health will be made available upon request should it not be possible to locate an extra copy in the Kansas City or Chicago offices of the Public Health Services.

Taste and Odor Problems in Cedar Rapids, Iowa - This is a report by the

EXHIBIT NO. 4
UPPER MISSISSIPPI RIVER BASIN
INDUSTRIAL WASTE SOURCES

Sub-basin

River Mileage	Name of Industry	Map Location Code	Waste Effluent		Type
			mgd	PE (5 day BOD)	

Public Health Service dated May, 1962, and should be available in the Kansas City or Chicago Offices.

Taste and Odor Control in Cedar and Other Rivers - Dr. R. L. Morris is now studying these problems under a PHS grant. A report should be available by FY 1966.

Mineral Contents of Waters - Chemical analyses of surface water in the Skunk, Des Moines, and other rivers are available in unpublished form in the State Pollution Control Office.

Surface Water Stations - Chemical analyses are available for 1957 in unpublished form at about two dozen locations in the State.

Public Water Supply Chemical Analyses - A report on raw and treated water for public water supplies will be published July 1, 1964.

Des Moines River - A report to the Corps of Engineers on the water supply and water pollution control needs in this river basin is available in the Project files.

Minnesota

Our memorandum dated September 25, 1963, in connection with a meeting held in Minneapolis with the State Health Department includes a list of some of the reports available in this State. Most of these have been obtained by the Twin-Cities Upper Mississippi River Project and will be made available for the Upper Mississippi River Project Study upon request.

Pollution and Natural Purification of the Upper Mississippi River - A study by the Public Health Service published in Bulletin No. 203 was made during FY 1927. It indicates the water quality in the river below Minneapolis-St. Paul prior to the construction of navigation dams.

Lower Minnesota River Study 1963-1964 - A report of the State Health Department (available in Project files).

Missouri

Meramec River Basin Study - A study by the Public Health Service for the Corps of Engineers in connection with a Type II Study of the basin showing municipal and industrial water supply needs and water quality control needs is available in the Project Office files.

Meramec River Basin Study - A study by the Water Pollution Control Board on quality conditions in the basin will be available after July 1, 1964.

St. Louis Metropolitan Area - A report of the bi-State authority used in the conference on Water Pollution Control held at St. Louis in 1958 is available in the Regional Office files.

Water Quality Stations - The State Pollution Control Commission is co-operating with the USGS in the operation of a number of water quality stations located throughout the State. Results of the chemical analyses of samples collected is available in the Project Office files.

Salt River Basin - Chemical analyses available in the Pollution Control Board files indicates that the sulphate content of waters in the basin is high.

Public Water Supplies in Missouri - The Census data contains chemical analyses of most of the States' public water supplies. A copy of the Missouri Census is available in the Project files.

Wisconsin

Water pollution control reports are being prepared for 11 subbasins draining into the Mississippi River. These reports include data on municipal and industrial sources of pollution, biological studies of various subbasin drainages, and physical, chemical and bacteriological data above and below each source of pollution. These reports are well prepared and contain most of the inventory data needed from the State of Wisconsin. Six of the reports have been completed and are now available in the Project Office files. The

remaining reports will be completed during calendar year 1965, and the early part of 1966, and will be made available to the Project Office as completed.

Water Quality Monitoring Stations - The State operates seven stations in Wisconsin in basins draining into the Mississippi River. These stations are located at the mouths of each of the major tributaries and at upstream locations. The Pollution Control Committee is planning to publish a report during 1964 including chemical analyses data for samples collected during the years 1961, 1962 and 1963. This information is now available in the State Health Department files.

Chemical Analyses of Public Water Supplies - The State Health Department has unpublished data in its files for most of the Public Water Supplies located within the Upper Mississippi River Basin.

Most of the information obtained from Wisconsin will be useful in connection with the Comprehensive Water Pollution Control Studies. However, additional sampling will be necessary for use in connection with the systems analysis approach.

It is believed, however, that the information available in the published reports and in the State files will be sufficient to make preliminary estimates of the storage needs for quality control water.

Field Stations

Field stations will be located in the vicinity of Minneapolis-St. Paul, Minnesota; Rock Island, Illinois and St. Louis, Missouri. Each station will be staffed and equipped with office and laboratory facilities for a period of one year.

The initial station will be located in the vicinity of Minneapolis-St. Paul, Minnesota and equipped to service subbasins 1, 2, 3, 15 and 16 and the main stem of the Mississippi River from the mouth of the Chippewa River to

Clinton, Iowa. In addition to the necessary office and laboratory facilities, three small boats with trailers for use on tributary streams will be required. A larger boat should be used for the sampling program on the main stem of the Mississippi River. This boat can be obtained from the Twin-Cities Project. The present plans include the use of the field station now occupied by the Twin-Cities Upper Mississippi River Project during the first year of the detailed sampling program. The first year program is scheduled to start March 4, 1968 and be completed March 3, 1969.

The staff assigned to the field stations will consist of a supervising sanitary engineer, a biologist, bacteriologist, two chemists, six engineering aides, two laboratory aides and one biologist aide. Following completion of the detailed sampling and laboratory analyses, this staff will be transferred to the Rock Island Field Station. Following completion of the investigations in the Rock Island area, the staff will be transferred to the St. Louis Field Station.

The Rock Island Field Station will conduct the detailed sampling program in subbasins 4, 11, 12, 13 and 14 and the main stem of the Mississippi River from Clinton, Iowa to the mouth of the Des Moines River. In order to avoid delays in the starting of the detailed sampling program it is proposed that a contract be made with the Illinois State Department of Health for use of space in its Rock Island Laboratory for a period of at least one year and for use of its laboratory facilities until the necessary equipment can be shipped from the Twin-Cities Laboratory. The contract should also provide for use of Department of Health facilities for a period following completion of the detailed sampling program of the Rock Island Field Station in order that detailed studies in the area to be served from the St. Louis Station will not be delayed. If this is not possible, a separate field station should

be located in the vicinity of Rock Island. All of the equipment, boats and other facilities used at the Twin-Cities Field Station should eventually be shipped to the Rock Island Station. The detailed sampling program for the Rock Island Station is scheduled to start March 17, 1969 and to be completed March 2, 1970.

The St. Louis Field Station will service subbasins 6, 7, 8, 9, 10 and the main stem of the Mississippi River from the mouth of the Des Moines River to the mouth of the Ohio River. The detailed sampling program at this station is scheduled to start March 16, 1970 and to be completed March 15, 1971. The equipment, boats and other facilities used at the Twin-Cities Field Station and the Rock Island Field Station will be shipped to the St. Louis Field Station for use during the studies in this area.

Following completion of the detailed sampling program of the St. Louis Field Station, a small staff will be retained to collect additional data that may be necessary. This staff will be headquartered at Chicago, Illinois.

Studies to Determine the Location, Quantities and Characteristics of Wastes

The inventory data will show the sources of municipal and industrial pollution contributing to the problem in the various stream stretches to be studied and will include an estimate of the pollutional loads contributed. The major sources of these waste loads should be located and sampled during the periods stream samples are being collected. Where necessary, provisions should be made to measure the quantities of waste flows in outlets to the streams. The location of waste outlet points to be sampled in each stream stretch should be determined following the preliminary and reconnaissance surveys. Additional waste sources should be located and sampled where tests indicate that the pollutional loads contributed from tributary streams are excessive.

In some lakes and streams, pollutional loads may be contributed from sources other than municipal and industrial wastes. In these areas the loads contributed from each source of pollution should be investigated. The following sources of pollution may be contributing toward the severe pollutional conditions which now exist in various lakes and streams.

1. Municipal sewage including storm water overflow
2. Industrial wastes
3. Wastes from recreational activities
4. Wastes from agricultural lands and suburban development activities
5. Steam electric generating stations return flows
6. Other types of wastes such as those resulting from radioactivity and the refuse disposal methods employed.

After the locations of the various sources of pollution contributing toward the problem in any specific lake or stream is determined, tests should be conducted to determine the quality of discharges, or runoff during storms and drainage from land areas. Where necessary, meters should be installed to measure the flows from combined and outfall sewers. The wastes from recreational activities may have to be estimated on the basis of information supplied by the Bureau of Outdoor Recreation on use of boats, marinas, and other facilities. The Department of Agriculture should be able to furnish sufficient data from its research investigations on runoff from various types of farming activities and land slope to estimate the runoff into the lake or stream on an annual basis. It should be possible to verify the estimates made in this manner with the inflow to lakes and streams as measured at existing gaging stations. The Federal Power Commission will supply data on the cooling water used at steam electric generating stations and the amount of heat loss to condensing water. Following the studies which may have to be carried out over a period of at least a year in certain loc-

ations, fairly reliable estimates of the annual amounts of nutrients, pesticides and/or other pollutants contributed from these sources can be made.

Measurements should be made of the sludge deposits on lake bottoms and samples should be collected and analyzed during the period when the other studies are being made. This will be necessary to estimate the contribution of pollution from bottom deposits. The estimated annual amounts of pollutants contributed from this source should also be determined.

The quantities of present and projected future pollution loads contributed from the various sources will be used in the plan formulation in determining the needs for tertiary treatment, land use practice changes, cooling water temperature reductions, or other measures necessary to improve and maintain the quality of water in the lake or stream for present and future beneficial uses.

Studies to Determine the Quality of Surface and Ground Waters

In each of the 15 subbasins (exclusive of the Illinois River Basin) and including the main stem of the Mississippi River below the mouth of the Chippewa River, it will be necessary to collect samples and make sufficient laboratory tests to determine the existing water quality in various stretches of streams. In five of the subbasins, sufficient information is available at the present time to indicate the streams that need to be studied in detail. In the other subbasins, preliminary sampling will be necessary before the stream stretches that need to be sampled can be determined. This is because acid mine drainage and other types of pollutants are now affecting the quality of water in these subbasins. Until studies by the Bureau of Mines and the Industrial waste surveys have been completed, it will be difficult to locate the stream stretches that need to be sampled. Reconnaissance surveys will be needed in all subbasins to locate the points in each stream stretch where sampling stations should be located. Accordingly, the preliminary and reconnaissance surveys are a most

important part of the studies necessary to determine the existing quality of surface waters.

Preliminary and Reconnaissance Survey

The preliminary and reconnaissance surveys should be carried out over a period of a full year. The schedule for conducting these surveys should be arranged so that each subbasin will be covered at four different periods throughout the year; namely; spring, summer, fall and winter.

Considering the main stem of the Mississippi River as a first level stream, it is believed that, except in special cases, detailed sampling will not be required on tributary streams above the third level. The stream stretches in which detailed sampling will be required are specified hereafter for five of the subbasins. Reconnaissance surveys to locate sampling stations will be necessary in each of these stream stretches. In the other subbasins where pollutional loads indicate that low dissolved oxygen conditions may exist, reconnaissance surveys should also be made. In some of the basins, particularly those in which acid mine drainage is the major pollutional source affecting water quality, preliminary sampling to locate sampling stations may be all that is necessary. The stretches of streams suggested for detailed studies and those subbasins in which preliminary sampling and/or reconnaissance surveys will be required are as follows:

Headwaters Sub Basin 1

In this subbasin it will not be necessary to restudy the area from the Rum River downstream to the mouth of the Chippewa River. The study to be completed by the Twin-Cities Upper Mississippi Project in FY 1966 is sufficiently comprehensive to require no further study in this area. However, it will be necessary to extend this study upstream on the main stem of the Mississippi River

and on the St. Croix River.

The Water Supply and Water Quality Control Study of the Mississippi Headwaters Reservoirs completed by the Region VI Office of the Public Health Service for the Corps of Engineers indicates that minimum historical flows of 0 cfs would have occurred in the Mississippi River at Grand Rapids had not releases been made from the headwaters reservoirs. Since no sampling was undertaken in connection with the water resources study of the Region VI Office, it is believed that additional studies may be required. Reconnaissance surveys should be made to locate the stretches of streams above the Rum River which need further study and to locate sampling stations.

The Water Pollution Study of the St. Croix River by the Wisconsin Department of Health and Water Pollution Committee will be completed during the spring of 1965. Information contained in this report should be sufficient to locate those stretches of the St. Croix River which need further study.

Chippewa River Subbasin 2

Based on the information available in the water pollution reports completed by the Wisconsin Department of Health and Water Pollution Committee, the stream stretch in this subbasin to be studied in detail is as follows:

Flambeau River from Park Falls, Wisconsin downstream through the Chippewa River to its junction with Mississippi River.

Wisconsin River Subbasin 3

Sufficient information is available in the water pollution report completed by the Wisconsin Department of Health and Water Pollution Committee to indicate the need for further study of the following stretch in this subbasin:

Wisconsin River from Rhinelander, Wisconsin downstream to its junction with Mississippi River.

Following completion of the State's water pollution report on the lower Wisconsin River, stretches of tributary streams that need further study may be indicated.

Rock River Subbasin 4

Sufficient preliminary information is available in the water pollution reports completed by the Wisconsin Department of Health and Water Pollution Committee to indicate the need for further study of the following stretches in this subbasin:

Rock River from the Stokely-Van Camp Cannery near Brandon, Wisconsin downstream to its junction with Mississippi River.

Tributary from Ashippun, Wisconsin downstream to its junction with Rock River.

Badfish Creek from the Village of Oregon, Wisconsin downstream through Yahara River to its junction with Rock River.

Following completion of the State's water pollution reports for the Grant and Platte River Basins and Pecatonica River Basin, additional stretches of these rivers and their tributaries may need to be designated for inclusion in the reconnaissance surveys.

Kaskaskia River Subbasin 6

Adverse effects on water quality in this subbasin are believed to be caused by acid mine drainage. Before the stream stretches in this basin needing study can be determined, it will be necessary to complete the industrial waste survey, obtain information on areas of water quality damage from the Bureau of Mines and collect information from unpublished test results available in the Illinois State Health Department and Water Survey Offices. Should this not be sufficient information to locate the sampling points, preliminary sampling will be required.

Big Muddy River Subbasin 7

A water supply and water quality control study for the Corps of Engineers in connection with its Type II Study of the basin will be undertaken during FYs 1965-66. Sufficient information should be available following completion of the study to locate the required sampling points in this subbasin.

Meramec River Subbasin 8

Information should be available from the report of the Region VI Office of the Public Health Service on the water supply and water quality control study for the Corps of Engineers to locate the stretches of the Meramec River and tributaries that will need further study. It may be necessary, however, to collect preliminary samples from the Headwaters Diversion Canal which drains the Upper Castor, Crooked and Whitewater Rivers into the Mississippi River below Cape Girardeau. Other streams in this subbasin draining directly to the Mississippi River that may need to be sampled to determine further needs are the Apple, Saline and Platin Creeks.

Salt River Subbasin 9

It has been reported that the sulphate content of the water in this subbasin is high, probably caused by the acid mine drainage. Preliminary sampling will be required in order to locate sampling stations.

Fox, Wyaconda and Fabius River Subbasin 10

As there is insufficient information available in the State offices to indicate existing water quality conditions in this subbasin, it will be necessary to conduct preliminary sampling in order to locate sampling stations.

Des Moines River Subbasin 11

The water supply and water quality control report prepared by the Region

VI Office for the Corps of Engineers covers only the area from Saylorville Reservoir downstream to the mouth of the Des Moines River. It is believed that the stretch of river to be studied should be extended upward some distance to include industrial waste loads discharged into the main river and tributaries above Des Moines. Based on present information, it is believed that the main river stretch that should be studied is as follows:

Des Moines River from Fort Dodge, Iowa downstream to its junction with Mississippi River.

Skunk River Subbasin 12

In view of the fact that a storage reservoir is proposed for construction on the main stem of the Skunk River above Ames, Iowa, it is suggested that the following main river stretch in this basin be studied:

Skunk River from Ames, Iowa downstream to its junction with Mississippi River.

Iowa-Cedar River Subbasin 13

The State reports that additional water for stream flow regulation is needed in this subbasin. Algae is reported to be the cause of taste and odor problems affecting water quality within the basin and in the Mississippi River. Both preliminary sampling and reconnaissance surveys will be necessary to locate the stretches of the rivers in this subbasin that need further study and to locate sampling stations.

Turkey, Maquoketa, Wapsipinicon and Upper Iowa Rivers Subbasin 14

The State reports that additional water for stream flow regulation is needed in this basin. Both preliminary sampling and reconnaissance surveys will be required to locate sampling stations.

Cannon, Zumbro and Root Rivers Subbasin 15

Both preliminary sampling and reconnaissance surveys will be required on each of these rivers to locate sampling points.

Minnesota River Subbasin 16

The Twin-Cities UMPB Study covers the lower stretch of the main river in this subbasin. Sufficient information may be available from this study to locate the upstream stretches that need further study. However, a preliminary sampling or reconnaissance survey will probably be needed to locate sampling stations.

Main Stem of Mississippi River

Two stretches of the Mississippi River Main Stem below the mouth of the Chippewa River are probably the most heavily polluted at the present time. These are the Clinton-Quad Cities stretch and the stretch within and below St. Louis, Missouri. However, because of the possibility that future water pollution in the main stem of the river may be extended into other areas, it is suggested that the entire stretch from the mouth of the Chippewa River downstream to the mouth of the Ohio River may need to be studied in detail. The reconnaissance surveys should cover this entire stretch of the river in order to locate sampling stations.

Detailed Studies

The Detailed Studies will include the intensive sampling and hydraulic measurements necessary to determine the present water quality in each of the 15 subbasins (exclusive of the Illinois River Basin) within the Upper Mississippi River Basin. The number of samples to be collected at each station will be determined after the preliminary and reconnaissance surveys have been completed.

Sampling Program

It is recommended that a systems analysis approach be used for determining both the present and future water quality conditions in each of the stream stretches. Field activities will provide for the actual collection of the routine and special samples. This entails the scheduling of sample collection in each stream stretch for a period of at least one year. In addition, monitoring equipment should be installed at selected locations in order to obtain a continuous record of dissolved oxygen concentrations during the spring, summer and fall months. The methods of collecting and handling samples is discussed in Chapter VI "Laboratory Program."

Hydraulic Measurements

The Corps of Engineers is responsible for the collecting of data on stream flows within the Upper Mississippi River Basin for the Type I Study and should have available in its files certain of the flow data needs required during the field investigations. However, it may be necessary to collect additional information on daily stream flows from the USGS. It may also be necessary to establish gaging stations and measure flows during the periods of sampling in stream stretches on which gaging stations are not presently located.

Processing of Data

Computers will be used in the processing of both the inventory and water quality data collected in the Upper Mississippi River Basin. This type of information should be submitted to the Basic Data Branch in Cincinnati, Ohio for computer processing. It may be necessary to contract with a local firm for analyzing data and making computations required for the systems analysis.

Use of Basic Data Branch Facilities

A considerable portion of the inventory data is already available for

processing by the Basic Data Branch. The additional inventory data collected in the field should be submitted to this branch of the service in order that it can be included with the data now stored.

It will be necessary to develop a River Mileage Index for the entire basin in order to make full use of the Basic Data Branch "STORET" system. This "STORET" system will make possible the storage of information from any source on analytical test results, or waste inputs at any specific location. In the development of the River Mileage Index and coding for the "STORET" system, special maps will be required. These maps will be purchased by the Project through the Basic Data Branch. Since most of the States in the Upper Mississippi River Basin have already developed mileages locating treatment plant effluent outlets and mouths of tributary streams, the mileages determined by the Project should be made to conform with those now in use by various Federal and State agencies.

VI - LABORATORY PROGRAM

Central Laboratory

The existing laboratory facilities of the Great Lakes-Illinois River Basins Project located in Chicago, Illinois will be used to the fullest extent possible in connection with the laboratory program. A laboratory staff of the size required to conduct the necessary tests in the central laboratory will be budgeted for under the Upper Mississippi River Basin Project. However, the hiring and assignment of the staff should be under the direction of GLIRBP. If possible, the necessary laboratory tests on samples should be conducted by GLIRBP on a reimbursable basis.

Field Station Laboratory

Space will be provided in each of the field stations for laboratory facilities. These stations will be located in the vicinities of Minneapolis-St. Paul, Minnesota; Rock Island, Illinois and St. Louis, Missouri. Each station will be operated for a period of one year. The laboratory program is based upon the use of existing facilities located in the Twin-Cities Upper Mississippi River Project Laboratory.

It is recommended that a contract agreement be made with the State of Illinois Department of Health Laboratory located at Rock Island, Illinois for office and laboratory space and assistance in conducting the laboratory analyses in this area. The contract with the Illinois State Department of Health should be made on the basis of using office and laboratory facilities at Rock Island until such time as additional facilities can be released by the Twin-Cities Laboratory. The contract should also include a provision for use of the State Department of Health facilities following completion of the detailed sampling in order to provide for the shipment of a portion of the equipment to St. Louis in sufficient time to start the detailed sampling in that area on schedule.

Laboratory Program

The laboratory program for the Upper Mississippi River Basin will consist of a detailed study of the water quality conditions in the various stretches of the main stem of the Upper Mississippi and its tributaries exclusive of the Illinois and Missouri River Drainage Basin and the area covered by the Twin-Cities Upper Mississippi Project. In each of these stream stretches emphasis will be directed to those water quality parameters showing greatest promise in differentiation of water quality. Since a systems analysis approach will be used in determining the present and future water quality in each of the stream stretches, the samples collected and tests made should be sufficiently repetitive to indicate variations throughout the year.

Biological Investigations

Biological investigations in the Upper Mississippi River Basin will be undertaken with three objectives: (1) to evaluate the general biological conditions of streams and lakes; (2) to provide the biological information required for explanation and interpretation of routine chemical, bacterial, and physical data and (3) to guide the development of water pollution control measures that will promote desirable, and inhibit undesirable, aquatic life.

Samples of benthic fauna, attached algae, and phytoplankton will be collected at stations selected to coincide with stations where chemical, physical and bacteriological measurements will be made.

A minimum program will involve seasonal studies of the biological parameters as outlined below:

<u>Parameters</u>	<u>Frequency</u>	<u>Collected by</u>	<u>Analyzed by</u>
Phytoplankton	Bi-weekly in streams and lakes	Aquatic samplers	Field station laboratory
Benthic fauna	May, August, October	Biologist	Field station laboratory

<u>Parameters</u>	<u>Frequency</u>	<u>Collected by</u>	<u>Analyzed by</u>
Attached algae	May, August, October	Biologist	Field station laboratory
Rooted weeds	July or August	Biologist	Field station laboratory

The field station-based biologist will be responsible for the investigations in both the main stem of the Mississippi River and tributaries.

In the tributary streams and lakes sampling by the biologist will be made independently of chemical and bacteriological sampling. In the main stem of the Mississippi River, however, it will be necessary to complete his studies during the routine boat operations on the Mississippi River.

Biological studies will be scheduled so that the biologist spends a portion of his time in the laboratory in the identification and evaluation of materials collected in the field.

In the Meramec River and tributaries in Missouri, the Cedar River in Iowa and the 11 subdrainage basins studied in the State of Wisconsin, the biological investigations should be undertaken only to supplement the studies completed by the States since 1960. A review of the biological studies conducted by the States in connection with their recent water quality surveys in these areas should be made prior to repeating such studies in the various stream stretches.

Chemical Tests

The preliminary and reconnaissance surveys will be used to locate sampling stations and establish the basis for the frequency of sampling and analysis of the various parameters. Chemical tests will be ~~made~~ both in the field laboratory and the central laboratory. All samples collected will be delivered to the field laboratory. Those which are to be analyzed in the field laboratory will remain there. The remainder of the samples will be sent to the central laboratory in Chicago. A suggested outline segregating the analytical

tests to be performed at the field laboratory and at the central laboratory into various groups based on the need for repeating determinations for each parameter under study follows.

Field Laboratory Outline

Tests to be run

pH

Specific Conductivity

DO

Alkalinity

Chloride

BOD

COD

Solids

(a) Dissolved

(b) Suspended

Cyanide

Phenols

Turbidity

Frequency of test

All samples collected

All samples collected

All samples collected

All samples collected

All samples collected

All samples collected

All samples collected

All samples collected

All samples collected

All samples collected

Special samples, waste

Each sample at selected stations

Each sample at selected stations

Central Laboratory Outline

Tests to be run

1. Selected samples (composites)

Solids (dissolved, suspended)

Gross Minerals (Na, K, Ca, Mg,

Si, SO₄, CL, Alk, F.)

2. Selected stations

a. All samples

Frequency of test

As composited

As composited

<u>Tests to be run</u>	<u>Frequency of test</u>
CCE	Special samples
ABS	Each sample collected
b. Selected samples	
Nitrogen	50% of all selected stations
(NH ₃ , Kjeldahl, NO ₂ , NO ₃)	
Phosphate	50% of all selected stations
c. Selected samples (composites)	
from selected stations	
Toxic Metals	Samples collected
(Cu, Pb, Zn, Cd, Ad, Se)	gross minerals and waste outfalls and further composited
Trace Element -	Samples collected
Spectrographic	gross minerals and waste
(Ag, Ba, Fe, Mn, Etc.)	outfalls and further composited.

Microbiological Investigations

Investigations will be made to determine the sanitary quality of waters in various lakes and streams. The tests conducted will provide information as to points of influx of domestic sewage and the wastes of certain industries. The tests listed as follows will be the chief items comprising the microbiological survey of streams and lakes.

Coliform Tests

1. Total coliform via membrane filter (all samples).
2. Coliform differentiation on selected samples by elevated temperature test (gas production from lactose, at 44.5 - 45.00° in 24 hours).
3. The coliform parameter provides information pertinent to the quality of water and will be one of the most important of the bacteriological tests

in a survey of this nature.

4. Differentiation of the coliform encountered on selected samples via the elevated temperature test will contribute valuable additional information, particularly in the comparison of coliform of fecal origin only.

Fecal Streptococcus Tests

1. Total fecal streptococci via membrane filter using K.F. Agar Plates. -
Selected samples as indicated by reconnaissance studies.
2. Streptococcus differentiation on selected samples via special fermentation and metabolic tests.
3. The membrane filter method of choice here reveals the presence of all the members of the enterococcus group consisting of Streptococcus faecalis, S. faecalis variety zymogenes, S. faecalis var. liquefaciens, and S. durans; and also other fecal streptococci originating from humans, fowl, cows, sheep, horses (S. Salivarius, S. Bovius, S. Equinus, and biotype strains associated with each of the major species.) However, to differentiate which of these groups contribute to a given membrane filter colony count, further physiological and metabolic tests are required. These latter tests involve from 2 to 10 steps, including tube tests and microscopical strains. The extent of these tests for each individual colony selected would necessarily limit their application to selected samples and the objective uses of the data.

Total Plate Counts

Total Plate Counts - All stream and lake samples. Procedures will be membrane filter or special pour plates.

1. 20°C.
2. 35 °C.

3. With further special bacteriological identification tests on selected samples.
4. When collecting data in a survey of streams and lakes, coliform and fecal streptococcus statistics give only partial information on general water quality. Total plate counts with parallel tests conducted at 20° C and 35° C in conjunction with the tests for fecal indicators provide a more complete bacteriological estimate of water quality. The flora from selected total counts will be identified so that the distribution and occurrence of bacterial species throughout the waters studied may be ascertained.

Pathogenic Detection

1. Enteroviruses
2. Salmonella
3. Tuberculosis
4. Other selected tests
5. In addition to using the indicator organism to determine bacteriological water quality, a study will be undertaken to determine the presence of pathogenic forms likely to be water-borne.
6. Each of these areas of pathogenic investigations are so specialized that special provisions must be made to accommodate these areas of activities. Either samples could be submitted to centers devoted to each of these lines of investigation (viral, enteric, tuberculosis, and parasitological) or appropriate specialists should be contracted for a short term (such as academic personnel or summer leave).

Field Procedures

1. Field Procedures will be covered by the necessity related to the proper collection and subsequent processing of microbiological samples.
2. Samples are to be collected in the same stations where chemical, physical

and biological tests are to be made.

3. The schedules established for sampling should be sufficiently repetitive to indicate seasonal variations throughout the year.
4. All samples collected during hot weather will be iced and those collected at other times will be transported to the laboratory prior to completion of the day's sampling activities. A maximum of 4-6 hours between the time of collection and delivery of the samples to the field laboratory should be maintained. This may require the use of air transport facilities in some of the subbasins.

Laboratory Procedures

All basic water bacteriology procedures will be conducted with strict adherence to (the current edition) Standard Methods for the Examination of Water and Wastewater, or with procedures as set forth by the Microbiology Department of Taft Sanitary Engineering Center, Cincinnati, Ohio.

Radiochemistry

All samples collected for radioactivity studies will be forwarded to the central laboratory in Chicago for analysis. Stream samples will be collected at the same locations where chemical, physical, and biological tests are to be made. Special samples will be collected when high results are encountered from routine samples. Sewage treatment plant and waste outfalls will be sampled, particularly where known radioisotopes users are involved.

Special biological samples will also be collected for radioactivity determinations.

VII - ENGINEERING ANALYSES

Preliminary Phase Studies

The Preliminary Phase studies will be conducted during FYs 1966-67 in order to provide preliminary estimates for the Type I Upper Mississippi River Comprehensive Basin Study (UMRCBS) sponsored by the Corps of Engineers. The preliminary estimates will be based on the basic data collected from the States and other Federal agencies and information that is included in published reports.

Headquarters for the staff assigned to making the preliminary engineering analysis will be located in the Regional Water Supply and Pollution Control Office during FY 1966, and in the Great Lakes-Illinois River Basin Project Central Office in Chicago, Illinois, during FY 1967. The engineering analyses conducted during the Preliminary Phase studies will include (1) data projections that supply preliminary estimates of the municipal and manufacturing industry water supply needs and the various types of water-borne wastes, (2) hydrologic studies for determining stream flows in various stretches of the Mississippi River and tributaries, (3) the making of an analysis of flow regulation requirements for water quality control, (4) the making of preliminary estimates of the municipal and manufacturing industry water supply needs and (5) the preparation of a preliminary report including planning subarea and summarized needs for the Upper Mississippi River Basin.

Preliminary Data Projections

The Economic Base Study completed by the National Planning Association for the UMRCBS will be in sufficient detail to permit the projection of the municipal and manufacturing industry water needs and various water-borne wastes by planning subareas (subbasins). However, it will not be in sufficient detail to permit making these projections for drainages of smaller size than

the planning subareas. Data projections will be made for all planning subareas, excepting the Illinois River Basin. In the Illinois River Basin, information required for the UMRCBS Report will be obtained from the GLIRBP study report.

Preliminary Hydrologic Studies

The Corps of Engineers will supply low flow frequency graphs of annual mean stream flows for representative gaging stations in each of the planning subareas and will furnish the inflow data from tributaries into the main river stretches where needed. The Corps of Engineers will also supply a tabulation representing the ratio of medium monthly flow to annual mean flow in each planning subarea.

The stream flow data needed in connection with the analysis of stream flow regulation requirements will be determined for one or more stream stretch in each planning subarea which includes the major sources of pollution.

Analysis of Flow Regulation Requirements for Water Quality Control

The analysis of flow regulation requirements for quality control will be made only in those planning subareas where Comprehensive Program or Water Supply and Water Quality Control studies have not previously been made by the Public Health Service. It is believed that sufficient information will be available from the Meramec River, Des Moines River, and Big Muddy River Subbasin Reports and the Headwaters Subbasin report to make the projected needs for municipal and industrial water supply and quality control water. The Comprehensive Program report for the Illinois River Basin will be used in connection with the projected requirements for this planning subarea. In the other eleven planning subareas, it will be necessary to make preliminary estimates of water quality control storage needs.

At the present time it appears that the best means of making the pre-

liminary estimates of storage needs for quality control water is by using the procedure entitled "Hydrologic Aspects of Analysis of Flow Regulation Requirements for Quality Control" as contained in the Headquarters Memorandum dated March 31, 1964.

Preliminary Estimates of the Needs for Municipal and Manufacturing Industry Water Supplies

In the UMRCBS the Corps of Engineers is responsible for determining surface water availability and the U.S. Geological Survey is responsible for determining ground water availability in each of the planning subareas. This information will be made available prior to the preliminary estimates to be made of the needs for the municipal and manufacturing industry water supplies. The projected water supply needs for these uses, together with the data on availability, will be used as a basis for the analysis that will be required prior to estimating the needs. These estimates should be made for all sub-basins (exclusive of the Illinois River).

Report Preparation

A preliminary report will be prepared based on the engineering analyses. This report should be completed in accordance with the outline Exhibit No. 7.5 and should include separate data for planning subareas and summarized data for the entire basin. Upon completion, the report will be included as Appendix H to the UMRCBS Report.

Detailed Studies

The Detailed studies will be conducted during fiscal years 1968-72. The engineering analysis will include: (1) identification of sources of waste input to streams and lakes, (2) the effectiveness of waste collection and treatment measures and land use practices, (3) hydrologic studies to determine

the stream flows available at specific locations within stream stretches, (4) a systems analysis of various stretches of the Mississippi River and tributaries, (5) a determination of the requirements for meeting additional water supply needs and maintaining adequate water quality and (6) the formulation of a plan to meet the objectives of the program including the establishment of a timetable for accomplishment.

Final Data Projection

It will be necessary to make a breakdown of the population estimates and data on the water-using industries of the manufacturing groups included in the Economic Base Study into the stream stretches that will be used in the systems analysis. The economic and demographic study will have been completed by the National Planning Association for the UMRCBS Type I Report. Since the information included in the Economic Base Study is being developed first by economic sub regions and broken down into planning subareas, the further breakdown to be made by the Public Health Service should be based on range values that can be obtained from the Corps of Engineers.

Most of the other Federal agencies that have cooperated in the UMRCBS Type I Report will have projected water supply needs by planning subareas. This information should also be broken down into the various stream stretch areas. These other Federal agencies will supply the data or suggest means of breaking it down into smaller areas. The data projections for each stream stretch should include the following:

1. Water uses
 - a. Municipal and industrial water supply
 - b. Other water uses
2. Waste loading
 - a. Municipal and industrial

- b. Recreation
- c. Agricultural
- d. Steam electric generating station return flows

Evaluation of Data

Hydrologic studies and programming for the systems analysis will be a responsibility of the Engineering Evaluation Branch. Arrangements for analyzing the data and performing the computational work also will be a responsibility of the Engineering and Evaluations Branch.

Hydrologic Studies

The UMRCBS Report will include low flow frequency graphs of the annual mean stream flows for representative gaging stations in each of the planning subareas and the time of flow between selected points for various ranges of flow. The Corps of Engineers will also supply data on the inflow from tributaries in order to permit the development of stream flow data under various recurrence probabilities for each section of the stream stretch.

The Hydrologic studies will require a determination of the stream flow data for each section within the stream stretch to be analyzed. Information available in the UMRCBS Report, USGS publication and additional data to be obtained from the USGS and Corps of Engineers will be needed to complete these studies.

Systems Analysis

The systems analysis recommended for use in the Upper Mississippi River Basin should be similar to that used by Dr. Robert V. Thomann in the study of the Delaware River Estuary. In view of the type of analysis and budgetary constraints, each stream stretch will be sampled throughout a period of at least one year. The input data used in connection with future estimates will

be based on various stream flows, estimated future waste loads and other factors derived from the waste studies and sampling analyses.

Engineering

Information will be included in the UMRCBS Type I Study Report indicating the availability of surface and ground water resources in each sub-basin. Information is also available in the project files or can be gathered from the State Water Resource Agency files and U.S. Geological Survey publications which will permit a breakdown of the water resource data into stream stretch areas and smaller areas where necessary. On the basis of the information available through these sources and the projections made of future water needs for the various beneficial uses, estimates can be made of the future dates when the capacity of ground water aquifers will be exceeded and additional surface storage will be required.

Using the information prepared by the technical committees on beneficial water uses and water quality objectives or goals as a basis, the engineering analysis will be concerned with an evaluation of the data in order to determine the amounts of various chemicals, pollutants and/or source that must be eliminated from lakes and streams in order to improve and/or preserve the quality of surface and ground waters. Furthermore, it will be concerned with obtaining the least cost solution to the problem subject to social, political and economical constraint.

EXHIBIT NO. 5
OUTLINE OF THE
PUBLIC HEALTH SERVICE APPENDIX H
WATER SUPPLY AND QUALITY CONTROL
TO THE

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY

- I. Introduction
 - A. Authority
 - B. Purpose and Scope
 - C. Acknowledgements
- II. Summary and study results
 - A. Summary (to include a briefing of the information included in Chapters I, II, and III of Part II)
 - B. Study results (UMRB totals only)
 - 1. Preliminary estimates of water supply needs to the year 2020
 - a. Municipal and industrial
 - b. Steam electric generating stations
 - 2. Preliminary estimates of water needs for water pollution control to year 2020
 - 3. Discussion
 - a. Existing and future use of available ground water resources
 - b. Existing and future use of available surface water resources
 - c. Alternate methods of providing additional water supply needs
 - d. Alternate methods of providing water pollution control

PART II - UPPER MISSISSIPPI RIVER BASIN WATER NEEDS

- I. Description of Upper Mississippi River Basin Area
 - A. General description and location
 - B. Physical features and adequacy of water resources to supply existing demands for municipal and industrial water and for water pollution control
 - C. Climate

- D. Major metropolitan areas and types of industries
- II. General economics and population
 - A. Upper Mississippi River Basin
 - B. Upper Mississippi River Subbasins
- III. Federal, State and local control of water supplies and water pollution
 - A. Summary of Federal laws
 - 1. Federal Water Pollution Control Act
 - a. Comprehensive Program Studies
 - b. Construction Grants Program
 - (1) Regular projects
 - (2) Accelerated Public Works Projects
 - c. Enforcement Program
 - d. Federal Installations Program
 - e. Research Program
 - 2. Oil Pollution Act
 - 3. Community Facilities Administration of HHFA
 - B. Summary of State laws and enforcement
 - 1. Public water supplies
 - 2. Water pollution control
 - 3. Agreements between States
 - C. Summary of local laws
- IV. Upper Mississippi River Basin Comprehensive Water Pollution Control Studies
 - A. Collection of data
 - 1. Use of existing data
 - 2. Additional studies underway
 - B. Preliminary estimates of water uses (summary by subbasins)
 - 1. Municipal water supply
 - a. Present

- (1) Quantity requirements
- (2) Quality requirements (discussion of drinking water standards)

b. Future

- (1) Method used for developing preliminary estimates of future needs
- (2) Quantity requirements

2. Industrial water supply

a. Present

- (1) Quantity requirements
- (2) Quality requirements

b. Future

- (1) Method used for developing preliminary estimates of future needs
- (2) Quantity requirements

3. Steam electric generating stations

a. Present

- (1) Quantity requirements
- (2) Quality requirements

b. Future

- (1) Method used for developing preliminary estimates of future needs
- (2) Quantity requirements

C. Waste discharges (summary by subbasins)

1. Types and amounts of wastes discharged into water courses

a. Present

- (1) Municipal sewage
- (2) Industrial wastes
- (3) Wastes from agricultural lands
- (4) Steam electric generating stations return flow

- (5) Other
- b. Future
 - (1) Municipal sewage
 - (2) Industrial wastes
 - (3) Wastes from agricultural lands
 - (4) Steam electric generating stations return flow
 - (5) Other
- 2. Effects of present waste discharges on water quality
 - a. Ground water
 - b. Surface water
- D. Discussion (summary by subbasins)
 - 1. Existing and future use of available ground water resources
 - 2. Existing and future use of available surface water resources
- E. Recommendations for field investigations and research on water supplies and water pollution control
- F. Need for Comprehensive Water Pollution Control Program
 - 1. Objectives
 - 2. Proposed study schedule

PART III - UPPER MISSISSIPPI RIVER SUBBASIN WATER NEEDS

- 1. Mississippi River Headwaters Basin
- 2. Chippewa and Black River Basin
- 3. Wisconsin River Basin
- 4. Rock River Basin
- 5. Illinois River Basin
- 6. Kaskaskia River Basin
- 7. Big Muddy River Basin
- 8. Meramec River Basin

9. Salt River Basin
10. Fox, Wyaconda, Fabius River Basins
11. Des Moines River Basin
12. Skunk River Basin
13. Iowa-Cedar Rivers Basin
14. Turkey, Maquoketa, Wapsipinicon and Upper Iowa Rivers Basin
15. Cannon, Zumbro, Root Rivers Basin
16. Minnesota River Basin

Note: For each of the subbasins a report will be prepared using the following outline:

I. Description of study area

- A. Location
- B. Physical features including streams, topography, etc.
- C. Climate
- D. Economy and population (from Economic Base Study)
 1. Entire basin
 2. Present
 - a. Municipal population
 - b. Industrial
 3. Projected to year 2020
 - a. Municipal population
 - b. Industrial

II. Water resources

- A. Water quantity
 1. Ground water
 - a. Areal extent of aquifers
 - b. Depth
 - c. Safe yield in acre feet per year

2. Surface water

- a. Runoff---acre feet per year
- b. Maximum, minimum, mean flows at specific locations on major streams

B. Gross estimates of water quality

1. Ground water

- a. Chemical
- b. Bacteriological

2. Surface water

- a. Physical and chemical
- b. Bacteriological
- c. Biological

3. Water quality objectives

III. Existing data on water supplies

A. Municipal

- 1. Number of systems and water used
- 2. Per capita water consumption (average day - maximum day)
- 3. Source of supply
 - a. Ground water
 - b. Surface water

B. Industrial

- 1. Major water using industries
- 2. Water used
- 3. Source of supply
 - a. Ground water
 - b. Surface water

C. Steam electric generating stations

- 1. Number and capacity of facilities

2. Water used
3. Source of supply
 - a. Ground water
 - b. Surface water
- D. Other (reference to water uses included in other parts of UMRCBS Report)
- IV. Discussion of additional water needs (present deficiencies)
 - A. Municipal
 - B. Industrial
 - C. Steam electric generating stations
- V. Preliminary estimates of water needs to year 2020
 - A. Municipal
 - B. Industrial
 - C. Steam electric generating stations
 - D. Discussion
- VI. Existing data on present waste loads and water pollution control
 - A. Existing wastes and control measures
 1. Sewage and waste treatment
 2. Agricultural land soil losses and conservation practices
 3. Steam electric generating stations return flows
 4. Other
 - B. Effects on water quality
 1. With existing degree of municipal and industrial waste treatment provided
 2. With adequate municipal and industrial waste treatment provided
 3. Other
- VII. Preliminary estimates of future waste loads
 1. Municipal sewage

2. Industrial wastes
 3. Wastes from agricultural lands
 4. Steam electric generating stations return flows
 5. Other
- VIII. Preliminary estimates of additional water required at present for pollution control
- IX. Preliminary estimates of water needs for pollution control to year 2020
- X. Method for providing additional municipal and industrial water supply needs
- A. Recharging ground water aquifers
 - B. Treatment and additional use of ground waters
 - C. New storage reservoirs
 - D. Reuse and water management practices
- XI. Methods for providing water pollution control
- A. Treatment of municipal sewage and industrial wastes
 - B. Recirculation of cooling waters
 - C. Changes in land use practices
 - D. Storage for stream flow regulation
- XII. Vector control
- XIII. Bibliography

MAPS, TABLES, CHARTS, GRAPHS

1. Map of Subbasin
2. Typical Stream Hydrographs
3. Public Water Supplies
4. Industrial Water Supplies
5. Sources of Municipal and Industrial Pollution
6. Pollution from Agricultural Lands

VIII - PLAN FORMULATION

A water pollution control plan for the Upper Mississippi River Basin will include a determination of (1) the needs for water to satisfy all beneficial uses and the methods of supplying such needs and (2) the future water pollution control needs in order to accommodate the water quality objectives or goals. The engineering analysis should supply the basis for such determinations.

Water Supply Needs

The Corps of Engineers and Department of Agriculture will supply information on potential reservoir sites, and, if possible, the plan should include recommendations of site selections to meet storage requirements. Every effort should be made in formulating a plan for a specific area to avoid the necessity for restudy following authorizations for the Corps of Engineers and Department of Agriculture to study specific reservoir sites.

Water Pollution Control Needs

Research to improve the methodology of sewage and waste treatment, the handling of storm water overflows from combined sewers, and the manufacturing of chemicals, may be a required recommendation in areas where it is found to be necessary to reduce waste loads beyond the limits obtainable through presently known practices.

In specific stream stretches where, from the engineering analyses, it is indicated that additional stream flow regulation will be needed, recommendations should be made indicating the possible reservoir location, sites where water for this purpose could be stored. The Corps of Engineers and Department of Agriculture will furnish potential reservoir site locations where water for stream flow regulation may be available.

The plan should also include the measures needed to (1) improve the collection of wastes and exclusion at source, (2) improvements in treatment of municipal and industrial, recreational area and other related wastes, and (3) means of controlling the temperature of cooling water return flows in various stream stretches.

In certain lakes and streams it may be found necessary to reduce the amounts of nutrients and/or toxic substances now entering the streams through runoff from agricultural lands. By working closely with the Soil Conservation Service, it is believed that recommendations will be welcomed and the necessary reductions may be obtained.

Estimating Costs and Benefits

In arriving at facilities and measures needed to provide the water pollution control requirements, a least cost solution to the problem will be obtained, subject to social, political and economical constraints. The solution will be obtained through the use of linear programming in conjunction with the systems analysis approach.

Estimates of cost for providing the facilities required to satisfy the future municipal and industrial water supply needs will also be made.

Benefits should be determined for both the water supply and water quality control facilities recommended.

IX - STAFFING REQUIREMENTS AND MANAGEMENT

Investigations Organization

Exhibit No. 6 is a typical organization chart indicating the functional responsibilities of the three main branches that will be used for conducting the Comprehensive Studies. These branches are entitled Field Investigation, Central Laboratory and Engineering Evaluations. During the period scheduled for the Preliminary Phase Studies, most of the activities will be assigned to the Engineering Evaluations Branch. This will be necessary in order to complete the Preliminary Phase Studies and make preliminary estimates of the needs for municipal and industrial water supply and storage needs for quality control water during FY 1967.

Exhibit No. 7 shows the total estimated personnel requirements of each of the branches during fiscal years 1966-1972. These estimates are shown separately for those to be employed at Headquarters and Field Stations. Exhibit No. 11 (included in the Study Plan Supplement) includes details of the budget estimates by fiscal years 1966-1972 that show the grade and title of each position, planned EOD date, and annual salary expense for each position. The annual salary expense includes only the amounts required to support the employee in each position from the date of his EOD until the end of the fiscal year exclusive of personnel benefits.

Sample job descriptions are available in the Project Office files for a number of the key positions. It is ~~also~~ understood that the personnel office in Washington, D.C., is now undertaking the preparation of job descriptions for similar type positions for use in the projects. Should this information be available by the date it is needed, the work of the project staff in preparing the necessary job descriptions will be simplified.

EXHIBIT NO. 6 - FUNCTIONAL ORGANIZATION CHART

UPPER MISSISSIPPI RIVER BASIN PROJECT

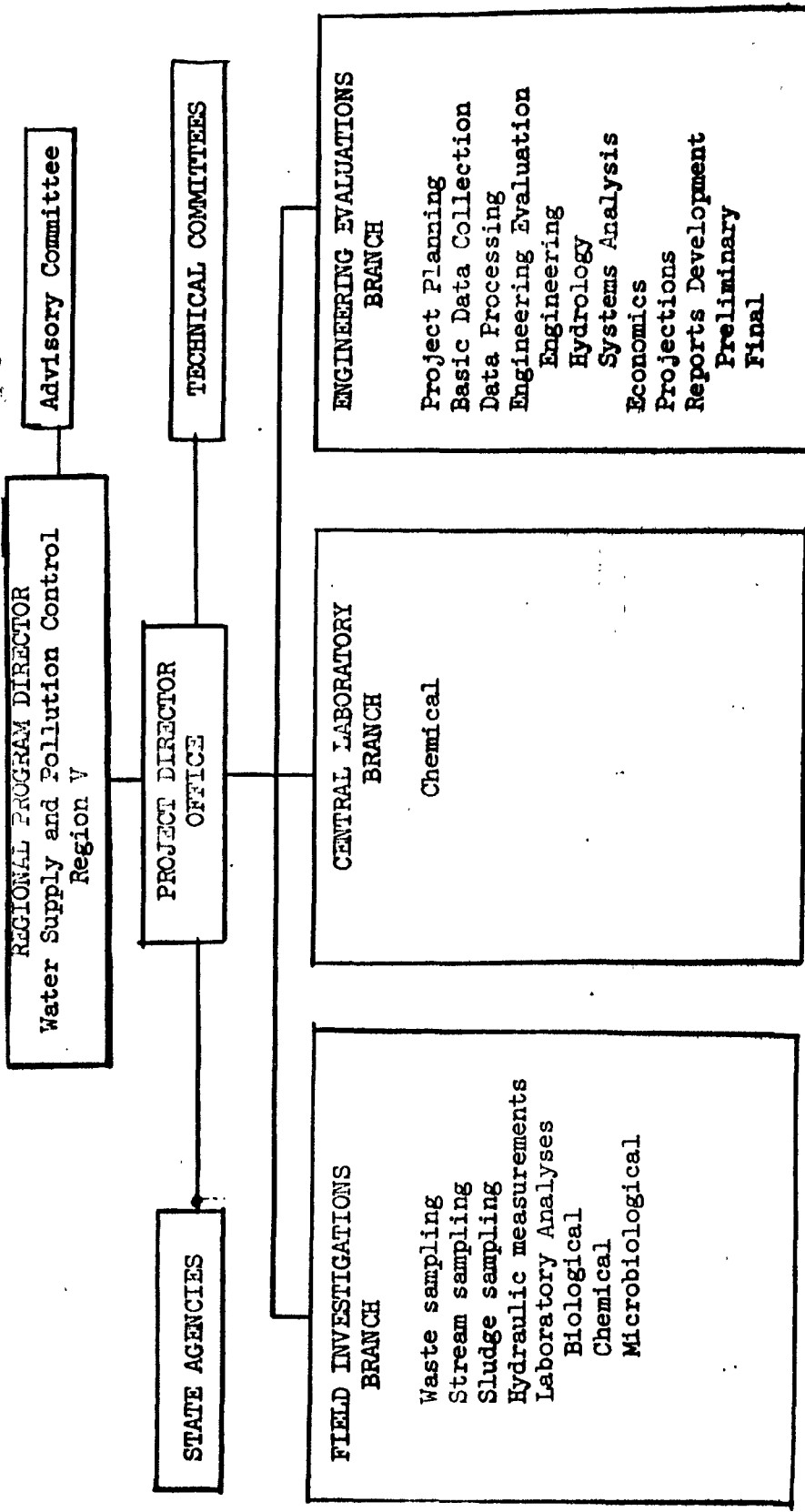


EXHIBIT NUMBER 7

UPPER MISSISSIPPI RIVER BASIN PROJECT

PERSONNEL REQUIREMENTS

ACTIVITY	Fiscal Years (numbers)						
	1966	1967	1968	1969	1970	1971	1972
Project Directors Office	1	3	5	5	5	5	5
Field Investigations Branch	0	7	15	15	15	15	0
Central Laboratory Branch	0	2	2	2	2	2	0
Engineering Evaluations Branch	7	7	8	8	8	8	9
TOTAL	8	19	30	30	30	30	14
Headquarters	8	19	16	16	16	16	14
Field Station	0	0	14	14	14	14	0

Headquarters Location and Space Requirements

Based on the information included in Exhibit No. 7 for personnel requirements in the headquarters and field stations, it is estimated that the following space requirements will be needed:

	Fiscal Years					
	1966	1967	1968 <u>3/</u>	1969	1970	1971 1972
<u>Headquarters</u>						
No. Personnel	8	19	16	16	16	16 14
Sq. Ft. Space <u>1/</u>	900	3800	3200	3200	3200	3200 2800
<u>Field Station</u>						
No. Personnel	0	0	14	14	14	14 0
Sq. Ft. Space <u>2/</u>	0	0	5000	5000	5000	5000 0

1/ Exclusive of laboratory space

2/ Including laboratory space

3/ After 3/1/68

Since the work of a number of the staff will be in the field during a major part of the time, the allocation of space to these individuals and the furniture requirements are not estimated at the same level as those for the staff that will be located in offices during a major portion of the time.

The Headquarters for the preliminary phase studies will remain in the Regional Office at 433 West Van Buren Street during FY 1966. Early in FY 1967, the headquarters will be moved to 1819 West Pershing Road, Chicago, Illinois, the headquarters of the Great Lakes-Illinois River Basins Project. The space requirements for field stations should be provided for at the time these stations are established or contracts are made for field laboratory services.

"Pert" Guide Charts

Exhibits 8 and 9 are "Pert" guide charts for the preliminary phase and

detailed studies. A separate "Pert" chart is included for each phase of the studies beginning January 4, 1965 and ending June 30, 1972. Beyond the Preliminary Phase studies only the TE and TL for each activity is included. This will allow for starting the Detailed Phase studies at an earlier or later date than presently scheduled. All of the activities necessary to complete the Preliminary Phase studies are covered in the activities planned for the Engineering Evaluation Branch. The preliminary and reconnaissance survey activities planned for Field Investigations and Central Laboratory Branches are planned to start March 6, 1967. The activities planned for the Engineering Evaluations Branch during fiscal years 1966-67 must be completed to comply with the Public Health Service commitments for participation in the UMRCBS Type I Report.

Proposed Work Schedule

Schedules should be prepared for each activity included in the "Pert" chart. These schedules should indicate the date when each activity will be started and completed. Each of the branches will be responsible for preparation of the schedules for the activities of the branch. The schedules should conform with the time requirements included in the "Pert" charts as to the start and completion dates for various activities. Should it be necessary to extend the date for completion of an operation beyond the scheduled completion date included in the "Pert" chart, the Deputy Project Director should be notified in order that the necessary revision can be made in the "Pert" chart and considerations can be given to such a change in relation to the final completion dates assigned to the Preliminary and Detailed Phase Studies.

Exhibit No. 10 is a bar chart indicating the duration of major operations necessary to complete the Comprehensive Water Pollution Control Studies.

Project Budget

Following is a summary by fiscal years of the estimated expenditures for completion of the Planning Phase, Preliminary Phase and Detailed Phase Studies.

<u>Planning Phase</u>	<u>Preliminary Phase</u>	<u>Detailed Studies</u>
FY 1964 \$19,775	FY 1965 \$16,500	FY 1967 \$49,000
FY 1965 <u>13,725</u>	FY 1966 60,000	FY 1968 310,000
TOTAL \$33,500	FY 1967 <u>144,000</u>	FY 1969 413,000
	TOTAL \$220,500	FY 1970 420,000
		FY 1971 347,000
		FY 1972 <u>206,000</u>
		TOTAL \$1,746,000

GRAND TOTAL \$2,000,000