SOUTHERN IOWA BASIN

Iowa Water Quality Management Plan

WATER QUALITY MANAGEMENT PLAN
SOUTHERN IOWA BASIN

July, 1976

PLANNING AND ANALYSIS SECTION
WATER QUALITY MANAGEMENT DIVISION
IOWA DEPARTMENT OF ENVIRONMENTAL QUALITY

A C K N O W L E D G M E N T

Water Quality Management Plans for the State of Iowa were prepared by the Department of Environmental Quality, Water Quality Management Division, Planning and Analysis Section. We gratefully acknowledge the assistance of the many State and Federal agencies and individuals that have provided data, reviewed drafts, and helped in other ways during the formulation and preparation of this plan. We also acknowledge the work of Veenstra & Kimm in the compilation of this plan, and of Stanley Consultants, Inc. in the development of a portion of the preliminary waste load allocations, both under contract to the Department of Environmental Quality.

FOREWORD

Under Section 455B.31, Code of Iowa, 1973, the Iowa Department of Environmental Quality (DEQ) is charged with the responsibility of protecting and maintaining surface and ground water quality throughout the State. To assist the Department in this task, this basin plan has been prepared to coordinate and direct the State's water quality management decisions on a river basin scale.

The national goal, established in the Federal Water Pollution Control Act Amendments of 1972, (the Act), provides for water quality suitable for the protection and propagation of fish and wildlife, as well as for recreational activities in all surface waters by July 1, 1983. The Amendments define basin planning (Section 303(e)) as a key element for the determination and implementation of the necessary requirements to achieve national water quality goals.

Six major river basins, as defined by the Department of Environmental Quality, are partially located in the State of Iowa. Basin boundary lines are drawn to separate hydrological drainage areas as shown on Figure 1. Any minor deviation from this is done only to be consistent with the boundaries of the six Iowa Conservancy Districts, as established by Chapter 467D.2 of the

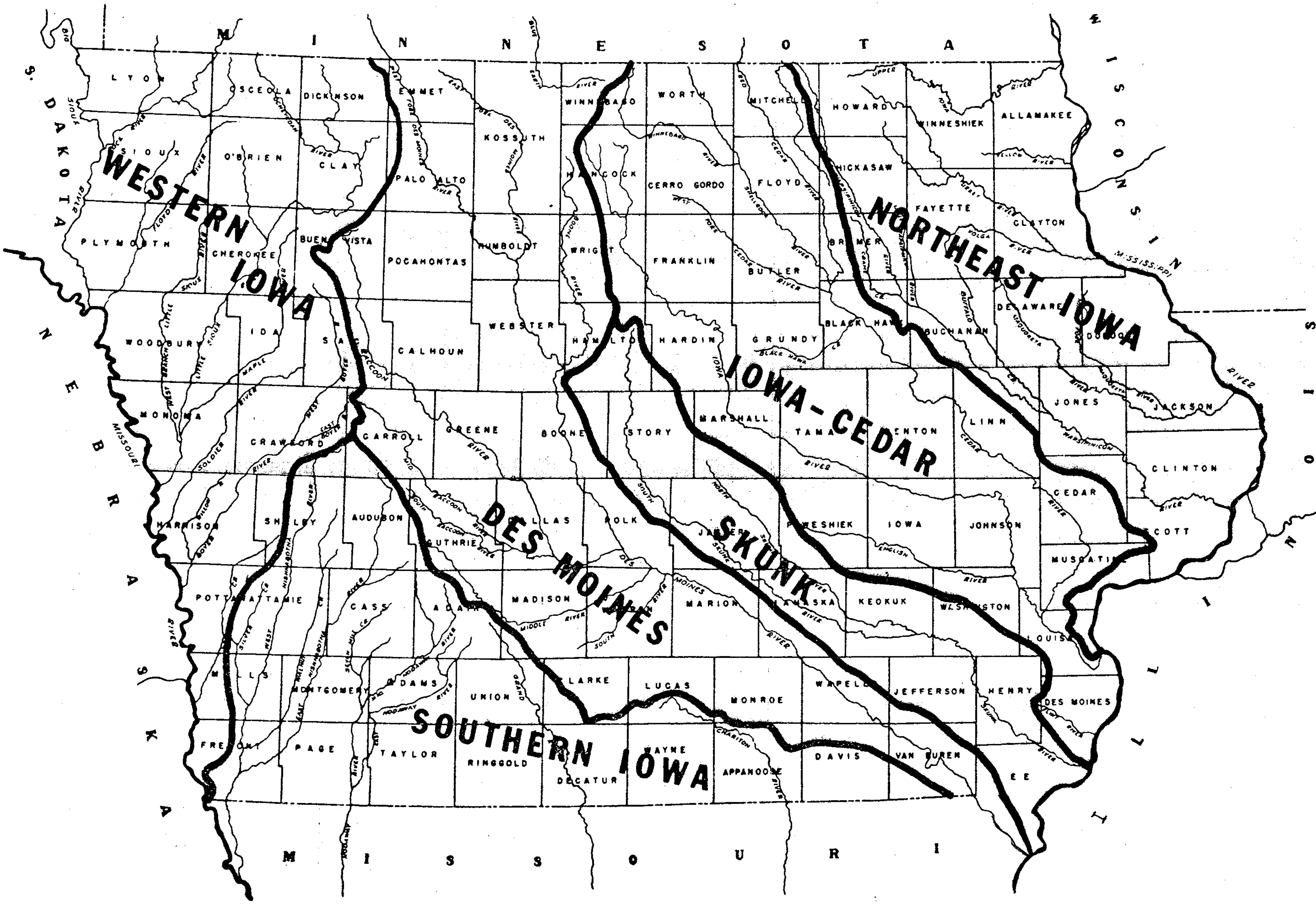

FIGURE 1

IOWA RIVER BASINS

Code of Iowa. This provides the most compatible use of data among different State agencies.

The Southern Iowa Basin Plan is one of a series for the six major river basins in Iowa. The planning documents have been prepared by or under the direction of the Water Quality Management Division of DEQ. The planning information contained herein is part of a continuing planning process. Changes will occur since this plan describes a dynamic process. Basin plans will be reviewed at least every five years with interim revisions as significant changes occur.

This plan includes a determination of existing water quality, applicable standards, and significant point and nonpoint sources of pollution in the Southern Iowa Basin. The plan identifies and sets forth measures to correct water quality problems of the basin. Authority for this basin plan is derived from Section 455B.32, of the Code of Iowa.

This basin plan is specifically directed towards satisfying requirements of Section 303(e) of the Federal Water Pollution Control Act, as amended; Public Law 92-500, 86 Statute 816 (1972); (33 United States Congress 1251 et sequens). The plan will serve local and regional governments as well as State and Federal agencies.

SCOPE

This basin plan addresses the Southern Iowa Basin in southern and southwestern Iowa. The basin includes the Iowa portions of the Nishnabotna, Tarkio, Nodaway, Platte, Grand, Chariton, Fabius, Wyaconda, and Fox Rivers. The Southern Iowa Basin and its tributary rivers are shown on Figure 2.

The scope of this plan entails the study of the following items: (1) Water Quality Management Programs, (2) Existing Development Patterns and Basin Characteristics, (3) Existing Water Quality, (4) Inventories of all Point Sources of Wastewater Discharge, (5) Assessment of Nonpoint Pollution Sources, (6) Stream Segment Analyses and Waste Load Allocations, and (7) Assessment of Needs and Compliance Schedules.

The complete water quality management plan for the Southern Iowa Basin is presented in this report. A more comprehensive description of the six Iowa River Basins and a detailed presentation of the background data and methodologies used in the development of the overall State basin management plan can be found in Supporting Document for Iowa Water Quality Management Plan; Department of Environmental Quality, 1976.

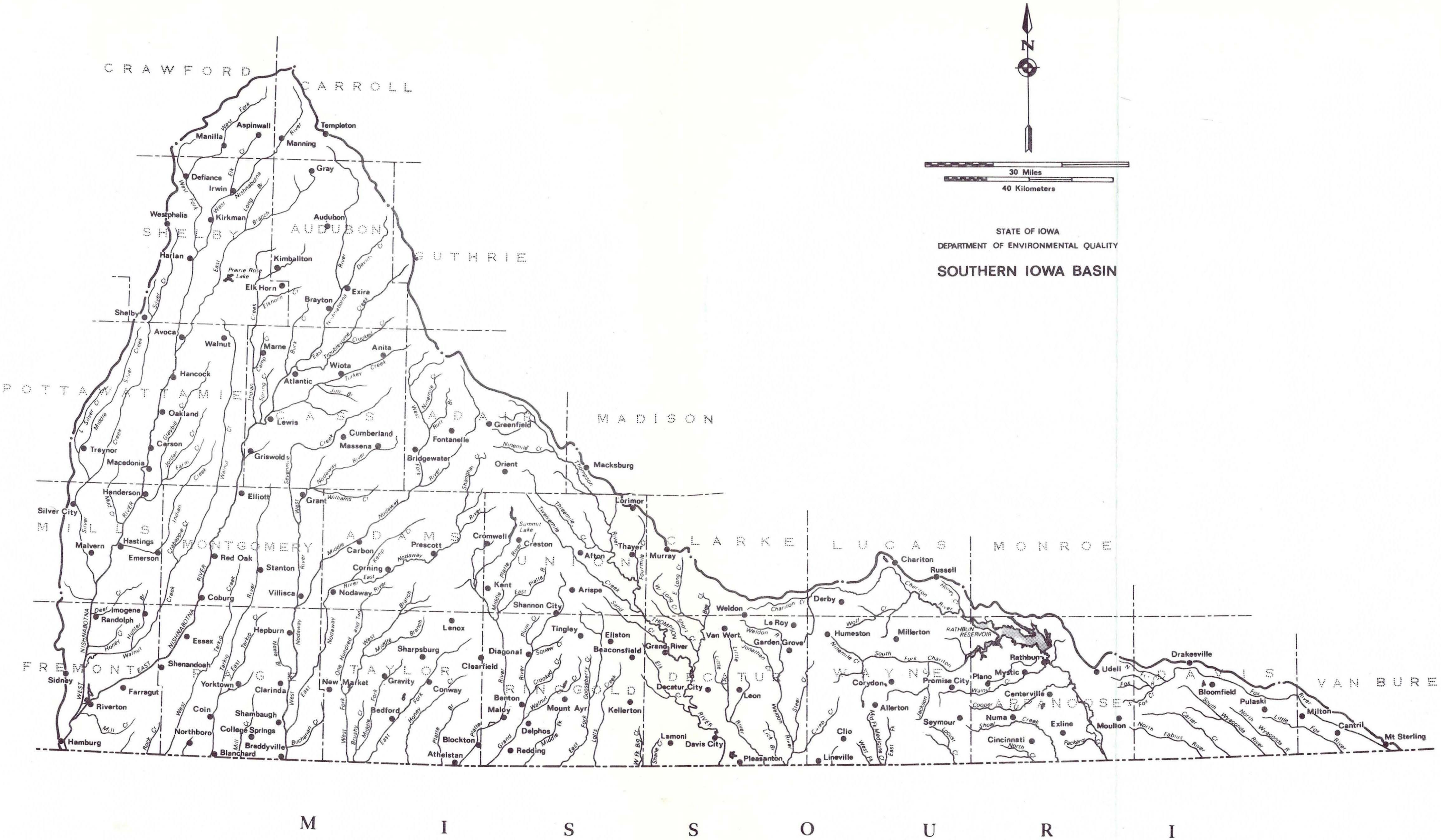
N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
MISSOURI
Manilla
Aspinwall
Templeton
Manning
Gray
Defiance
Irwin
Kirkman
Westphalia
Audubon
Harlan
Kimballton
Prairie Rose Lake
Elk Horn
Exira
Brayton
Shelby
Avoca
Walnut
Marne
Anita
Wiota
Hancock
Atlantic
Oakland
Lewis
Cumberland
Massena
Greenfield
Fontanelle
Treynor
Carson
Macedonia
Griswold
Bridgewater
Orient
Macksburg
Henderson
Elliott
Grant
Lorimor
Silver City
Malvern
Hastings
Emerson
Red Oak
Carbon
Prescott
Cromwell
Creston
Afton
Thayer
Murray
Chariton
Russell
Corning
Stanton
Nodaway
Villisca
Kent
Arispe
Shannon City
Coburg
Imogene
Randolph
Essex
Hepburn
Lenox
Tingley
Ellston
Beaconsfield
Weldon
Le Roy
Garden Grove
Van Wert
Derby
Humeston
Millerton
RATHBUN RESERVOIR
Rathbun
Drakesville
Udell
Grand River
Shenandoah
Sharpsburg
Diagonal
Clearfield
Mystic
Plano
Promise City
Corydon
Centerville
Bloomfield
Pulaski
Milton
Sidney
Farragut
Yorktown
Clarinda
New Market
Gravity
Conway
Benton
Maloy
Mount Ayr
Kellerton
Decatur City
Leon
Allerton
Seymour
Numa
Exline
Moulton
Cantril
Mt Sterling
Riverton
Coin
Shambaugh
College Springs
Braddyville
Blanchard
Northboro
Hamburg
Bedford
Blockton
Athelstan
Delphos
Redding
Lamoni
Davis City
Pleasanton
Clio
Lineville
Cincinnati
NISHNABOTNA
THOMPSON
RIVER
Nodaway
Platte
Chariton

FIGURE 2

Study Detail - Southern Iowa Basin Plan

Chapter

I. Iowa's Water Quality Management Program

A summary of the basin planning process is presented along with brief descriptions of the water quality management program and strategy of DEQ.

II. Existing Development Patterns

Information concerning population, economics and recreational activities within the basin is presented.

III. Basin Characteristics

The physical characteristics of the basin, including climatology, physiography, geology, hydrogeology and hydrology, are discussed.

IV. Water Quality

Available water quality data for the rivers of the basin are evaluated to present the best possible picture of the recent history of basin water quality. Existing water quality is described and compared with the Iowa Water Quality Standards.

V. Point Source Discharge Inventory

Available records are reviewed to determine the location and characteristics of point source wastewater discharges. This information is tabulated and summarized.

VI. Waste Load Allocations and Ranking

Point source waste discharges to the basin are listed. The types of wastes discharged to the basin and the waste treatment processes employed are summarized. Waste load allocations are listed. Segments are classified and ranked. Dischargers are ranked.

VII. Nonpoint Pollution Sources

The problems of nonpoint pollution sources are addressed. Combined sewer overflows, urban runoff, and rural sources of pollution from animal feeding operations and general agricultural activities are discussed. Based upon information extrapolated from other areas, the potential pollution from typical sources is identified.

VIII. Needs and Compliance Schedules

The needs for improved wastewater treatment in the basin are evaluated. Costs associated with these needs are estimated.

IX. Recommendations and Conclusions

Conclusions drawn from the plan are presented along with recommendations that will aid in attaining the goal of improved water quality in the basin.

X. Review and Revision

The procedures for review and revision of this plan are described.

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CHAPTER I

IOWA'S WATER QUALITY MANAGEMENT PROGRAM

The main objective of water quality management is protection and enhancement of water resources to ensure acceptable conditions for designated uses. The establishment of a realistic management program requires a comparison of existing water quality with the desired water quality.

The Iowa Water Quality Standards, as adopted by the Iowa Water Quality Commission, establish a baseline for desired water quality and stream uses. The National Water Quality Criteria, as proposed by the U.S. Environmental Protection Agency (EPA), provide additional measures of desirable water quality.

WATER QUALITY STANDARDS

Iowa's Water Quality Standards and accompanying use classifications were established by the Water Quality Commission. The Standards were adopted by the State on February 12, 1974, and approved by EPA on March 12, 1974. These water quality standards, therefore, carry the weight of State and Federal law. When the established limit or range of a constituent or characteristic is exceeded, the water quality standards are violated and, according to law, the water is polluted and its quality must be improved.

WATER USE CLASSIFICATIONS

DEQ has responsibility for establishing water use classifications for the surface waters of the State. Assistance in this task has been provided by the State Conservation Commission which has the major responsibility for fish and wildlife protection. DEQ has established and defined four use classifications for surface waters and has placed all surface waters of the State into one or more of these classifications. These classifications are:

Class A - Body Contact Recreation.

Class B - Wildlife, Non-body Contact Recreation and Aquatic Life (with subclasses for cold and warm waters).

Class C - Potable Water Supply

General Use Classification.

All surface waters are designated for General Use. In addition, many streams are also designated for one or more of the Class A, Class B or Class C uses. Each of the use classifications implies specific water quality standards.

SURFACE WATER QUALITY STANDARDS

Iowa water quality standards define the maximum levels and ranges for certain constituents which may be present in the surface waters of the State. Specific concentrations of various constituents which cannot be exceeded are assigned to each water use to protect the water for that use.

The Act provides that the requirements of the water quality standards be met at all times when the flow in the receiving stream equals or exceeds the 7-day, 1-in-10 year low flow (7Q10). Exceptions may be made for intermittent or extremely low flow streams. When intermittent streams are classified for aquatic life protection, the Water Quality Commission may waive the 7Q10 requirement and establish a minimum flow in lieu thereof. Such a waiver is granted by the Commission only when it has been determined that the aquatic resources of the receiving waters are of no significance at flows less than the established minimum.

The specific criteria which apply to A, B, C, or General Use classifications are discussed in Chapter IV of the Supporting Document for Iowa Water Quality Management Plans (1).

REVISION OF WATER QUALITY STANDARDS

The Act requires that the State shall, from time to time, and at least once every three years, hold public hearings to review water quality standards and, if appropriate, modify and adopt new standards.

Some of the most likely changes in the standards will be revisions to the use classifications. Since the National water quality goal is swimmable-fishable waters by 1983, most anticipated changes will be to upgrade existing Class B waters to Class A usage. There will also be cases of upgrading current General Use waters to Classes A and B. Other revisions may include changes in the criteria of the current Water Quality Standards. Any revisions in the standards will be subject to public hearings and approval by EPA before they become law.

IMPLEMENTATION STRATEGY

If a management plan is to be effective, it must include a strategy for implementation of its elements. This section describes the strategy of DEQ for implementation of its basin plans.

GENERAL

In most cases, water quality violations are the result of cultural activities. Typical sources of pollution include municipal discharges, industrial discharges, and runoff or discharges associated with agricultural practices. The solution to water pollution abatement is to identify the contributing sources and eliminate them or control them to the extent necessary to assure that water quality standards will not be violated.

Monitoring and surveillance are important parts of DEQ's strategy. The monitoring and surveillance program in Iowa includes the establishment of a stream sampling station network throughout the State, stream water quality surveys, point source discharge self-monitoring and plant inspection.

Waste load allocations establish the quantities of pollutants which may be discharged to the receiving waters without exceeding the limits allowed by the water quality standards. Through the use of waste load allocations, effluent limitations are established for municipal and industrial wastewater point source discharges. Only point sources of pollution are included in the waste load allocations in the initial version of the basin plans. Point sources of pollution are easiest to identify and control. Nonpoint sources of pollution will receive further consideration in subsequent revision to the plans.

In addition to waste load allocations for point sources, Public Law 92-500 establishes further limitations. Publicly owned treatment plants must provide as a minimum, "secondary treatment", and industrial plants must provide, as a minimum, "best practicable control technology currently available" (BPT) by July 1, 1977. The actual effluent limitations established under these required degrees of treatment are described in Chapter VI of this report.

The principal mechanism for attaining and maintaining compliance with the water quality standards is issuance of operation permits to all point sources of wastewater discharge. The permits contain either minimum allowable effluent limitations or other, more stringent, limitations as necessary to assure compliance with water quality standards. Where existing sources are not in compliance with the effluent limitations, the operation permit will include an implementation schedule to assure compliance within a reasonable time period.

Water quality management deadlines have been established to implement a remedial program for the basin.

An additional step in the implementation of remedial measures to abate water pollution is a grant program for construction of municipal wastewater treatment facilities. The Act has established a program for assisting with funding of improvements to publicly owned wastewater treatment works necessary to meet the goals of the Act. DEQ, as the State water pollution control agency, has responsibility for administering the program. DEQ allocates the Federal funds available for the improvement of Iowa municipal treatment facilities.

Since financial resources are limited, needed projects must be funded in accordance with a priority system. The system proposed for Iowa is discussed in this chapter.

MONITORING AND SURVEILLANCE

Stream Sampling Station Network - The Iowa stream sampling station network is a series of sampling points distributed throughout the State. These are permanent stations, sampled at the same location and on a fixed quarterly frequency. The samples are normally analyzed for the same parameters each quarter. The objective of the sampling network is to give a general and broad measure of water quality. The network is effective for measuring trends of either improvement or degradation of water quality. Although only minimal assistance is obtained in the area of enforcement, the network provides some background data for planning and assessing the effectiveness of the program.

The present network consists of thirty-six (36) stations across Iowa. Five of these stations are in the Southern Iowa Basin. The five stations are located on the Chariton River, southeast of Chariton; on the Chariton River, north of Centerville; on the Nishnabotna River at Hamburg; on the Nodaway River, south of Shambaugh; and on the East Fork, One Hundred and Two River, about three-fourths mile north of the State line. All stations are sampled by the State Hygienic Laboratory of the University of Iowa, under contract with DEQ. The State Hygienic Laboratory also analyzes the samples.

The monitoring network should be expanded to be more effective as a trend indicator. To be most effective, stations should be located below major point source discharges, and at points of distinct change in characteristics of the stream. These locations would be at points of confluence of major tributaries, above and below impoundments, and at points of change in water quality standards designation.

Intensive Stream Water Quality Surveys - The limiting factor in the effectiveness of the stream sampling network is the difficulty in detecting cause and effect relationships. The water quality monitoring program therefore includes a complementary program of intensive stream water quality surveys. The intensive surveys are in-depth studies of water quality in a specific area or segment of a stream, over a definite time period. The purpose of the surveys is to provide a detailed determination of the biological, physical, and chemical qualities of the stream water. Information obtained is used to determine the effects of a specific point source or combination of point sources upon the receiving stream. The surveys provide documentation for enforcement actions and determine the effectiveness of any corrective measures initiated. Such surveys are also used for evaluating priorities, verifying waste load allocations, and as aids for planning.

The bulk of the intensive surveys program is conducted by the State Hygienic Laboratory which usually performs both sampling and sample analyses. Intensive surveys are also conducted by the DEQ staff to obtain answers to specific questions. Limited surveys are occasionally conducted by the DEQ Regional staff in connection with point source discharge compliance inspections.

All survey data storage and analyses are performed using computer data processing. The stream water quality data is also stored in the U.S. Environmental Protection Agency computer storage system, STORET. The STORET system includes a variety of report and analysis formats for evaluating and using the data.

Point Source Discharge Self-Monitoring - The principal tool for the management of point source discharge monitoring and enforcement of effluent limitations is the State Operation Permit Program, in coordination with the Federal National Pollutant Discharge Elimination System (NPDES Permit Program). The permits set discharge effluent limitations and prescribe compliance schedules for bringing about corrections. They also specify a program for effluent monitoring and recording by the permit holder.

Dischargers are currently required to report to DEQ each month.

Report contents are specified and are tailored to the size and complexity of the plant and to the effluent limitations specified in the permit. Plant flows are required to be recorded as well as certain laboratory test results.

The self-monitoring reports are used as a screening mechanism to point out operation problems and existing or impending violations of effluent limitations. The reports are used as a guide to direct DEQ resources to more detailed monitoring and possible enforcement action.

The reports serve as an aid to the operator in evaluating his own operation. The requirements, in effect, mandate the availability of operational data which the operator can use in improving his operation.

Another self-monitoring program is the State initiated Effluent Quality Analysis Program (EQAP). The State Hygienic Laboratory mails specially prepared sample bottles to each discharger. The plant operator collects a sample at times and locations recommended by DEQ, and mails the sample to the State Hygienic Laboratory for analysis. Samples are analyzed monthly for biochemical oxygen demand (BOD_5) and, in some cases, ammonia. Other water quality parameters compatible with acid fixing can also be analyzed from the EQAP sample. Occasionally, heavy metals or other analyses are performed at the request of DEQ.

Plant Inspection - DEQ also conducts on-site plant inspections. The inspections provide an in-depth analysis of the operation, maintenance, and effectiveness of the treatment plant. The inspections provide for verification of self-monitoring reports and determination of whether the plant is in compliance with permit stipulations.

Influent and effluent samples are collected and analyzed when possible, but in many cases, visual observation of the effluent by the inspector is satisfactory. The inspection also includes an evaluation of the effects of the effluent on the receiving stream, occasionally by sampling but more often by visual observation.

The advantage of the on-site inspection over the other monitoring programs is the opportunity to make cause and effect evaluations. The inspector can observe the raw waste load and the operation and maintenance factors which determine the efficiency and effectiveness of the treatment process.

The inspections provide a valuable tool for evaluating permit compliance. They document the need for and provide data for enforcement actions. The inspections also provide a vehicle for assistance to the operator. The inspectors can provide counsel and advice to the local officials on meeting permit requirements as well as suggest operation and maintenance methods to improve plant operation and efficiency.

The DEQ regional staff normally makes the inspections when minimal or no sampling is needed. The central office staff makes inspections when intensive composite sampling is required. The number of inspections conducted each year is limited by the availability of fiscal and personnel resources. Approximately three to four hundred municipal and industrial inspections are made each year, along with a like number of quick stop visits. All municipal and major industrial plants should be inspected each year. The number of inspections will be increased as staff is added to the regional offices.

WASTE LOAD ALLOCATIONS

Waste load allocations have been made for point sources of wastewater discharge to determine effluent limitations necessary to maintain water quality standards. The scope of the allocations was limited to evaluation of effluent limitations necessary to meet the dissolved oxygen (DO) and ammonia-nitrogen (NH_3-N) standards, at the 7Q10 flow.

The DO and NH_3-N parameters have been selected for making the evaluations because they are generally the most critical and difficult to achieve criteria of the water quality standards. Data from some five years of municipal treatment plant effluent sampling is available on these parameters and is readily adaptable to data processing. The other criteria of the water quality standards can normally be met with secondary treatment. If other criteria are not being met, this will usually be indicated by stream sampling. An intensive survey can then be initiated to determine the cause and the necessary corrective measures.

It is recognized that other parameters could be considered in the waste load allocation analyses. An analysis of historical water quality data shows that other water quality criteria have been violated in the past and that critical conditions may also exist for some parameters during high stream flow periods. Some other parameters of particular concern include heavy metals, toxic elements, fecal coliform and thermal discharges. Where violations of water quality standards are apparent for parameters other than DO and NH_3-N, they are studied on an individual basis and effluent limits incorporated into the operation permits. More detailed waste load allocation analyses will be included in subsequent revisions of this plan when additional data and information become available.

A computer-based mathematical model was used to predict the variation in DO and NH_3-N concentrations in the streams. Input data for the model was developed from existing information and cursory field investigations of the streams. When necessary, conservative assumptions were made to assure a high degree of protection for water quality without necessitating unrealistically stringent effluent limitations. Future stream surveillance should help to verify particular constants and assumptions used and improve the validity of the model. It is believed that with presently available data, the impact of different wastewater loads or treatment arrangements upon the DO and NH_3-N concentrations may be reasonably predicted. Available data should also permit determination of wastewater discharges that will comply with water quality standards.

A detailed discussion of the mathematical model and methodology and assumptions used in the waste load allocation analyses is included in the Supporting Document*. The final allocations for the Southern Iowa Basin are contained in Chapter VI of this report.

PERMIT SYSTEM

The major mechanism by which the water quality management plan

*Supporting Document for Iowa Water Quality Management Plan; Department of Environmental Quality, 1976.

will be implemented is the wastewater construction and operation permit program conducted by DEQ, under authority of Chapter 19, of the rules of the Department (1973 IDR). Any person intending to construct, modify or extend any wastewater disposal system in the State must first obtain a construction permit from the Executive Director of DEQ. An operation permit is also required prior to the operation of any disposal system, or the discharge of sewage, industrial waste, or other wastes from any discharge source. Chapter 455B of the Code also has provisions for correcting violations of any permit, rule, standard, or order issued under Part I of Division III of the Chapter.

NPDES Permit Program - The Federal Water Pollution Control Act Amendments of 1972 (the Act) established a National Pollutant Discharge Elimination System (NPDES) permit program. Any person presently discharging wastewater to public waters is required to obtain an NPDES permit. Any person proposing a disposal system which will result in a wastewater discharge is required to apply for an NPDES permit at least 180 days before such discharge is to commence.

The Act also established a procedure whereby the EPA can delegate permit authority to those states that desire to administer the NPDES program. The state must demonstrate ability to conduct the program and must have adequate legal authority to enforce the permits. DEQ is presently in the process of submitting a delegation request to EPA for issuance of NPDES permits in Iowa.

Operation Permits - An operation permit is a legally enforceable document which specifies the type of waste which may be discharged and the allowable quantities, concentrations, and rates of discharge. As a minimum, the effluent limitations are equivalent to secondary treatment for municipalities or BPT for industries. More stringent limits may be required to meet water quality standards.

The permits also contain self-monitoring and reporting provisions that require dischargers to monitor their effluents and report the results to DEQ. The monitoring data is managed by a DEQ processing system. This system stores and reports the water quality and compliance schedule data in formats designed to point out violations and problem areas. Fiscal and personnel constraints limit the number of violations and problem areas that can be effectively pursued. Staff resources are, therefore, directed to those discharges which are determined to be of sufficient importance by the priority ranking formula.

Provisions of the State Construction and Operation Permit Program require that certain agricultural operations obtain a permit for wastewater disposal. This subject is discussed in Chapter VII.

Industries which discharge their wastewater to municipal plants do not need an operation permit, but must follow certain pretreatment standards published by EPA.

Operation permits are written for a maximum of five years, before which time the discharger is required to apply for another permit to continue to discharge. A permit can be modified by DEQ at any time if there is a violation of any terms or condition of the permit. A permit can also be modified on the basis of a change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge or if it is found that the permit was obtained under any type of misrepresentation of fact.

Many dischargers are not treating their wastewaters to a sufficient degree to comply with the final effluent limitations of their permit. In these cases, the permits are written with interim and final effluent limitations and legally enforceable compliance schedules. These compliance schedules usually specify a series of interim dates to assure steady progress in the remedial efforts.

Iowa water pollution control law provides for stiff penalties for violations of permits and rules or standards. A large part of the DEQ compliance action work load is directed toward negotiating achievable timetables. Negotiations are aimed at identifying practical and achievable remedial measures. Legal enforcement actions follow only when negotiations are not effective.

Funding of most municipal wastewater treatment improvements is dependent on Federal and State grant monies. Regardless of the availability of grant monies, permits are issued with the intent of obtaining compliance with all effluent limitations by July 1, 1977. It is the responsibility of the municipalities to initiate necessary action to comply with the July, 1977, date. A part of the necessary action will be application for Federal grant funds to aid in preliminary planning and construction of any necessary project. If grant monies are not available to fund all projects, enforcement action may not be taken for non-compliance provided a municipality has shown good faith in attempting to comply with the established schedule.

Operation permits are now being written to require the best possible treatment from the existing facility until such time as grant monies do become available.

WATER QUALITY MANAGEMENT DEADLINES

The basin plans are to help direct the water quality management strategies necessary to implement a remedial program needed to meet the goals of the Act. The Act and DEQ specify several deadlines that must be met in the implementation of the management program. Several key dates have been established by EPA and DEQ for improving wastewater treatment to protect National and State water quality. These dates are used to establish implementation schedules for the remedial measures defined by this plan and are as follows:

Date	Action
December 31, 1974	National Pollutant Discharge Elimination System permits issued.
June 30, 1975	Section 303(e) basin plans completed.
July 1, 1977	Secondary treatment required for all publicly owned treatment works.
July 1, 1977	Best practicable waste treatment technology required for all industrial discharges.
July 1, 1977	More stringent effluent limits to meet Iowa water quality standards.
July 1, 1983	Best practicable waste treatment technology required for all publicly owned treatment works.
July 1, 1983	Best available technology required for all industrial discharges.
July 1, 1985	Zero pollutant discharge.

CONSTRUCTION GRANTS

If all point source dischargers are to meet the effluent limitations imposed by the waste load allocations, considerable monetary expenditures will be required on behalf of municipalities and industries. Industrial dischargers must provide their own waste treatment financing. Federal grants for publicly owned wastewater treatment facilities are provided for by the Federal Water Pollution Control Act Amendments of 1972, under Title II - "Grants for Construction of Treatment Works". Municipalities may apply to EPA through DEQ for Federal grants of 75% of eligible costs of their wastewater treatment works improvements. Municipalities must provide the remaining 25% of the cost from other sources. Eligible project costs include those for treatment, interceptor sewers and collection facilities. Collection facilities have been assigned the lowest priority.

In the past, Federal funds allocated to Iowa had been sufficient to cover the grant funding of all needed treatment facilities. However, during the past two years the needs have outgrown the availability of Federal funds. Nationwide Federal allotments for fiscal years 1974 and 1975 were $3 billion and $4 billion, respectively. Of the National allotment, Iowa's shares were $34.7 million and $39.3 million, respectively. Current needs for the State for all eligible facilities, excluding storm sewers, based on 1973 dollars is $989,584,000, as contained in the 1974 "Needs Survey" for the State of Iowa. These needs have and will continue to increase as better information is developed through the waste load allocations and basin planning processes. Inflation is also having a significant influence on treatment facility costs.

Priorities for Funding - To receive grant funding, a municipality must meet certain requirements. DEQ is responsible for establishing an orderly priority process for the administration and obligation of Federal grant funds. All municipalities are placed on the State discharge inventory and assigned a discharge priority. Should a municipality have a need for improvement or construction of wastewater treatment facilities and apply for Federal grant funds, it is then placed in the Construction Grant priority listing according to its discharge priority rank. The Construction Grant Priority list is revised annually. After determination of the available Federal grant funds for the year, the annual project list can be established. The project list must be based upon the number of projects from the priority list that can be funded.

Prior to adoption of the annual priority list and project list for each fiscal year, a public hearing is held where interested persons may comment on the proposed lists. After consideration of comments, the final lists are prepared and approved by the Water Quality Commission and EPA.

Types of Grants - Once a municipality has been placed on the project list and has been found to be eligible for grant funding, a three-step grant process is initiated in accordance with Federal Regulations 40 CFR 35 to implement Title II of the Federal Act.

Step One, known as the Facility Plan, provides for an engineering report including an evaluation of the water pollution control problem; exploration of a number of alternatives to eliminate the problem; a cost-effectiveness study for each alternative; evaluation of the environmental impact of each alternative; and finally, choice of the specific alternatives which seem to have the most environmental, economic, and social benefits. The Facility Plan must be submitted to DEQ and EPA for approval before the second step can be considered.

Step Two covers the preparation of construction plans and specifications based on the alternative chosen and approved in the Facility Plan.

After approval of the plans and specifications by DEQ and EPA, Step Three, which is the actual construction of the required facilities, can be initiated. Grants are made to applicants for each of the three steps.

Before the Facility Planning (Step 1) process is begun, DEQ will inform the applicant of the minimum quality of effluent which can be discharged to the receiving waters. The facility planning for a specific discharge is then directed at meeting these effluent limitations.

PRIORITY SYSTEM

Application of the waste load allocations and effluent limitations results in considerable need to upgrade or expand existing wastewater treatment facilities. Although there is considerable expense involved to meet State and Federal water quality goals, the financial resources available each year for publicly owned facilities are limited. As discussed previously, not all needed projects can be funded at once. To solve this problem, a system of priorities has been established. This section describes a portion of the system proposed for use by the State of Iowa.

Stream Segment Priority Ranking - Each major river basin is first divided into various stream segments. Each stream segment consists of surface waters that have common hydrologic characteristics and similar natural, physical, chemical, and biological processes. In accordance with EPA guidelines, the stream segments must be classified either Effluent Limited (EL) or Water Quality Limited (WQ).

Segment classification is a contributing factor in the determination of the segment ranking, discharger ranking, and compliance scheduling. The two segment classifications are defined as follows:

1. An Effluent Limited (EL) segment is any segment where it is known that water quality is meeting and will continue to meet standards, or where there is adequate demonstration that standards will be met after application of secondary treatment or BPT to all point discharges to the segment.

2. A Water Quality Limited (WQ) segment is any segment where it is known that water quality does not currently meet applicable standards and it is not expected that standards would be met even after application of secondary treatment or BPT to all point discharges to the segment.

All segments are next ranked in order of abatement priority using a ranking methodology based on the following:

Severity of pollution problems;

Affected population;

Need for preservation of high quality waters;

National priorities.

Two major concepts were considered necessary and sufficient to distinguish any segment from other segments of the basin. These concepts are the degree of usefulness of the segment assuming water quality standards are met, and the number of dischargers required to meet effluent limitations to bring the segment into compliance with water quality standards. These concepts form the basis of the ranking methodology.

The formula used to calculate the total points for a segment is as follows:

$$\text{TOTAL SEGMENT POINTS} = (0.5 + A + B_C + B_W + C + BC + AES + POP) \times SQ$$

Where: A = 2 if the segment contains any designated Class A waters and 0 otherwise.

B_C = 2 if the segment contains any designated Class B cold waters and 0 otherwise.

B_W = 1 if the segment is designated as Class B warm waters and 0 otherwise.

C = 2 if the segment contains any designated Class C waters and 0 otherwise.

BC = 1 if the segment is designated as being useful for either boating and/or canoeing and 0 otherwise.

AES = 1 if the segment is considered to include an area of significant aesthetic value and 0 otherwise.

$$POP = \begin{bmatrix} 2.0 \\ 1.5 \\ 1.0 \\ 0.5 \\ 0 \end{bmatrix} \text{ if } \begin{bmatrix} 30 \text{ or more} \\ 15 \text{ to } 30 \\ 5 \text{ to } 15 \\ 0.5 \text{ to } 5 \\ 0 \text{ to } 0.5 \end{bmatrix} \text{ thousand people reside}$$

within a 10-mile wide corridor adjacent to either side of the segment and at least one of the above terms (A, B_C, B_W, C, BC, or AES) is not 0.

SQ = 6 if the segment is designated as Water Quality Limited and more than four dischargers have a waste load allocation more stringent than secondary treatment.

SQ = 5 if the segment is designated as Water Quality Limited and three or four dischargers in the segment have a waste load allocation more stringent than secondary treatment.

SQ = 4 if the segment is designated as Water Quality Limited and one or two dischargers in the segment have a waste load allocation more stringent than secondary treatment.

SQ = 3 if the segment is designated as Effluent Limited with water quality standards violated.

SQ = 2.5 if the segment is designated as Effluent Limited with water quality standards met.

SQ = 2 if the pollution load to the segment is contributed equally by point and nonpoint sources.

SQ = 1 if the pollution load to the segment is predominantly from nonpoint sources.

The formula for total segment points includes two factors. The first factor allocates points for the degree of usefulness of the segment. It is believed that the population that uses, or would use, the waters of a segment is the population most affected by any pollution problems in the segment. This population increases in direct proportion to the potential usefulness of the segment.

The intent in allowing the points for terms A, B_C, B_W, C, BC, and AES, which designate specific water uses, is obvious. The term POP is included to provide additional points when a segment has any of the above uses, since any usefulness is considered to be of somewhat greater value if a large population resides nearby. The constant term of 0.5 is included so the product of factors cannot be zero.

The second factor allocates a varying number of points based on whether the segment is designated as Effluent Limited or Water Quality Limited. The highest level of points is given to segments which have a large number of dischargers required to meet waste load allocations more stringent than secondary treatment or BPT to bring the segment into compliance with water quality standards. The scale of points for this factor gives an increasing amount of points in those areas where the greatest degree of point source pollution exists.

The total points for a segment are determined from a product of the points earned from each of the two factors. The formula was written in the form of a product so as to give low total points if either factor was low, and high points only if both factors are high. In this manner the formula weighs both the degree of usefulness of a segment and the severity of the pollution problem.

After the total points are determined for each segment in the basin, the segments are then ranked in decreasing order of points. The number one ranked segment is the segment receiving the most total points.

Following the segment ranking, abatement priority points are assigned to each segment. The abatement points are used as a factor in the municipal discharger ranking which is discussed later. The abatement priority points are determined as follows:

$$\text{ABATEMENT PRIORITY POINTS} = \left[\begin{array}{c}\text{Total number of segments}\\ \text{in the basin}\end{array}\right] + 1 - \left[\begin{array}{c}\text{Segment}\\ \text{Rank}\end{array}\right]$$

The selected stream segments for the Southern Iowa Basin are detailed in Chapter VI. Total segment points, segment rank, and abatement priority points are also presented in the chapter.

Municipal Discharger Ranking Methodology - In compliance with 40 CFR 130.43, a discharger ranking methodology has been promulgated for the Southern Iowa Basin Plan. Part 130 states that significant municipal dischargers shall be ranked to be subsequently used in establishing priorities and output estimates for municipal facilities construction. The ranking methodology is also in collaboration with current EPA Basin Plan Guidelines (Part IV, para. c) which states that significant municipal dischargers should be ranked in order of abatement priority.

The methodology ranks the municipal dischargers in order of significance to provide the following:

1. A means of indicating the relative magnitude of one discharger with respect to all other dischargers.
2. A means of accounting for the present effluent quality of the dischargers.
3. A means of indicating the relative magnitude of the discharger in comparison to the capacity of the stream segment at the point of discharge.
4. A means of indicating the relative magnitude of the discharger in comparison to the total waste load of all

other dischargers to the stream segment.

5. A means of comparison of the relative ranking of the stream segment, to which the municipality discharges, to other segments in the basin.

To incorporate these criteria in the ranking methodology, several factors were considered and evaluated. These are numbered to correspond to that of the preceding criteria:

1. Total pounds of BOD_5 and NH_3-N presently being discharged, using average reported flows.
2. Discharger's present BOD_5 and NH_3-N concentrations as reported through EQAP.
3. Discharger's present BOD_5 and NH_3-N waste load compared to the capacity of the stream segment.
4. Discharger's present BOD_5 and NH_3-N waste load compared to the total waste load to the stream segment from all dischargers.
5. Abatement priority points of the stream segment into which the municipality discharges.

Sufficient data is readily available to assess the degree of significance of a municipal discharger in terms of factors 1, 2, and 3. Likewise, the stream segment abatement priority points, as indicated in factor 5, have previously been determined. The selection and manipulation of data needed to comply with factor 4 is difficult. This is due to the non-coincidental cause and effect nature of certain discharged pollutant materials. A blending of factors 3 and 4 was deemed the most feasible alternative. This was accomplished by comparing the discharger's present BOD_5 and NH_3-N waste load to the respective values allowed for the discharger under its waste load allocation. This comparison was felt reasonable and justified since the calculations performed in determining waste load allocations take into account both stream capacities and the waste loads of other dischargers.

The methodology ranks a discharger with respect to its relative share of the waste load to the segment, as well as to the waste load the discharger contributes at its present degree of treatment. This rationale also takes into account population equivalency in lieu of the contributing population, the relative overloading of the stream segment as determined by waste load allocations analyses, and the relative ranking of the stream segments as determined by the segment ranking methodology.

The specific formula used to rank dischargers is as follows:

$$\text{DISCHARGER PRIORITY POINTS} = (A_1 + D_1) \times B_1 + (A_2 + D_2) \times B2 + C$$

The discharger ranking formula includes four elements which incorporate the criteria described above. These are as follows:

Element A: Present Effluent Discharge;

$$A_1 = \begin{bmatrix} 60 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 1 \end{bmatrix} \text{ if the present } BOD_5 = \begin{bmatrix} \text{60 or more} \\ 60\text{-}50.1 \\ 50\text{-}40.1 \\ 40\text{-}30.1 \\ 30\text{-}20.1 \\ 20\text{-}10.1 \\ 10\text{-}0 \end{bmatrix} \text{ mg/l}$$

$$A_2 = \begin{bmatrix} 60 \\ 50 \\ 40 \\ 30 \\ 20 \\ 10 \\ 1 \end{bmatrix} \text{ if the present } NH_3\text{-}N = \begin{bmatrix} \text{40 or more} \\ 40\text{-}30.1 \\ 30\text{-}23.1 \\ 23\text{-}15.1 \\ 15\text{-}\ 8.1 \\ 8\text{-}\ 2.1 \\ 2\text{-}\ 0 \end{bmatrix} \text{ mg/l}$$

This element uses present average EQAP BOD_5 and NH_3-N reported values as representative effluent values (where possible).

Element B: Degree of Stream Overloading;

1. BOD Overloading Factor:

$$1 - \frac{\text{lb. W.L.A.}}{\text{lb. Present}} = B_1$$

where: lb. W.L.A. is the total lbs./day of BOD_5 allowed, as determined by the waste load allocations.

lb. Present is the average lbs./day of BOD_5 which is currently being discharged.

2. NH_3-N Overloading Factor:

$$1 - \frac{\text{lbs. W.L.A.}}{\text{lbs. Present}} = B_2$$

where: lbs. W.L.A. is the total lbs./day of NH_3-N allowed as determined by the waste load allocations.

lbs. Present is the average lbs./day of NH_3-N which is currently being discharged.

Note: B_1 and B_2 are only allowed to vary from zero to 1.00 in this methodology. All other values are set equal to zero.

Element C: The segment abatement priority points are used for element C.

Element D: Total contributing lbs. of BOD_5 and NH_3-N:

$$D_1 = \begin{bmatrix} 0 \\ 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 12 \\ 14 \\ 16 \\ 18 \\ 21 \\ 25 \end{bmatrix} \text{ if the present } BOD_5 = \begin{bmatrix} 1.5 \text{ or less} \\ 1.5-\ 3 \\ 3-\ 5 \\ 5-\ 10 \\ 10-\ 20 \\ 20-\ 50 \\ 50-\ 100 \\ 100-\ 250 \\ 250-\ 750 \\ 750-1500 \\ 1500-2500 \\ 2500 \text{ or more} \end{bmatrix} \text{ lbs.}$$

$$D_2 = \begin{bmatrix} 0 \\ 1 \\ 3 \\ 5 \\ 7 \\ 9 \\ 12 \\ 14 \\ 16 \\ 18 \\ 21 \\ 25 \end{bmatrix} \text{ if the present } NH_3\text{-}N = \begin{bmatrix} .75 \text{ or less} \\ .75- \quad 1.5 \\ 1.5- \quad 2.5 \\ 2.5- \quad 5 \\ 5- \quad 10 \\ 10- \quad 25 \\ 25- \quad 50 \\ 50- \quad 125 \\ 125- \quad 375 \\ 375- \quad 750 \\ 750-1250 \\ 1250 \text{ or more} \end{bmatrix} \text{ lbs.}$$

This element takes into account the actual waste load which the stream receives, instead of a representation of the actual population.

The relative position of each discharger is determined by its total points as calculated by the discharger ranking formula. The dischargers are finally ranked in decreasing order of discharger priority points. The ranking of municipal dischargers in the Southern Iowa Basin, as well as the priority points for each discharger, are presented in Chapter VI of this plan.

REFERENCES

1. Supporting Document for Iowa Water Quality Management Plans, Iowa Department of Environmental Quality, Water Quality Management Division, Des Moines, Iowa, 1976.

CHAPTER II

EXISTING DEVELOPMENT PATTERNS

POLITICAL SUBDIVISIONS

The Southern Iowa Basin includes twenty-five counties or parts of counties. Table II-1 lists these counties and the approximate percentage of area of each county within the basin. One hundred thirty-two incorporated communities are included within the basin boundaries. The 1970 population of these incorporated municipalities was 115,064. Twenty-seven cities had populations greater than 1,000. Eight cities had populations in excess of 5,000. Creston and Atlantic are the largest cities in the basin with 1970 populations of 8,234 and 7,306, respectively. Figure II-1 shows the location of the incorporated municipalities in the basin and Table II-2 summarizes their 1970 populations.

POPULATION PROJECTION

DEQ has made 1990 population estimates for the cities in the basin, based on the projections of Taylor (1). For individual municipalities not estimated by Taylor, the 1990 population of the community has been estimated by multiplying its 1970 population by the ratio of the projected 1990 county population to the 1970 county population. The 1990 population projections used for this study are set out in Table II-2.

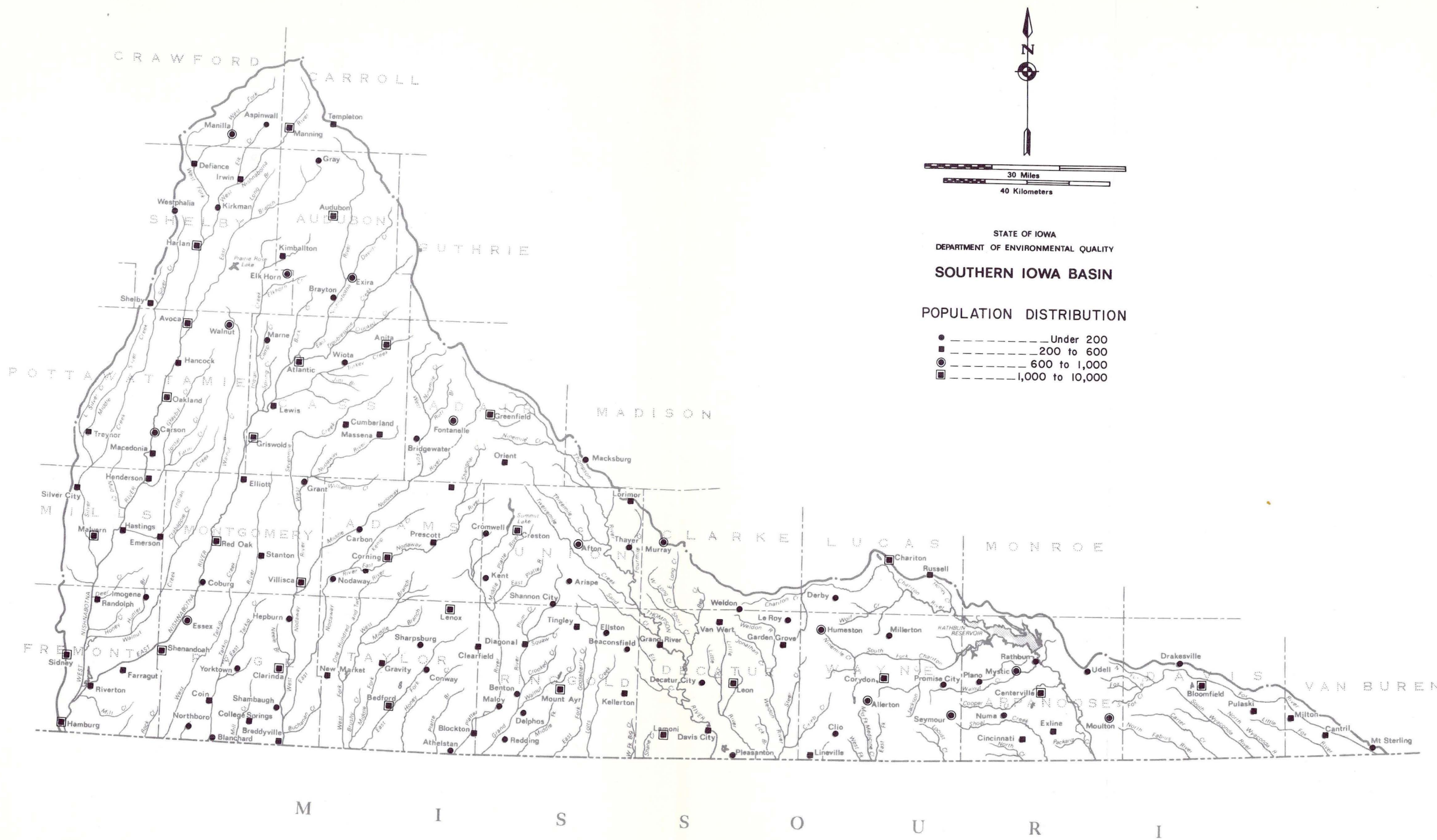
N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
POPULATION DISTRIBUTION
Under 200
200 to 600
600 to 1,000
1,000 to 10,000
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
MISSOURI
Manilla
Aspinwall
Manning
Templeton
Defiance
Irwin
Gray
Westphalia
Kirkman
Audubon
Harlan
Kimballton
Elk Horn
Exira
Brayton
Shelby
Avoca
Walnut
Marne
Anita
Wiota
Atlantic
Hancock
Oakland
Lewis
Cumberland
Massena
Greenfield
Fontanelle
Bridgewater
Carson
Treynor
Griswold
Macedonia
Orient
Macksburg
Henderson
Elliott
Grant
Silver City
Lorimor
Malvern
Hastings
Emerson
Red Oak
Stanton
Carbon
Prescott
Corning
Cromwell
Creston
Afton
Thayer
Murray
Chariton
Russell
Coburg
Villisca
Nodaway
Kent
Arispe
Shannon City
Imogene
Randolph
Essex
Hepburn
Lenox
Tingley
Ellston
Weldon
Derby
Le Roy
Van Wert
Garden Grove
Humeston
Millerton
RATHBUN RESERVOIR
Shenandoah
Sharpsburg
Diagonal
Beaconsfield
Grand River
Sidney
Farragut
Yorktown
Clarinda
New Market
Gravity
Clearfield
Conway
Rathbun
Mystic
Plano
Promise City
Corydon
Udell
Drakesville
Riverton
Benton
Maloy
Mount Ayr
Kellerton
Decatur City
Leon
Allerton
Centerville
Bloomfield
Pulaski
Coin
Shambaugh
College Springs
Bedford
Northboro
Blanchard
Braddyville
Hamburg
Blockton
Athelstan
Delphos
Redding
Lamoni
Davis City
Pleasanton
Clio
Lineville
Seymour
Numa
Exline
Cincinnati
Moulton
Milton
Cantril
Mt Sterling

FIGURE II-1

TABLE II-1

SOUTHERN IOWA BASIN

PORTION OF COUNTIES WITHIN SOUTHERN IOWA BASIN

County	Percent of Area
Adair	67.0
Adams	100.0
Appanoose	88.5
Audubon	95.9
Carroll	15.4
Cass	100.0
Clarke	31.8
Crawford	16.2
Davis	61.7
Decatur	100.0
Fremont	78.2
Guthrie	6.3
Lucas	34.1
Madison	5.3
Mills	62.1
Monroe	2.2
Montgomery	100.0
Page	100.0
Pottawattamie	56.3
Ringgold	100.0
Shelby	72.9
Taylor	100.0
Union	98.2
Van Buren	16.9
Wayne	100.0

TABLE II-2
SOUTHERN IOWA BASIN
EXISTING AND PROJECTED POPULATIONS

City	County	1970 Population	1990 Population
Afton	Union	823	823
Allerton	Wayne	643	643
Anita	Cass	1,101	1,200
Arispe	Union	93	93
Aspinwall	Crawford	81	81
Athelstan	Taylor	65	65
Atlantic	Cass	7,306	9,500
Audubon	Audubon	2,907	3,470
Avoca	Pottawattamie	1,535	1,900
Beaconsfield	Ringgold	48	48
Bedford	Taylor	1,733	2,100
Benton	Ringgold	46	46
Blanchard	Page	139	154
Blockton	Taylor	273	273
Bloomfield	Davis	2,718	3,600
Braddyville	Page	207	230
Brayton	Audubon	151	151
Bridgewater	Adair	188	188
Cantril	Van Buren	258	281
Carbon	Adams	135	135
Carson	Pottawattamie	756	1,299
Centerville	Appanoose	6,531	8,700
Chariton	Lucas	5,009	5,800
Cincinnati	Appanoose	570	663
Clarinda	Page	5,420	7,000
Clearfield	Taylor & Ringgold	430	430
Clio	Wayne	113	113
Coburg	Montgomery	36	60
Coin	Page	294	327
College Springs	Page	295	328

TABLE II-2 (Continued)

City	County	1970 Population	1990 Population
Conway	Taylor	91	91
Corning	Adams	2,095	2,300
Corydon	Wayne	1,745	2,300
Creston	Union	8,234	10,200
Cromwell	Union	168	168
Cumberland	Cass	385	400
Davis City	Decatur	301	301
Decatur City	Decatur	198	198
Defiance	Shelby	392	452
Delphos	Ringgold	35	35
Derby	Lucas	161	193
Diagonal	Ringgold	327	327
Drakesville	Davis	163	178
Elk Horn	Shelby	667	769
Elliott	Montgomery	423	710
Ellston	Ringgold	76	76
Emerson	Mills	484	617
Essex	Page	770	856
Exira	Audubon	966	966
Exline	Appanoose	224	260
Farragut	Fremont	521	633
Fontanelle	Adair	752	752
Garden Grove	Decatur	285	285
Grand River	Decatur	211	211
Grant	Montgomery	152	255
Gravity	Taylor	286	286
Gray	Audubon	145	145
Greenfield	Adair	2,212	2,700
Griswold	Cass	1,181	1,400
Hamburg	Fremont	1,649	2,400
Hancock	Pottawattamie	228	392
Harlan	Shelby	5,049	7,800
Hastings	Mills	229	292
Henderson	Mills	211	269

TABLE II-2 (Continued)

City	County	1970 Population	1990 Population
Hepburn	Page	38	42
Humeston	Wayne	673	673
Imogene	Fremont	192	233
Irwin	Shelby	446	514
Kellerton	Ringgold	299	299
Kent	Union	86	86
Kimballton	Audubon	343	343
Kirkman	Shelby	72	83
Lamoni	Decatur	2,540	3,400
Lenox	Taylor	1,215	1,700
Leon	Decatur	2,142	2,300
Le Roy	Decatur	43	43
Lewis	Cass	526	547
Lineville	Wayne	385	385
Lorimor	Union	346	346
Macedonia	Pottawattamie	330	567
Macksburg	Madison	142	189
Maloy	Ringgold	45	45
Malvern	Mills	1,158	1,600
Manilla	Crawford	943	943
Manning	Carroll	1,656	2,100
Marne	Cass	187	194
Massena	Cass	433	450
Millerton	Wayne	82	82
Milton	Van Buren	567	619
Moulton	Appanoose	763	887
Mount Ayr	Ringgold	1,762	2,600
Mt. Sterling	Van Buren	87	95
Murray	Clarke	620	758
Mystic	Appanoose	696	809
New Market	Taylor	501	501
Nodaway	Adams	176	176
Northboro	Page	115	128
Numa	Appanoose	165	192
Oakland	Pottawattamie	1,603	2,500

TABLE II-2 (Continued)

City	County	1970 Population	1990 Population
Orient	Adair	324	324
Plano	Appanoose	109	127
Pleasanton	Decatur	62	62
Prescott	Adams	305	305
Promise City	Wayne	148	148
Pulaski	Davis	255	278
Randolph	Fremont	214	260
Rathbun	Appanoose	113	131
Redding	Ringgold	111	111
Red Oak	Montgomery	6,210	6,800
Riverton	Fremont	331	402
Russell	Lucas	591	709
Seymour	Wayne	931	931
Shambaugh	Page	178	198
Shannon City	Union & Ringgold	100	100
Sharpsburg	Taylor	106	106
Shelby	Shelby & Pottawattamie	537	619
Shenandoah	Page & Fremont	5,968	7,600
Sidney	Fremont	1,061	1,500
Silver City	Mills	272	347
Stanton	Montgomery	574	964
Templeton	Carroll	312	368
Thayer	Union	100	100
Tingley	Ringgold	244	244
Treynor	Pottawattamie	472	811
Udell	Appanoose	71	83
Van Wert	Decatur	244	244
Villisca	Montgomery	1,402	1,800
Walnut	Pottawattamie	870	1,494
Weldon	Decatur	155	155
Westphalia	Shelby	121	139
Wiota	Cass	171	178
Yorktown	Page	105	117

ECONOMICS

Population, employment and income are three basic economic indicators that need to be considered in a water quality management plan. Future demands for water quality control measures will be related to the economic level and distribution of the population in the basin. Personal income level is an important factor in determining future water consumption and wastewater treatment needs. Employment in various industries, especially heavy water-using industries, and the productivity levels in these industries have a bearing on both the quality and quantity of water needed. Population, income and employment have an influence on the demand for food and fiber. Demands for water oriented recreational facilities are also related to population density as well as income levels.

There are no current economic studies that specifically relate to the Southern Iowa Basin. The 1972 Obers Projections of Economic Activity in the United States (2) by Water Resources Subareas includes economic data for the selected area shown on Figure II-2. The selected area is a combination of the Missouri-Nemaha-Nodaway and Grand-Chariton Water Resources Subareas. Population, employment and economic data for the Non-SMSA portion of the selected area are shown in Table II-3. The data are considered to be representative of economic activity in the Southern Iowa Basin.

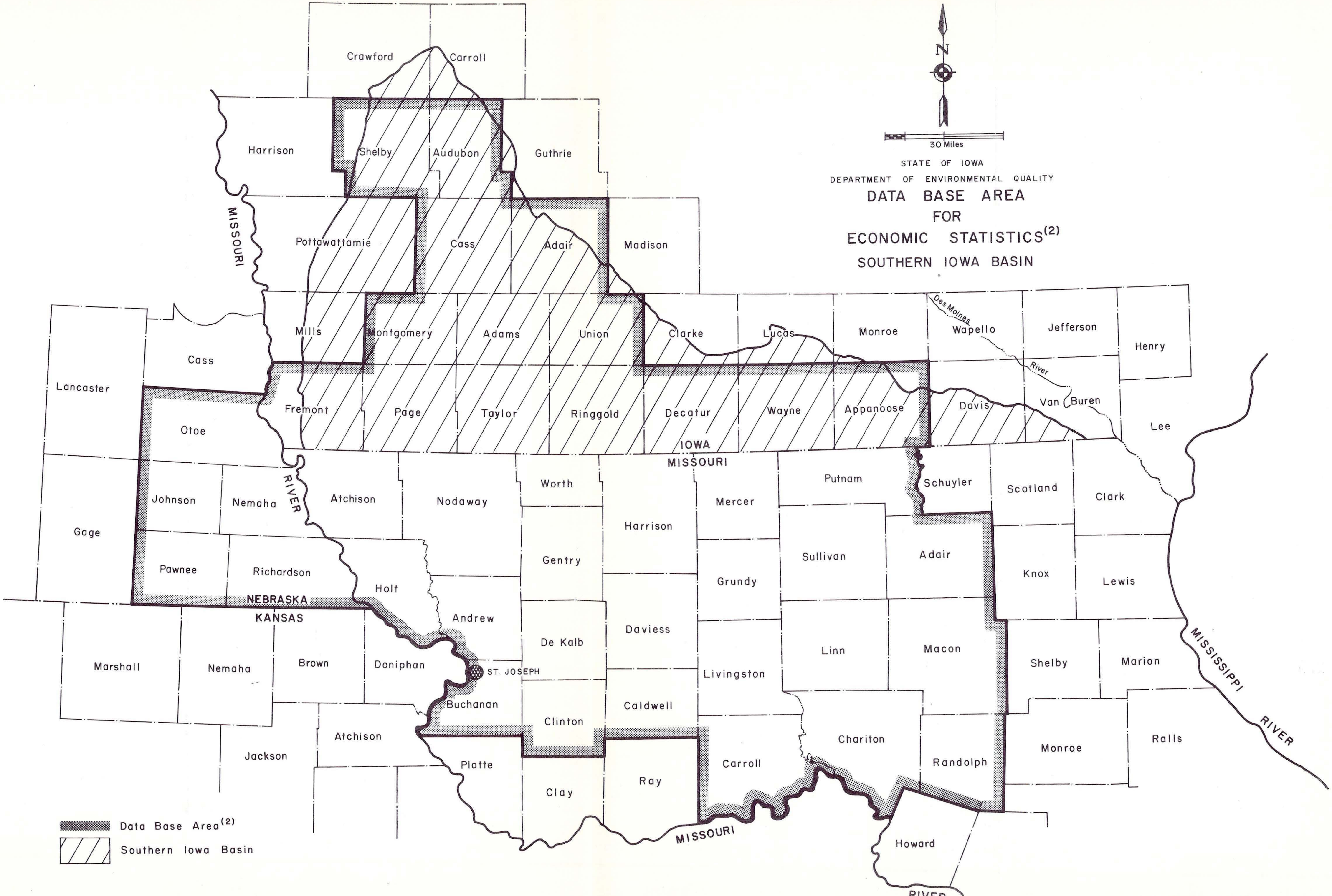
N
30 Miles
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
DATA BASE AREA
FOR
ECONOMIC STATISTICS(2)
SOUTHERN IOWA BASIN
Crawford
Carroll
Harrison
Shelby
Audubon
Guthrie
Pottawattamie
Cass
Adair
Madison
Mills
Montgomery
Adams
Union
Clarke
Lucas
Monroe
Wapello
Jefferson
Henry
Des Moines River
Fremont
Page
Taylor
Ringgold
Decatur
Wayne
Appanoose
Davis
Van Buren
Lee
IOWA
MISSOURI
MISSOURI RIVER
Lancaster
Cass
Otoe
Johnson
Nemaha
Gage
Pawnee
Richardson
NEBRASKA
KANSAS
Atchison
Nodaway
Worth
Harrison
Mercer
Putnam
Schuyler
Scotland
Clark
Holt
Gentry
Grundy
Sullivan
Adair
Knox
Lewis
Andrew
De Kalb
Daviess
Linn
Macon
Shelby
Marion
Marshall
Nemaha
Brown
Doniphan
ST. JOSEPH
Buchanan
Livingston
Clinton
Caldwell
Chariton
Randolph
Monroe
Ralls
Jackson
Atchison
Platte
Carroll
Clay
Ray
Howard
MISSOURI
RIVER
MISSISSIPPI RIVER
Data Base Area(2)
Southern Iowa Basin

FIGURE II-2

TABLE II-3
SOUTHERN IOWA BASIN
ECONOMIC DATA FOR SELECTED AREA SHOWN ON FIGURE II-2* (2)

	1950	1970	1980	2000	2020
Population, midyear	617,604	513,523	483,000	450,200	435,800
Per capita income	$1,669	$2,821	$3,900	$7,000	$11,750
Per capital income relative (U.S. = 1.00)	0.81	0.81	0.84	0.87	0.89
Total Employment	227,428	195,948	203,800	199,200	190,000
Employment/population ratio	0.37	0.38	0.42	0.44	0.44
Total personal income**	$1,030,793	$1,448,609	$1,922,000	$3,186,400	$5,136,500
Total earnings**	853,938	1,026,163	1,331,500	2,203,900	3,587,400
Agriculture, forestry and fisheries	451,420	346,274	363,300	441,200	563,700
Mining			10,800	16,100	23,500
Contract construction	24,594	48,076	60,100	97,100	148,700
Manufacturing	37,413	104,979	158,900	289,800	488,700
Food and kindred products			51,500	73,600	104,900
Apparel and other fabric products			9,500	14,100	20,300
Lumber products and furniture			5,300	8,700	13,300
Printing and publishing			11,400	18,600	28,800
Chemicals and allied products			3,000	7,500	15,900
Fabricated metals and ordnance			7,600	16,900	31,600
Machinery, excluding electrical			9,700	21,200	38,600
Electrical machinery and supplies			7,700	15,600	24,300
Transportation equipment, excluding motor vehicles			2,600	3,700	4,800
Other manufacturing			27,300	62,700	120,200
Transportation, communications and public utilities**	65,405	59,854	75,000	119,100	191,000
Wholesale and retail trade**	130,186	164,247	248,800	411,600	652,800
Finance, insurance and real estate**	11,899	24,574	39,600	77,300	135,300
Services**	60,099	114,320	169,400	337,300	625,800
Government**	60,126	141,161	204,900	413,700	757,100

*Excludes St. Joseph, Missouri SMSA.
**In 1,000's of dollars.

All figures adjusted to 1967 dollars.

Population in the basin is expected to decrease by about 15 percent between 1970 and 2020. Total employment is also forecast to decrease by about 3 percent between 1970 and 2020. However, as the higher wage industries expand, total personal income is projected to increase. Per capita income for the area is expected to approximate 90 percent of the national average by the year 2020.

Historically, agriculture has been the largest employer in the area. Total earnings from agriculture exceed all other industrial groups, although these earnings have shown a general decline since 1950. Following national and state trends, agricultural employment is expected to decline in the future, while employment in the other basic industries increases. Agricultural earnings are forecast to increase in the future, but not at the rate projected for manufacturing, wholesale and retail trade, services and government. Agriculture will continue to be a dominant factor in the economy of the basin.

RECREATIONAL ACTIVITIES

The Southern Iowa Basin provides numerous areas for water-related recreational activities. The following general types of areas are suitable for recreational sites:

1. Hilly land with tree cover for nature observation, hiking, and camping.

2. Lakes and streams for swimming, boating, waterskiing, and fishing.

3. Flood plains and plateaus for organized sports activities.

4. Combinations of the above for game habitats and wildlife preserves.

A common element in all the available county and city recreation plans reviewed for this study is the concept of retaining land along the rivers and streams for conservation purposes. These areas are recommended to be left in a natural state for recreational uses.

Water must be of sufficient quality to support the propagation of desirable forms of fish and wildlife. Iowa Class B warm water standards are adequate to satisfy this requirement. The surface water classification of streams in the basin is discussed in Chapter IV. In areas where human body contact with the water is permitted, Class A standards are required for public health reasons. Maintenance of either Class A or Class B standards is required to retain an aesthetically acceptable water condition.

Figure II-3 shows the location of areas designated for boating activities in the Southern Iowa Basin. In areas allowing power boat motors in excess of 10 horsepower, it is assumed that

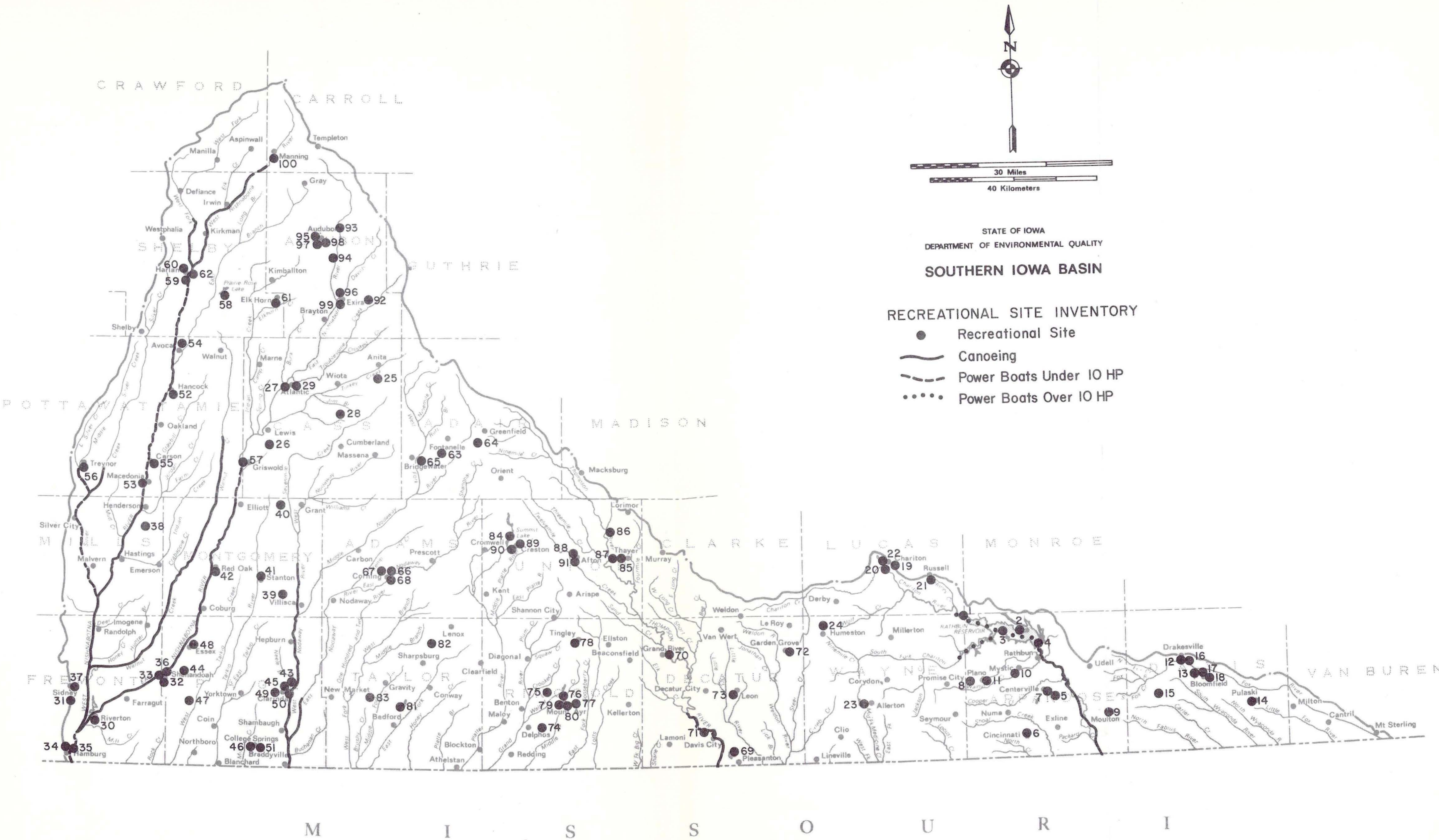
N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
RECREATIONAL SITE INVENTORY
Recreational Site
Canoeing
Power Boats Under 10 HP
Power Boats Over 10 HP
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
M I S S O U R I
Manning
Templeton
Aspinwall
Manilla
Gray
Defiance
Irwin
Kirkman
Westphalia
Audubon
Harlan
Kimballton
Elk Horn
Brayton
Exira
Shelby
Avoca
Walnut
Marne
Anita
Wiota
Atlantic
Hancock
Oakland
Lewis
Cumberland
Massena
Greenfield
Fontanelle
Bridgewater
Orient
Macksburg
Treynor
Carson
Macedonia
Griswold
Henderson
Elliott
Grant
Silver City
Malvern
Hastings
Emerson
Red Oak
Stanton
Villisca
Carbon
Corning
Prescott
Cromwell
Creston
Afton
Thayer
Murray
Lorimor
Chariton
Russell
Derby
Nodaway
Kent
Shannon City
Arispe
Coburg
Imogene
Randolph
Essex
Shenandoah
Hepburn
Lenox
Sharpsburg
Tingley
Ellston
Beaconsfield
Diagonal
Grand River
Weldon
Van Wert
Le Roy
Garden Grove
Humeston
Millerton
Rathbun Reservoir
Rathbun
Udell
Drakesville
Bloomfield
Pulaski
Milton
Cantril
Mt Sterling
Sidney
Farragut
Yorktown
Clarinda
New Market
Gravity
Clearfield
Conway
Bedford
Benton
Maloy
Mount Ayr
Kellerton
Decatur City
Leon
Corydon
Allerton
Promise City
Plano
Mystic
Centerville
Numa
Exline
Seymour
Cincinnati
Moulton
Riverton
Coin
Shambaugh
Northboro
College Springs
Braddyville
Blanchard
Hamburg
Blockton
Athelstan
Delphos
Redding
Lamoni
Davis City
Pleasanton
Clio
Lineville

FIGURE II-3

waterskiing and swimming will occur and that Class A standards will apply even though they may not now be in effect. Total or partial body contact with water will probably occur in areas not specifically designated. For example, body contact will generally occur in the canoeing regions. However, only those areas designated as body contact areas need to meet Class A standards.

Figure II-3 also shows the location of existing and proposed recreational sites in the basin. Table II-4 lists data relative to each site. Average peak daily attendance at parks was assumed to be 3 percent of the total yearly attendance. Total yearly attendance figures were obtained from State and county park records, where available. All wildlife areas were assumed to have less than 500 persons per peak day.

High user densities at specific recreation sites along the major rivers of the basin and at certain lakes such as Rathbun, can impart a high pollution load to ground and surface waters unless wastes are satisfactorily handled. Although many of the lakes are lightly developed now, future development will increase the pollution potential. Proper planning of recreational and wastewater handling facilities will control the adverse impact upon water quality.

The Rathbun Reservoir, which is the major recreational facility in the basin, is discussed in greater detail in later chapters of this report.

TABLE II-4

SOUTHERN IOWA BASIN

EXISTING AND PROPOSED RECREATION FACILITIES

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
1	Rathbun Wildlife Area	Federal	1	14,663	9,063	5,600		x	x		x			x		
2	Honey Creek State Park	Federal	4	796	796			x	x	x	x		x		x	x
3	Rathbun Reservoir (7 Sites)	Federal		2,800	2,800			x	x	x	x		x		x	x
4	Rathbun Reservoir (Excluding Nos. 1, 2 & 3)	Federal	6	16,631	11,231	5,400		x			x			x		
5	Sharon Bluffs	State		144	114	30					x		x		x	
6	Cincinnati Recreational Area	County		4	4					x					x	
7	Lelah Bradley Park	County		41	41			x	x	x	x				x	
8	Little Flock Chapel	County		1	1										x	
9	Moulton Recreational Area	County		1	1										x	
10	Mystic Reservoir	County		16	16			x			x				x	
11	Plano Recreational Area	County		2	2					x					x	
12	Drakesville Park	County		12	12					x	x					
13	Lake Fisher Park	County		85	85									x		
14	Pulaski Park	County		2	2					x						
15	West Grove County Park	County		3	3					x						
16	Boy Scout Camp	Private														
17	Iowa-Missouri Christian Service Camp	Private														
18	Izaak Walton League	Private														
19	Red Haw State Park	State	4	420	348	72		x	x	x	x		x		x	x
20	Freedom Bible Camp	Private														
21	Russell Sportsmen Club	Private														
22	Chariton Archery Club	Private					x									
23	Bob White State Park	State	3	381	266	115		x	x	x	x					
24	Humeston Reservoir	County		33	33											

TABLE II-4 (Continued)

EXISTING AND PROPOSED RECREATION FACILITIES

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES: TOTAL AREA	ACRES: LAND AREA	ACRES: WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
25	Lake Anita	State	4	942	772	170		x	x	x	x		x		x	x
26	Cold Springs	State		104	88	16		x	x	x	x		x		x	x
27	Indian Creek Wildlife Area	County	1	10	10									x		
28	Cass County Conservation Club	Private														
29	Circle T Campground	Private		12	12					x						
30	Riverton Wildlife Area	State	1	1,738	1,097	641								x		
31	Fremont County Recreational Area	County		80	80							x			x	
32	Manti Memorial Park	County		12	12						x	x			x	
33	Shenandoah Boat Club	Private							x							
34	Hamburg Boat and Gun Club	Private														
35	Hamburg Landing	Private														
36	Taylor Slough Wildlife Area	Private	1											x		
37	American Legion Park	Private														
38	Willow Slough Wildlife Area	State	1	599	449	150		x	x		x			x		
39	Viking Lake	State	4	954	806	148		x	x	x	x		x		x	x
40	Pilot Grove Park	County		40	36	4				x					x	
41	Methodist Church Camp	Private														
42	American Legion Park	Private														
43	Nodaway Valley Park	County		72	72					x					x	
44	Pioneer Park	County		22	18	4				x	x				x	
45	American Vets	Private		3	3		x									
46	Crystal Lake	Private		60	50	10		x	x	x	x		x		x	x
47	Izaak Walton League	Private					x									
48	Porters Lake	Private		4		4					x					
49	Robinson's Pond	Private		2		2					x					
50	Schneck's Lake	Private		36		36		x	x		x					

TABLE II-4 (Continued)

EXISTING AND PROPOSED RECREATION FACILITIES

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES: TOTAL AREA	ACRES: LAND AREA	ACRES: WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
51	College Springs Recreational Area	Private														
52	Botna Bend Park	County		119	114	5				x	x				x	
53	Old Towne Park	County		8	7	1				x	x				x	
54	Parkway Trailer Park	Private		4	4					x						
55	Carson KOA	Private		10	10					x						
56	Treynor Recreational Area	Private														
57	Boy Scout Camp	Private														
58	Prairie Rose Lake	State	4	661	443	218		x	x	x	x				x	
59	Little George Park	State		6	4	2				x	x				x	
60	Harlan Boy Scouts	Private														
61	Boy Scouts of America	Private														
62	Meadow Lake	State		320	273	47		x	x		x			x		
63	Adair Wildlife Area	State	1	352	352									x		
64	Greenfield Reservation	County		98		98										
65	Mormon Trail Park	County		160	125	35		x	x	x	x				x	
66	Walters Creek	State		1,389	1,389									x		
67	Adams County Wildlife Club	Private		3	3		x									
68	Archery Range and Club	Private					x									
69	Nine Eagles State Park	State	3	1,081	1,025	56		x	x	x	x				x	x
70	Shewmaker Park	County		2	2					x					x	
71	Slip Bluff Park	County		188	188											
72	Trailside Historical Park	County		3	3											
73	Lake - Carl Neusbaum	Private														
74	Mt. Ayr Fish Hatchery	State		22	15	7					x					
75	Mt. Ayr Game Area	State		1,158	1,088	70				x				x		
76	Fife's Grove Park	County		29	29										x	
77	Poe Hollow Park	County		72	72											

TABLE II-4 (Continued)

EXISTING AND PROPOSED RECREATION FACILITIES

NO.	NAME OF AREA	OWNERSHIP	USAGE *	ACRES TOTAL AREA	ACRES LAND AREA	ACRES WATER AREA	ARCHERY/GUN CLUB	BOATING	BOATING ACCESS	CAMPING	FISHING	GOLF COURSE	HIKING TRAILS	HUNTING	PICNICKING	SWIMMING
78	Lions Club Park	Private														
79	Ringgold County Sportsmans Club	Private														
80	Lions Club	Private														
81	Lake of Three Fires	State	5	655	524	131		x	x	x	x		x		x	x
82	Wilson Park	County		54	37	17		x	x		x				x	
83	Windmill Lake	County		61	43	18		x	x		x				x	
84	Green Valley Recreational Area	State	3	990	600	390		x	x	x	x				x	x
85	Thayer Pond	State		47	36	11		x	x		x			x		
86	Mt. Pisgah Park	County		8	8										x	x
87	Talmadge Hill Park	County		18	18											
88	Breezy Ridge	Private		120	120					x						
89	Creston Boating Club	Private														
90	Izaak Walton League	Private														
91	Union County Archery Range	Private					x									
92	Littlefield Timber	County		60	60					x			x		x	
93	Nabotna Pond	County		11	9	2					x				x	
94	Audubon County Wildlife Area	County	1	1	1											
95	Legion Park	Private														
96	Legion Park	Private														
97	Audubon County Conservation Club	Private														
98	Carlson's Farm Pond	Private														
99	Audubon County Recreational Center	Private														
100	Nishnabotna Conservation Club	Private														

*Approximate Probable Usage

Visitors Per Average Peak Day	Usage Class
0 - 500	1
501 - 1,000	2
1,001 - 5,000	3
5,001 - 10,000	4
10,001 - 15,000	5
Over - 15,000	6

REFERENCES

1. J. R. Taylor, Provisional Projections of the Population of Iowa Counties and Cities: 1975 to 1990, Iowa State Department of Health, June, 1972.

2. 1972 Obers Projections of Economic Activity in the United States, U.S. Water Resources Council, Washington, D.C.; April, 1974.

3. Outdoor Recreation in Iowa, vol. V(b), Iowa Outdoor Recreation Guide, prepared by Planning and Coordination Section, Iowa Conservation Commission, July, 1972.

CHAPTER III

BASIN CHARACTERISTICS

Iowa is located in the Missouri and Upper Mississippi River drainage basins, bounded on the east by the Mississippi River and on the west by the Missouri and Big Sioux Rivers. In general, the surface shows slight relief with the highest elevation (1,669 feet) in the northwest corner of the State and the lowest elevation (480 feet) in the southeast corner.

The entire State is drained by either the Mississippi River or its tributary, the Missouri River. Streams flowing to the Mississippi River flow in a general course from northwest to southeast. The major drainage basins are long and narrow and have fairly regular outlines with the lateral boundaries tending to be parallel. The streams which flow into the Missouri River generally flow from the northeast to the southwest in the western part of the State, and from the northwest to the south-southeast in much of the Southern Iowa Basin. These stream basins are relatively long and narrow.

The Southern Iowa Basin includes the Iowa portions of the Nishnabotna, Tarkio, Nodaway, Platte, Grand, Chariton, Fabius, Wyaconda and Fox Rivers. The basin is bordered on the north and east by the Des Moines River Basin, on the north and west by the

Western Iowa Basin, and on the south by the Iowa-Missouri state line. (Figure III-1).

The basin includes approximately 8,217 square miles, including all or parts of 25 western and southern Iowa counties. This is about 14.6 percent of the total area of the State. All of the nine stream basins discharge to the State of Missouri and drain the northern portion of that state. The Fox, Wyaconda and Fabius Rivers are eventually tributary to the Mississippi River; the other streams discharge to the Missouri River.

The drainage areas of the individual stream basins are as follows:

Stream Basin	Area in Square Miles: Iowa-Missouri State Line	Area in Square Miles: Mouth
Nishnabotna River	2,819	2,892
Tarkio River	206	721
Nodaway River	1,182	1,780
Platte River	282	2,440
Grand River	206	7,900
Thompson River	729	
Chariton River	817	3,040
Fabius River	49	940
Wyaconda River	53	462
Fox River	188	502

The elevation of the land surface is generally higher in the western portion of the basin with the headwaters of the West Nishnabotna River at an elevation of about 1,450 feet compared with the Fox River elevation of about 900 feet.

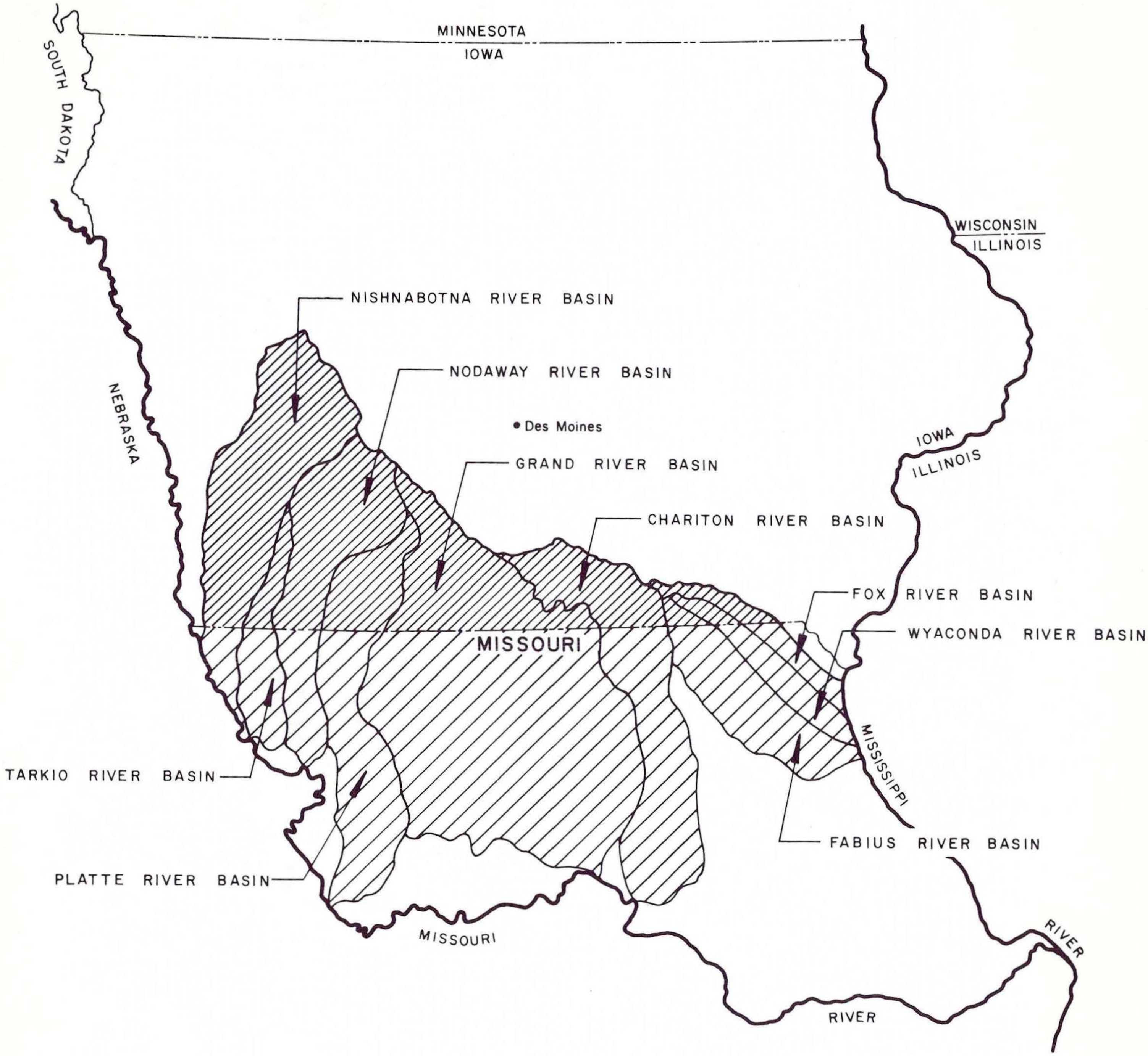
MINNESOTA
IOWA
SOUTH DAKOTA
WISCONSIN
ILLINOIS
NISHNABOTNA RIVER BASIN
NODAWAY RIVER BASIN
NEBRASKA
Des Moines
IOWA
ILLINOIS
GRAND RIVER BASIN
CHARITON RIVER BASIN
FOX RIVER BASIN
WYACONDA RIVER BASIN
MISSOURI
MISSISSIPPI
TARKIO RIVER BASIN
FABIUS RIVER BASIN
PLATTE RIVER BASIN
MISSOURI
RIVER
RIVER

FIGURE III-1

Within the major stream basins, listed above, there are a number of tributary rivers and sub-drainage basins. Table III-1 lists the drainage areas at the Iowa-Missouri State line of the major rivers and their tributary streams within the Southern Iowa Basin.

TABLE III-1
DRAINAGE AREAS OF STREAMS IN THE
SOUTHERN IOWA BASIN*

Stream	Area (Square Miles)**
Nishnabotna River Basin	
West Nishnabotna River (at mouth)	1,649.0
East Nishnabotna River (at mouth)	1,148.0
Nishnabotna River	2,819.0
Tarkio River Basin	
West Tarkio Creek	92.5
Middle Tarkio Creek	10.6
Tarkio River	206.0
Nodaway River Basin	
Mill Creek	24.7
East Mill Creek	16.4
Nodaway River	1,182.0
Platte River Basin	
West Fork One Hundred and Two River	212.0
Middle Fork One Hundred and Two River	62.1
East Fork One Hundred and Two River	111.0
Honey Creek	52.9
Platte Branch	49.9
Platte River	282.0
Grand River Basin	
Grand River	206.0
Middle Fork Grand River	42.1
Fletchall Creek	8.4
East Fork Grand River	97.7
Lotts Creek	63.4

TABLE III-1 (Continued)

Stream	Area (Square Miles)**
Grand River Basin (Continued)	
Wolf Creek	16.6
West Fork Big Creek	31.8
Shain Creek	11.4
Zadie Creek	3.6
East Fork Big Creek	13.4
Indian Creek	5.3
Thompson River	729.0
Little River	102.0
Weldon River	240.0
East Muddy Creek	6.7
West Fork Medicine Creek	17.8
Middle Fork Medicine Creek	13.3
Big Fork Medicine Creek	32.3
East Fork Medicine Creek	11.2
West Locust Creek	5.9
Locust Creek	33.2
Chariton River Basin	
South Shoal Creek	22.4
Shoal Creek	71.5
Chariton River	817.0
Fabius River Basin	
North Fabius River	49.1
North Fork North Fabius River	38.2
Hickory Branch	7.5
Wyaconda River Basin	
South Wyaconda River	53.1
North Wyaconda River	25.0
Fox River Basin	
Little Fox River	36.3
Fox River	188.0

*Drainage Areas of Iowa Streams; Bulletin No. 7, Iowa Highway Research Board; March, 1974.

**Area at Iowa-Missouri State Line, except as noted.

LAKES AND IMPOUNDMENTS

There is one major man made impoundment in the Southern Iowa Basin. The Rathbun Dam and Reservoir is located on the Chariton River, southeast of the City of Chariton. The dam site and most of the reservoir surface area are located in Appanoose County. The reservoir extends upstream into Lucas, Monroe and Wayne Counties. Constructed as a major flood control project, the reservoir has a storage capacity of 552,000 acre-feet and regulates flow from an upstream drainage area of 549 square miles.

The reservoir provides a conservation pool of 11,000 acres of surface area and is the largest man made impoundment in Iowa. At the conservation pool level there are approximately 180 miles of shoreline. Rathbun Reservoir provides flood control benefits to 149,300 acres downstream from the dam in the Chariton River Basin in Iowa and Missouri. Additional benefits include stream flow regulation and recreation.

There are approximately 50 smaller lakes, or impoundments, varying in size from about 1 to 400 acres of surface area, also located in the Southern Iowa Basin. Of these, 21 are designated as Class A, 45 as Class B, and 18 as Class C surface waters (see Chapter IV on water quality classifications). Data relating to these lakes are set out in Table III-2.

TABLE III-2

SOUTHERN IOWA BASIN

LAKES AND IMPOUNDMENTS

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water**	Surface Water Classification		
						A	B	C
Mormon Trail	Adair	35	33-74-3	CCB	OSI	x	x	
Nodaway Lake	Adair	25	32-75-14	City	OSI	x	x	x
Binder Lake	Adams	60	34-72-25	City	OSI	x	x	x
West Lake	Adams						x	x
Corning Reservoir	Adams	13	34-72-36	City	OSI			
Upper Centerville Reservoir	Appanoose	200	18-68-11	City	OSI	x	x	x
Lower Centerville Reservoir	Appanoose	20	18-68-12	City	OSI	x	x	x
Mystic Reservoir	Appanoose	7	18-69-8	City	OSI	x	x	x
Rathbun Reservoir	Appanoose	11,000	18-70-26	Federal	OnSI (Chariton River)	x	x	
Carlson Pond	Audubon	17	34-79-34	Private	FP			
Nabotna Pond	Audubon	2	35-80-11	CCB	OSI		x	
Lake Anita	Cass	187	34-77-32	State	OSI	x	x	
Cold Springs	Cass	16	37-75-15	CCB	OSI	x	x	

TABLE III-2 (Continued)

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water**	Surface Water Classification A	B	C
Griswold Park	Cass	8	37-75-32	City	OSI		x	
Drakesville Ponds	Davis	4	14-69-4	City	OSI		x	
Nine Eagles	Decatur	80	25-67-18	State	OSI	x	x	
Slip Bluff	Decatur	25	26-68-28	CCB	OSI		x	
Browns Slough	Lucas	200	20-71-35	State	OSI		x	
North Colyn	Lucas	200	20-71-30	State	OSI		x	
South Colyn	Lucas	98	20-71-30	State	OSI		x	
Malvern Pond	Mills	10	41-72-29	City	OSI		x	
Willow Slough	Mills	150	40-73-28	State	OSI		x	
Ossian Pond	Montgomery	2.5	37-71-8	Private	OSI			
Viking Lake	Montgomery	150	36-71-6	State	OSI	x	x	
I.W.L.A. Pond	Page	1	39-69-26	Private	OSI			
Pioneer Park	Page	7	38-69-28	CCB	OSI		x	
Minser Pond	Pottawattamie	5	40-74-3	CCB	OSI		x	
Game Area Ponds	Ringgold	5	30-68-17	State	OSI		x	

TABLE III-2 (Continued)

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water**	Surface Water Classification A	B	C
Lions Club Ponds	Ringgold	1.5	29-69-31	CCB	OSI		x	
Old Reservoir	Ringgold	12	29-69-31	City	OSI		x	
Lock Ayr	Ringgold	95	29-69-30	City	OSI	x	x	
North Lake	Ringgold						x	x
Walnut Creek Marsh	Ringgold	60	30-68-17	State	OSI		x	
Little George	Shelby	2	38-79-19	State	OSI		x	
Prairie Rose	Shelby	218	38-79-36	State	OSI	x	x	
Bedford Impoundment	Taylor						x	x
East Lake (Lenox)	Taylor	18	32-70-5	City	OSI	x	x	x
Lake of Three Fires	Taylor	125	34-68-12	State	OSI	x	x	
Stroburg & Hill	Taylor	18	32-67-15	Private	OSI			
Stroburg Pond	Taylor	10.5	32-67-8	Private	OSI			
West Lake (Lenox)	Taylor	10	32-70-5	Private	OSI			
Wilson Park	Taylor	15	32-70-28	CCB	OSI		x	
Windmill Lake	Taylor	25	35-69-36	CCB	OSI		x	

TABLE III-2 (Continued)

Lake or Impoundment	County	Surface Acres	Location*	Ownership	Type of Water**	Surface Water Classification A	B	C
Afton City Reservoir	Union	18	29-72-17	City	OSI	x	x	x
Green Valley	Union	400	31-73-26	State	OSI	x	x	x
McKinley Lake	Union	50	31-72-11	City	OSI	x	x	x
Summit Lake	Union						x	x
Thayer Lake	Union	11	28-72-22	State	OSI		x	
Bob White Lake	Wayne	115	22-68-4	State	OSI	x	x	x
Corydon Reservoir	Wayne	50	22-69-24	City	OSI	x	x	x
Humeston Reservoir	Wayne	14	23-70-9	City	OSI	x	x	x
Lineville Reservoir	Wayne						x	x
Seymour Reservoir	Wayne	30	20-68-23	City	OSI	x	x	x

*Range-Township-Section

**Type of Water: FP - Farm Pond
OnSI - On Stream Impoundment
OSI - Off Stream Impoundment

CCB - County Conservation Board

PHYSIOGRAPHIC FEATURES (1)

The physiographic features of the basin developed during a long geologic interval in which the area was submerged beneath shallow seas most of the time. During that interval, large amounts of sediment were deposited and then consolidated into the sedimentary rocks which underlie the area. The most recent interval of submergence occurred in the Cretaceous Period and sediment deposited during that time now forms the youngest consolidated rocks of the area. Near the end of the Cretaceous Period, the land emerged from the sea, and the surface was subjected to the forces of weathering and erosion for millions of years. A mature erosional topography developed and the Cretaceous rocks were removed from all but the western part of the basin, exposing older rock of the Pennsylvanian System.

The first continental glacier of which there is evidence moved into southern Iowa over this mature erosional topography which probably had a local relief of 200 to 300 feet. This glacier, the Nebraskan, altered the bedrock surface by smoothing off part of the uplands and filling the valleys with debris. This debris remained and formed a nearly level drift plain when the ice melted. The material deposited in these major preglacial valleys varies from fine silt and clay to very coarse gravel and boulders.

The Nebraskan glacial stage was followed by a long ice-free interglacial stage called the Aftonian. During this stage, chemical decomposition of the glacial till resulted in the formation of deep gumbotil which averages 8 to 9 feet in thickness on the flat uplands.

The final continental glacier to invade this part of the State was the Kansan. When this glacier advanced and then receded, the area was again covered with a relatively level drift plain which was probably similar in topography to the young Wisconsin drift plain found in north central Iowa. The area was not covered with ice again and during post-Kansas time a deep gumbotil developed on the upland surface. The plain has been maturely dissected until only remnants of the original surface remain.

Although no evidence of subsequent glaciation occurs in the basin, a thick layer of wind-blown silt, called loess, was deposited over most of southern Iowa and adjacent areas after the Kansan glacier. Although other deposits of loess occur, the most extensive deposition was probably during the same geologic era as the Wisconsin ice sheets further north. In southwest Iowa, most of the loess probably had its origin in the flood plain of the Missouri River. To the east, the loess may have been derived, in part, from the margin of the Wisconsin drift and from local bottomlands.

Recent accelerated erosion is evident along many of the drainageways, particularly in the western part of the basin where gullies have developed in the floors of many of the valleys.

The present topography of the basin is dissected with a large part of the land in sloping, broad stream valleys, and well-developed flood plains. In general, the topography becomes progressively more mature from east to west. In the east, the old Kansan drift plain is preserved in numerous flat-topped divides, some of which are from one to two miles in width. Natural drainage is often poor on these flat ridges and artificial drainage may be required for agriculture in limited areas. The most extensive flat uplands occur in the vicinity of Humeston, Allerton, and Seymour in Wayne County. Eastward, in Appanoose and Davis Counties, the divisions are narrower but the streams are not entrenched as deeply as they are west of Wayne County. Westward from Wayne County, these divides become narrower and have been termed "shoe string divides". In Decatur, Ringgold, Taylor and Page Counties, most divides are rounded and tend to be parallel to the regional drainage in a northeast-southwest direction giving rise in the west to a "washboard" topography. A few rather extensive flat uplands are found near Lamoni and Weldon in Decatur County; along the divide between the Chariton and Des Moines drainage basins in Clarke County; near Tingley in Ringgold County; and in the vicinity of Lenox and Clearfield in Taylor County.

The soils of the Southern Iowa Basin result from a combination of factors including parent materials, topography, vegetation and climate. The soils have been grouped into association areas which indicate the usual arrangement of soil types and topography giving rise to a characteristic landscape within an individual area. A soil association, therefore, indicates a repeating pattern of soil types most commonly found in a given area. Six major soil associations are found in the Southern Iowa Basin. These are shown on Figure III-2. Detailed information for each soil type can be found in "Principal Soils of Iowa" (6).

The soil associations in the basin relate directly or indirectly to the loessial deposits of the Kansan drift. Erosion has exposed the underlying drift material in some areas. On the broad ridges the loessial soil cover ranges from more than 200 inches in the west to 75-100 inches in the east. The loess cap is thickest on the ridges and thins uniformly east and west of the divides. Loess also becomes finer textured and less permeable from west to east. The loessial soil of the various associations, with the major exception of Lindley-Keswick-Weller, were formed under a cover of prairie grass and, in general, are more fertile than those developed under forest cover. Severe erosion problems occur

MAJOR SOIL ASSOCIATIONS (6)

IN THE

SOUTHERN IOWA BASIN

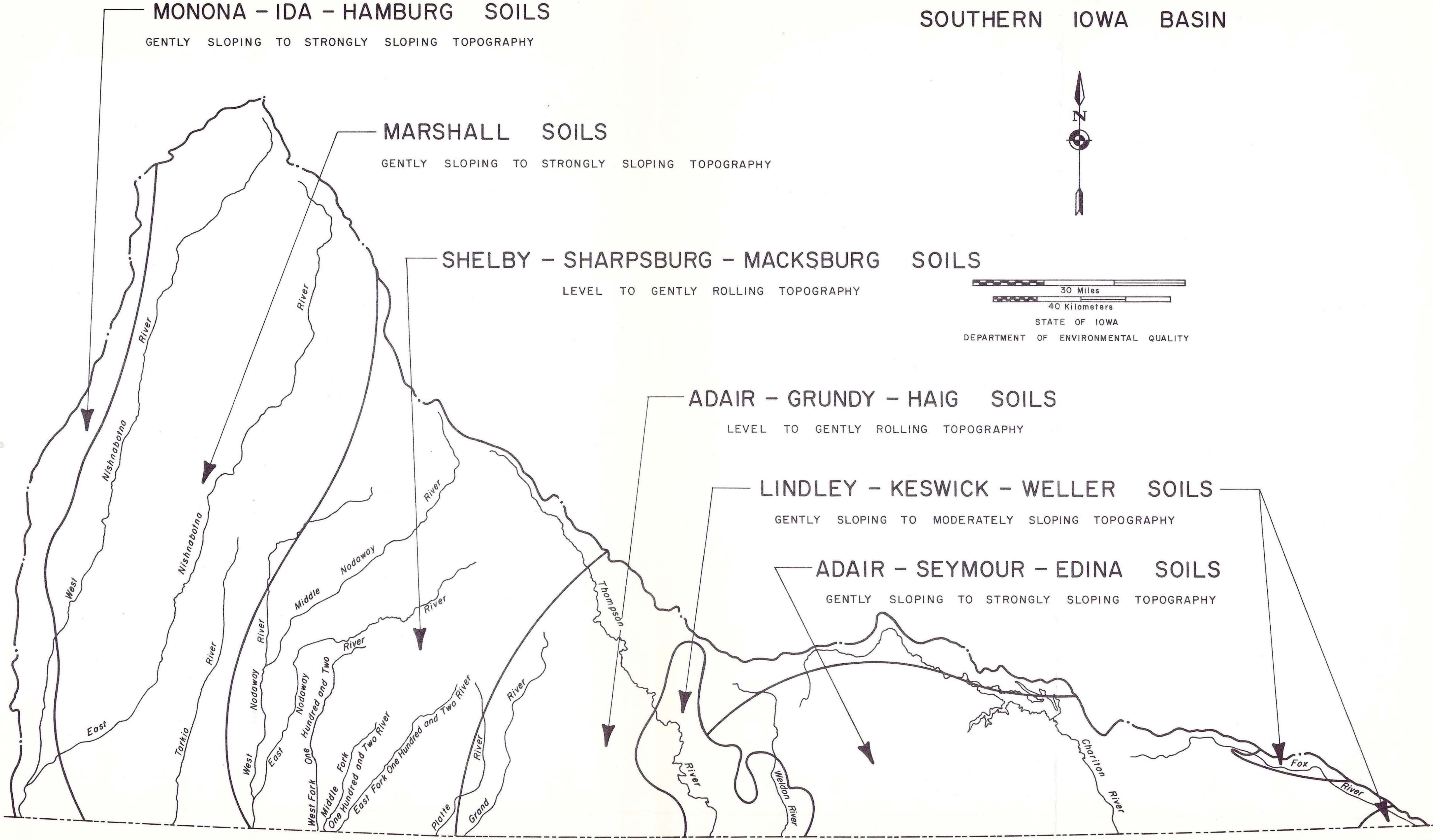

FIGURE III-2

on the steeper slopes. The subsoil is difficult to work and relatively unproductive in areas where the surface soil has been removed.

CLIMATOLOGY

Average annual temperatures are higher and the average growing season longer in the Southern Iowa Basin than in the other river basins in Iowa. To facilitate the interpretation of climatological records, the calendar year is divided into agricultural growing seasons of the staple crops of the basin. The agricultural growing season generally covers the period from early April to early October. The dormant season includes the period from October through March. The average temperature in the basin, during the growing season, is about 66 degrees. Normal temperatures during the dormant season are about 31 degrees lower or an average of 35 degrees. The average frost-free season varies in the basin from 150 days in Cass County to 170 days in Van Buren County.

Annual precipitation tends to increase from west to east. Data available from U.S. Weather Bureau reporting stations in the basin show a range in mean annual precipitation from 28.95 inches at Harlan in Shelby County to 33.46 inches at Centerville in Appanoose County. During most years, southern Iowa receives adequate precipitation for satisfactory crop growth. Normally, rainfall during the growing season is about 23.4 inches or 71 percent of the annual average for the basin.

Summer winds are variable, but are usually from the southern quadrant, bringing moist air from the Gulf of Mexico. The resulting precipitation frequently is in the form of heavy thunderstorms. Hot southerly winds during periods of prolonged high temperatures have created water management problems during some years, particularly in the western part of the basin. These conditions have occasionally resulted in major crop damage in recent years.

A more detailed description of climatology for the basin and the State can be found in the Supporting Document (7).

SURFACE WATERS

STREAM FLOW

That portion of precipitation which flows across the land surface into artificial and natural drainage channels is usually referred to as storm runoff. This runoff, supplemented by discharge from groundwater sources, constitutes the flow observed in streams. Therefore, stream flow is highly correlated to precipitation, which varies from year to year and from area to area. Precipitation and stream flow also vary with time. While most years are in the normal range, some years can be extremely wet or dry.

Average annual runoff in the basin (4) ranges from less than five inches in the northwest part of the basin to more than seven inches in the southeast. In general, runoff follows the pattern of mean annual precipitation which ranges from about 29 inches to more than 34 inches from the western to the southeastern parts of the basin (7).

Although no definite cycles are apparent, runoff tends to be above, or below, average for periods longer than one year. The longest stream flow periods on the Cedar River at Cedar Rapids when runoff was above average were the two six-year periods of 1915-20 and 1942-47. Also at the same site, the longest below average period was the seven years from 1953 to 1959. Statistics showing extremes in annual runoff at selected stations in the Southern Iowa Basin are shown in Table III-3.

The stations included in Table III-3 are those measuring the flow from drainage areas of moderate size and those whose records include the drought of the mid-1950's. Small drainage areas are too sensitive to indicate hydrologic conditions. Large drainage areas, which integrate widespread meteorologic and physical patterns, are too insensitive to be representative of basin conditions.

Stream flow is characteristically variable. In Iowa, it is common for peak stream flows to be 10,000 or more times the minimum flows. As an indicator of the variability of high flows, the ratio of the mean annual flood to the mean discharge for selected stations in the basin is shown in Table III-3. The mean annual flood is the peak flow that is equaled or exceeded once on an average of about every other year (recurrence interval of 2.33 years). It is a fairly stable statistic which is generally unaffected by the chance occurrence of a very large flood. The ratios for the stations listed in Table III-3 vary from 23.1 to 34.2.

As an index of the variation in low flows, the ratio of the flow at the 90 percent duration level (Q90) to the mean flow is also listed in Table III-3. This ratio, which varies from 0.02 to 0.12, is much less than the ratio defining high flows.

Analysis of Table III-3 indicates that stream flow is highly variable. On the average, every 2.33 years a peak flow is reached that is about 28 or more times the mean flow. During 10 percent of the time, low flows are lower than 6 percent of the mean flow.

LOW FLOW CHARACTERISTICS

Water quality criteria of the State must be met at all times when the flow of the stream equals or exceeds the statistical 7Q10 low flow. The 7Q10 low flow and the physical characteristics of the stream must be established if the assimilative capacity is to be analyzed and allowable discharges determined.

TABLE III-3

ANNUAL RUNOFF AND INDICATORS OF FLOW VARIABILITY FOR SELECTED STATIONS IN THE SOUTHERN IOWA BASIN (4)

Station Name	Period of Record	Drainage Area Sq. Mi.	Mean Flow cfs	Annual Runoff in Inches Mean	Max.	Year	Min.	Year	Q2.33* / Qmean	Q90** / Qmean
West Nishnabotna River at Randolph	1948-67	1,326	498	5.50	11.58	1951	1.14	1968	28.9	0.12
Nodaway River at Clarinda	1918-24, 1936-67	762	304	5.43	11.89	1947	0.67	1968	34.2	0.05
Thompson River at Davis City	1918-24, 1941-67	701	354	6.80	14.37	1947	1.01	1956	23.1	0.02

NOTE: Minimum annual runoff for period through 1968.

*Q2.33 is mean annual flood; Qmean is mean flow.

** Q90 is flow equaled or exceeded 90 percent of time; Qmean is mean flow.

The United States Geological Survey (USGS) maintains an extensive nationwide network of stream gaging stations. Stream flow is monitored continuously at some stations and periodically at others. By extrapolation of data from this established gaging network and review of partial-record stations, additional flow information may be determined for streams where continuously recording gaging stations are not provided. Not all gages in a river basin are of the same period of record. Published values of statistical flows such as Q90 (the flow equaled or exceeded 90 percent of the time) or the 7Q10 low flow cannot be expected to correlate exactly at different gages.

Specific USGS gaging station locations in the basin are shown on Figure III-3. Both partial and continuous recording gaging stations are identified. Table III-4 lists the USGS station number, tributary drainage areas above the station, and the 7Q10 low flow, where available, for each station.

As indicated in Table III-4, data are not available for identification of 7Q10 low flow at each gaging station. At those stations where data are insufficient, low flow was determined by extrapolation to permit waste load allocations. Verification of the extrapolated results will be required as additional flow information is collected in the future.

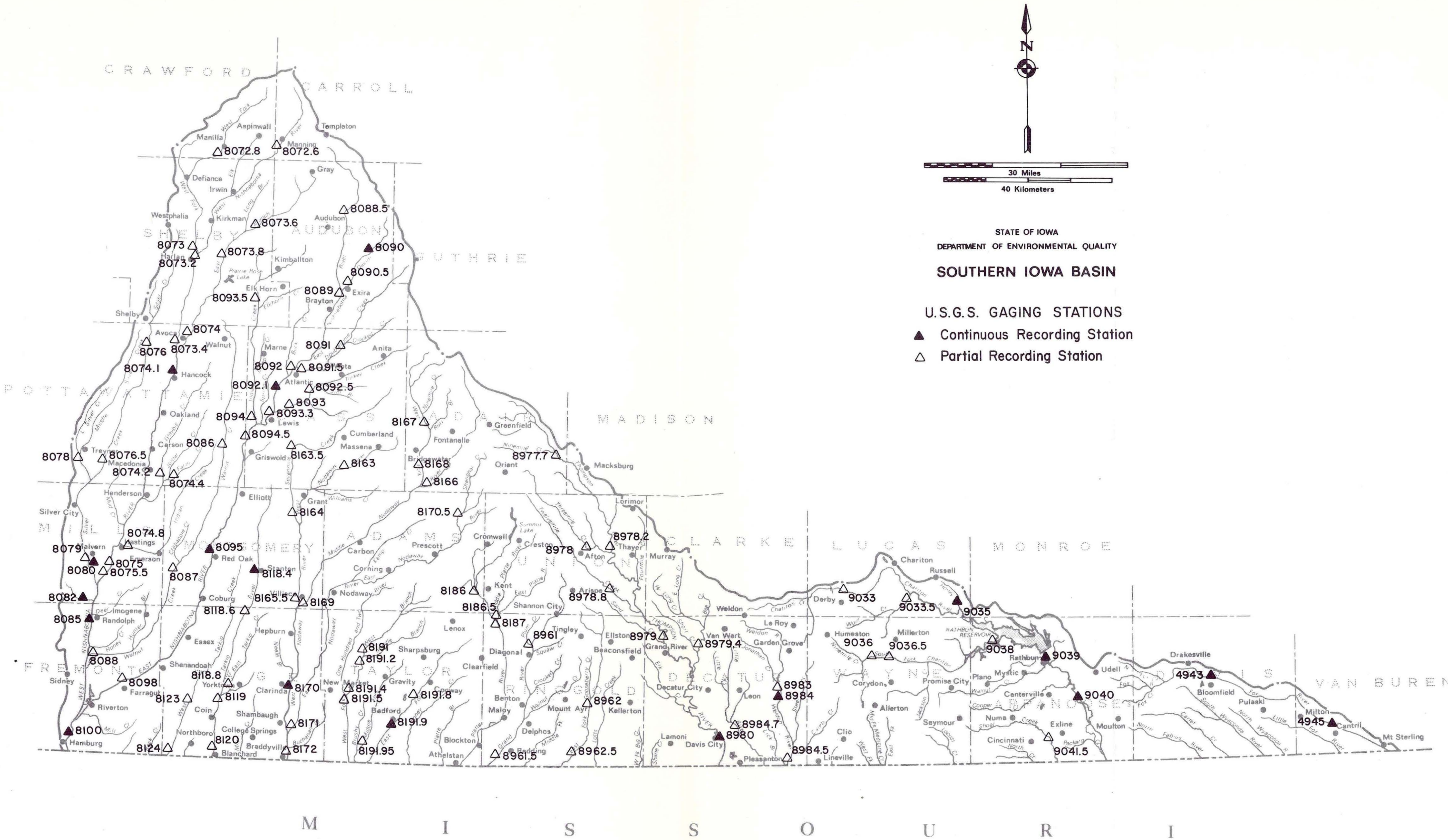
N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
U.S.G.S. GAGING STATIONS
▲ Continuous Recording Station
△ Partial Recording Station
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
MISSOURI

FIGURE III-3

TABLE III-4

SOUTHERN IOWA BASIN

USGS GAGING STATION INFORMATION

USGS Station No.	Stream	Location	Drainage Area Sq. Miles	7Q10 Low Flow cfs	7Q10 Low Flow cfs/Sq. Mile
4943	Fox River	Bloomfield	87.7	0.00	0.0000
4945	Fox River	Cantril	161.0	--	--
8072.6	West Nishnabotna River	Near Manning	58.6	<0.10	--
8072.8	West Fork West Nishnabotna River	Near Manilla	64.2	<0.10	--
8073	West Fork West Nishnabotna River	Harlan	146.0	--	--
8073.2	West Nishnabotna River	Harlan	316.0	--	--
8073.4	West Nishnabotna River	Avoca	357.0	--	--
8073.6	East Branch West Nishnabotna River	Near Red Line	70.3	--	--
8073.8	East Branch West Nishnabotna River	Near Jacksonville	151.0	--	--
8074	East Branch West Nishnabotna River	Avoca	223.0	--	--
8074.1	West Nishnabotna River	Hancock	609.0	--	--
8074.2	Graybill Creek	Near Macedonia	52.1	--	--
8074.4	Farm Creek	Near Macedonia	104.0	--	--
8074.8	Indian Creek	Near Hastings	67.9	--	--

TABLE III-4 (Continued)

USGS Station No.	Stream	Location	Drainage Area Sq. Miles	7Q10 Low Flow cfs	7Q10 Low Flow cfs/Sq. Mile
8075	West Nishnabotna River	White Cloud	967.0	--	--
8075.5	West Nishnabotna River	Near Malvern	974.0	--	--
8076	Silver Creek	Near Avoca	59.2	--	--
8076.5	Silver Creek	Near Treynor	115.0	--	--
8078	Middle Silver Creek	Near Treynor	74.3	--	--
8079	Silver Creek	Near Malvern	282.0	--	--
8080	Mule Creek	Near Malvern	10.6	--	--
8082	Spring Valley Creek	Near Tabor	7.65	<0.10	--
8085	West Nishnabotna River	Randolph	1,326.0	17.0	0.0128
8086	Walnut Creek	Near Griswold	61.3	--	--
8087	Walnut Creek	Near Hawthorne	140.0	--	--
8088	Walnut Creek	Near Randolph	222.0	--	--
8088.5	East Nishnabotna River	Near Audubon	66.7	--	--
8089	East Nishnabotna River	Exira	195.0	--	--
8090	Davids Creek	Near Hamlin	26.0	<0.10	--

TABLE III-4 (Continued)

USGS Station No.	Stream	Location	Drainage Area Sq. Miles	7Q10 Low Flow cfs	7Q10 Low Flow cfs/Sq. Mile
8090.5	Davids Creek	Exira	56.7	--	--
8091	Troublesome Creek	Near Wiota	68.4	<0.10	--
8091.5	Troublesome Creek	Near Atlantic	128.0	--	--
8092	East Nishnabotna River	Atlantic	382.0	--	--
8092.1	East Nishnabotna River	Near Atlantic	432.0	--	--
8092.5	Turkey Creek	East of Atlantic	69.5	--	--
8093	Turkey Creek	Near Atlantic	133.0	--	--
8093.3	East Nishnabotna River	Near Lewis	574.0	--	--
8093.5	Indian Creek	Near Elk Horn	67.4	--	--
8094	Indian Creek	Near Lewis	183.0	--	--
8094.5	East Nishnabotna River	Near Griswold	778.0	--	--
8095	East Nishnabotna River	Red Oak	894.0	12.0	0.0134
8098	East Nishnabotna River	Near Farragut	1,082.0	--	--
8100	Nishnabotna River	Above Hamburg	2,806.0	19.0	0.0068
8118.4	Tarkio River	Stanton	49.3	<0.10	--

TABLE III-4 (Continued)

USGS Station No.	Stream	Location	Drainage Area Sq. Miles	7Q10 Low Flow cfs	cfs/Sq. Mile
8118.6	Tarkio River	Near Coburg	66.6	<0.10	--
8118.8	East Tarkio Creek	Near Yorktown	58.0	<0.10	--
8119	Tarkio River	Near Yorktown	155.0	<0.10	--
8120	Tarkio River	Blanchard	200.0	--	--
8123	West Tarkio Creek	Near Coin	66.9	<0.10	--
8124	West Tarkio Creek	Near Northboro	87.7	<0.10	--
8163	West Nodaway River	Near Cumberland	65.1	<0.10	--
8163.5	Sevenmile Creek	Near Lyman	60.8	--	--
8164	Sevenmile Creek	Near Morton Mill	124.0	--	--
8165.5	West Nodaway River	Near Villisca	344.0	--	--
8166	Middle Nodaway River	Near Bridgewater	89.3	--	--
8167	West Fork Middle Nodaway River	Near Fontanelle	67.9	<0.10	--
8168	West Fork Middle Nodaway River	Near Bridgewater	128.0	<0.10	--
8169	Middle Nodaway River	Near Villisca	341.0	--	--
8170	Nodaway River	Clarinda	762.0	5.4	0.0071

TABLE III-4 (Continued)

USGS Station No.	Stream	Location	Drainage Area Sq. Miles	7Q10 Low Flow cfs	7Q10 Low Flow cfs/Sq. Mile
8170.5	East Nodaway River	Near Williamson	54.2	--	--
8171	East Nodaway River	Near Shambaugh	333.0	--	--
8172	Nodaway River	Near Braddyville	1,135.0	6.8	0.0060
8186	Platte River	Near Kent	77.9	<0.10	--
8186.5	East Platte River	Near Knowlton	66.8	--	--
8187	Platte River	Near Knowlton	179.0	<0.10	--
8191	West Branch 102 River	Near Gravity	52.2	--	--
8191.2	West Branch 102 River	Near Gravity	106.0	--	--
8191.4	West Branch 102 River	Near New Market	123.0	<0.10	--
8191.5	West Fork 102 River	Near New Market	183.0	<0.10	--
8191.8	East Fork 102 River	Near Bedford	60.4	--	--
8191.9	East Fork 102 River	Near Bedford	92.1	--	--
8191.95	Middle Fork 102 River	Near Bedford	59.8	--	--
8961	Grand River	Knowlton	67.5	<0.10	--
8961.5	Grand River	Near Blockton	207.0	--	--

TABLE III-4 (Continued)

USGS Station No.	Stream	Location	Drainage Area Sq. Miles	7Q10 Low Flow cfs	7Q10 Low Flow cfs/Sq. Mile
8962	East Fork Grand River	Near Mount Ayr	64.7	--	--
8962.5	East Fork Grand River	South of Mount Ayr	95.9	<0.10	--
8977.7	Thompson River	Near Hebron	80.0	<0.10	--
8978	Threemile Creek	Near Afton	54.8	<0.10	--
8978.2	Thompson River	Near Afton	231.0	--	--
8978.8	Twelvemile Creek	Near Arispe	68.0	<0.10	--
8979	Thompson River	Near Grand River	401.0	--	--
8979.4	Long Creek	Near Van Wert	117.0	<0.10	--
8980	Thompson River	Davis City	701.0	1.20	0.0017
8983	Weldon River	East of Leon	72.4	<0.10	--
8984	Weldon River	Near Leon	104.0	--	--
8984.5	Weldon River	Near Pleasanton	228.0	<0.10	--
8984.7	Little River	Near Leon	69.2	--	--
9033	Chariton River	Near Derby	71.0	--	--
9033.5	Wolf Creek	Near Chariton	65.0	--	--

TABLE III-4 (Continued)

USGS Station No.	Stream	Location	Drainage Area Sq. Miles	7Q10 Low Flow	
				cfs	cfs/Sq. Mile
9035	Honey Creek	Near Russell	13.2	0.00	0.0000
9036	South Fork Chariton River	Near Cambria	58.0	--	--
9036.5	South Fork Chariton River	Near Corydon	68.1	--	--
9038	South Fork Chariton River	Griffinsville	234.0	<0.10*	--
9039	Chariton River	Near Rathbun	551.0	<0.10*	--
9040	Chariton River	Near Centerville	708.0	0.21	0.0003
9041.5	Shoal Creek	Near Cincinnati	56.6	--	--

*Flow is now protected to]] cfs by releases from Lake Rathbun.

Low flows usually occur either during August and September or during January and February. Analyses of critical conditions for defining waste load allocations must therefore be conducted for both warm and cold water temperatures.

In general, low flows per square mile in the Southern Iowa Basin are significantly less than the State average when results are compared on the basis of discharge per square mile. However, the low flows per square mile in the East and West Nishnabotna Rivers are similar to or higher than the State average as shown in Table III-5.

Low flow in the Chariton River below Rathbun Dam has been regulated since closure of the dam in 1969. Corps of Engineers' operating procedure provides for a minimum low flow of 11 cfs to be maintained below the dam.

Table III-5 shows a comparison of average flows from long term continuously recording gaging stations within the basin with the average flows for 84 stations within the State.

Table III-5 refers to average daily discharges recorded at each gaging station regardless of chronological sequence. Similar to the daily flow data shown in Table III-5, the average 7Q10 low flow for the rivers within the basin is considerably lower than the

TABLE III-5
SOUTHERN IOWA BASIN
LOW FLOW DATA

Location	Flows, in cfs/sq mi, Equaled or Exceeded, for Percentage of Time Indicated in Column Headings*				
	50	90	95	98	99
State of Iowa Average	0.150	0.033	0.024	0.018	0.015
Chariton River near Centerville	0.055	0.003	0.002	0.001	0.001
Chariton River near Rathbun	0.074	0.004	0.002	0.001	0.001
E. Nishnabotna River at Red Oak	0.157	0.035	0.026	0.019	0.016
E. Nishnabotna River near Atlantic	0.220	0.060	0.046	0.035	0.030
Fox River at Bloomfield	0.042	0.004	0.002	0.001	0.001
Fox River at Cantril	0.087	0.009	0.006	0.004	0.003
Nishnabotna River above Hamburg	0.153	0.030	0.019	0.012	0.009
Nodaway River at Clarinda	0.106	0.020	0.013	0.010	0.008
East Fork 102 River near Bedford	0.072	0.007	0.004	0.003	0.002
Tarkio River at Stanton	0.223	0.026	0.013	0.008	0.006
Thompson River at Davis City	0.103	0.011	0.005	0.002	0.001
Weldon River near Leon	0.084	0.008	0.005	0.003	0.002

TABLE III-5 (Continued)

Location	Flows, in cfs/sq mi, Equaled or Exceeded, for Percentage of Time Indicated in Column Headings* 50	90	95	98	99
W. Nishnabotna River at Hancock	0.217	0.072	0.053	0.038	0.030
W. Nishnabotna River at Randolph	0.189	0.045	0.026	0.016	0.013

*Iowa Natural Resources Council, Low-Flow Characteristics of Iowa Streams Through 1966, Bulletin No. 10, 1970.

average for the State. The 7Q10 low flow for the Nishnabotna River Basin averages 0.00677 cfs/sq.mi., while the State of Iowa averages 0.020 cfs/sq.mi.

HYDROLOGY

The problems of water supply are more serious in the Southern Iowa Basin than in the other basins of the State. Dependable ground water sources are limited. Many of the communities in the basin are supplied from surface sources. However, groundwater supplies are still essential for the farms and many of the small communities in the basin.

A detailed analysis of the geology of the groundwater reservoirs of the basin and the State is included in the Supporting Document Report (7). This section summarizes the groundwater resources of the basin.

The principal sources of groundwater are the alluvial deposits that underlie the floodplains and terraces of the rivers and streams of the basin and the bedrock aquifers.

Alluvial deposits are found along the existing water courses, in outwash sands occupying buried bedrock channels and in thin discontinuous sand bodies in glacial drift. Sand and gravel deposits along the major river valleys are productive water sources for many of the smaller communities. Individual wells from these deposits are capable of yielding up to 40 gpm. These wells are generally confined to the immediate valleys of the rivers.

Glacial drift is a source of water in much of the basin for stock watering and rural supply. The drift thickness averages about 200 feet across the basin. The sand layers near the base of the drift produce water. Wells to the sand deposits yield only a few gallons per minute, but with favorable conditions and proper well design, yields of 10 to 20 gpm may be obtained. In many areas of the basin, these drift sands are the only sources of acceptable water at a reasonable depth.

Much of the Southern Iowa Basin is underlain by bedrock formations that have the potential to yield large amounts of water. Deep depths and generally poor water quality of these aquifers precludes their use in most cases. The more important aquifers in the basin are the Dakota Sandstone, Lower Pennsylvanian Sandstone, Mississippian Limestone, St. Peter Sandstone and the Jordan Sandstone.

The Dakota Sandstone yields moderate to large quantities of mineralized water in the southwest part of the basin. At Red Oak, in Montgomery County, where this aquifer is very thin, yields of up to 1,000 gpm are available.

Pennsylvanian Sandstone and Mississippian Limestone occur throughout the basin. These aquifers have not been developed in the area because of extreme depth and poor water quality.

The St. Peter and Jordan Sandstones are found at great depths (below 3,200 feet) in southern Iowa. The Jordan aquifer is the principal water producer and is used extensively in the eastern three-fourths of the State where it is found at shallower depths. However, several communities in southern Iowa use the Jordan aquifer because the overlying formations do not yield sufficient water or are highly mineralized. Throughout most of the basin, the aquifer occurs so deeply buried that the development cost of wells is prohibitive for most communities and industries.

GROUNDWATER QUALITY

Certain characteristics of Iowa's groundwaters are common to all areas and all sources. Others are widespread but not typical for the entire State. Nearly all of the groundwaters are hard. Groundwaters available in the Southern Iowa Basin are generally very hard and highly mineralized.

The mineral content of groundwater, in terms of total dissolved solids and hardness, generally increases with increased depth.

The better quality waters in Iowa consistently occur in north-central, northeast and eastern Iowa. The water from all the bedrock aquifers is more mineralized in the south, southwest and west parts of the State.

A detailed discussion of groundwater quality throughout the State can be found in the Supporting Document Report (7).

The more commonly used sources of groundwater in the basin are the alluvial aquifers and the Dakota Sandstones. The quality of water from the alluvial aquifers in the basin is quite variable. Some of the alluvial deposits yield water with a hardness of 150 to 200 mg/l. In general, water containing less than 500 mg/l of dissolved solids can be obtained from the alluvial aquifers of the basin. The exception to this is the areas along the West Nishnabotna River valley in Shelby County where the dissolved solids content may be as high as 1,000 mg/l.

The Dakota Sandstone is found in the basin primarily in Audubon, Cass, Montgomery and Pottawattamie Counties. The dissolved solids concentrations in these counties is generally in the range of 500 to 1,000 mg/l.

Iron in troublesome amounts (more than 0.3 mg/l) is commonly found in water from the alluvial aquifers, in sand aquifers beneath the glacial drift, and in bedrock aquifers.

Nitrates in excess of acceptable concentrations have been found in many shallow wells in Southern Iowa. More than 45 mg/l of nitrates (as NO_3) is believed to be a cause of methemoglobinemia in infants. The source of nitrates is of organic origin coming primarily from agricultural wastes, septic tank effluent and fertilizers.

The occurrence of high nitrate concentrations is related more to improper well construction and location than to a particular region. However, instances of properly constructed wells yielding high nitrate concentrations are common in some alluvial aquifers. Upper layers of sand and gravel may contain unacceptable amounts whereas parts of the aquifer below an intervening clay layer contain negligible amounts of nitrate. Continued applications of fertilizer on floodplain and terrace areas may result in this problem becoming more widespread. Where clay layers do not separate the alluvial aquifers into two or more parts, nitrates may contaminate the only major source of groundwater over a large area.

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CHAPTER IV

WATER QUALITY

The objective of water quality management is to protect and enhance water resources to ensure acceptable conditions for designated uses. Sound management requires knowledge of the existing water quality.

Existing water quality for the Southern Iowa Basin has been identified from available data. The data indicate some areas of degraded water quality.

It is the purpose of water quality standards to limit waste inputs to streams so that designated water uses will not be impaired.

The Iowa Water Quality Commission has classified streams into four use classifications; A,B,C and General. Class A waters are those which are to be preserved for whole body contact. Class B Waters are those which are to be preserved for wildlife, aquatic life, and non-body contact recreation. Class C Waters are those which must be of a quality to meet requirements for use as a potable water supply. The General classification, which applies to all surface waters, provides for generally acceptable physical conditions and elimination of toxic substances. The Supporting Document for Iowa Water Quality Management Plans (1) lists in detail the standards for each class.

In addition to material contamination, thermal discharges are important to water quality. Many life forms cannot adapt to a wide range of temperature. Temperature variations within a stream can result in different proportions of species, and may even result in the disappearance of some forms and the appearance of others. Standards have been set for thermal discharges and Class B streams have been further classified as "cold water" or "warm water".

Table IV-1, based on Water Quality Standards, Chapter 16, Iowa Departmental Rules, sets out the classifications of the various streams in the Southern Iowa Basin. Figure IV-1 shows the locations of these streams.

TABLE IV-1
SOUTHERN IOWA BASIN
SURFACE WATER CLASSIFICATION

Stream Segment	Classification A	Classification B Warm Water	Classification C
A. Missouri River - Main Stem			
Missouri State line to South Dakota State line	x	x	x (above Council Bluffs)
1. Chariton River			
Missouri State line to Rathbun Reservoir		x	
Rathbun Reservoir	x	x	
Rathbun Reservoir to Highway 65		x	
2. Weldon River - Missouri State line to Highway 2		x	
3. Thompson River			
Missouri State line to Madison County line		x	
4. Grand River - Missouri State line to Highway 66		x	
5. Platte River			
Missouri State line to Adams County line		x	

TABLE IV-1 (Continued)

Stream Segment	Classification A	B Warm Water	C
6. East Fork One Hundred and Two River			x (above Bedford)
7. West Fork One Hundred and Two River Missouri State line to Highway 2		x	
8. Nodaway River Missouri State line to East and West Nodaway Rivers		x	
a. West Nodaway River - Mouth to Sevenmile Creek		x	x (above Clarinda)
(1) Middle Nodaway River - Mouth to Adair County line		x	
b. East Nodaway River - Mouth to Highway 148		x	
9. Tarkio River - Missouri State line to East Tarkio Creek		x	
10. West Tarkio Creek Missouri State line to Page County Road J52		x	
11. Nishnabotna River Missouri State line to East and West Nishnabotna Rivers		x	
a. East Nishnabotna River - Mouth to Interstate 80		x	
(1) Indian Creek - Mouth to Camp Creek		x	
(2) Turkey Creek - Mouth to Highway 71		x	
(3) Troublesome Creek - Mouth to Crooked Creek		x	
b. West Nishnabotna River - Mouth to Highway 44		x	
(1) Walnut Creek - Mouth to Hunter Branch		x	
(2) Silver Creek - Mouth to Prairie Creek		x	
(3) East Branch West Nishnabotna River - Mouth to Shelby County line		x	

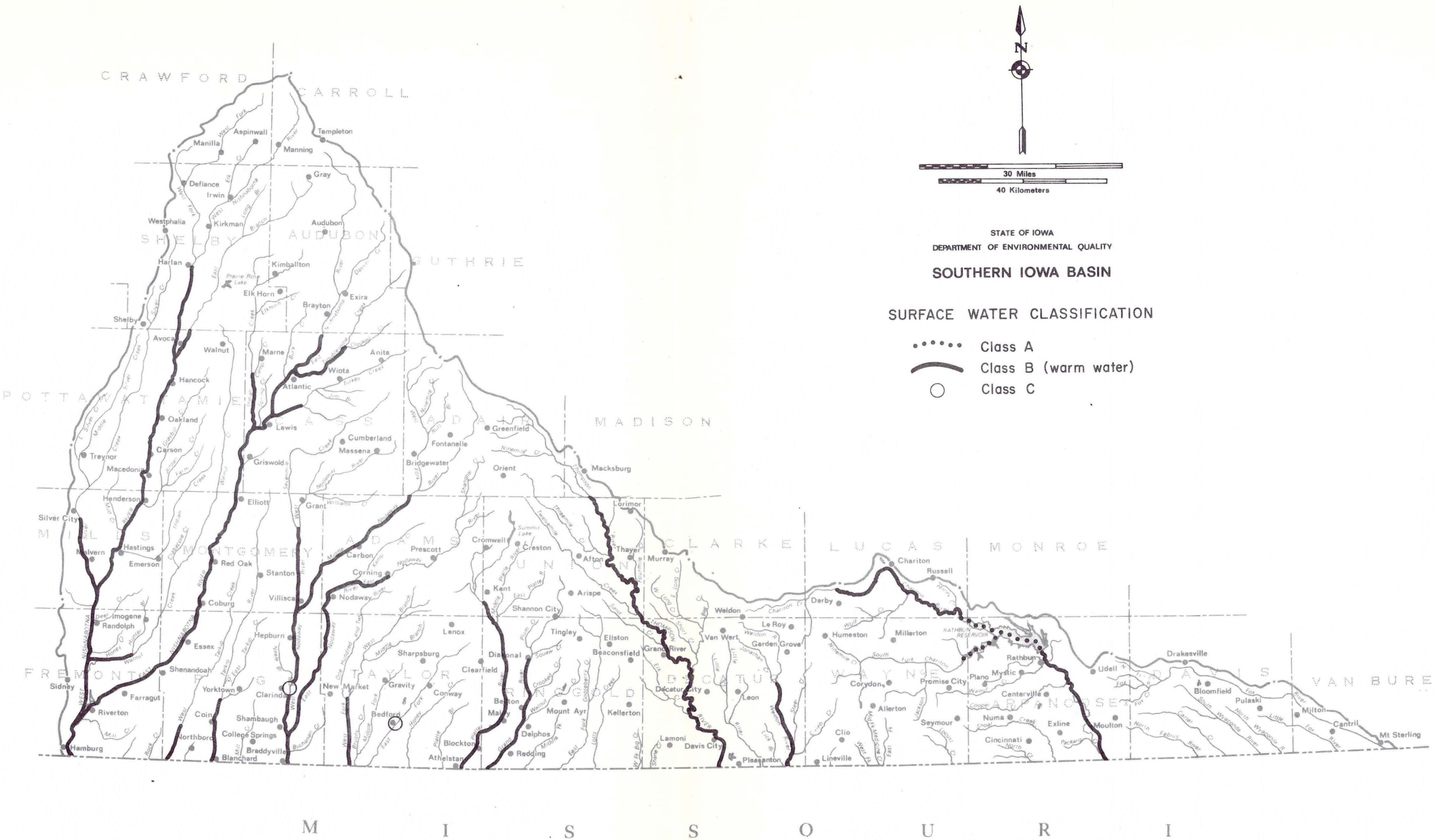

N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
SURFACE WATER CLASSIFICATION
Class A
Class B (warm water)
Class C
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
RATHBUN RESERVOIR
MISSOURI

FIGURE IV-1

SAMPLING LOCATIONS

The evaluation of water quality in the Southern Iowa Basin is based upon data collected by DEQ, the State Health Department, the State Hygienic Laboratory, and Iowa State University. Some additional data are available from other State, local, and Federal agencies.

Sampling locations in the Southern Iowa Basin are shown on Figure IV-2.

CHARITON RIVER (2)

Water in the Chariton River is generally of good quality with the exception of the segment directly below the City of Chariton. This segment is characterized by undesirable bacteria, elevated BOD_5, excessive nutrients, and depressed dissolved oxygen, particularly during low flow conditions. Pesticide levels in the Chariton River from nonpoint sources may be of concern if current levels persist.

WATER QUALITY CONDITIONS

Harmful Substances - The soils in the Chariton River Basin are rich in manganese. High manganese levels in the river are associated more with surface runoff than with point waste discharges. Manganese, although not toxic, can cause problems in drinking water supplies. Concentrations of manganese have exceeded standards for drinking water supplies in many of the samples collected since 1970 (Table IV-2). While there are

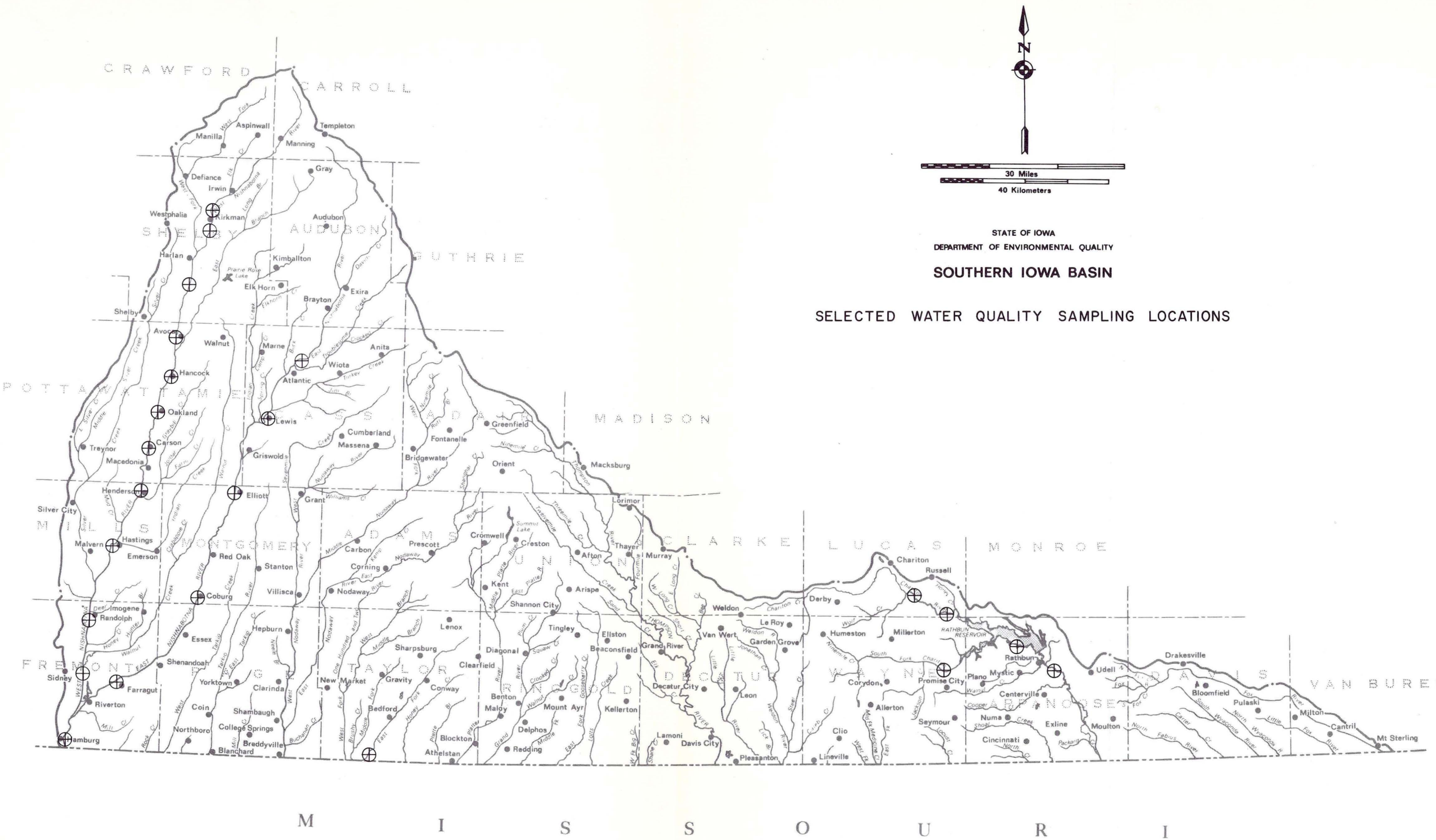

30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
SELECTED WATER QUALITY SAMPLING LOCATIONS
M I S S O U R I

FIGURE IV-2

currently few surface water supplies in the Chariton Basin, the Rathbun Regional Water Association serving Lucas, Monroe, Wayne, and Appanoose Counties is planning on the use of the Rathbun Reservoir for a water supply.

Pesticide levels for dieldrin and DDE have exceeded the recommended maximum concentrations established by the National Academy of Science (1972) (Table IV-3).

TABLE IV-2
SOUTHERN IOWA BASIN
HEAVY METALS IN THE CHARITON RIVER

Parameter	Total Samples	Number of Samples With Detectable Levels	Mean of Those With Detectable Levels (µg/l)	Maximum (µg/l)
As	19	0		
Ba	21	16	169	300
Cd	25	0		
Cr	27	0		
Cu	25	5	18	18
Pb	25	0		
Mn	25	20	294	940
Hg	8	0		
Ni	17	0		
Ag	13	0		
Zn	25	18	44	100

TABLE IV-3
SOUTHERN IOWA BASIN
PESTICIDES IN THE CHARITON RIVER

Parameter	Total Samples	Number of Samples With Detectable Levels	Mean of Those With Detectable Levels (ng/l)	Maximum (ng/l)
DDE	29	26	198	1,121
Dieldrin	29	29	5	22
Atrazine	29	17	3,105	9,400

Physical Modification - The Chariton River and its tributaries are characterized by high turbidity during periods of heavy rain and runoff conditions. The high turbidity has the effect of preventing significant light penetration which prevents algal blooms that might otherwise result from the increased nutrients associated with the runoff events.

The rechannelization and dredging of some portions of the river have had serious effects on water quality and biological parameters. Due to the extreme variations in flow, these segments fluctuate between high flow scouring periods and low flow stagnant pooling. The City of Chariton's sewage treatment plant discharges into one of these pool areas and further contributes to this problem.

Eutrophication Potential - Both nitrate and phosphate are consistently found in high concentrations in the Chariton River. While the nutrient concentrations are high, nuisance algal blooms have not developed. This is probably due to the high turbidity described previously. Water quality data on nutrients in the Chariton River are shown in Figures IV-3, IV-4, IV-5, IV-6, and IV-7.

Oxygen Depletion - Dissolved oxygen has generally been sufficient to support a variety of fish life in the river. Exceptions are noted above, near the City of Chariton. Reaeration takes place below Chariton and adequate oxygen has been found throughout the rest of the river. The water quality violations for dissolved oxygen and ammonia are found almost exclusively in the segment

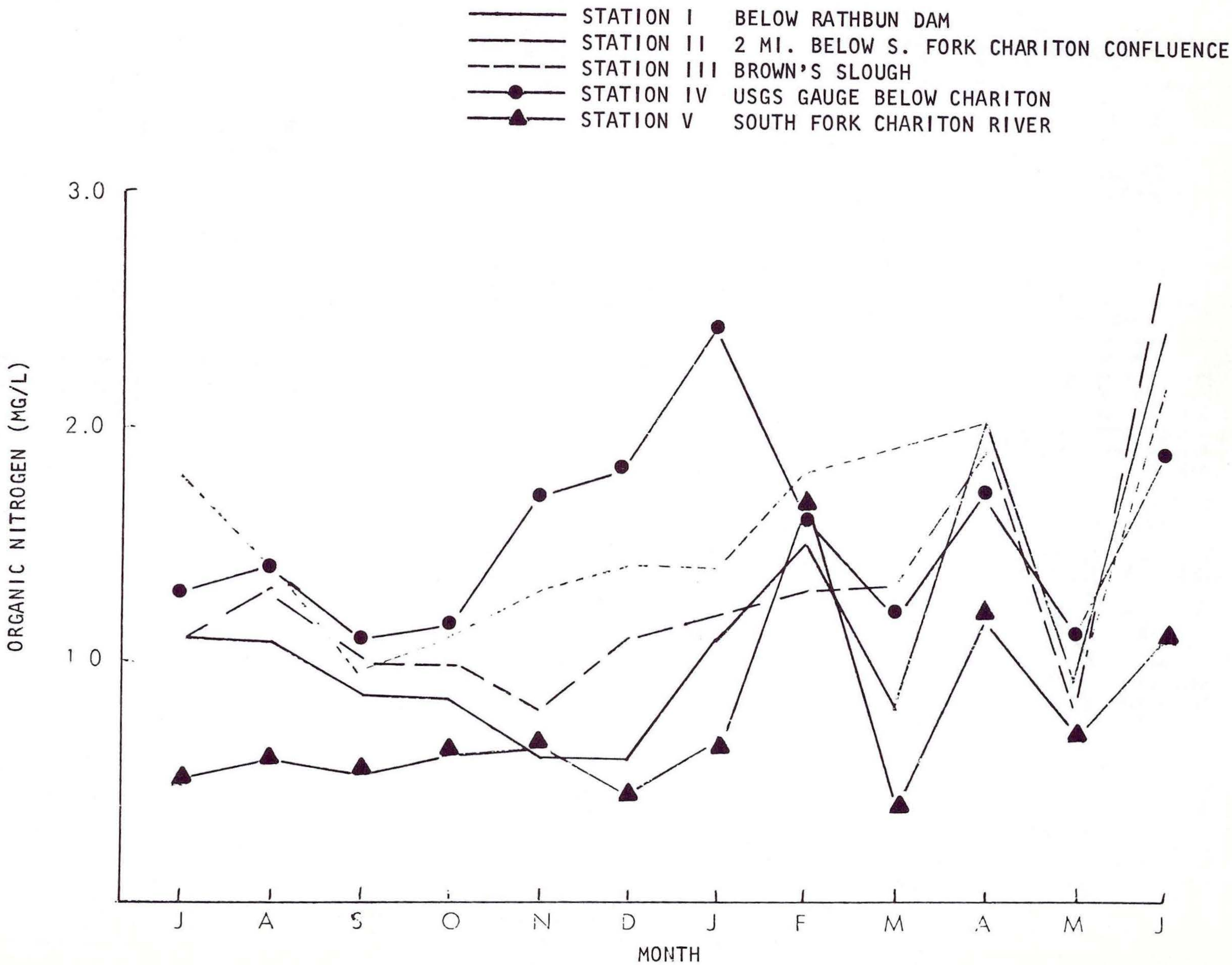


FIGURE IV-3 ORGANIC NITROGEN CONCENTRATIONS AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

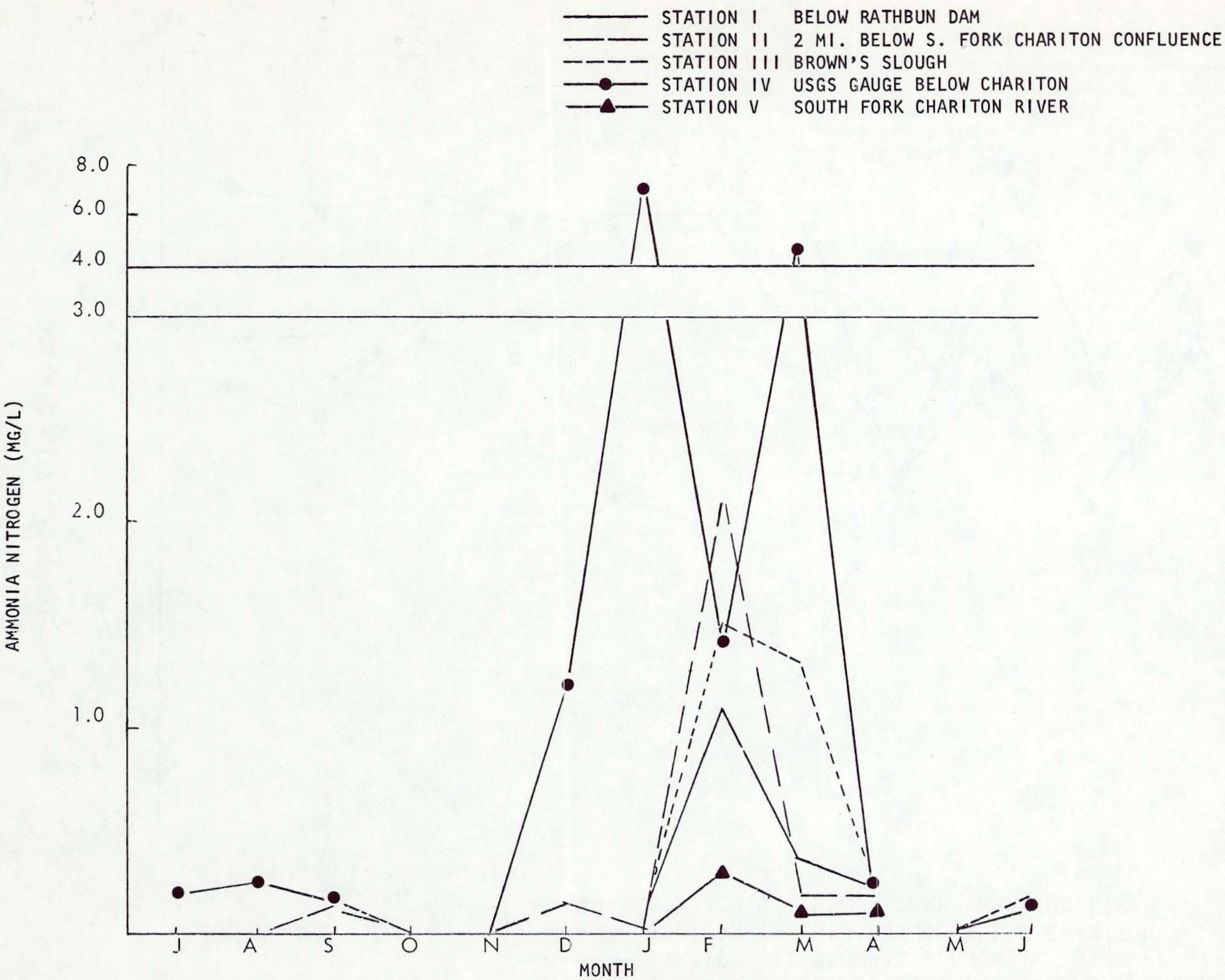


FIGURE IV-4 AMMONIA NITROGEN CONCENTRATIONS AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

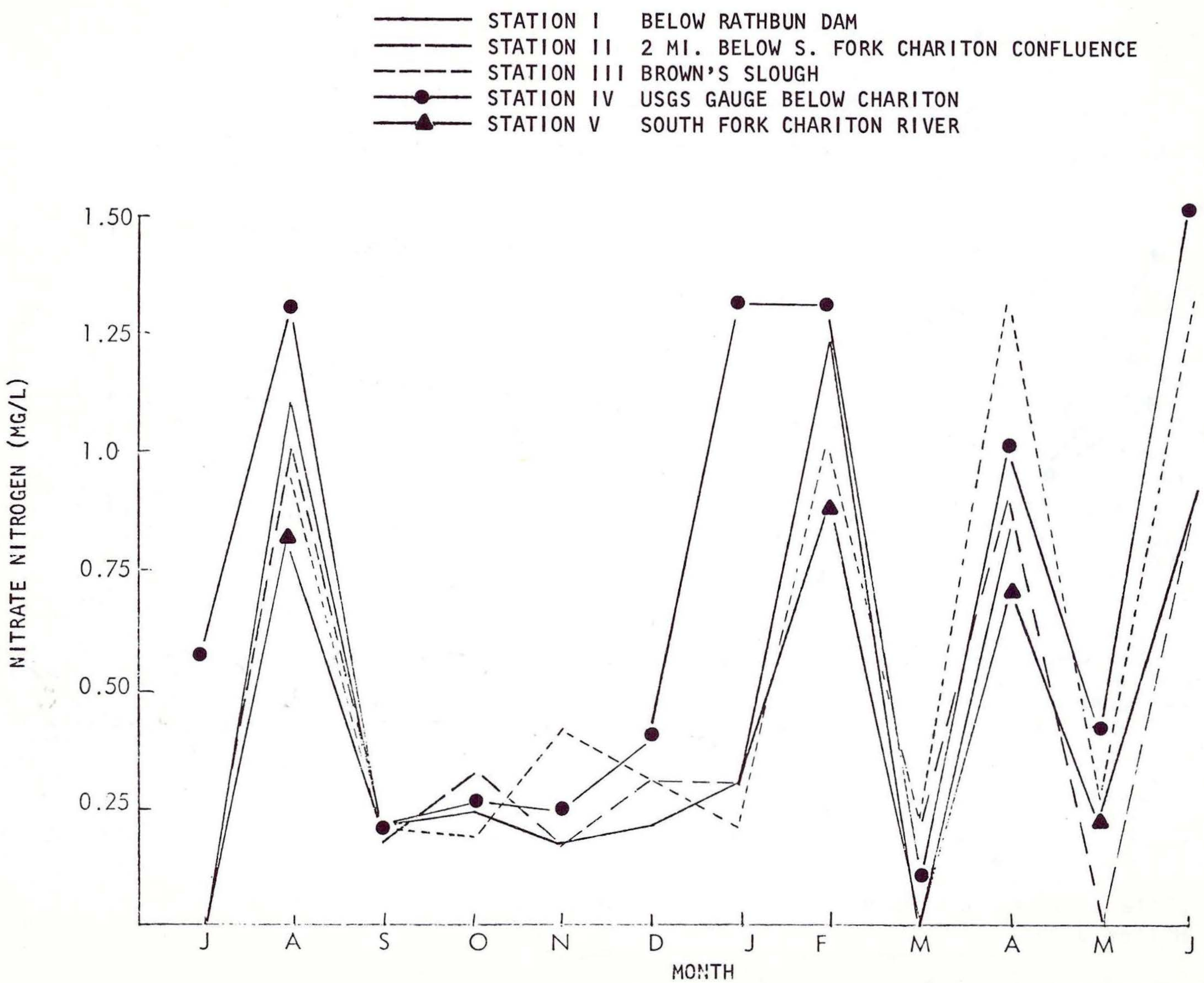


FIGURE IV-5 NITRATE NITROGEN CONCENTRATIONS AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

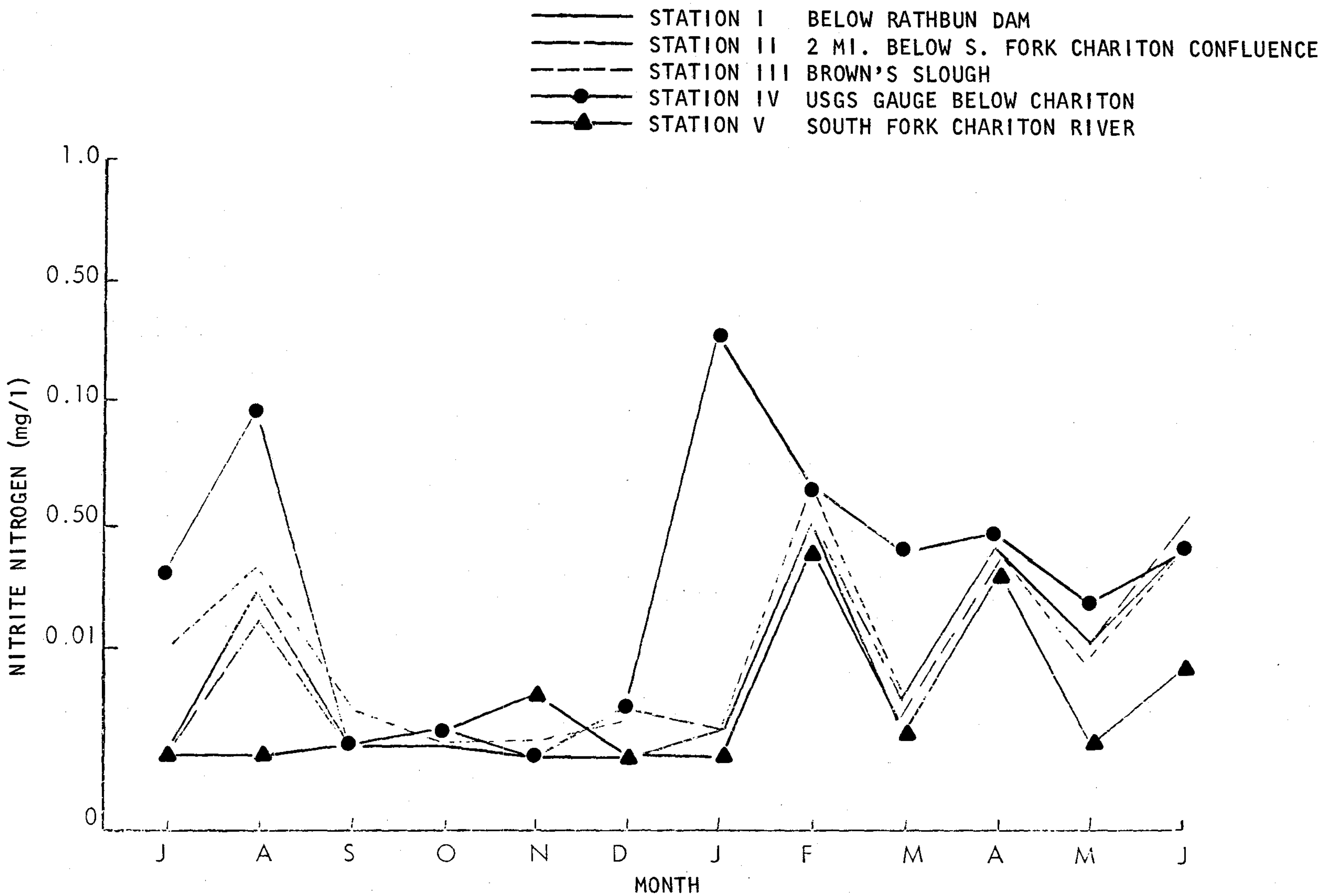


FIGURE IV-6 NITRITE NITROGEN CONCENTRATIONS AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

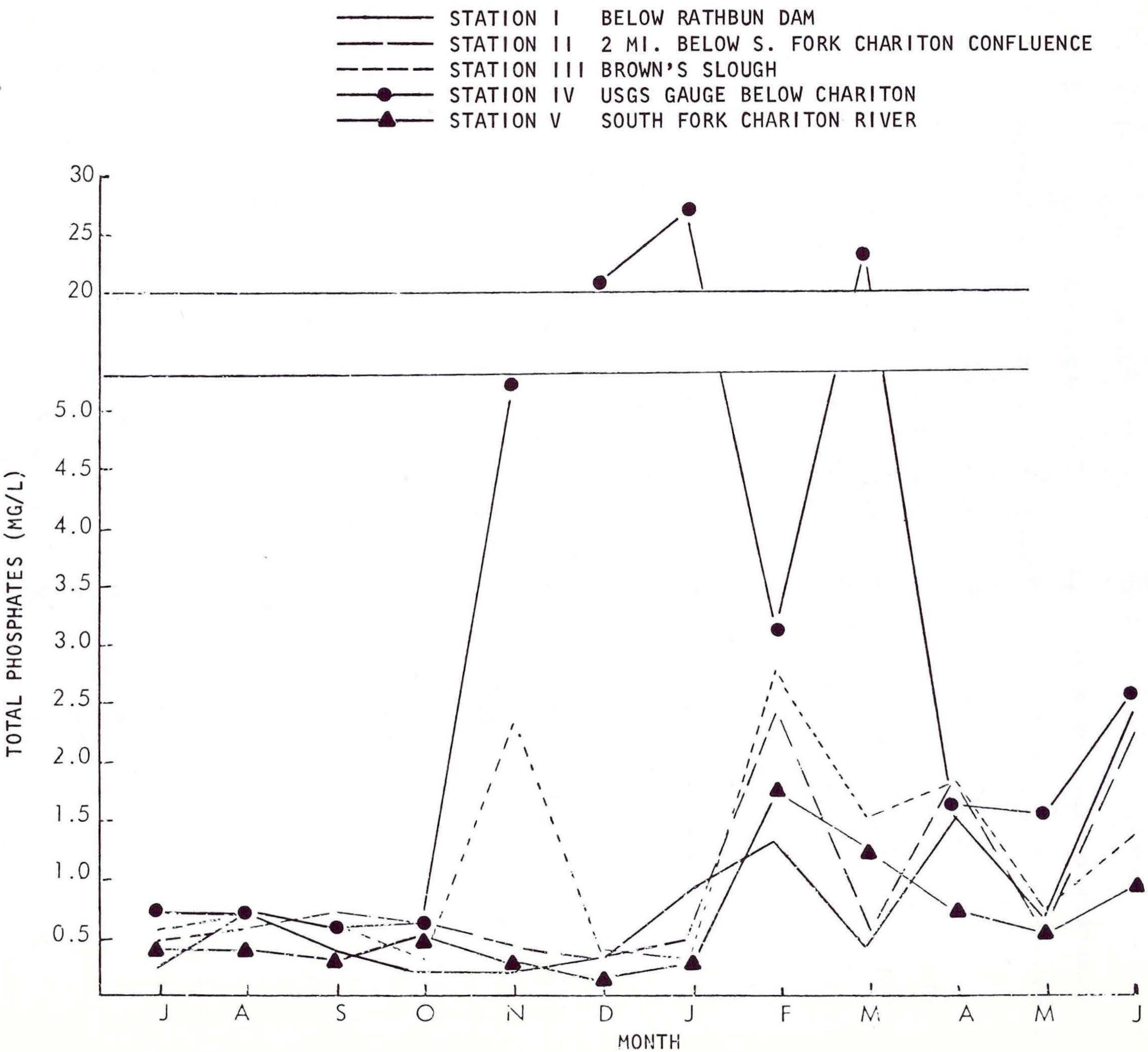


FIGURE IV-7 TOTAL PO_4 CONCENTRATIONS AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969) immediately below Chariton. (See Figures IV-8 and IV-9.)

Health Hazards and Aesthetic Degradation - Fecal and total coliform concentrations reflect the point source nature of these parameters during low stream flows. Coliform concentrations decrease from a peak below the City of Chariton and are within standards for water supplies and recreational use by the time they reach Rathbun Reservoir. During runoff conditions, the fecal coliform concentrations are high throughout the river reflecting the contributions of nonpoint source runoff to the river.

Salinity, Acidity, and Alkalinity - Salinity and acidity have not been problems in the Chariton River to date. Concentrations of dissolved solids have generally been within Iowa standards. Water quality data on total dissolved solids and alkalinity are shown in Figures IV-10 and IV-11, respectively.

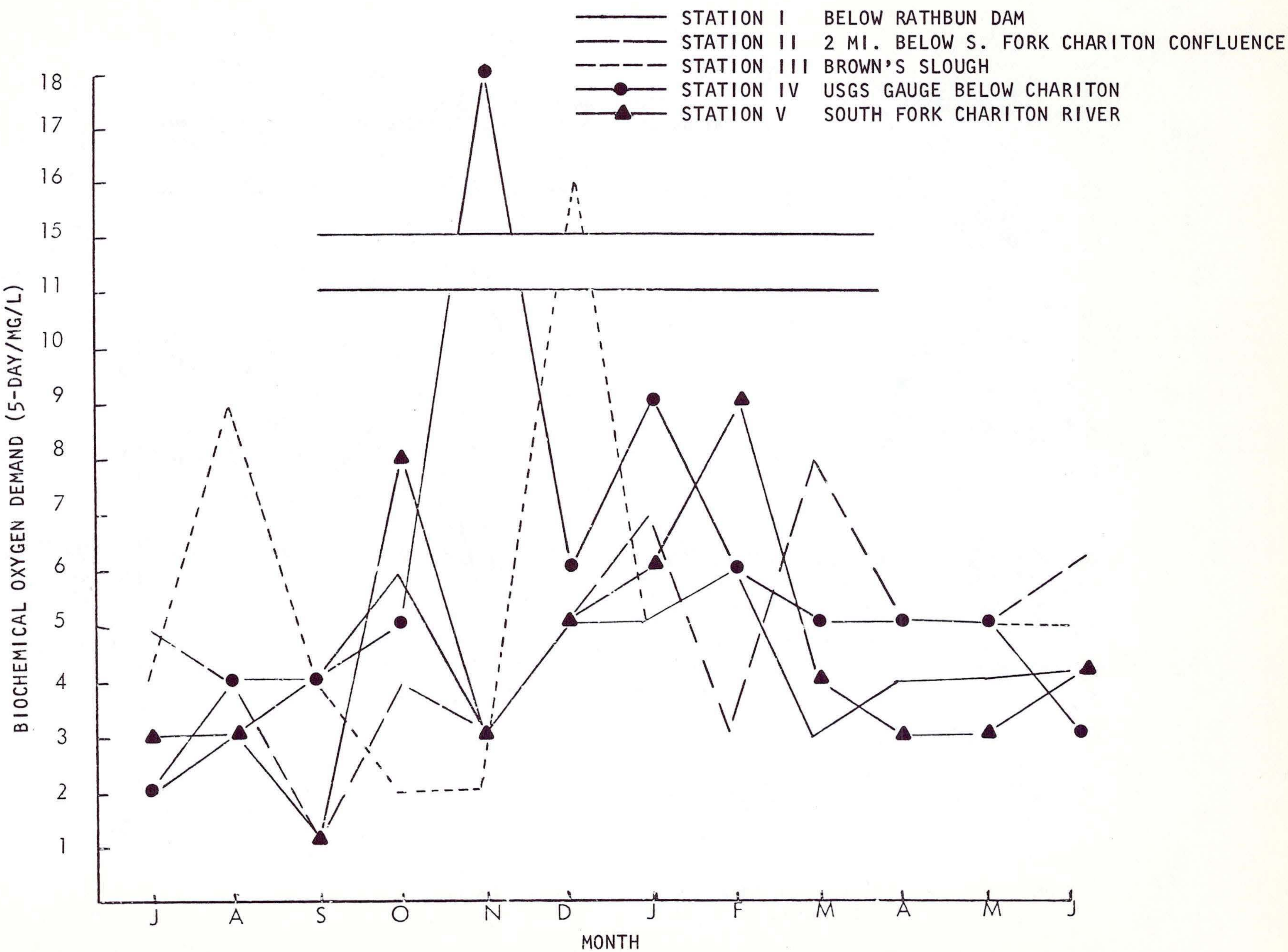


FIGURE IV-8 FIVE-DAY BOD AT THE MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

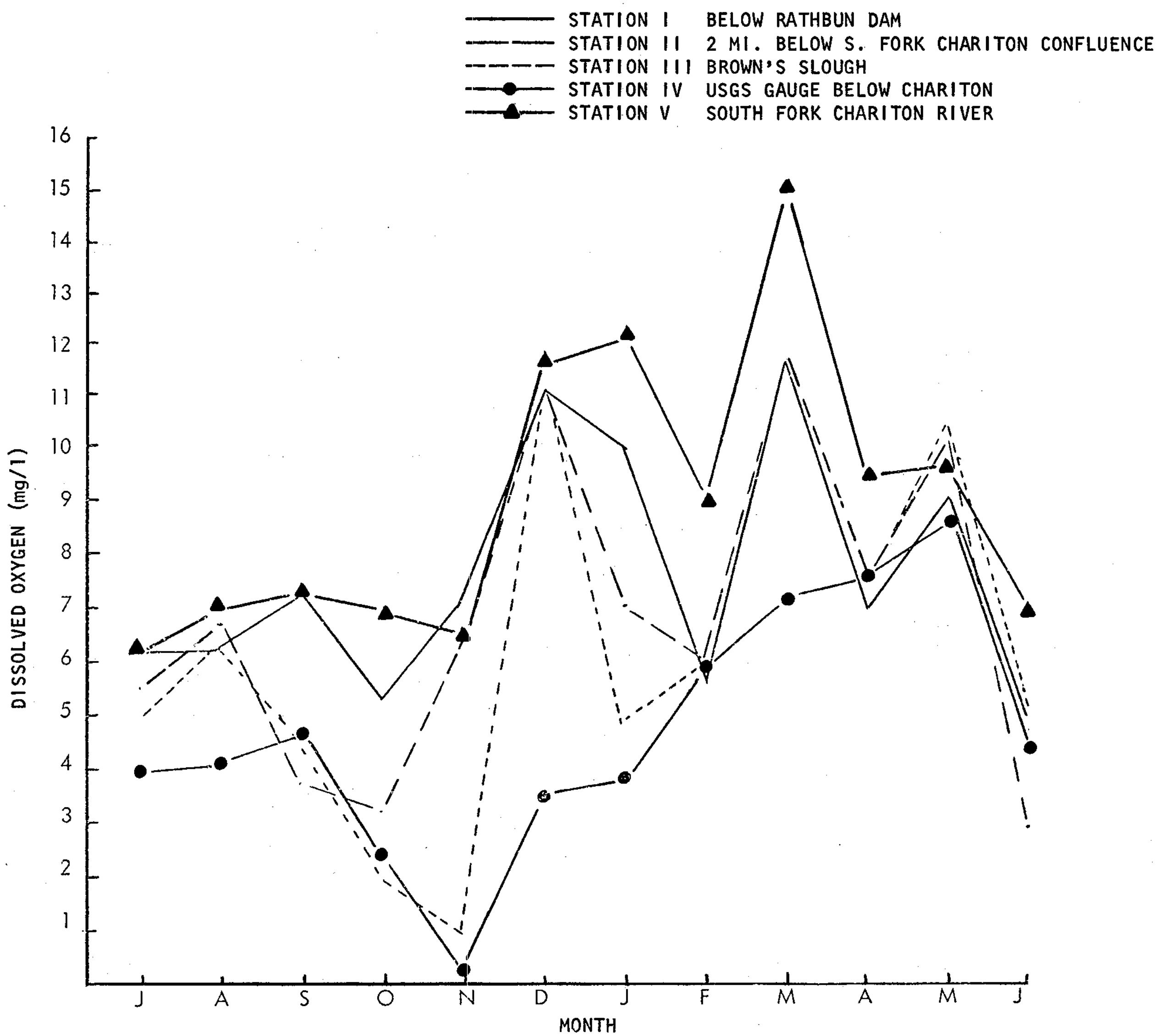


FIGURE IV-9 DO CONCENTRATIONS AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

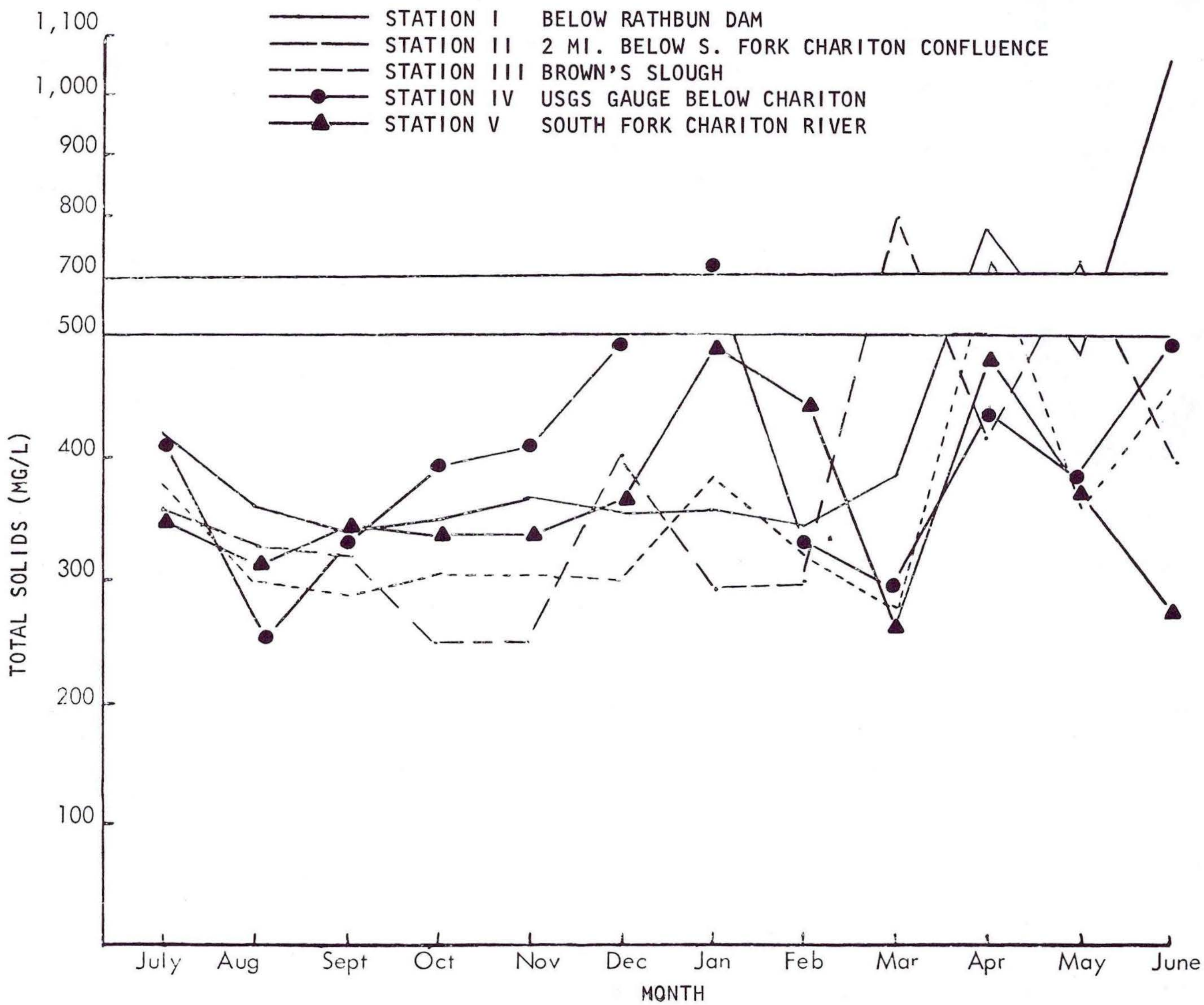


FIGURE IV-10 TOTAL SOLIDS CONCENTRATIONS AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

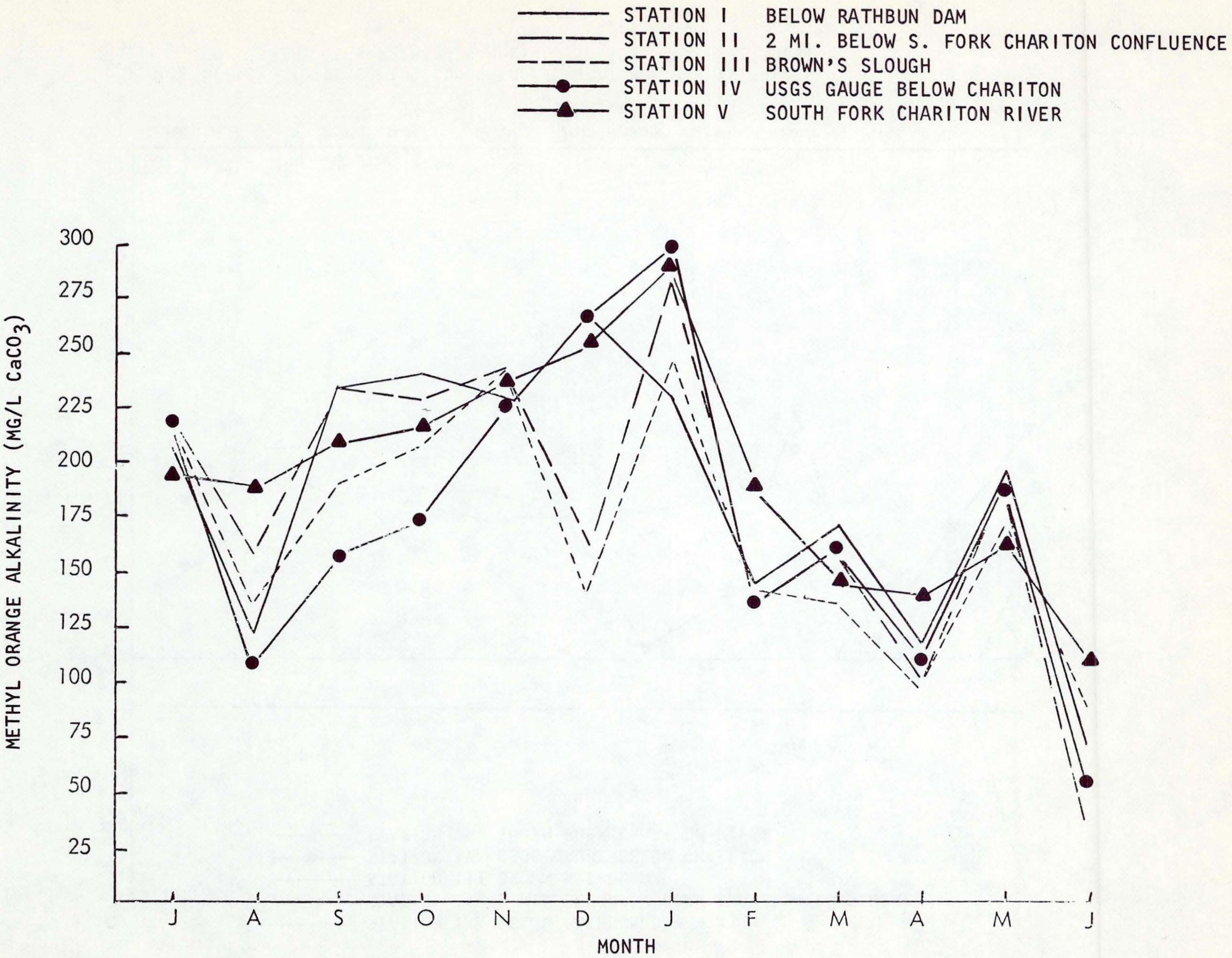


FIGURE IV-11 METHYL ORANGE ALKALINITY AT MONTHLY INTERVALS AT THE PRIMARY SAMPLING STATIONS (MAYHEW, 1969)

Rathbun Reservoir - Rathbun Dam is located on the Chariton River about six miles north of Centerville. Rathbun Reservoir (Lake Rathbun), located near the headwaters of the river, controls 549 square miles of drainage area. At conservation pool level, the reservoir has a length of eleven miles, a surface area of about 11,000 acres, and 180 miles of shoreline.

Water quality problems in Lake Rathbun originate, for the most part, from a few basic conditions inherent in the Chariton River basin and the morphology of the lake. These are (1) high turbidity, (2) high nutrient input, and (3) regular thermal stratification with oxygen depletion in the lower strata.

Thermal stratification exists yearly from June through August or September. The high nutrient input derives from sewage treatment plant discharges to the Chariton River and agricultural runoff in the upstream drainage basin. These nutrients stimulate heavy seasonal algae and macrophyte growth. This eventually creates a large BOD load on the lake. In conjunction with summer stratification, this BOD load is a cause of oxygen depletion in the lower depths of the lake. Low oxygen concentrations in the lower levels of the lake severely restrict populations of fish food organisms as well as fish habitat.

In spite of these problems, Lake Rathbun is the most attractice large reservoir in the State for recreation and has probably the best water quality of the large reservoirs. Algal problems, while present, are not as great as in most Iowa lakes.

NISHNABOTNA RIVER (2)

Water quality problems occur in the Nishnabotna River Basin at both high and low flows. Point sources, including large livestock operations, have caused ammonia and dissolved oxygen violations during low flow periods. During high flow, runoff causes very high turbidity and suspended solids concentrations. These parameters create serious problems for aquatic life.

WATER QUALITY CONDITIONS

Harmful Substances - Various heavy metals have been found in the Nishnabotna River (Table IV-4). Only barium and copper have been found in violation of Iowa Water Quality Standards. Since there are no known dischargers of heavy metal to the Nishnabotna River, the source of these violations is unknown.

Pesticides found in the Nishnabotna River include DDE, DDT, dieldrin, heptachlor, heptachlor epoxide, and lindane (Table IV-5). Herbicides found include 2,4-D and 2,4,5-T. Concentrations of DDE, DDT, dieldrin, heptachlor, and heptachlor epoxide have been found in concentrations higher than the recommended maximums established by the National Academy of Science. The wide variety of pesticides found is typical of a predominantly agricultural basin.

TABLE IV-4
SOUTHERN IOWA BASIN
HEAVY METALS IN THE NISHNABOTNA RIVER

Parameter	Total Samples	Number of Samples With Detectable Levels	Mean of Those With Detectable Levels (µg/l)	Maximum (µg/l)
As	18	0		
Ba	15	12	467	1,700
Cd	17	0		
Cr	22	2	10	10
Cu	17	6	23	30
Pb	17	4	40	60
Mn	23	20	401	2,800
Hg	4	0		
Ni	13	0		
Ag	7	0		
Zn	17	12	53	160

TABLE IV-5
SOUTHERN IOWA BASIN
PESTICIDES IN THE NISHNABOTNA RIVER

Parameter	Total Samples	Number of Samples With Detectable Levels	Mean of Those With Detectable Levels (ng/l)	Maximum (ng/l
DDE	5	1	17	17
DDT	5	1	14	14
Dieldrin	13	13	30	30
Heptachlor Epoxide	3	1	20	20
Heptachlor	4	2	310	600

Physical Modification - Between 1881 and 1929 about 75% and 90% of the lower 100 miles of the East and West Nishnabotna Rivers, respectively, were straightened. In addition, major portions of Walnut, Silver, and Indian Creeks were straightened. The channel straightening and levee work in the Nishnabotna River

Basin was successful in improving drainage and reducing flooding so that cultivated crops could be produced profitably on the bottomlands. Extensive channel straightening has also changed the natural stream characteristics in the basin, and serious problems have developed. Artifical degradation of the channels due to straightening, and the natural scour that followed, has lowered the outlets of tributary streams causing them to dig deeply into the loess soil. As a result, the rate of development of gullies in the basin has been seriously increased.

The natural stream channels in the basin, which once meandered extensively, have tended to be wide and shallow. After straightening, they became steepsided, flat-bottomed ditches which are narrow and deeply entrenched in the valleys.

The increased velocity of flow, due to the straightened channels, has greatly increased the capacity of the flowing water to erode soil from the bottom and sides of the channel and to transport this sediment downstream. This tendency for the straightened channels to increase in size is quite evident in the basin.

The sediment produced in the Nishnabotna River Basin from sheet erosion, gully erosion, and channel erosion is substantial. During June, 1947, over 28.8 million tons of suspended sediment were carried past the gage at Hamburg, as reported by the Corps of Engineers. Recent measurements of sediment loading and turbidity indicate that there has been no improvement since the 1940's. Suspended sediment measurements at Red Oak, on the East Nishnabotna River above much of the straightened channel, indicated 1.5 million tons of sediment loading for the year 1972. Turbidity levels have averaged 100 JTU, among the highest in the State, with maximum levels of 1,700 JTU.

A 1968 report on fish and wildlife conditions in the Nishnabotna River by the Fish and Wildlife Service states: "The streams in the Nishnabotna River drainage basin have been channelized in all but a few reaches and provide very little fishing except during occasional periods of high water. Channel alterations have almost completely eliminated game fish habitat. That which remains is marginal, of limited value, and unlikely to improve."

Eutrophication Potential - Phosphate and nitrate concentrations in the Nishnabotna River are high. Concentrations are similar to other rivers in the State in this regard. Nutrient sources include both point and nonpoint. Point sources generally provide an elevated background level with peaks downstream from dischargers. High concentrations on the entire river result from runoff conditions and nonpoint sources. While concentrations of nutrients are adequate to stimulate large algal blooms, no nuisance algal conditions have been reported. Light penetration or other physical factors may often limit algal populations instead of nitrates or phosphates.

Salinity, Acidity, and Alkalinity - Data on total dissolved solids concentrations in the Nishnabotna River have ranged from 207 mg/l to 539 mg/l with an average of 348 mg/l. Total alkalinity data averages 236 mg/l, similar to other Iowa streams. The alkalinity data has fluctuated from 134 mg/l to 283 mg/l.

Oxygen Depletion - Water quality data collected since 1970 have pointed out violations of the dissolved oxygen and ammonia standards on the Nishnabotna River (Figures IV-12, IV-13, and IV-14). No such violations have been found on the East Nishnabotna River (Figures IV-15 and IV-16).

Western Iowa Pork at Harlan and American Beef Packers at Oakland have caused severe pollution of the upper West Nishnabotna River. This pollution is sufficiently diluted at high flows to prevent violations of standards (Figure IV-12). However, during low flows gross pollution over the entire reach has occurred (Figures IV-13 and IV-14). Maximum ammonia concentrations of 27 mg/l have been found in the river below Oakland.

Both Silver Creek and Walnut Creek, major tributaries entering the West Nishnabotna River, have relatively low ammonia nitrogen concentrations. However, flow relative to that of the West Nishnabotna River is insufficient to significantly lower ammonia concentrations in the main stem.

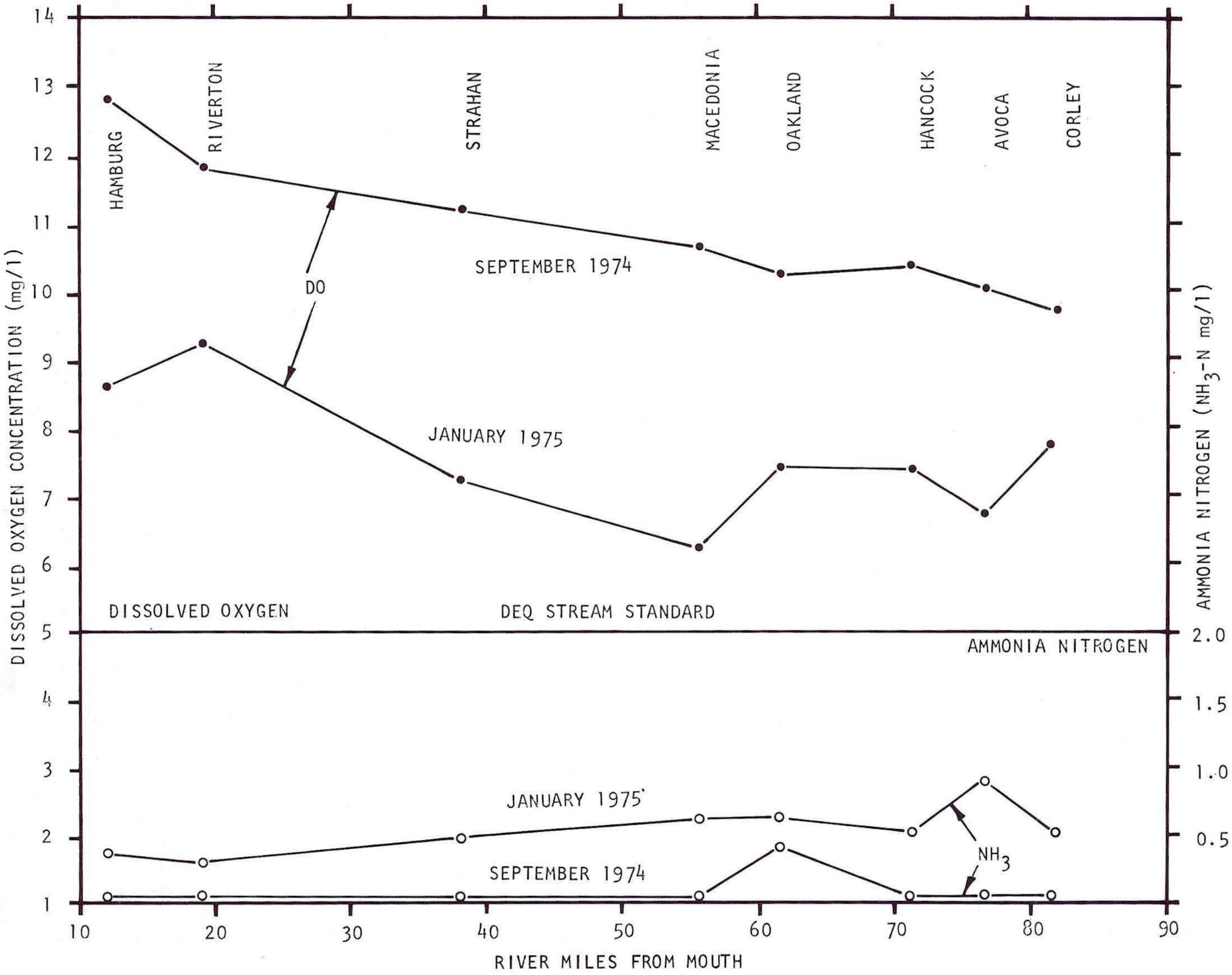


FIGURE IV-12 DISSOLVED OXYGEN AND AMMONIA NITROGEN CONCENTRATIONS IN THE WEST NISHNABOTNA RIVER, SPETEMBER 1974 AND JANUARY 1975

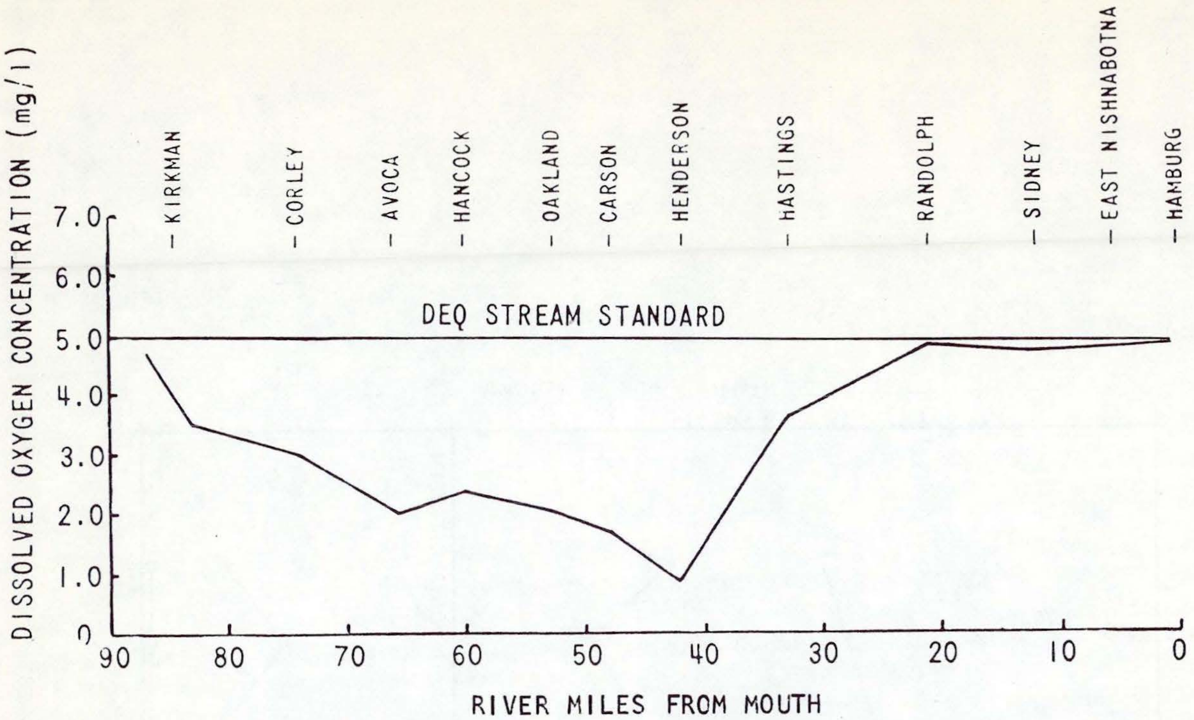


FIGURE IV-13 WEST NISHNABOTNA AND NISHNABOTNA, DISSOLVED OXYGEN CONCENTRATIONS

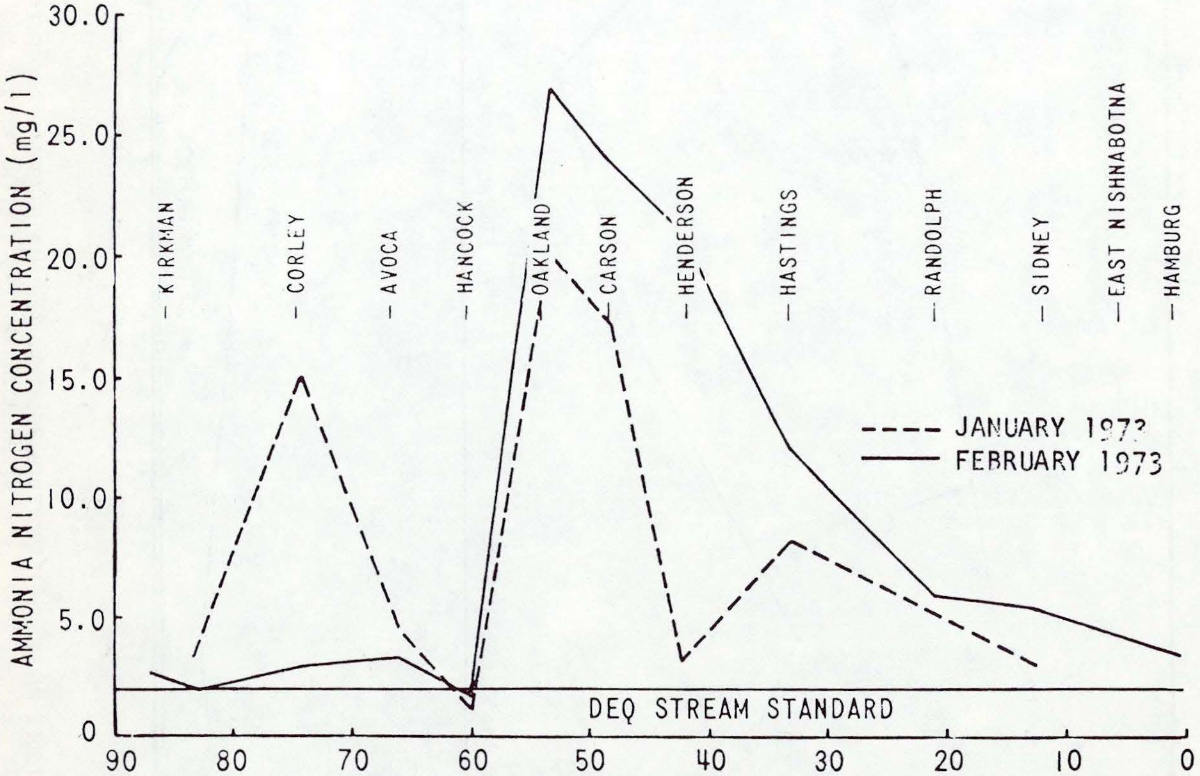


FIGURE IV-14 WEST NISHNABOTNA AND NISHNABOTNA, AMMONIA NITROGEN CONCENTRATIONS

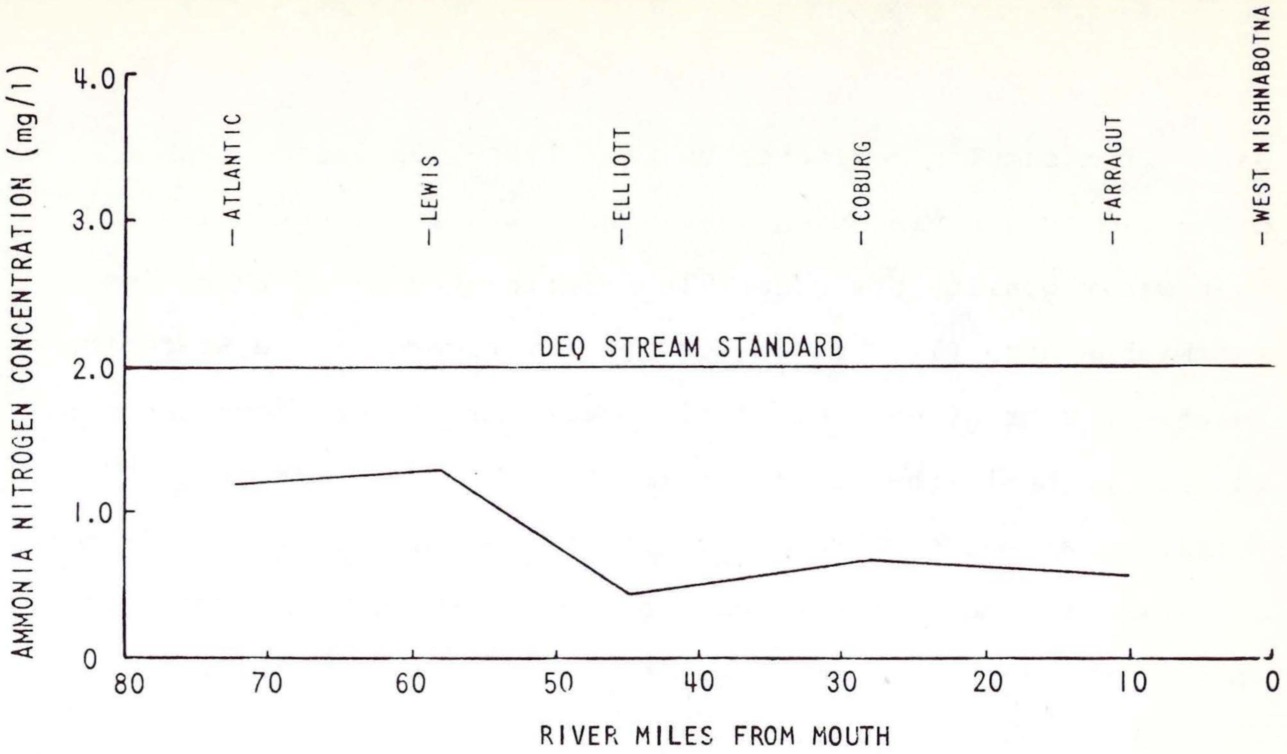


FIGURE IV-15 EAST NISHNABOTNA, DISSOLVED OXYGEN CONCENTRATIONS

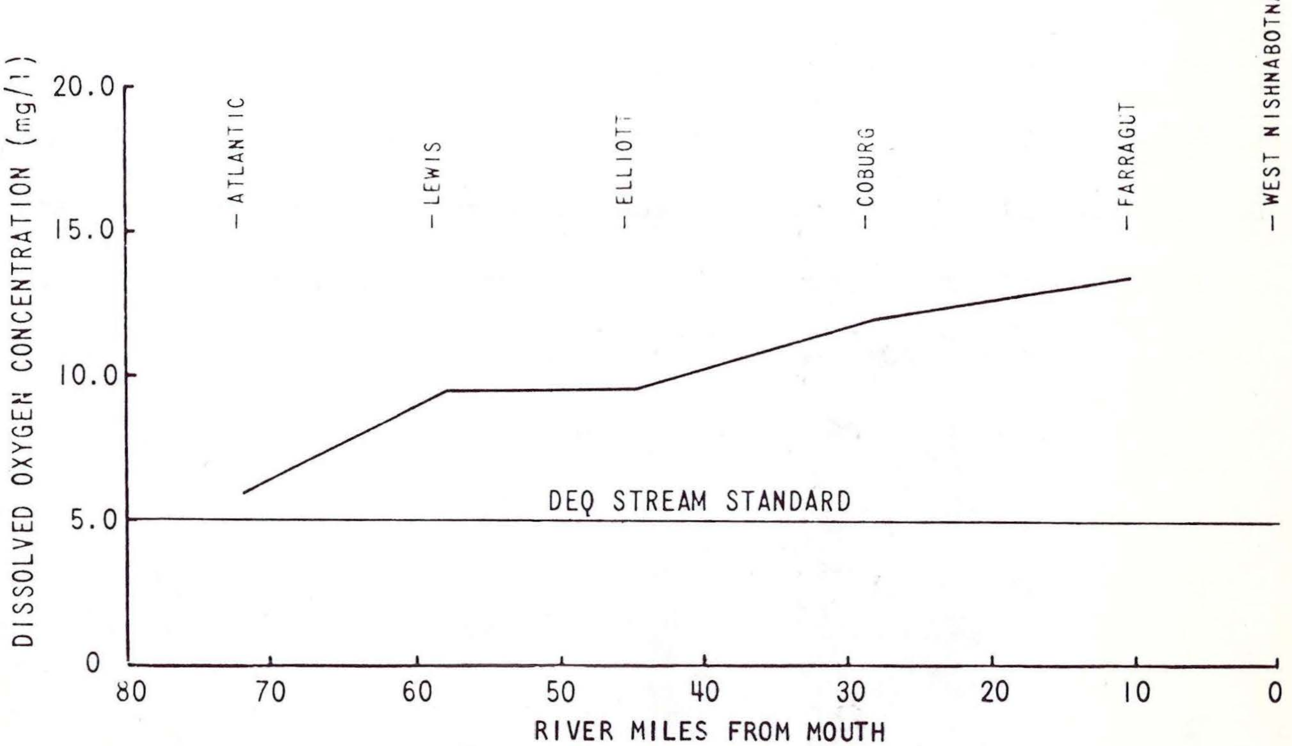


FIGURE IV-16 EAST NISHNABOTNA, AMMONIA NITROGEN CONCENTRATIONS

Data from samples collected between 1950-1959 indicate that dissolved oxygen violations have increased in recent years and that water quality has generally deteriorated since that time. The Nishnabotna River is one of the few rivers in the State that indicates current water quality poorer than in previous decades. This is probably the result of the large increase in meat packing that has occurred in the area and the subsequent discharge of wastes to the West Nishnabotna River. Dramatic improvement in water quality could be achieved if point source pollution is reduced.

<u>Health Hazards and Aesthetic Degradation</u> - Fecal coliform concentrations increase below point sources and throughout the river during runoff periods. No municipalities on thè Nishnabotna River have chlorination facilities. During low flow conditions, point sources are the main source of fecal coliform in the river. During high flows, nonpoint sources also contribute large numbers of fecal coliform to the river. Concentrations in the Nishnabotna River are similar to those found in most Iowa streams and have not resulted in any reported health hazards.

REFERENCES

1. Supporting Document for Iowa Water Quality Management Plan, Iowa Department of Environmental Quality, Des Moines, Iowa, 1976.

2. Iowa Water Quality Report*, Iowa Department of Environmental Quality, Des Moines, Iowa, April, 1975.

*References used in this report include:

   a. Mayhew, J.K., "Some Physical, Chemical and Biological Characteristics of the Chariton River Prior to Impoundment of Rathbun Reservoir", Biology Sections, State Conservation Commission, Des Moines, Iowa, 1969.

   b. Nishnabotna River Basin Waste Load Allocation Study, Stanley Consultants, Muscatine, Iowa, 1974.

   c. West Nishnabotna Water Quality Survey, Iowa State Hygienic Laboratory Report No. 72-39.

   d. Iowa Internal Stream Quality Survey, Iowa State Hygienic Laboratory Report No. 74-21.

   e. East and West Nishnabotna Rivers Water Quality Survey, Iowa State Hygienic Laboratory Report No. 75-26.

CHAPTER V

POINT SOURCE DISCHARGE INVENTORY

Point sources of wastewater, identified in DEQ files as discharging to surface waters in the Southern Iowa Basin, have been inventoried and tabulated. Municipal, industrial, and semipublic sources are included. Agricultural and nonpoint sources are discussed in Chapter VII.

An alphabetical listing of individual municipal, industrial and semipublic wastewater dischargers is set out in Table V-1 at the end of this chapter. Table V-1 also shows the location of each discharger by county and river mile and identifies the receiving stream for each discharger.

A reference number system is included in Table V-1, which identifies each discharger or potential discharger. Reference numbers for municipal sources are prefixed by "M", industrial sources by "I", and semipublic sources by "S". All incorporated municipalities have been assigned reference numbers whether they have discharges or not. The reference numbers are used to identify specific discharges on Figure V-1 which shows the location of point source dischargers in the Southern Iowa Basin. Reference numbers have been assigned in a downstream order, by river subbasins, beginning at the north and west end of the basin.

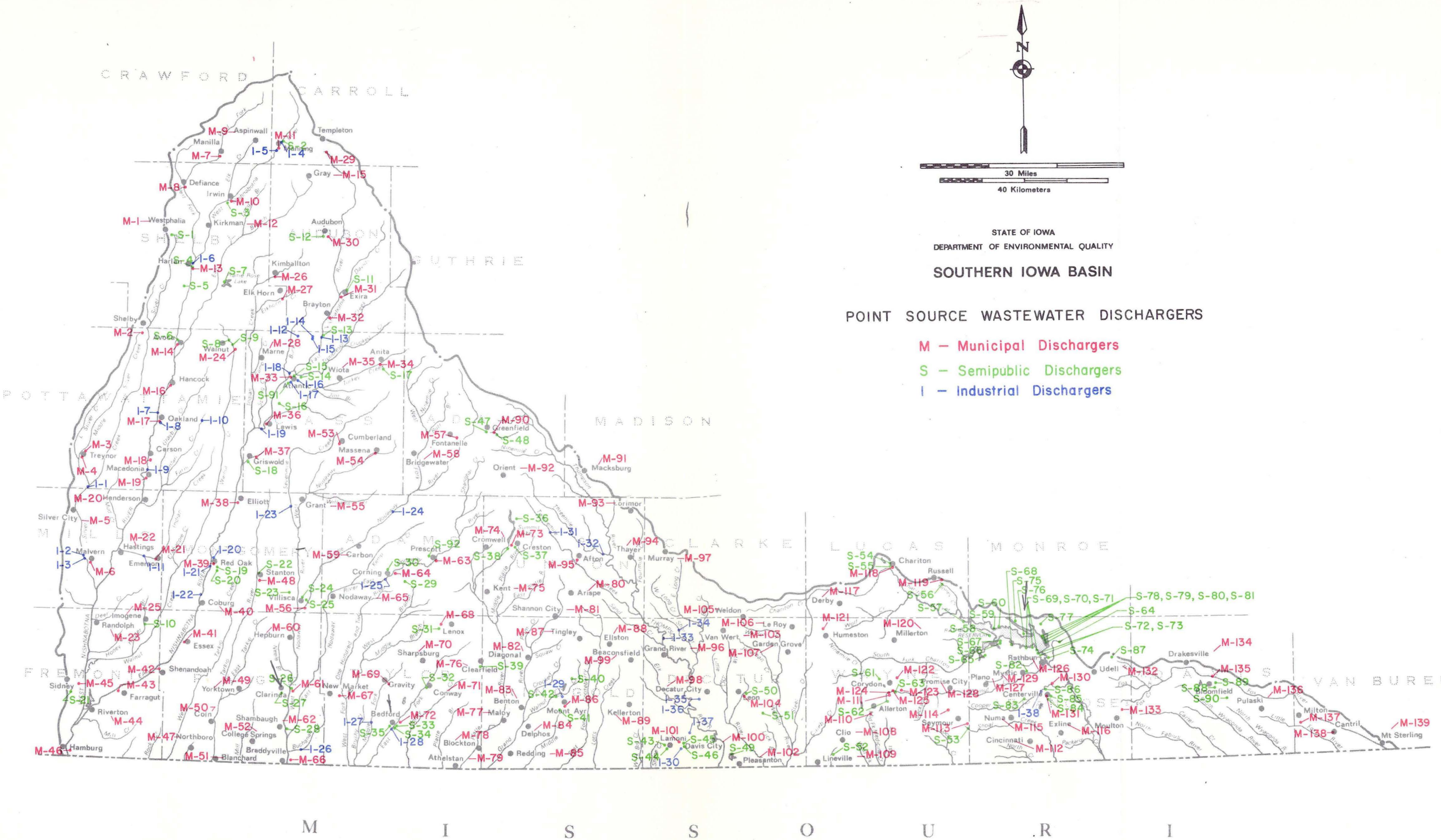

N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
POINT SOURCE WASTEWATER DISCHARGERS
M — Municipal Dischargers
S — Semipublic Dischargers
I — Industrial Dischargers
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
M I S S O U R I

FIGURE V-1

Table V-1 also includes a page reference to other parts of the report where information is set out concerning the present characteristics of each discharge, the waste load allocation each discharge will be required to meet, and for municipalities, an estimate of the cost involved in meeting the waste load allocation.

Table V-2, at the end of this chapter, identifies characteristics of each point wastewater discharge from municipal, semipublic, and industrial sources. Table V-2 lists dischargers in a downstream order from west to east across the basin. Beginning with the upstream end of the West Nishnabotna River, dischargers are listed in order proceeding downstream to the Iowa-Missouri border. The table then continues with the upstream end of the East Nishnabotna River and lists dischargers in the same downstream order. For each tributary stream, the point source furthest upstream is identified and the table continues downstream to the main channel.

Table V-2 lists present design capacity, present average daily flow, BOD_5 and ammonia nitrogen effluent concentrations, type of treatment process, method of sludge handling, and general comments from DEQ files, for each discharger. Treatment processes are identified only in general terms. Specific process descriptions can be obtained from DEQ. The comments include information obtained by DEQ personnel concerning existing operation, age of existing facilities, specific DEQ operation permit requirements, DEQ orders for additional treatment, or delineation of proposed facilities.

A total of 69 municipal treatment facilities have been identified in the basin. In addition, 70 small communities presently without municipal collection or treatment systems, are included in Tables V-1 and V-2.

MUNICIPAL

Municipal sewage flow and operational data for municipalities were extracted from DEQ records and files. Average flow values contained in reports submitted by treatment plant operators have been used. Flow values shown in Table V-2 are the averages obtained for the last full year of record; in most instances, 1974.

Most of the effluent quality data was collected from DEQ's Effluent Quality Analysis Program (EQAP). These data were supplemented by review of treatment facility operation reports. Data reported through EQAP are the results of tests conducted by the Iowa State Hygienic Laboratory on wastewater samples supplied by the individual dischargers. In most instances, no more than four BOD_5 values and two ammonia nitrogen values are reported each year. This is because many of the facilities are lagoons that discharge only a few times each year. No samples are required when the facilities are not discharging.

The results of BOD_5 analyses performed by the Iowa State Hygienic Laboratory are reported as between 25 mg/l and 150 mg/l. For some communities, a large percentage of the values reported are 25 or "25-" mg/l. Values designated "25-" are believed to be less than 25 mg/l, but were assumed to equal 25 mg/l for this study. The actual average effluent BOD_5 concentration may, in some cases, be lower than that obtained from EQAP information. The adequacy of the program will be reviewed since some dischargers are, or soon will be, required to provide BOD_5 removals to less than 25 mg/l. In some instances, due to a lack of data, engineering judgment has been applied to arrive at representative values rather than taking strict averages of the available data.

SEMIPUBLIC

Information identifying semipublic treatment facilities in the study area was obtained from DEQ files. Description of wastewater discharges from semipublic facilities was difficult to obtain. Quantitative and qualitative data was obtained from EQAP reports, where available, or design information from DEQ files. Values in Table V-2 are based on both limited operational data and design information and may not accurately reflect present operating conditions.

INDUSTRIAL

Information on industries discharging wastewater to streams within the study area was obtained from Corps of Engineers discharge permit applications (Discharge Permit Program, River and Harbors Act of 1899), DEQ industrial files, and the National Pollutant Discharge Elimination System (NPDES) permit applications. These sources provide the best available discharge information. However, caution should be exercised in interpretation of the data, since it has been submitted by the individual industries with very little verification.

SUMMARY

The distribution of hydraulic and organic loads upon the streams in the Southern Iowa Basin from municipal, industrial, and semipublic point sources, is summarized in Table V-3. The relatively small quantity of BOD_5 and ammonia-N discharged by industries and semipublic facilities compared to their flow is due to the following:

1. Several quarries discharge large volumes of water, but add very little BOD_5 to the stream.

2. Several industrial discharges consist only of cooling water which adds negligible amounts of BOD_5 to the stream.

3. Sufficient monitoring data is not available for most of the semipublic and industrial facilities to detect actual quantities.

Table V-4 summarizes the various types of municipal wastewater treatment facilities, the number of communities served, and the population served, for each subbasin. Table V-5 is a composite of Table V-4 for the Southern Iowa Basin.

TABLE V-1
SOUTHERN IOWA BASIN
POINT SOURCE WASTEWATER DISCHARGERS

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory Chapter V	Page Reference Allocation Chapter VI	Page Reference Needs Chapter VIII
MUNICIPAL							
Afton	M-95	Union	53	Twelvemile Creek	27	7, 48	12
Allerton S.	M-110	Wayne	6	Unnamed Creek Tributary to Middle Fork Medicine Creek	29	8, 49	12
Allerton N.	M-111	Wayne	29-29	West Jackson Creek	29	8, 50	11
Anita	M-34	Cass	82-5	Turkey Creek	20	4, 42	14
Arispe	M-80	Union	-	NEMTF	25	46	14
Aspinwall	M-9	Crawford	-	NEMTF	16	39	11
Athelstan	M-79	Taylor	-	NEMTF	25	46	12
Atlantic	M-33	Cass	69-5	East Nishnabotna River	19	4, 41	8
Audubon	M-30	Audubon	92-5	Blue Grass Creek Tributary to East Nishnabotna River	18	3, 41	9
Avoca	M-14	Pottawattamie	62-5	West Nishnabotna River	16	2, 40	10
Beaconsfield	M-99	Ringgold	-	NEMTF	27	48	11
Bedford	M-72	Taylor	8	East Fork One Hundred and Two River	24	6, 45	13
Benton	M-83	Ringgold	-	NEMTF	25	47	14
Blanchard	M-51	Page	-	NEMTF	22	43	14
Blockton	M-78	Taylor	-	NEMTF	25	46	12
Bloomfield	M-135	Davis	30	Dry Run to Fox River	33	10,52	14
Braddyville	M-66	Page	0	Nodaway River	24	6,44	9
Brayton	M-32	Audubon	82-5	East Nishnabotna River	19	3, 41	8
Bridgewater	M-58	Adair	-	NEMTF	23	44	13
Cantril	M-138	Van Buren	2	Unnamed Tributary to Little Fox River	34	11, 52	15
Carbon	M-59	Adams	-	NEMTF	23	44	13
Carson	M-18	Pottawattamie	44-5	West Nishnabotna River	17	3, 40	8
Centerville N.E.	M-130	Appanoose	18	Dry Run to Cooper Creek	32	10, 51	8
Centerville W.	M-131	Appanoose	20	Manson Branch Creek Tributary to Cooper Creek	33	10, 51	12
Chariton	M-118	Lucas	55	Chariton River	29	8, 50	8
Cincinnati	M-112	Appanoose	-	NEMTF	29	49	15
Clarinda	M-61	Page	8-4	West Nodaway River	23	5, 44	9
Clearfield	M-76	Taylor & Ringgold	-	NEMTF	25	46	12
Clio	M-108	Wayne	-	NEMTF	29	49	16
Coburg	M-40	Montgomery	-	NEMTF	21	42	10
Coin	M-50	Page	-	NEMTF	22	43	14
College Springs	M-52	Page	-	NEMTF	22	43	16
Conway	M-71	Taylor	-	NEMTF	24	45	13
Corning	M-64	Adams	34-4	East Nodaway River	23	6, 45	9
Corydon N.E.	M-122	Wayne	24-29	Wildcat Creek Tributary to South Fork Chariton River			
Corydon S.E.	M-123	Wayne	24-29	West Jackson Creek			
Corydon S.W.	M-124	Wayne	26-29	West Jackson Creek			
Corydon S.	M-125	Wayne	25-29	West Jackson Creek			
Creston	M-73	Union	13-25	West Jackson Creek			
Cromwell	M-74	Union	-	NEMTF			

TABLE V-1 (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory Chapter V	Page Reference Allocation Chapter VI	Page Reference Needs Chapter VIII
Cumberland	M-53	Cass	53-4	Tributary to Sevenmile Creek	22	5, 43	11
Davis City	M-100	Decatur	-	NEMTF	27	48	11
Decatur City	M-98	Decatur	-	NEMTF	27	48	11
Defiance	M-8	Shelby	89-5	West Fork West Nishnabotna River	15	2, 39	8
Delphos	M-84	Ringgold	-	NEMTF	25	47	14
Derby	M-117	Lucas	-	NEMTF	29	50	10
Diagonal	M-82	Ringgold	-	NEMTF	25	47	14
Drakesville	M-134	Davis	-	NEMTF	33	52	15
Elk Horn	M-27	Shelby	81-5	Elkhorn Creek	18	3, 41	9
Elliott	M-38	Montgomery	47-5	East Nishnabotna River	20	4, 42	10
Ellston	M-88	Ringgold	-	NEMTF	26	47	15
Emerson	M-21	Mills	35-5	Indian Creek	18	3, 40	10
Essex	M-41	Page	22-5	East Nishnabotna River	21	5, 42	10
Exira	M-31	Audubon	84-5	East Nishnabotna River	19	3, 41	9
Exline	M-116	Appanoose	-	NEMTF	29	50	16
Farragut	M-43	Fremont	6-5	East Nishnabotna River	21	5, 42	8
Fontanelle	M-57	Adair	59-4	Dry Run to Middle Nodaway River	23	5, 44	13
Garden Grove	M-107	Decatur	-	NEMTF	29	49	14
Grand River	M-96	Decatur	-	NEMTF	27	48	11
Grant	M-55	Montgomery	-	NEMTF	22	44	13
Gravity	M-69	Taylor	-	Middle Fork One Hundred and Two River	24	6, 45	13
Gray	M-15	Audubon	-	NEMTF	17	40	11
Greenfield	M-90	Adair	89	Tributary to Thompson River	26	7, 47	8
Griswold	M-37	Cass	54-5	Baughman's Creek	20	4, 42	10
Hamburg	M-46	Fremont	2	Nishnabotna River	21	5, 41	11
Hancock	M-16	Pottawattamie	56-5	West Nishnabotna River	17	3, 40	10
Harlan	M-13	Shelby	72-5	West Nishnabotna River	16	2, 40	8
Hastings	M-22	Mills	-	NEMTF	18	40	10
Henderson	M-20	Mills	-	NEMTF	17	40	10
Hepburn	M-60	Page	-	NEMTF	23	44	10
Humeston	M-121	Wayne	33-29	Unnamed Tributary to Chariton River	30	9, 50	11
Imogene	M-25	Fremont	-	NEMTF	18	41	12
Irwin	M-10	Shelby	84-5	West Nishnabotna River	16	2, 39	8
Kellerton	M-89	Ringgold	-	NEMTF	26	47	15
Kent	M-75	Union	-	NEMTF	25	46	12
Kimballton	M-26	Audubon	84-5	Indian Creek	18	3, 41	8
Kirkman	M-12	Shelby	-	NEMTF	16	40	11
Lamoni	M-101	Decatur	14	Unnamed Tributary to Thompson River	28	7, 48	11
Lenox	M-68	Taylor	20-10	Unnamed Tributary of Middle Branch of West Fork One Hundred and Two River	24	6, 45	8
Leon	M-104	Decatur	3-9	McGruder Creek to Little River	28	8, 49	9
Le Roy	M-106	Decatur	-	NEMTF	28	49	14
Lewis	M-36	Cass	60-5	East Nishnabotna River	20	4, 42	10
Lineville	M-109	Wayne	-	NEMTF	29	49	15
Lorimor	M-93	Union	-	NEMTF	27	48	12
Macedonia	M-19	Pottawattamie	40-5	Ditch to West Nishnabotna River	17	3, 40	9

TABLE V-1 (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory Chapter V	Page Reference Allocation Chapter VI	Page Reference Needs Chapter VIII
Macksburg	M-91	Madison	-	NEMTF	26	47	13
Maloy	M-77	Ringgold	-	NEMTF	25	46	12
Malvern	M-6	Mills	25-5	Silver Creek	15	2, 39	13
Manilla	M-7	Crawford	97-5	West Fork West Nishnabotna River	15	2, 39	8
Manning	M-11	Carroll	108-5	West Nishnabotna River	16	2, 40	8
Marne	M-28	Cass	-	NEMTF	18	41	14
Massena	M-54	Cass	52-4	Unnamed Tributary to West Nodaway River	22	5, 43	10
Millerton	M-120	Wayne	-	NEMTF	30	50	10
Milton	M-137	Van Buren	11	Little Fox River	34	11, 52	15
Moulton	M-133	Appanoose	47	Fox River	33	10, 51	14
Mount Ayr	M-86	Ringgold	12	Dry Run to Middle Fork Grand River	26	7, 47	9
Mt. Sterling	M-139	Van Buren	-	NEMTF	34	52	15
Murray	M-97	Clarke	-	NEMTF	27	48	11
Mystic	M-129	Appanoose	-	NEMTF	32	51	12
New Market	M-67	Taylor	1-10	Dry Run to West Fork One Hundred and Two River	24	6, 45	9
Nodaway	M-65	Adams	-	NEMTF	24	45	11
Northboro	M-47	Page	-	NEMTF	22	43	16
Numa	M-115	Appanoose	-	NEMTF	29	50	16
Oakland	M-17	Pottawattamie	49-5	West Nishnabotna River	17	3, 40	9
Orient	M-92	Adair	-	NEMTF	26	47	13
Plano	M-127	Appanoose	-	NEMTF	32	51	12
Pleasanton	M-102	Decatur	-	NEMTF	28	48	11
Prescott	M-63	Adams	42-4	East Nodaway River	23	6, 44	16
Promise City	M-128	Wayne	-	NEMTF	32	51	12
Pulaski	M-136	Davis	-	NEMTF	33	52	15
Randolph	M-23	Fremont	-	NEMTF	18	40	12
Rathbun	M-126	Appanoose	-	NEMTF	32	51	12
Redding	M-85	Ringgold	-	NEMTF	25	47	14
Red Oak	M-39	Montgomery	36-5	East Nishnabotna River	20	4, 42	9
Riverton	M-44	Fremont	-	NEMTF	21	42	10
Russell	M-119	Lucas	42	Honey Creek			
Seymour E.	M-114	Wayne	13-29	Walnut Creek			
Seymour S.W.	M-113	Wayne	19	Shoal Creek			
Shambaugh	M-62	Page	-	NEMTF			
Shannon City	M-81	Union & Ringgold	-	NEMTF			
Sharpsburg	M-70	Taylor	-	NEMTF			
Shelby	M-2	Shelby & Pottawattamie	65-5	Middle Silver Creek	15	2, 39	9
Shenandoah	M-42	Page & Fremont	16-5	East Nishnabotna River	21	5, 42	9
Sidney	M-45	Fremont	7-5	Dry Run to West Nishnabotna River	21	5, 41	11
Silver City	M-5	Mills	-	NEMTF	15	39	13

TABLE V-1 (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory: Chapter V	Allocation: Chapter VI	Needs: Chapter VIII
Stanton	M-48	Montgomery	29	Tarkio River	22	5, 43	13
Templeton	M-29	Carroll	110-5	East Nishnabotna River	18	3, 41	10
Thayer	M-94	Union	-	NEMTF	27	48	13
Tingley	M-87	Ringgold	-	NEMTF	26	47	15
Treynor N.W.	M-3	Pottawattamie	43-4	Middle Silver Creek	15	2, 39	9
Treynor S.E.	M-4	Pottawattamie	42-4	Middle Silver Creek	15	2, 39	13
Udell	M-132	Appanoose	-	NEMTF	33	51	15
Van Wert	M-103	Decatur	-	NEMTF	28	49	15
Villisca	M-56	Montgomery	22-4	Middle Nodaway River	23	5, 44	13
Walnut	M-24	Pottawattamie	69-5	Walnut Creek	18	3, 40	11
Weldon	M-105	Decatur	-	NEMTF	28	49	14
Westphalia	M-1	Shelby	-	NEMTF	15	39	13
Wiota	M-35	Cass	-	NEMTF	20	42	14
Yorktown	M-49	Page	-	NEMTF	22	43	14
SEMIPUBLIC							
Abild M.H.P.	S-15	Cass	-	NA	19	4	
Adair County Home	S-47	Adair	-	NA	26	7	
Adams County Home	S-29	Adams	-	NA	23	6	
Administration Area Rathbun Lake STP	S-72	Appanoose	20	Rathbun Lake	31	9	
Administration Area Rathbun Lake WTP	S-73	Appanoose	20	Rathbun Lake	31	9	
A. E. Butler Campground	S-75	Appanoose	26	Honey Creek to Rathbun Lake	31	9	
Allerton WTP	S-62	Wayne	58	West Jackson Creek	30	9	
Antler Acres - Parkside Knolls Subdivision	S-76	Appanoose	-	NA	32	10	
Appanoose County Home	S-83	Appanoose	-	NA	32	10	
Atlantic-City Maintenance Building	S-91	Cass	-	NA	19	4	
Atlantic WTP	S-14	Cass	70-5	Troublesome Creek	19	4	
Audubon County Home	S-12	Audubon	-	NA	18	3	
Avoca WTP	S-6	Pottawattamie	63-5	West Nishnabotna River	16	2	
Barth Supper Club	S-43	Decatur	3	Ditch	28	8	
Bedford Country Club	S-34	Taylor	-	NA	25	6	
Bedford WTP	S-33	Taylor	7	East Fork One Hundred and Two River	24	8	
Blue Grass Inn	S-54	Lucas	-	NA	29	9	
Bridge View Public Use Area STP	S-60	Appanoose	23-5	Rathbun Lake	30	9	
Bridge View Public Use Area WTP	S-59	Appanoose	23-5	Rathbun Lake	30	9	
Buck Creek Development	S-78	Appanoose	21-5	Rathbun Lake	32	10	

TABLE V-1 - (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory Chapter V	Page Reference Allocation Needs Chapter VI
Buck Creek Public Use Area WTP	S-80	Appanoose	21-5	Rathbun Lake	32	10
Buck Creek Public Use Area East	S-79	Appanoose	21-5	Rathbun Lake	32	10
Buck Creek Public Use Area West	S-81	Appanoose	21-5	Rathbun Lake	32	10
Camp Aldersgate United Methodist Camp	S-25	Montgomery	-	NA	22	5
Cass County Home	S-16	Cass	-	NA	20	4
Centerville WTP	S-86	Appanoose	-	NA	33	10
Clarinda WTP	S-26	Page	-	NA	23	5
Clearfield WTP	S-39	Taylor	19	Tributary to Platte River	25	7
Colonial Motor Inn	S-9	Pottawattamie	70-5	Walnut Creek	18	3
Conway WTP	S-32	Taylor	16	East Fork One Hundred and Two River	24	6
Corydon WTP	S-63	Wayne	25-29	Unnamed Tributary of W. Jackson Creek	31	9
Creston WTP	S-38	Union	12-35	West Platte River	25	7
Davis County Home	S-90	Davis	-	NA	33	10
Decatur County Home	S-51	Decatur	-	NA	28	8
Exira WTP	S-11	Audubon	85-5	Davids Creek	19	3
Farmsong M.H.P.	S-44	Decatur	-	NA	28	8
Floyd Dixon's Lazy Daz	S-65	Appanoose	-	NA	31	9
Fremont County Home	S-21	Fremont	-	NA	21	5
Greenfield WTP	S-48	Adair	88	Marvel Creek to Thompson River	26	7
Green Valley State Park	S-36	Union	-	NA	25	7
Griswold WTP	S-18	Cass	54-5	Baughman's Creek	20	4
Harlan WTP	S-4	Shelby	73-5	West Nishnabotna River	16	2
Heavenly Hide-Away	S-58	Appanoose	-	NA	30	8
Imogene WTP	S-10	Fremont	-	NA	18	3
Indian Ridge M.H.P.	S-57	Wayne	-	NA	30	8
Iowa Highway Commission Rest Area I-35 East Side No. 034R	S-45	Decatur	5	Thompson River	28	8
Irwin WTP	S-3	Shelby	-	NA	16	2
Island View Public Use Area East STP	S-71	Appanoose	21	Rathbun Lake	31	9
Island View Public Use Area West STP	S-69	Appanoose	21	Rathbun Lake	31	9
Island View Public Use Area WTP	S-70	Appanoose	21	Rathbun Lake	31	9
Jack Huff Motel	S-13	Cass	77-5	East Nishnabotna River	19	3
Lake Anita State Park	S-17	Cass	-	NA	20	4
Lake Rathbun KOA Campground	S-77	Appanoose	24	Honey Creek Branch to Rathbun Lake	32	10
Leighton Development	S-46	Decatur	4	Ditch to Thompson River	28	8

TABLE V-1 (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory Chapter V	Allocation Needs Chapter VI
Lenox WTP	S-31	Taylor	-	NA	24	6
Leon WTP	S-50	Decatur	3-9	McGruder Creek to Little River	28	8
Lineville WTP	S-52	Wayne	1	East Muddy Creek	29	8
Lucas County Home	S-55	Lucas	-	NA	30	8
MBZ M.H.P.	S-89	Davis	-	NA	33	10
Montgomery County Home	S-20	Montgomery	-	NA	20	4
Mount Ayr Fish Hatchery	S-42	Ringgold	5-8	Walnut Creek	26	7
Mount Ayr WTP	S-41	Ringgold	-	NA	26	7
Mystic Primary School	S-82	Appanoose	-	NA	32	10
Nine Eagles State Park	S-49	Decatur	-	NA	28	8
Oaks Campground	S-87	Appanoose	-	NA	33	10
Page County Home	S-27	Page	-	NA	23	6
Powell School	S-19	Montgomery	-	NA	20	4
Prairie Rose State Park	S-7	Shelby	-	NA	17	3
Prescott WTP	S-92	Adams	42-4	East Nodaway River	23	6
Rathbun Fish Hatchery	S-74	Appanoose	18	Chariton River	32	10
Rathbun Heights Development	S-85	Appanoose	-	NA	33	10
Rathbun Regional Water Association WTP	S-84	Appanoose	-	NA	33	10
Ridgeview East Subdivision	S-64	Appanoose	10-29	Ditch to Snider Branch to Chariton River	31	9
Ringgold County Home	S-40	Ringgold	-	NA	26	7
Rolling Cove Public Use Area WTP	S-68	Appanoose	24	Rathbun Lake	31	9
Rupe Campgrounds	S-88	Davis	-	NA	33	10
Russell WTP	S-56	Lucas	4-38	Honey Creek	30	8
Seymour WTP	S-53	Wayne	18	Shoal Creek	29	8
Shambaugh WTP	S-28	Page	-	NA	23	6
Shelby County Home	S-5	Shelby	-	NA	16	2
South Fork Public Use Area WTP	S-67	Appanoose	1-29	Rathbun Lake	31	9
South Fork Public Use Area STP	S-66	Appanoose	1-29	Rathbun Lake	31	9
Stanton WTP	S-22	Montgomery	29	Tarkio River	22	5
Taylor County Home	S-35	Taylor	-	NA	25	6
Union County Home	S-37	Union	-	NA	25	7
Viking Lake State Park	S-23	Montgomery	-	NA	22	5
Villisca Community School	S-24	Montgomery	-	NA	22	5
Walnut WTP	S-8	Pottawattamie	69-5	Baby Creek to Walnut Creek	18	3
Walter's Creek Recreation Area	S-30	Adams	-	NA	23	6
Wayne County Home	S-61	Wayne	-	NA	30	9
West Central Iowa Rural Water Association WTP	S-2	Carroll	65-5	West Nishnabotna River	16	2
Westphalia WTP	S-1	Shelby	-	NA	15	2

TABLE V-2
DISCHARGER INVENTORY*
SOUTHERN IOWA BASIN

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Nishnabotna River							
West Nishnabotna River							
Silver Creek							
Westphalia (M-1)	121	---	---	---	---	NEMTF	
Westphalia WTP (S-1)	---	---	0.001/NA	---	---	None	Iron filter backwash.
Schildberg Construction Company (I-1)	---	---	2.030/NA	---	---	None	Quarry dewatering, Silver City Quarry, Sec. 31, T74N, R41W.
Middle Silver Creek							
Shelby (M-2)	537	650	---/0.063	---	---	Two Cell Lagoon / Not Applicable	6.53 acres, total retention during dry periods, placed into operation in 1974.
Treynor N.W. (M-3)	472**	400	.017/0.040	34/5	7/1	One Cell Lagoon / Not Applicable	3.2 acres, lagoon not to specifications.
Treynor S.E. (M-4)	472**	150	.013/0.015	55/6	5/.5	One Cell Lagoon / Not Applicable	1.4 acres.
Silver Creek							
Silver City (M-5)	272	---	---	---	---	NEMTF	
Henningsen Foods Inc. (I-2)	---	---	0.108/---	74/67	1/1	One Cell Lagoon / Not Applicable	3.5 acres, total retention for cooling water.
Malvern (M-6)	1,158	1,570	.434/0.165	91/329	---	Two Cell Lagoon / Not Applicable	Built in 1974.
Kaser Construction Company (I-3)	---	---	0.114/NA	---	---	None	Limestone quarry dewatering, Malvern Quarry, SW¼, Sec. 5.
Elk Creek							
Aspinwall (M-9)	81	---	---	---	---	NEMTF	
West Nishnabotna River							
West Central Iowa Rural Water Association WTP (S-2)	---	---	0.005/NA	---	---	None	Iron and manganese filter backwash.
Culligan Soft Water Service (I-4)	---	---	0.003/NA	---	---	None	

TABLE V-1 (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory Chapter V	Page Reference Allocation Needs Chapter VI
Lenox WTP	S-31	Taylor	-	NA	24	6
Leon WTP	S-50	Decatur	3-9	McGruder Creek to Little River	28	8
Lineville WTP	S-52	Wayne	1	East Muddy Creek	29	8
Lucas County Home	S-55	Lucas	-	NA	30	8
MBZ M.H.P.	S-89	Davis	-	NA	33	10
Montgomery County Home	S-20	Montgomery	-	NA	20	4
Mount Ayr Fish Hatchery	S-42	Ringgold	5-8	Walnut Creek	26	7
Mount Ayr WTP	S-41	Ringgold	-	NA	26	7
Mystic Primary School	S-82	Appanoose	-	NA	32	10
Nine Eagles State Park	S-49	Decatur	-	NA	28	8
Oaks Campground	S-87	Appanoose	-	NA	33	10
Page County Home	S-27	Page	-	NA	23	6
Powell School	S-19	Montgomery	-	NA	20	4
Prairie Rose State Park	S-7	Shelby	-	NA	17	3
Prescott WTP	S-92	Adams	42-4	East Nodaway River	23	6
Rathbun Fish Hatchery	S-74	Appanoose	18	Chariton River	32	10
Rathbun Heights Development	S-85	Appanoose	-	NA	33	10
Rathbun Regional Water Association WTP	S-84	Appanoose	-	NA	33	10
Ridgeview East Subdivision	S-64	Appanoose	10-29	Ditch to Snider Branch to Chariton River	31	9
Ringgold County Home	S-40	Ringgold	-	NA	26	7
Rolling Cove Public Use Area WTP	S-68	Appanoose	24	Rathbun Lake	31	9
Rupe Campgrounds	S-88	Davis	-	NA	33	10
Russell WTP	S-56	Lucas	4-38	Honey Creek	30	8
Seymour WTP	S-53	Wayne	18	Shoal Creek	29	8
Shambaugh WTP	S-28	Page	-	NA	23	6
Shelby County Home	S-5	Shelby	-	NA	16	2
South Fork Public Use Area WTP	S-67	Appanoose	1-29	Rathbun Lake	31	9
South Fork Public Use Area STP	S-66	Appanoose	1-29	Rathbun Lake	31	9
Stanton WTP	S-22	Montgomery	29	Tarkio River	22	5
Taylor County Home	S-35	Taylor	-	NA	25	6
Union County Home	S-37	Union	-	NA	25	7
Viking Lake State Park	S-23	Montgomery	-	NA	22	5
Villisca Community School	S-24	Montgomery	-	NA	22	5
Walnut WTP	S-8	Pottawattamie	69-5	Baby Creek to Walnut Creek	18	3
Walter's Creek Recreation Area	S-30	Adams	-	NA	23	6
Wayne County Home	S-61	Wayne	-	NA	30	9
West Central Iowa Rural Water Association WTP	S-2	Carroll	65-5	West Nishnabotna River	16	2
Westphalia WTP	S-1	Shelby	-	NA	15	2

TABLE V-2
DISCHARGER INVENTORY*
SOUTHERN IOWA BASIN

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Nishnabotna River							
West Nishnabotna River							
Silver Creek							
Westphalia (M-1)	121	---	---	---	---	NEMTF	
Westphalia WTP (S-1)	---	---	0.001/NA	---	---	None	Iron filter backwash.
Schildberg Construction Company (I-1)	---	---	2.030/NA	---	---	None	Quarry dewatering, Silver City Quarry, Sec. 31, T74N, R41W.
Middle Silver Creek							
Shelby (M-2)	537	650	---/0.063	---	---	Two Cell Lagoon Not Applicable	6.53 acres, total retention during dry periods, placed into operation in 1974.
Treynor N.W. (M-3)	472**	400	.017/0.040	34/5	7/1	One Cell Lagoon Not Applicable	3.2 acres, lagoon not to specifications.
Treynor S.E. (M-4)	472**	150	.013/0.015	55/6	5/.5	One Cell Lagoon Not Applicable	1.4 acres.
Silver Creek							
Silver City (M-5)	272	---	---	---	---	NEMTF	
Henningsen Foods Inc. (I-2)	---	---	0.108/---	74/67	1/1	One Cell Lagoon Not Applicable	3.5 acres, total retention for cooling water.
Malvern (M-6)	1,158	1,570	.434/0.165	91/329	---	Two Cell Lagoon Not Applicable	Built in 1974.
Kaser Construction Company (I-3)	---	---	0.114/NA	---	---	None	Limestone quarry dewatering, Malvern Quarry, SW¼, Sec. 5.
Elk Creek							
Aspinwall (M-9)	81	---	---	---	---	NEMTF	
West Nishnabotna River							
West Central Iowa Rural Water Association WTP (S-2)	---	---	0.005/NA	---	---	None	Iron and manganese filter backwash.
Culligan Soft Water Service (I-4)	---	---	0.003/NA	---	---	None	

TABLE V-1 (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference: Inventory Chapter V	Page Reference: Allocation Needs Chapter VI
Lenox WTP	S-31	Taylor	-	NA	24	6
Leon WTP	S-50	Decatur	3-9	McGruder Creek to Little River	28	8
Lineville WTP	S-52	Wayne	1	East Muddy Creek	29	8
Lucas County Home	S-55	Lucas	-	NA	30	8
MBZ M.H.P.	S-89	Davis	-	NA	33	10
Montgomery County Home	S-20	Montgomery	-	NA	20	4
Mount Ayr Fish Hatchery	S-42	Ringgold	5-8	Walnut Creek	26	7
Mount Ayr WTP	S-41	Ringgold	-	NA	26	7
Mystic Primary School	S-82	Appanoose	-	NA	32	10
Nine Eagles State Park	S-49	Decatur	-	NA	28	8
Oaks Campground	S-87	Appanoose	-	NA	33	10
Page County Home	S-27	Page	-	NA	23	6
Powell School	S-19	Montgomery	-	NA	20	4
Prairie Rose State Park	S-7	Shelby	-	NA	17	3
Prescott WTP	S-92	Adams	42-4	East Nodaway River	23	6
Rathbun Fish Hatchery	S-74	Appanoose	18	Chariton River	32	10
Rathbun Heights Development	S-85	Appanoose	-	NA	33	10
Rathbun Regional Water Association WTP	S-84	Appanoose	-	NA	33	10
Ridgeview East Subdivision	S-64	Appanoose	10-29	Ditch to Snider Branch to Chariton River	31	9
Ringgold County Home	S-40	Ringgold	-	NA	26	7
Rolling Cove Public Use Area WTP	S-68	Appanoose	24	Rathbun Lake	31	9
Rupe Campgrounds	S-88	Davis	-	NA	33	10
Russell WTP	S-56	Lucas	4-38	Honey Creek	30	8
Seymour WTP	S-53	Wayne	18	Shoal Creek	29	8
Shambaugh WTP	S-28	Page	-	NA	23	6
Shelby County Home	S-5	Shelby	-	NA	16	2
South Fork Public Use Area WTP	S-67	Appanoose	1-29	Rathbun Lake	31	9
South Fork Public Use Area STP	S-66	Appanoose	1-29	Rathbun Lake	31	9
Stanton WTP	S-22	Montgomery	29	Tarkio River	22	5
Taylor County Home	S-35	Taylor	-	NA	25	6
Union County Home	S-37	Union	-	NA	25	7
Viking Lake State Park	S-23	Montgomery	-	NA	22	5
Villisca Community School	S-24	Montgomery	-	NA	22	5
Walnut WTP	S-8	Pottawattamie	69-5	Baby Creek to Walnut Creek	18	3
Walter's Creek Recreation Area	S-30	Adams	-	NA	23	6
Wayne County Home	S-61	Wayne	-	NA	30	9
West Central Iowa Rural Water Association WTP	S-2	Carroll	65-5	West Nishnabotna River	16	2
Westphalia WTP	S-1	Shelby	-	NA	15	2

TABLE V-1 (Continued)

Discharger*	Reference Number	County	River Mile**	Discharge To***	Page Reference Inventory Chapter V	Page Reference Allocation Needs Chapter VI
INDUSTRIAL						
Allied Mills Inc.	I-16	Cass	-	NA	19	4
American Beef Packers Inc.	I-7	Pottawattamie	49-5	Dry Run to West Nishnabotna River	17	3
American Natural Gas Company	I-11	Mills	35-5	Indian Creek	18	3
Armour & Company	I-29	Ringgold	5-8	Unnamed Tributary to Walnut Creek	26	7
Carter-Waters Corporation	I-38	Appanoose	19	Ditch to Cooper Creek	33	10
Culligan Soft Water Service	I-4	Carroll	108-5	West Nishnabotna River	16	2
E. I. Sargent Quarries Inc.	I-33	Decatur	34	Thompson River	27	7
E. I. Sargent Quarries Inc.	I-34	Decatur	8-20	Short Creek	27	7
E. I. Sargent Quarries Inc.	I-36	Decatur	16	Thompson River	27	7
Gendler Stone Products Co.	I-27	Taylor	7	Middle Fork One Hundred and Two River	24	6
Gendler Stone Products Co.	I-28	Taylor	6	East Fork One Hundred and Two River	25	6
Gendler Stone Products Co.	I-26	Page	1-2	Buchanan Creek	24	6
Green Valley Chemical Corporation	I-31	Union	18-40	Twelvemile Creek	27	7
Hallett Construction Co.	I-22	Montgomery	34-5	East Nishnabotna River	21	4
Henningsen Foods Inc.	I-2	Mills	26-5	Silver Creek	15	2
Kaser Construction Co.	I-3	Mills	25-5	Silver Creek	15	2
Kaser Construction Co.	I-21	Montgomery	35-5	East Nishnabotna River	21	4
Kaser Construction Co.	I-23	Montgomery	36-4	Sevenmile Creek	22	5
Le Roy's Skelly Service Station & Restaurant	I-35	Decatur	-	NA	27	7
Manley Car & Truck Plaza	I-14	Cass	-	NA	19	4
Martin Marietta Corp.	I-37	Decatur	2-8	Patterhoff Creek	27	7
Northern Natural Gas Compressor Station	I-10	Pottawattamie	53-5	East Branch of Jordan Creek	17	3
Oakland Feeding Corp.	I-8	Pottawattamie	-	NA	17	3
Phillips 66 Service Station and Restaurant	I-15	Cass	79-5	Dry Run to East Nishnabotna River	19	4
Schildberg Construction Co.	I-1	Pottawattamie	37-5	Silver Creek	15	2
Schildberg Construction Co.	I-9	Pottawattamie	41-5	West Nishnabotna River	17	3
Schildberg Construction Co.	I-24	Adams	42-4	Middle Nodaway River	23	5
Schildberg Construction Co.	I-25	Adams	33-4	East Nodaway River	24	6
Schildberg Construction Co.	I-19	Cass	60-5	East Nishnabotna River	20	4
Schildberg Construction Co.	I-18	Cass	69-5	East Nishnabotna River	20	4
Schildberg Construction Co.	I-32	Union	1-55	Threemile Creek	26	7
Skelly Oil Service Center	I-13	Cass	79-5	East Nishnabotna River	19	4
Soypro International Inc.	I-5	Carroll	107-5	West Nishnabotna River	16	2
Standard Oil Service Station, Restaurant and Motel	I-30	Decatur	-	NA	28	8
Stuckeys No. 244	I-12	Cass	-	NA	20	4
Uniroyal Inc.	I-20	Montgomery	37-5	East Nishnabotna River	21	4
Western Iowa Pork Co.	I-6	Shelby	73-5	West Nishnabotna River	16	2
Wise Owl Motel	I-17	Cass	-	NA	19	4

TABLE V-1 (Continued)

* STP = Sewage treatment plant
WTP = Water treatment plant
M.H.P. = Mobile Home Park

** When only one number is listed, the discharge is directly into the main stem of the river and the number indicates the mileage from the Iowa-Missouri border to the point of discharge.

Where two numbers are listed, the first number is the mileage up the tributary stream from the point of discharge to the point of confluence of the tributary stream with the river. The second number is the mileage from the Iowa-Missouri border to the point of confluence.

*** NEMTF = No Existing Municipal Treatment Facility
NA = Not Available

TABLE V-2
DISCHARGER INVENTORY*
SOUTHERN IOWA BASIN

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Nishnabotna River							
West Nishnabotna River							
Silver Creek							
Westphalia (M-1)	121	---	---	---	---	NEMTF	
Westphalia WTP (S-1)	---	---	0.001/NA	---	---	None	Iron filter backwash.
Schildberg Construction Company (I-1)	---	---	2.030/NA	---	---	None	Quarry dewatering, Silver City Quarry, Sec. 31, T74N, R41W.
Middle Silver Creek							
Shelby (M-2)	537	650	---/0.063	---	---	Two Cell Lagoon / Not Applicable	6.53 acres, total retention during dry periods, placed into operation in 1974.
Treynor N.W. (M-3)	472**	400	.017/0.040	34/5	7/1	One Cell Lagoon / Not Applicable	3.2 acres, lagoon not to specifications.
Treynor S.E. (M-4)	472**	150	.013/0.015	55/6	5/.5	One Cell Lagoon / Not Applicable	1.4 acres.
Silver Creek							
Silver City (M-5)	272	---	---	---	---	NEMTF	
Henningsen Foods Inc. (I-2)	---	---	0.108/---	74/67	1/1	One Cell Lagoon / Not Applicable	3.5 acres, total retention for cooling water.
Malvern (M-6)	1,158	1,570	.434/0.165	91/329	---	Two Cell Lagoon / Not Applicable	Built in 1974.
Kaser Construction Company (I-3)	---	---	0.114/NA	---	---	None	Limestone quarry dewatering, Malvern Quarry, SW¼, Sec. 5.
Elk Creek							
Aspinwall (M-9)	81	---	---	---	---	NEMTF	
West Nishnabotna River							
West Central Iowa Rural Water Association WTP (S-2)	---	---	0.005/NA	---	---	None	Iron and manganese filter backwash.
Culligan Soft Water Service (I-4)	---	---	0.003/NA	---	---	None	

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Manning (M-11)	1,656	2,940	0.150/0.198	34/43	---	Trickling Filter / Open Sludge Beds	Plant rebuilt in 1965.
Soypro International Inc. (I-5)	---	---	---	---	---	None	Proposed to connect to Manning's sewer system or build private treatment facility.
Irwin (M-10)	446	600	0.031/0.045	104/27	---	One Cell Lagoon / Not Applicable	1 acre, built in 1958, in violation of construction permit, overloaded at present.
Irwin WTP (S-3)	---	---	---	---	---	None	
West Fork West Nishnabotna River							
Manilla (M-7)	943	1,020	0.057/0.102	79/38	---	Two Cell Lagoon / Not Applicable	At design load, needs upgrading.
Defiance (M-8)	392	447	0.031/0.041	52/13	---	Two Cell Lagoon / Not Applicable	3.97 acres, total retention, controlled discharge, built in 1968, over designed, one cell needs to be sealed.
Kirkman (M-12)	72	---	---	---	---	NEMTF	
Western Iowa Pork Company (I-6)	---	---	---	45/---	22/---	Anaerobic, Aerated and Aerobic Lagoons / Not Applicable	Complex slaughter house, built in 1971, trouble in meeting discharge requirements related to stream flow.
Harlan WTP (S-4)	---	---	---	---	---	None	Lime sludge discharge.
Harlan (M-13)	5,049	5,500	0.632/0.550	47/248	24/127	Trickling Filter / Open Sludge Beds and Wet Haul to Farmland	Plant to be replaced in future.
Shelby County Home (S-5)	---	---	---	---	---	Septic Tank and Soil Absorption System / Unknown	Proposed new lagoon designed for 60 people, site approved on 1/15/75.
Avoca WTP (S-6)	---	---	---	---	---	None	Lime sludge discharge.
Avoca (M-14)	1,535	1,750	0.143/0.131	28/33	---	Two Cell Lagoon / Not Applicable	10.6 acres, built in 1972.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
East Branch West Nishnabotna River							
Gray (M-15)	145	---	---	---	---	NEMTF	
Prairie Rose State Park (S-7)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Total retention.
West Nishnabotna River							
Hancock (M-16)	228	450	.007/0.080	42./2	---	Two Cell Lagoon / Not Applicable	3 acres, built in 1971, problem in filling east cell, estimated flow of 0.015 mgd is not adequate to require 3 acre lagoon system.
American Beef Packers Inc. (I-7)	---	86,400	0.750/1.000	54/338	151/945	Anaerobic, Aerated and Aerobic Lagoons / Not Applicable	Complex slaughter house, 4.6 acres two cell anaerobic lagoon, 1.76 acres two cell aerated lagoon, 25 acres aerobic lagoon, 7.5 acres aerobic polishing lagoon; discharge permit requirements related to stream flow.
Oakland (M-17)	1,603	1,650	0.484/0.148	47/190	10/40	Two Cell Lagoon / Not Applicable	Controlled discharge, 12.16 acres, placed into operation in 1970.
Oakland Feeding Corporation (I-8)	---	---	---	---	---	Runoff Retention Lagoons / Wet Haul to Farmland	Overflow in violation of consent order of 1973, recommended legal action.
Carson (M-18)	756	700	0.119/0.049	69/68	29/29	Imhoff Tank and Trickling Filter / Open Sludge Beds	Not designed to meet secondary treatment.
Schildberg Construction Company (I-9)	---	---	---	---	---	Settling Ponds / Not Applicable	Quarry dewatering and rock washing, Macedonia Quarry, Sec. 21 and 22, T74N, R40W.
Macedonia (M-19)	330	350	0.012/0.035	56/6	21/2	Two Cell Lagoon / Not Applicable	3 acres, built in 1963, east cell needs to be sealed.
Henderson (M-20)	211	---	---	---	---	NEMTF	Construction permit issued on 2/11/75 for 2.52 acres, three cell lagoon for P.E. of 250.
Jordan Creek							
Northern Natural Gas Compressor Station (I-10)	---	---	---	---	---	Septic Tank and Soil Absorption System / Unknown	No discharge.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Indian Creek							
Emerson (M-21)	484	520	0.036/0.021	25/8	17/5	Imhoff Tank and Trickling Filter / Open Sludge Beds	Built in 1942, now in poor condition.
American Natural Gas Company (I-11)	---	---	---/0.010	---	---	Activated Sludge / Septic Tanks	Package plant, built in 1963.
West Nishnabotna River							
Hastings (M-22)	229	---	---	---	---	NEMTF	
Deer Creek							
Randolph (M-23)	214	---	---	---	---	NEMTF	Applied for Federal assistance to build STP.
Walnut Creek							
Walnut WTP (S-8)	---	---	---	---	---	None	
Colonial Motor Inn (S-9)	---	---	---/0.020	---	---	Activated Sludge / Polishing Lagoon	Package plant, built in 1974.
Walnut (M-24)	870	1,010	0.072/0.104	37/22	---	Two Cell Lagoon / Not Applicable	6.82 acres, placed into operation in 1964.
Hunter Branch							
Imogene (M-25)	192	---	---	---	---	NEMTF	Lagoon site approved 1/12/71.
Imogene WTP (S-10)	---	---	---	---	---	None	Proposed iron filter backwash.
East Nishnabotna River							
Indian Creek							
Kimballton (M-26)	343	515	0.040/0.050	90/30	---	Two Cell Aerated Lagoon / Not Applicable	4 acres, built in 1971, creamery waste overloading lagoon.
Elkhorn Creek							
Elk Horn (M-27)	667	833	0.065/0.083	49/27	---	Two Cell Lagoon / Not Applicable	6.09 acres, built in 1960.
Camp Creek							
Marne (M-28)	187	---	---	---	---	NEMTF	
East Nishnabotna River							
Templeton (M-29)	312	420	0.020/0.042	30/5	---	Two Cell Lagoon / Not Applicable	3.96 acres, built in 1973.
Blue Grass Creek							
Audubon (M-30)	2,907	3,500	0.354/NA	25/74	4/12	Trickling Filter / Sludge Lagoon	Infiltration is under study, considerable bypassing.
Audubon County Home (S-12)	---	---	---	---	---	Septic Tanks / Unknown	Built in 1942.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
East Nishnabotna River							
Exira (M-31)	966	1,530	0.068/0.050	32/18	---	Two Cell Lagoon / Not Applicable	11.59 acres, built in 1962.
Davids Creek							
Exira WTP (S-11)	---	---	0.050/---	---	---	None	
East Nishnabotna River							
Brayton (M-32)	151	225	0.014/---	35/4	---	Two Cell Lagoon / Not Applicable	2.2 acres, built in 1969, sealed in 1973.
Jack Huff Motel (S-13)	---	155	---/0.008	---	---	Activated Sludge / Polishing Lagoon	Package plant, at I-80 and U.S. Hwy 71.
Skelly Oil Service Center (I-13)	---	50	---/0.005	---	---	One Cell Lagoon / Not Applicable	0.74 acres, at I-80 and U.S. Hwy 71.
Manley Car and Truck Plaza (I-14)	---	---	---	45/---	---	One Cell Lagoon / Not Applicable	Total retention, at I-80 and U.S. Hwy 71.
Phillips 66 Service Station & Restaurant (I-15)	---	90	---/0.001	---	---	One Cell Lagoon / Not Applicable	0.57 acres, at I-80 and U.S. Hwy 71.
Atlantic (M-33)	7,306	7,410	0.753/0.880	27/170	14/88	Trickling Filter / Open Sludge Beds and Wet Haul to Farmland.	Built in 1942, improved in 1972, needs infiltration/inflow analysis.
Atlantic-City Maintenance Building (S-91)	---	20	---/0.001	---	---	Septic Tank and Subsurface Absorption System / Unknown	Built in 1974, no discharge.
Troublesome Creek							
Atlantic WTP (S-14)	---	---	0.003/---	---	---	Holding Pond / Not Applicable	
East Nishnabotna River							
Abild M.H.P. (S-15)	---	95	---	---	---	One Cell Lagoon / Not Applicable	Total retention, built in 1974, to be aerated after 19 homes are connected.
Allied Mills Inc. (I-16)	---	50	---/0.002	---	---	Septic Tank and Subsurface Absorption System / Unknown	No discharge.
Wise Owl Motel (I-17)	---	---	---	---	---	One Cell Lagoon / Not Applicable	Total retention.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Schildberg Construction Company (I-18)	---	---	2.030/---	---	---	None	Quarry dewatering, Lewis Quarry, Sec. 17, T75N, R37W.
Stuckeys No. 244 (I-12)	---	30	---	---	---	Septic Tank and Subsurface Absorption System / Unknown	New, no discharge, plans approved 2/11/74, at I-80 and North Olive Street.
Cass County Home (S-16)	---	---	---	---	---	Septic Tank / Unknown	Built in 1939.
Turkey Creek							
Anita (M-34)	1,101	1,400	0.098/0.140	28/23	---	Two Cell Lagoon / Not Applicable	12.61 acres, built in 1964, needs to be upgraded.
Lake Anita State Park (S-17)	---	---	---	---	---	One Cell Lagoon / Not Applicable	Total retention.
Wiota (M-35)	171	---	---	---	---	NEMTF	
East Nishnabotna River							
Lewis (M-36)	526	767	---/0.061	30/---	---	Two Cell Lagoon / Not Applicable	7.02 acres, built in 1969, one cell sealed.
Schildberg Construction Company (I-19)	---	---	2.030/---	---	---	None	Quarry dewatering, Atlantic Quarry, Sec. 6, T76N, R36W.
Baughman's Creek							
Griswold (M-37)	1,181	1,420	0.120/0.118	30/30	11/11	Imhoff Tank and Trickling Filter / Open Sludge Beds	Built in 1952, improved in 1962.
Griswold WTP (S-18)	---	---	---	---	---	None	
East Nishnabotna River							
Elliott (M-38)	423	620	0.056/0.074	31/14	2/1	Two Cell Lagoon / Not Applicable	5.72 acres, placed into operation in 1968.
Red Oak (M-39)	6,210	8,000	0.775/0.800	39/252	21/136	Trickling Filter / Open Sludge Beds	Needs infiltration/inflow study and ammonia reduction.
Powell School (S-19)	---	---	---	35/---	---	None	
Montgomery County Home (S-20)	---	---	---	---	---	Septic Tank / Unknown	Built before 1937.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Uniroyal Inc. (I-20)	---	930	---	---	---	Retention Pond / Not Applicable	Sanitary wastes separately collected and sent to the City treatment plant; industrial and process wastes flow from a common gravity main into a retention pond, then by open ditch to river.
Kaser Construction Company (I-21)	---	---	0.040/---	---	---	None	Limestone quarry dewatering, Stennett Quarry, Red Oak, operates 80 days a year.
Hallett Construction Company (I-22)	---	---	---	---	---	None	All discharges from the quarry have been discontinued.
Coburg (M-40)	36	---	---	---	---	NEMTF	
Essex (M-41)	770	844	0.190/0.166	25/40	5/8	Two Cell Lagoon / Not Applicable	8.58 acres, built in 1962.
Shenandoah (M-42)	5,968	7,500	0.575/---	28/134	15/72	Trickling Filter / Wet Haul to Farmland.	Placed into operation in 1965.
Farragut (M-43)	521	647	0.031/0.032	52/13	2/1	Two Cell Lagoon / Not Applicable	5.23 acres, built in 1967, lagoon flooded, intermittent discharge, only at average or above average stream flow.
Riverton (M-44)	331	---	---	---	---	NEMTF	
West Nishnabotna River							
Sidney (M-45)	1,061	1,100	0.054/0.110	37/17	15/7	Imhoff Tank and Trickling Filter / Open Sludge Beds and Wet Haul to Farmland.	Built in 1941, require to be maintained at optimum operating condition.
Fremont County Home(S-21)	---	---	---	---	---	Septic Tank / Unknown	Built before 1943.
Nishnabotna River							
Hamburg (M-46)	1,649	2,100	0.115/0.250	---	---	Two Cell Lagoon / Not Applicable	13.6 acres, placed into operation in 1969.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Tarkio River							
Middle Tarkio Creek							
Northboro (M-47)	115	---	---	---	---	NEMTF	
Tarkio River							
Stanton (M-48)	574	630	0.046/---	35/13	1/0.4	Two Cell Lagoon / Not Applicable	5 acres, placed into operation in 1969.
Stanton WTP (S-22)	---	---	---	---	---	None	
East Tarkio Creek							
Yorktown (M-49)	105	---	---	---	---	NEMTF	
Tarkio River							
Coin (M-50)	294	---	---	---	---	NEMTF	Site approved on 2/26/75 for three cell lagoon.
Blanchard (M-51)	139	---	---	---	---	NEMTF	
Nodaway River							
Mill Creek							
College Springs (M-52)	295	---	---	---	---	NEMTF	
West Nodaway River							
Sevenmile Creek							
Cumberland (M-53)	385	510	0.039/0.051	34/11	---	Imhoff Tank and Trickling Filter / Open Sludge Beds	Placed into operation in 1965.
West Nodaway River							
Massena (M-54)	433	565	0.025/0.051	35/7	---	Imhoff Tank and Trickling Filter / Open Sludge Beds	Need to improve operation.
Grant (M-55)	152	---	---	---	---	NEMTF	
Sevenmile Creek							
Kaser Construction Company (I-23)	---	---	0.250/---	---	---	None	Limestone quarry dewatering, Grant Quarry, Grant, operates 80 days a year.
West Nodaway River							
Viking Lake State Park (S-23)	---	---	---	---	---	One Cell Lagoon / Not Applicable	Total retention.
Middle Nodaway River							
Villisca Community School (S-24)	---	---	---	153/---	---	None	
Camp Aldersgate United Methodist Camp (S-25)	---	---	---	---	---	One Cell Lagoon / Not Applicable	0.75 acres, total retention.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Villisca (M-56)	1,402	2,114	---/0.189	27/---	---	Trickling Filter / Open Sludge Beds and Wet Haul to Farmland.	Built in 1957.
Fontanelle (M-57)	752	900	0.084/0.054	29/20	2/1	Two Cell Lagoon / Not Applicable	6 acres, placed into operation in 1960.
West Fork							
Bridgewater (M-58)	188	---	---	---	---	NEMTF	Proposed two cell lagoon designed for P.E. of 404, design approved 2/11/75.
Middle Nodaway River							
Schildberg Construction Company (I-24)	---	---	2.030/---	---	---	None	Quarry dewatering, Mt. Etna Quarry.
Carbon (M-59)	135	---	---	---	---	NEMTF	
West Nodaway River							
Hepburn (M-60)	38	---	---	---	---	NEMTF	
Clarinda (M-61)	5,420	8,400	1.287/0.838	25/268	---	Trickling Filter / Open Sludge Beds	Built in 1944, remodeled in 1954, planning plant improvements.
Clarinda WTP (S-26)	---	---	---	---	---	None	
Page County Home (S-27)	---	---	---	---	---	Septic Tank / Unknown	
Shambaugh (M-62)	178	---	---	---	---	NEMTF	
Shambaugh WTP (S-28)	---	---	---	---	---	None	
East Nodaway River							
Prescott (M-63)	305	---	---	25/---	---	Two Cell Lagoon / Not Applicable	Built in 1971.
Prescott WTP (S-92)	---	---	0.001/---	---	---	None	
Adams County Home (S-29)	---	51	---/0.005	60/---	---	One Cell Lagoon / Not Applicable	0.606 acres, built in 1965.
Walter's Creek Recreation Area (S-30)	---	---	0.708/---	---	---	Two Cell Lagoon / Not Applicable	Total retention.
Corning (M-64)	2,095	---	0.281/0.500	27/63	---	Activated Sludge and Trickling Filter / Vacuum Filtration and Wet Haul to Farmland.	Built in 1935, improved in 1970.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent: Flow (mgd) Average/Design	Effluent: BOD_5 (mg/l)/(lb/day)	Effluent: Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Schildberg Construction Company (I-25)	---	---	0.120/---	---	---	Settling Ponds / Not Applicable	Quarry dewatering and rock washing, Corning Quarry.
Nodaway (M-65)	176	---	---	---	---	NEMTF	
Nodaway River							
Buchanan Creek							
Gendler Stone Products Company (I-26)	---	---	---	---	---	Settling Ponds / Not Applicable	Limestone quarry, rock washing, Braddyville Quarry, Braddyville.
Nodaway River							
Braddyville (M-66)	207	260	0.028/0.026	33/8	---	Two Cell Lagoon / Not Applicable	1.8 acres, built in 1973.
One Hundred and Two River							
West Fork 102 River							
New Market (M-67)	501	600	---/0.060	---	---	Two Cell Lagoon / Not Applicable	6 acres, built in 1974.
Middle Branch							
Lenox (M-68)	1,215	1,547	0.080/0.220	100/67	16/11	Two Cell Aerated Lagoon / Not Applicable	10.97 acres, built in 1973, north cell aerated in 1974.
Lenox WTP (S-31)	---	---	---	---	---	None	
Middle Fork 102 River							
Gravity (M-69)	286	---	---	---	---	None	
Gendler Stone Products Company (I-27)	---	---	---	---	---	Settling Ponds / Not Applicable	Rock washing, Bedford 102 Quarry, Bedford.
East Fork 102 River							
Sharpsburg (M-70)	106	---	---	---	---	NEMTF	
Conway (M-71)	91	---	---	---	---	NEMTF	
Conway WTP (S-32)	---	---	0.002/--	---	---	None	
Bedford (M-72)	1,733	5,140	0.179/0.400	26/39	7/10	Two Stage Trickling Filter / Open Sludge Beds	Built in 1938, improved in 1958, sludge handling problems, need general updating of equipment.
Bedford WTP (S-33)	---	---	0.007/---	---	---	None	

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Bedford Country Club (S-34)	---	---	---	---	---	One Cell Lagoon / Not Applicable	Total retention.
Taylor County Home (S-35)	---	---	---	---	---	Septic Tank / Unknown	Built in 1942.
Gendler Stone Products Company (I-28)	---	---	0.100/---	---	---	Settling Ponds / Not Applicable	Limestone quarry, rock washing, Bedford Quarry (Mohler-Sexton), Bedford.
Platte River							
West Platte River							
Creston (M-73)	8,234	17,750	1.474/1.750	30/369	---	Trickling Filter / Open Sludge Beds	Built in 1931, improved in 1967, plant near design load.
Creston WTP (S-38)	---	---	---	---	---	None	Filter backwash.
Green Valley State Park (S-36)	---	---	---	---	---	One Cell Lagoon / Not Applicable	
Union County Home (S-37)	---	---	---	---	---	Septic Tank / Unknown	Needs secondary treatment.
Cromwell (M-74)	168	---	---	---	---	NEMTF	
Kent (M-75)	86	---	---	---	---	NEMTF	
Platte River							
Clearfield (M-76)	430	---	---	---	---	NEMTF	
Clearfield WTP (S-39)	---	---	---	---	---	Evaporation Pond and Tile Field / Not Applicable	
Maloy (M-77)	45	---	---	---	---	NEMTF	
Blockton (M-78)	273	---	---	---	---	NEMTF	Site approved on 10/20/72 for two cell lagoon.
Athelstan (M-79)	65	---	---	---	---	NEMTF	
Grand River							
Arispe (M-80)	93	---	---	---	---	NEMTF	
Shannon City (M-81)	100	---	---	---	---	NEMTF	
Diagonal (M-82)	327	---	---	---	---	NEMTF	
Benton (M-83)	46	---	---	---	---	NEMTF	
Delphos (M-84)	35	---	---	---	---	NEMTF	
Redding (M-85)	111	---	---	---	---	NEMTF	

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type Sludge Disposal	Comments
Grand River							
Walnut Creek							
Ringgold County Home (S-40)	---	---	---	---	---	None	
Armour and Company (I-29)	---	---	---	76/---	38/---	None	Proposed holding basin.
Mount Ayr Fish Hatchery (S-42)	---	---	---	---	---	None	Fish rearing ponds.
Middle Fork Grand River							
Mount Ayr (M-86)	1,762	2,152	0.200/0.129	56/93	---	Imhoff Tank and Trickling Filter Open Sludge Beds and Wet Haul to Farmland.	Built in 1956, need infiltration/inflow study.
Mount Ayr WTP (S-41)	---	---	---	---	---	None	
East Fork Grand River							
Tingley (M-87)	244	---	---	---	---	NEMTF	
Ellston (M-88)	76	---	---	---	---	NEMTF	
Lotts Creek							
Kellerton (M-89)	299	---	---	---	---	NEMTF	
Thompson River							
Greenfield (M-90)	2,212	2,893	0.430/0.272	26/93	---	Trickling Filter Open Sludge Beds	Built in 1932, reconstructed in 1963, hydraulically overloaded.
Adair County Home (S-47)	---	---	---	---	---	Septic Tank Unknown	
Marvel Creek							
Greenfield WTP S-48)	---	---	---	---	---	None	Iron and manganese filter backwash.
Thompson River							
Macksburg (M-91)	142	---	---	---	---	NEMTF	
Threemile Creek							
Orient (M-92)	324	---	---	---	---	NEMTF	
Schildberg Construction Company (I-32)	---	---	2.030/---	---	---	None	Limestone quarry dewatering, Thayer Quarry.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent: Flow (mgd) Average/Design	Effluent: BOD_5 (mg/l)/(lb/day)	Effluent: Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Fourmile Creek							
Lorimor (M-93)	346	---	---	---	---	NEMTF	
Thayer (M-94)	100	---	---	---	---	NEMTF	
Twelvemile Creek							
Afton (M-95)	823	1,254	0.060/0.100	27/14	---	Two Cell Lagoon / Not Applicable	11.18 acres, built in 1960.
Green Valley Chemical Corporation (I-31)	---	---	0.150/---	---	---	One Cell Lagoon / Not Applicable	Cooling water, process water and boiler blow down during ammonia manufacturing, seven day retention, built in 1967.
Thompson River							
E. I. Sargent Quarries Inc. (I-33)	---	---	0.002/---	---	---	Settling Ponds / Not Applicable	Limestone rock washing, Grand River Quarry, Grand River.
Grand River (M-96)	211	---	---	---	---	NEMTF	
East Long Creek							
Murray (M-97)	620	---	---	---	---	NEMTF	
Short Creek							
E. I. Sargent Quarries Inc. (I-34)	---	---	0.440/---	---	---	None	Limestone rock washing, De Kalb-Cox Quarry.
Thompson River							
Decatur City (M-98)	198	---	---	---	---	NEMTF	
Le Roy's Skelly Service Station & Restaurant(I-35)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Built in 1970, at I-35 and Hwy 2.
E. I. Sargent Quarries Inc. (I-36)	---	---	0.003/---	---	---	Settling Ponds / Not Applicable	Rock washing,
Elk Creek							
Beaconsfield (M-99)	48	---	---	---	---	NEMTF	
Patterhoff Creek							
Martin Marietta Corporation (I-37)	---	---	0.100/---	---	---	None	Limestone rock washing, Spaulding Quarry.
Thompson River							
Davis City (M-100)	301	---	---	---	---	NEMTF	Proposed lagoon designed for P.E. of 320.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	BOD$_5$ (mg/l)/(lb/day)	Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Lamoni (M-101)	2,540	4,250	0.301/---	36/90	---	Three Cell Lagoon / Not Applicable	32.8 acres, built in 1962, organically overloaded, proposed aeration in one cell and use other two cells as polishing ponds.
Barth Supper Club (S-43)	---	---	---	28/---	---	One Cell Lagoon / Not Applicable	0.3 acres, total retention, built in 1974.
Farmsong M.H.P. (S-44)	---	50	---	---	---	One Cell Lagoon / Not Applicable	Total retention.
Leighton Development (S-46)	---	128	---	---	---	One Cell Lagoon / Not Applicable	1.5 acres, total retention.
Iowa Dept. of Transportation Rest Area I-35 East Side No. 034R (S-45)	---	---	0.002/---	---	---	Two Cell Lagoon / Not Applicable	
Standard Oil Service Station, Restaurant and Motel (I-30)	---	---	---/0.007	---	---	Two Cell Lagoon / Not Applicable	At I-35 and Hwy 69.
Nine Eagles State Park (S-49)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Total retention.
Pleasanton (M-102)	62	---	---	---	---	NEMTF	
Weldon River							
Little River							
Van Wert (M-103)	244	---	---	---	---	NEMTF	Proposed lagoon and sewer system in 1973.
McGruder Creek							
Leon (M-104)	2,142	2,000	0.187/0.147	47/73	---	Trickling Filter / Open Sludge Beds	Built in 1915, modified in 1939, hydraulically and organically overloaded, proposed new two cell lagoon in 1973.
Leon WTP (S-50)	---	---	---	---	---	None	
Decatur County Home (S-51)	---	---	---	---	---	Septic Tank and Sand Filter / Unknown	Built before 1942.
Weldon River							
Weldon (M-105)	155	---	---	---	---	NEMTF	
Le Roy (M-106)	43	---	---	---	---	NEMTF	

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Garden Grove (M-107)	285	---	---	---	---	NEMTF	
Little Muddy Creek							
Clio (M-108)	113	---	---	---	---	NEMTF	
Lineville (M-109)	385	---	---	---	---	NEMTF	
Lineville WTP (S-52)	---	---	---	---	---	None	Sand filter backwash
Medicine Creek							
Middle Fork Medicine Creek							
Allerton S. (M-110)	643**	600	.015/0.089	150/19	9/1	Two Cell Lagoon / Not Applicable	6 acres, industrial waste, built in 1974.
Chariton River							
South Fork Chariton River							
West Jackson Creek							
Allerton N. (M-111)	643**	171	.002/0.020	22/.4	8/0.1	Two Cell Lagoon / Not Applicable	1.70 acres, water plant backwash, built in 1974.
North Creek							
Cincinnati (M-112)	570	---	---	---	---	NEMTF	
Shoal Creek							
Seymour S.W. (M-113)	931**	---	0.009/---	26/2	---	Imhoff Tank and Sand Filter / Unknown	Built in 1918, reworked in 1974, proposed 6 acre lagoon, City is on grant priority list.
Seymour WTP (S-53)	---	---	0.072/---	---	---	Settling Basin / Not Applicable	
Walnut Creek							
Seymour E. (M-114)	931**	---	0.027/---	33/7	---	Imhoff Tank and Sand Filter / Unknown	Built in 1918, reworked in 1974, proposed 7.20 acre lagoon, City is on grant priority list.
Shoal Creek							
Numa (M-115)	165	---	---	---	---	NEMTF	
Exline (M-116)	224	---	---	---	---	NEMTF	
Chariton River							
Derby (M-117)	161	---	---	---	---	NEMTF	
Chariton (M-118)	5,009	6,420	0.621/1.000	27/140	---	Trickling Filter / Open Sludge Beds	Built in 1956, City is on grant priority list for upgrading treatment facilities.
Blue Grass Inn (S-54)	---	---	---	---	---	Septic Tank / Unknown	Proposed new one cell lagoon in 1974.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent: Flow (mgd) Average/Design	Effluent: BOD_5 (mg/l)/(lb/day)	Effluent: Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Lucas County Home (S-55)	---	60	---	---	---	Septic Tank and Sand Filter / Unknown	Built before 1942.
Honey Creek							
Russell (M-119)	591	716	0.048/0.072	32/13	---	Two Cell Lagoon / Not Applicable	7.84 acres, built in 1968.
Russell WTP (S-56)	---	---	---	---	---	None	
Rathbun Lake							
Indian Ridge M.H.P.(S-57)	---	175	---/0.011	---	---	None	Proposed 3 acre, two cell, total retention lagoon in 1974.
Heavenly Hide-Away (S-58)	---	300	---	---	---	Two Cell Lagoon / Not Applicable	Total retention.
Bridge View Public Use Area WTP (S-59)	---	---	---	---	---	None	
Bridge View Public Use Area STP (S-60)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	
Chariton River							
Wolf Creek							
Millerton (M-120)	82	---	---	---	---	NEMTF	
Chariton River							
South Fork Chariton River							
Ninemile Creek							
Humeston (M-121)	673	650	.055/0.065	32/15	---	One Cell Lagoon / Not Applicable	6.36 acres, built in 1967, is at design load.
Wildcat Creek							
Corydon N.E. (M-122)	1,745**	700	0.060/0.035	58/29	---	Two Cell Lagoon / Not Applicable	5.5 acres, built in 1962, organically overloaded.
West Jackson Creek							
Corydon S.E. (M-123)	1,745**	120	0.025/0.006	34/7	10/2	One Cell Lagoon / Not Applicable	1.41 acres, built in 1963, organically overloaded.
Corydon S.W. (M-124)	1,745**	120	0.025/0.006	33/7	---	One Cell Lagoon / Not Applicable	1.27 acres, built in 1962, organically overloaded.
Corydon S. (M-125)	1,745**	1,080	0.060/0.054	26/13	6/3	Two Cell Lagoon / Not Applicable	9.87 acres, built in 1963, organically overloaded.
Wayne County Home (S-61)	---	---	---	---	---	One Cell Lagoon / Not Applicable	Total retention.
Allerton WTP (S-62)	---	---	---	---	---	None	Discharge to north lagoon.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Corydon WTP (S-63)	---	---	---	---	---	None	Proposed three cell, total retention lagoon in 1975.
Chariton River							
Snider Branch							
Ridgeview East Subdivision (S-64)	---	650	---	---	---	Two Cell Aerated Lagoon / Not Applicable	Initial operation for 300 people is only one cell operation.
Rathbun Lake							
Floyd Dixon's Lazy Daz (S-65)	---	---	---	---	---	None	Proposed one cell, total retention lagoon in 1974.
South Fork Public Use Area STP (S-66)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Batch discharge.
South Fork Public Use Area WTP (S-67)	---	---	---	---	---	None	
Rolling Cove Public Use Area WTP (S-68)	---	---	---	---	---	None	
Island View Public Use Area West STP (S-69)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Batch discharge.
Island View Public Use Area WTP (S-70)	---	---	---	---	---	None	
Island View Public Use Area East STP (S-71)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Batch discharge.
Administration Area STP (S-72)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	
Administration Area WTP (S-73)	---	---	---	---	---	None	
A. E. Butler Campground (S-75)	---	---	---	---	---	None	Proposed 1.5 acre lagoon and 0.9 acre polishing pond in 1973.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent: Flow (mgd) Average/Design	Effluent: BOD_5 (mg/l)/(lb/day)	Effluent: Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Antler Acres - Parkside Knolls Subdivision (S-76)	---	150	---	---	---	Two Cell Lagoon / Not Applicable	Total retention, only one cell, 1.6 acres, built in 1972.
Lake Rathbun KOA Campground (S-77)	---	200	---	---	---	Two Cell Lagoon / Not Applicable	Total retention, 1.5 acre lagoon and 0.9 acre evaporation pond.
Buck Creek Development (S-78)	---	---	---	---	---	None	Proposed lagoon in 1971.
Buck Creek Public Use Area East (S-79)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	
Buck Creek Public Use Area WTP (S-80)	---	---	---	---	---	None	
Buck Creek Public Use Area West (S-81)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	
Chariton River							
Rathbun (M-126)	113	---	---	---	---	NEMTF	
Little Walnut Creek							
Plano (M-127)	109	---	---	---	---	NEMTF	
Chariton River							
Rathbun Fish Hatchery (S-74)	---	---	8.000/---	---	---	Pollution Abatement Ponds and Lagoon / Not Applicable	4 acres, 24-hour detention, ponds for rearing raceways, lagoon for domestic wastes.
Walnut Creek							
Promise City (M-128)	148	---	---	---	---	NEMTF	
Mystic (M-129)	696	---	---	---	---	NEMTF	
Mystic Primary School (S-82)	---	150	---/0.001	---	---	One Cell Lagoon / Not Applicable	
Chariton River							
Cooper Creek							
Appanoose County Home (S-83)	---	---	---	---	---	None	
Centerville N.E. (M-130)	6,531**	4,470	0.783/1.150	50/327	---	Trickling Filter / Open Sludge Beds	Built in 1971.

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent Flow (mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Centerville W. (M-131)	6,531**	2,180	0.291/0.136	34/83	---	Imhoff Tank and Trickling Filter / Open Sludge Beds	Built in 1920, obsolete and overloaded, needs to be replaced.
Rathbun Regional Water Association WTP (S-84)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Total retention.
Rathbun Heights Development (S-85)	---	462	---	---	---	Two Cell Lagoon / Not Applicable	Total retention.
Centerville WTP (S-86)	---	---	---	---	---	None	Proposed a two cell open sludge drying bed for clarifier sludge.
Carter - Waters Corporation (I-38)	---	---	---	---	---	Settling Ponds / Not Applicable	Rock washing, open pit quarry, Centerville.
Fox River							
Udell (M-132)	71	---	---	---	---	NEMTF	
Oaks Campground (S-87)	---	---	---	---	---	Two Cell Lagoon / Not Applicable	Total retention.
Moulton (M-133)	763	900	0.074/---	27/17	---	Two Cell Lagoon / Not Applicable	7 acres, built in 1971.
Drakesville (M-134)	163	---	---	---	---	NEMTF	
Bloomfield (M-135)	2,718	4,887	0.284/0.245	32/76	17/40	Trickling Filter / Open Sludge Beds	Built in 1959.
Rupe Campgrounds (S-88)	---	---	---	---	---	Septic Tank / Unknown	Built in 1974
MBZ M.H.P. (S-89)	---	60	---	---	---	One Cell Lagoon / Not Applicable	Total retention, may have been connected to City of Bloomfield sewerage system.
Davis County Home (S-90)	---	---	---	---	---	None	
Pulaski (M-136)	255	---	---	---	---	NEMTF	

TABLE V-2 (Continued)

Discharger (Ref. No.)	1970 Pop.	Design P.E.	Effluent: Flow (mgd) Average/Design	Effluent: BOD_5 (mg/l)/(lb/day)	Effluent: Ammonia-N (mg/l)/(lb/day)	Treatment Type / Sludge Disposal	Comments
Little Fox River							
Milton (M-137)	567	646	---/0.082	25/---	---	Two Cell Lagoon / Not Applicable	4.6 acres, placed into operation in 1974.
Cantril (M-138)	258	347	0.045/0.034	30/11	---	Two Cell Lagoon / Not Applicable	2.2 acres, placed into operation in 1972.
Fox River							
Mt. Sterling (M-139)	87	---	---	---	---	NEMTF	

*Note: Ammonia-N = Ammonia-Nitrogen
BOD_5 = Five Day Biochemical Oxygen Demand
lb/day = Pounds per day
mgd = Million gallons per day
mg/l = Milligrams per liter
M.H.P. = Mobile Home Park
NA = Not Available
NEMTF = No Existing Municipal Treatment Facility
P.E. = Population Equivalent
Ref. No. = Reference Number
STP = Sewage Treatment Plant
WTP = Water Treatment Plant

** Total population of the City

TABLE V-3
SOUTHERN IOWA BASIN
POINT SOURCE
WASTEWATER DISCHARGE SUMMARY

	Municipal	Semipublic	Industrial
Nishnabotna River			
Flow (mgd)	5.095	0.059	6.997
% Total Flow	42	---	58
BOD_5 (lbs/day)	1,547	---	338
% Total BOD_5	82	---	18
Ammonia-N (lbs/day)	539	---	945
% Total Ammonia-N	36	---	64
Tarkio River			
Flow (mgd)	0.046	---	---
% Total Flow	100	---	---
BOD_5 (lbs/day)	13	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	---	---	---
% Total Ammonia-N	---	---	---
Nodaway River			
Flow (mgd)	1.744	0.709	2.400
% Total Flow	36	14	50
BOD_5 (lbs/day)	377	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	1	---	---
% Total Ammonia-N	100	---	---
One Hundred and Two River			
Flow (mgd)	0.259	0.009	0.100
% Total Flow	70	3	27
BOD_5 (lbs/day)	106	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	21	---	---
% Total Ammonia-N	100	---	---
Platte River			
Flow (mgd)	1.474	---	---
% Total Flow	100	---	---
BOD_5 (lbs/day)	369	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	---	---	---
% Total Ammonia-N	---	---	---

TABLE V-3 (Continued)

	Municipal	Semipublic	Industrial
Grand River			
Flow (mgd)	0.200	---	---
% Total Flow	100	---	---
BOD_5 (lbs/day)	93	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	---	---	---
% Total Ammonia-N	---	---	---
Thompson River			
Flow (mgd)	0.791	0.002	2.725
% Total Flow	22	---	78
BOD_5 (lbs/day)	197	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	---	---	---
% Total Ammonia-N	---	---	---
Weldon River			
Flow (mgd)	0.187	---	---
% Total Flow	100	---	---
BOD_5 (lbs/day)	73	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	---	---	---
% Total Ammonia-N	---	---	---
Chariton River			
Flow (mgd)	1.949	8.072	---
% Total Flow	19	81	---
BOD_5 (lbs/day)	628	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	5	---	---
% Total Ammonia-N	100	---	---
Fox River			
Flow (mgd)	0.403	---	---
% Total Flow	100	---	---
BOD_5	104	---	---
% Total BOD_5	100	---	---
Ammonia-N (lbs/day)	40	---	---
% Total Ammonia-N	100	---	---

TABLE V-4
SOUTHERN IOWA BASIN
MUNICIPAL WASTEWATER TREATMENT
FACILITIES SUMMARY
BY SUBBASIN

Treatment Facility	Number of Communities	Population Served
Nishnabotna River		
One-cell Lagoon	2	918
Two-cell Lagoon	19	14,682
Aerated Lagoon	1	343
Imhoff Tank-Trickling Filter	4	3,482
Trickling Filter	6	29,096
TOTAL		48,521
No Treatment	13	2,262
Tarkio River		
Two-cell Lagoon	1	574
TOTAL		574
No Treatment	4	653
Nodaway River		
Two-cell Lagoon	3	1,264
Imhoff Tank-Trickling Filter	2	818
Trickling Filter	2	6,822
Activated Sludge-Trickling Filter	1	2,095
TOTAL		10,999
No Treatment	7	1,162
One Hundred and Two River		
One-cell Lagoon	1	286
Two-cell Lagoon	1	501
Aerated Lagoon	1	1,215
Trickling Filter	1	1,733
TOTAL		3,735
No Treatment	2	197
Platte River		
Trickling Filter	1	8,234
TOTAL		8,234
No Treatment	6	1,067

TABLE V-4 (Continued)

Treatment Facility	Number of Communities	Population Served
Grand River		
Imhoff Tank-Trickling Filter	1	1,762
TOTAL		1,762
No Treatment	9	1,331
Thompson River		
Two-cell Lagoon	1	823
Three-cell Lagoon	1	2,540
Trickling Filter	1	2,212
TOTAL		5,575
No Treatment	10	2,352
Weldon River		
Trickling Filter	1	2,142
TOTAL		2,142
No Treatment	6	1,225
Chariton River		
One-cell Lagoon	1	880
Two-cell Lagoon	3	2,772
Imhoff Tank-Trickling Filter	1	2,141
Trickling Filter	1	9,399
Imhoff Tank-Sand Filter	1	931
TOTAL		16,123
No Treatment	9	2,268
Fox River		
Two-cell Lagoon	3	1,588
Trickling Filter	1	2,718
TOTAL		4,306
No Treatment	4	576

TABLE V-5

SOUTHERN IOWA BASIN
MUNICIPAL WASTEWATER TREATMENT
FACILITIES SUMMARY

Treatment Facility	Communities Served	Population Served
One-cell Lagoon	4	2,084
Two-cell Lagoon	31	22,204
Three-cell Lagoon	1	2,540
Aerated Lagoon	2	1,558
Imhoff Tank-Trickling Filter	8	8,203
Imhoff Tank-Sand Filter	1	931
Activated Sludge-Trickling Filter	1	2,095
Trickling Filter	14	62,356
TOTAL		101,971
NEMTF	70	13,093

CHAPTER VI

POINT WASTEWATER SOURCES

WASTE LOAD ALLOCATIONS

An inventory of point source wastewater dischargers in the Southern Iowa Basin was discussed in Chapter V. Using a computer methodology, effluent limitations required for dischargers to meet State water quality standards within the basin have been determined. Waste load allocation analyses were performed assuming projected 1990 wastewater discharges at the 7Q10 low flow under both summer and winter conditions. Analyses were performed on streams classified as A, B, or C, with existing wastewater discharges. Some of the basic considerations that are included in the analyses are discussed below. A detailed description of the computer methodology and the assumptions used in the waste load allocation analyses are included in the Supporting Document (1). The winter and summer waste load allocations are listed in Table VI-1. The effluent limitation for all dischargers in the Southern Iowa Basin not included in Table VI-1 is either secondary treatment or BPT.

Dissolved oxygen and ammonia nitrogen concentration profiles for 1990 discharges, with the waste load allocations given in Table VI-1, for the Nishnabotna River, East Nishnabotna River, West Nishnabotna River, East Nodaway River, Nodaway River, West Nodaway River and

TABLE VI-1
SOUTHERN IOWA BASIN
SUMMER-WINTER
WASTE LOAD ALLOCATION

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer Ultimate BOD* (mg/l)/(lbs/day)	Summer Ammonia-N (mg/l)/(lbs/day)	Winter Ultimate BOD* (mg/l)/(lbs/day)	Winter Ammonia-N (mg/l)/(lbs/day)
Nishnabotna River						
Silver Cr.						
Westphalia WTP (S-1)	---	0.001[a]	b	b	b	b
Schildberg Construction Company (I-1)	1.594	2.030[a]	c	c	c	c
Shelby (M-2)	0.342	Controlled Discharge				
Treynor N.W. (M-3)	0.354	Controlled Discharge				
Treynor S.E. (M-4)	0.354	Controlled Discharge				
Henningson Foods Inc. (I-2)	---	Complete Retention				
Malvern (M-6)	2.341	Controlled Discharge				
Kaser Construction Company (I-3)	2.341	0.114[a]	c	c	c	c
West Nishnabotna River						
West Central Iowa Rural Water Association WTP (S-2)	0.360	0.005[a]	b	b	b	b
Culligan Soft Water Service (I-4)	0.360	0.003[a]	e	e	e	e
Manning (M-11)	0.360	0.173	45/65	10/14	30/43	5/7
Soypro International Inc. (I-5)	0.360	d	f	f	f	f
Irwin (M-10)	1.038	Controlled Discharge				
Irwin WTP (S-3)	---	d	b	b	b	b
Manilla (M-7)	---	Controlled Discharge				
Defiance (M-8)	---	Controlled Discharge				
Western Iowa Pork Company (I-6)	2.589	Controlled Discharge				
Harlan WTP (S-4)	2.589	d	b	b	b	b
Harlan (M-13)	2.589	1.038	15/130	4/35	30/258	3/26
Shelby County Home (S-5)	---	No Discharge				
Avoca WTP (S-6)	2.905	d	b	b	b	b
Avoca (M-14)	2.905	Controlled Discharge				

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer Ultimate BOD* (mg/l)/(lbs/day)	Summer Ammonia-N (mg/l)/(lbs/day)	Winter Ultimate BOD* (mg/l)/(lbs/day)	Winter Ammonia-N (mg/l)/(lbs/day)
Prairie Rose State Park (S-7)	---	Controlled Discharge				
Hancock (M-16)	5.137	Controlled Discharge				
American Beef Packers Inc. (I-7)	---	Controlled Discharge				
Oakland (M-17)	5.403	Controlled Discharge				
Oakland Feeding Corporation (I-8)	---	Complete Retention				
Carson (M-18)	5.552	0.150	45/56	10/13	45/56	15/19
Schildberg Construction Company (I-9)	5.669	c	c	c	c	c
Macedonia (M-19)	---	Controlled Discharge				
Northern Natural Gas Compressor Station (I-10)	---	No Discharge				
Emerson (M-21)	0.310	0.038	45/14	10/3	45/14	15/5
American Natural Gas Company (I-11)	0.415	0.010	45/4	10/1	45/4	15/1
Walnut WTP (S-8)	0.153	d	b	b	b	b
Colonial Motor Inn (S-9)	0.153	0.020	45/8	10/2	45/8	15/3
Walnut (M-24)	0.153	Controlled Discharge				
Imogene WTP (S-10)	---	d	b	b	b	b
East Nishnabotna River						
Kimballton (M-26)	0.187	Controlled Discharge				
Elk Horn (M-27)	0.117	Controlled Discharge				
Templeton (M-29)	0.068	Controlled Discharge				
Audubon (M-30)	0.144	0.380	45/139	10/31	40/123	3.5/11
Audubon County Home (S-12)	---	No Discharge				
Exira (M-31)	1.697	Controlled Discharge				
Exira WTP (S-11)	0.530	0.050[a]	b	b	b	b
Brayton (M-32)	1.827	Controlled Discharge				
Jack Huff Motel (S-13	1.949	0.008	45/3	10/1	45/3	15/1

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer Ultimate BOD* (mg/l)/(lbs/day)	Summer Ammonia-N (mg/l)/(lbs/day)	Winter Ultimate BOD* (mg/l)/(lbs/day)	Winter Ammonia-N (mg/l)/(lbs/day)
Skelly Oil Service Center (I-13)	1.949	Controlled Discharge				
Manley Car and Truck Plaza (I-14)	---	Controlled Discharge				
Phillips 66 Service Station and Restaurant (I-15)	---	Controlled Discharge				
Atlantic (M-33)	3.732	0.945	15/118	4/32	45/355	4/32
Atlantic-City Maintenance Building (S-91)	---	No Discharge				
Atlantic WTP (S-14)	1.079	0.003[a]	b	b	b	b
Abild M.H.P. (S-15)	---	Controlled Discharge				
Allied Mills Inc. (I-16)	---	No Discharge				
Wise Owl Motel (I-17)	---	Complete Retention				
Schildberg Construction Company (I-18)	3.732	2.030[a]	c	c	c	c
Stuckeys No. 244 (I-12)	---	No Discharge				
Cass County Home (S-16)	---	No Discharge				
Anita (M-34)	0.171	Controlled Discharge				
Lake Anita State Park (S-17)	---	Complete Retention				
Lewis (M-36)	4.985	Controlled Discharge				
Schildberg Construction Company (I-19)	4.985	2.030[a]	c	c	c	c
Griswold (M-37)	0.062	0.124	45/47	10/10	45/47	15/16
Griswold WTP (S-18)	0.062	d	b	b	b	b
Elliott (M-38)	7.282	Controlled Discharge				
Red Oak (M-39)	7.778	0.800	45/300	10/67	45/300	15/100
Powell School (S-19)	---	d	d	d	d	d
Montgomery County Home (S-20)	---	No Discharge				
Uniroyal Inc. (I-20)	7.778	0.135	45/51	10/11	45/51	15/17
Kaser Construction Company (I-21)	7.778	0.040[a]	c	c	c	c
Hallett Construction Company (I-22)	---	No Discharge				

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer		Winter	
			Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)	Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)
Essex (M-41)	8.361	Controlled Discharge				
Shenandoah (M-42)	8.865	0.800	45/300	10/67	45/300	7/47
Farragut (M-43)	9.213	Controlled Discharge				
West Nishnabotna River						
Sidney (M-45)	---	0.060	45/23	10/5	45/23	15/8
Fremont County Home (S-21)	---	No Discharge				
Nishnabotna River						
Hamburg (M-46)	12.346	Controlled Discharge				
Tarkio River						
Stanton (M-48)	0.132	Controlled Discharge				
Stanton WTP (S-22)	0.132	d	b	b	b	b
Nodaway River						
West Nodaway River						
Cumberland (M-53)	0.168	0.051	45/19	10/4	45/19	15/6
Massena (M-54)	0.036	0.051	45/19	10/4	45/19	15/6
Kaser Construction Company (I-23)	0.506	0.250[a]	c	c	c	c
Viking Lake State Park (S-23)	---	Complete Retention				
Middle Nodaway River						
Villisca Community School (S-24)	---	d	d	d	d	d
Camp Aldersgate United Methodist Camp (S-25)	---	Controlled Discharge				
Villisca (M-56)	1.527	0.180	45/68	10/15	45/68	15/23
Fontanelle (M-57)	---	Controlled Discharge				
Schildberg Construction Company (I-24)	1.178	2.030[a]	c	c	c	c
West Nodaway River						
Clarinda (M-61)	3.505	1.660	45/623	5/69	45/623	5/69
Clarinda WTP (S-26)	---	d	b	b	b	b

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer		Winter	
			Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)	Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)
Page County Home (S-27)	---	No Discharge				
Shambaugh WTP (S-28)	---	d	b	b	b	b
East Nodaway River						
Prescott (M-63)	0.557	Controlled Discharge				
Prescott WTP (S-92)	0.557	0.001[a]	b	b	b	b
Adams County Home (S-29)	---	Controlled Discharge				
Walter's Creek Recreation Area (S-30)	---	Complete Retention				
Corning (M-64)	0.759	0.310	45/116	10/26	45/116	8/21
Schildberg Construction Company (I-25)	0.759	0.120[a]	c	c	c	c
Nodaway River						
Gendler Stone Products Company (I-26)	0.161	d	c	c	c	c
Braddyville (M-66)	5.419	Controlled Discharge				
One Hundred and Two River						
New Market (M-67)	---	Controlled Discharge				
Lenox (M-68)	0.0	Controlled Discharge				
Lenox WTP (S-31)	---	d	b	b	b	b
Gravity (M-69)	0.0	Controlled Discharge				
Gendler Stone Products Company (I-27)	0.151	d	c	c	c	c
Conway WTP (S-32)	0.250	0.002[a]	b	b	b	b
Bedford (M-72)	0.362	0.400	45/150	10/33	45/150	15/50
Bedford WTP (S-33)	0.362	0.007[a]	b	b	b	b
Bedford Country Club (S-34)	---	Complete Retention				
Taylor County Home (S-35)	---	No Discharge				
Gendler Stone Products Company (I-28)	0.362	0.100[a]	c	c	c	c

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer		Winter	
			Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)	Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)
Platte River						
Creston (M-73)	0.093	1.828	15/229	2/31	15/229	2/31
Creston WTP (S-38)	0.093	d	b	b	b	b
Green Valley State Park (S-36)	---	Controlled Discharge				
Union County Home (S-37)	---	No Discharge				
Clearfield WTP (S-39)	---	No Discharge				
Grand River						
Ringgold County Home (S-40)	---	d	d	d	d	d
Armour and Company (I-29)	---	d	d	d	d	d
Mount Ayr Fish Hatchery (S-42)	0.110	d	d	d	d	d
Mount Ayr (M-86)	---	0.215	45/81	10/18	45/81	15/27
Mount Ayr WTP (S-41)	---	d	b	b	b	b
Thompson River						
Greenfield (M-90)	---	0.525	15/66	2/9	15/66	2/9
Adair County Home (S-47)	---	No Discharge				
Greenfield WTP (S-48)	---	d	b	b	b	b
Schildberg Construction Company (I-32)	0.058	2.030[a]	c	c	c	c
Afton (M-95)	0.033	Controlled Discharge				
Green Valley Chemical Corporation (I-31)	0.015	Controlled Discharge				
E.I. Sargent Quarries Inc. (I-33)	0.482	0.002[a]	c	c	c	c
E.I. Sargent Quarries Inc. (I-34)	0.005	0.440[a]	c	c	c	c
Le Roy's Skelly Station and Restaurant (I-35)	---	Controlled Discharge				
E.I. Sargent Quarries Inc. (I-36)	0.657	0.003[a]	c	c	c	c
Martin Marietta Corporation (I-37)	0.005	0.100[a]	c	c	c	c
Lamoni (M-101)	---	Controlled Discharge				

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer		Winter	
			Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)	Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)
Barth Supper Club (S-43)	---	Complete Retention				
Farmsong M.H.P. (S-44)	---	Complete Retention				
Leighton Development (S-46)	---	Complete Retention				
Iowa Dept. of Transportation Rest Area I-35 East Side No. 034R (S-45)	0.771	Controlled Discharge				
Standard Oil Service Station, Restaurant and Motel (I-30)	---	Controlled Discharge				
Nine Eagles State Park (S-49)	---	Complete Retention				
Weldon River						
Leon (M-104)	0.011	0.230	45/86	10/19	45/86	15/29
Leon WTP (S-50)	0.011	d	b	b	b	b
Decatur County Home (S-51)	---	No Discharge				
Lineville WTP (S-52)	---	d	b	b	b	b
Medicine Creek						
Allerton S. (M-110)	---	Controlled Discharge				
Chariton River						
Allerton N. (M-111)	---	Controlled Discharge				
Seymour S.W. (M-113)	---	0.045	45/17	10/4	45/17	15/6
Seymour WTP (S-53)	---	0.072[a]	b	b	b	b
Seymour E. (M-114)	---	0.045	45/17	10/4	45/17	15/6
Chariton (M-118)	0.020	0.642	15/80	2/11	15/80	2/11
Blue Grass Inn (S-54)	---	Proposed Controlled Discharge				
Lucas County Home (S-55)	---	No Discharge				
Russell (M-119)	---	Controlled Discharge				
Russell WTP (S-56)	---	d	b	b	b	b
Indian Ridge M.H.P. (S-57)	---	Proposed Controlled Discharge				
Heavenly Hide-Away (S-58)	---	Complete Retention				

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer		Winter	
			Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)	Ultimate BOD* (mg/l)/(lbs/day)	Ammonia-N (mg/l)/(lbs/day)
Bridge View Public Use Area WTP (S-59)	---	d	b	b	b	b
Bridge View Public Use Area WTP (S-60)	---	Controlled Discharge				
Humeston (M-121)	---	Controlled Discharge				
Corydon N.E. (M-122)	---	Controlled Discharge				
Corydon S.E. (M-123)	0.001	Controlled Discharge				
Corydon S.W. (M-124)	0.001	Controlled Discharge				
Corydon S. (M-125)	0.001	Controlled Discharge				
Wayne County Home (S-61)	---	Complete Retention				
Allerton WTP (S-62)	---	Controlled Discharge				
Corydon WTP (S-63)	---	Proposed Controlled Discharge				
Ridgeview East Subdivision (S-64)	---	Controlled Discharge				
Floyd Dixon's Lazy Daz (S-65	---	Proposed Controlled Discharge				
South Fork Public Use Area STP (S-66)	---	Controlled Discharge				
South Fork Public Use Area WTP (S-67)	---	d	b	b	b	b
Rolling Cove Public Use Area WTP (S-68)	---	d	b	b	b	b
Island View Public Use Area West STP (S-69)	---	Controlled Discharge				
Island View Public Use Area WTP (S-70)	---	d	b	b	b	b
Island View Public Use Area East STP (S-71)	---	Controlled Discharge				
Administration Area STP (S-72)	---	Controlled Discharge				
Administration Area WTP (S-73)	---	d	b	b	b	b
A.E. Butler Campground (S-75)	0.001	Proposed Controlled Discharge				

TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer Ultimate BOD* (mg/l)/(lbs/day)	Summer Ammonia-N (mg/l)/(lbs/day)	Winter Ultimate BOD* (mg/l)/(lbs/day)	Winter Ammonia-N (mg/l)/(lbs/day)
Antler Acres - Parkside Knolls Subdivision (S-76)	---	Complete Retention				
Lake Rathbun KOA Campground (S-77)	---	Complete Retention				
Buck Creek Development (S-78)	---	Proposed Controlled Discharge				
Buck Creek Public Use Area East (S-79)	---	Controlled Discharge				
Buck Creek Public Use Area WTP (S-80)	---	d	b	b	b	b
Buck Creek Public Use Area West (S-81)	---	Controlled Discharge				
Rathbun Fish Hatchery (S-74)	7.106	Controlled Discharge				
Mystic Primary School (S-82)	---	Controlled Discharge				
Appanoose County Home (S-83)	---	d	d	d	d	d
Centerville N.E. (M-130)	---	1.152	45/432	10/96	45/432	9/96
Centerville W. (M-131)	0.001	.41	45/154	10/34	45/154	15/51
Rathbun Regional Water Association WTP (S-84)	---	Complete Retention				
Rathbun Heights Development (S-85)	---	Complete Retention				
Centerville WTP (S-86)	---	d	b	b	b	b
Carter-Waters Corporation (I-38)	---	d	c	c	c	c
Fox River						
Oaks Campground (S-87)	---	Complete Retention				
Moulton (M-133)	---	Controlled Discharge				
Bloomfield (M-135)	---	0.360	45/135	10/30	45/135	15/45
Rupe Campgrounds (S-88)	---	No Discharge				
MBZ M.H.P. (S-89)	---	Complete Retention				
Davis County Home (S-90)	---	d	d	d	d	d

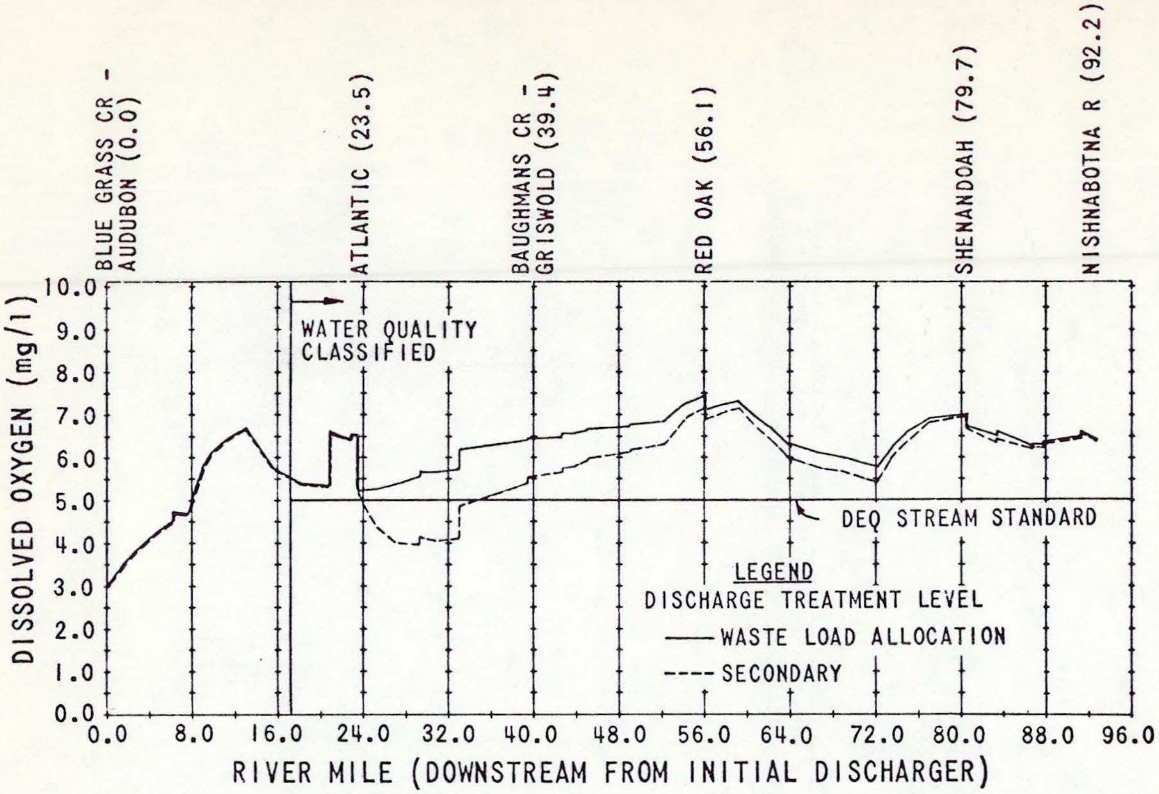
TABLE VI-1 (Continued)

Discharger (Ref. No.)	Stream Flow (mgd)	1990 Discharge (mgd)	Summer Ultimate BOD* (mg/l)/(lbs/day)	Summer Ammonia-N (mg/l)/(lbs/day)	Winter Ultimate BOD* (mg/l)/(lbs/day)	Winter Ammonia-N (mg/l)/(lbs/day)
Milton (M-137)	0.003	Controlled Discharge				
Cantril (M-138)	0.005	Controlled Discharge				

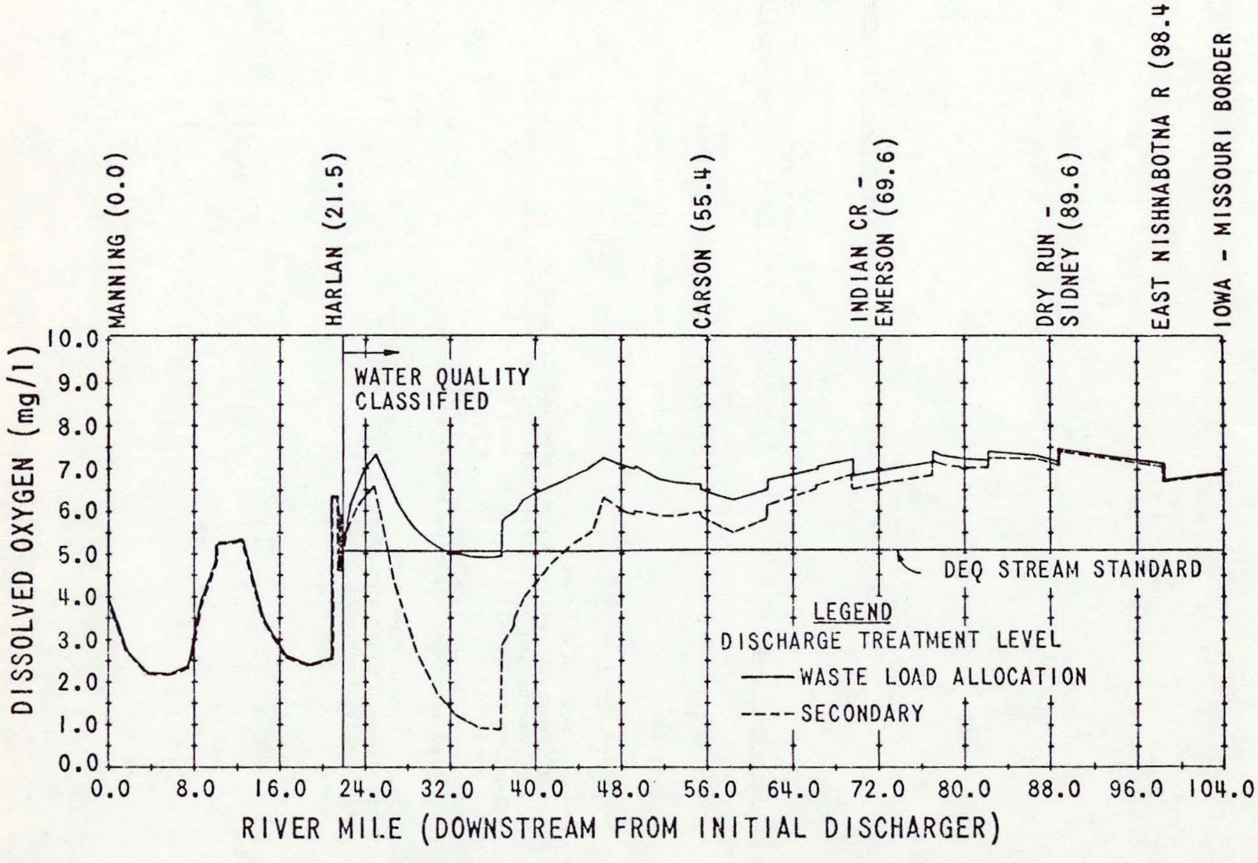
*Ultimate BOD = 1.5 (BOD_5)

a = Present average discharge.
b = Water Treatment Plant. No reported BOD or Ammonia.
c = Quarry dewatering and/or rock washing. No reported BOD or Ammonia. Flow from Quarry will be low or zero during low flow periods.
d = Not available.
e = Brine wastes. No reported BOD or Ammonia.
f = Expected to connect to city sewerage system.

Note: M.H.P.= Mobile Home Park
STP = Sewage Treatment Plant
WTP = Water Treatment Plant

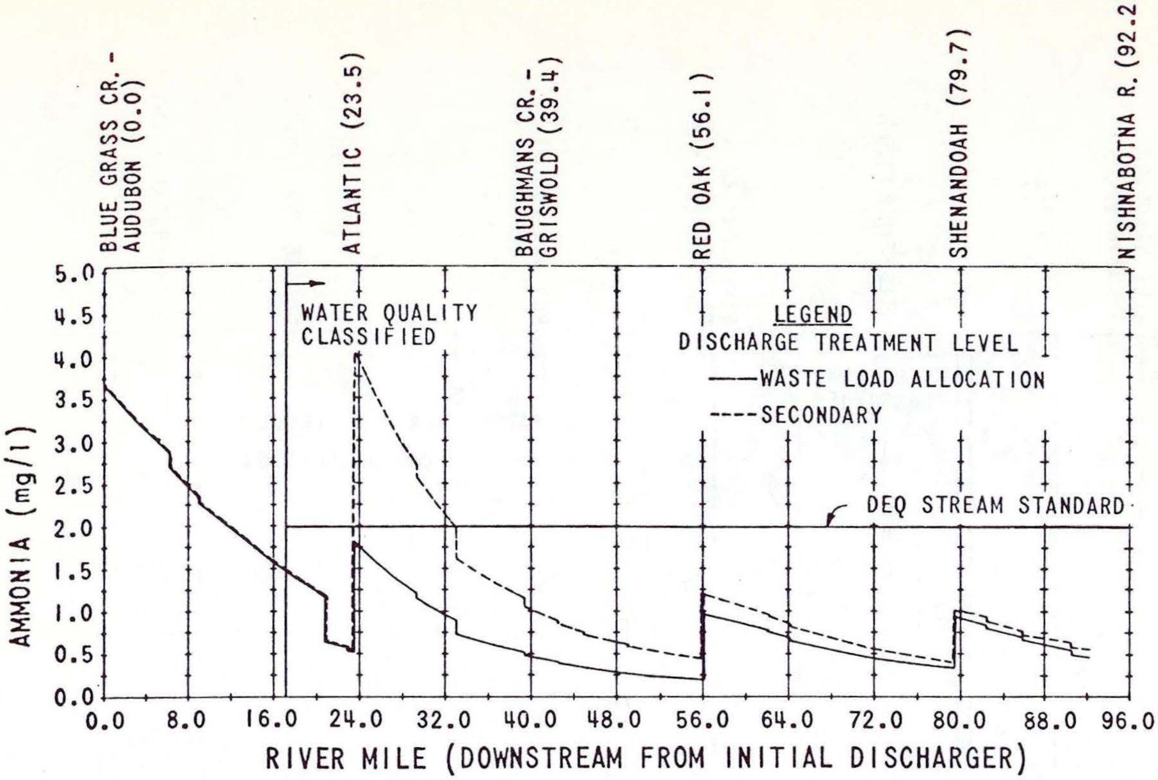


EAST NISHNABOTNA RIVER

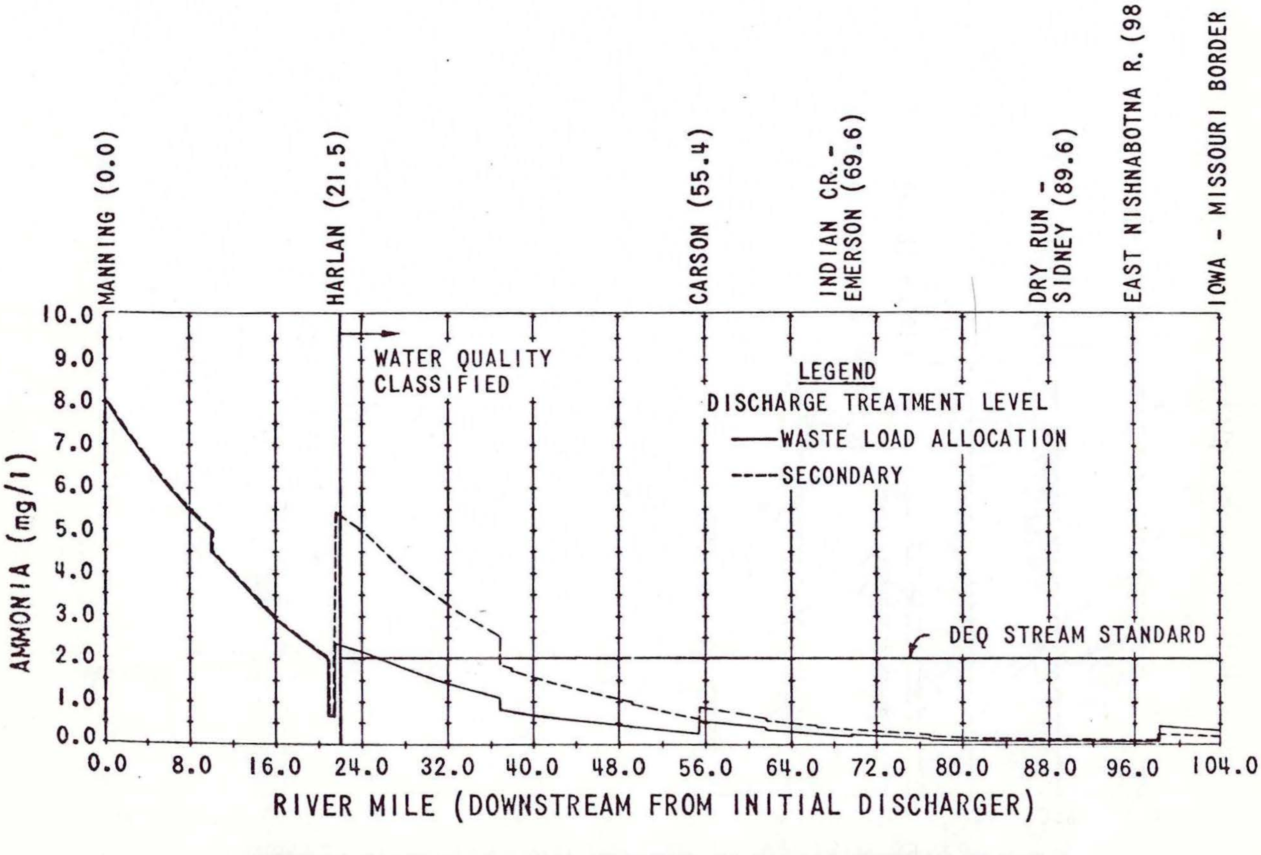


WEST NISHNABOTNA RIVER & NISHNABOTNA RIVER

FIGURE VI-1
DISSOLVED OXYGEN
CONCENTRATIONS ·
SUMMER CONDITIONS

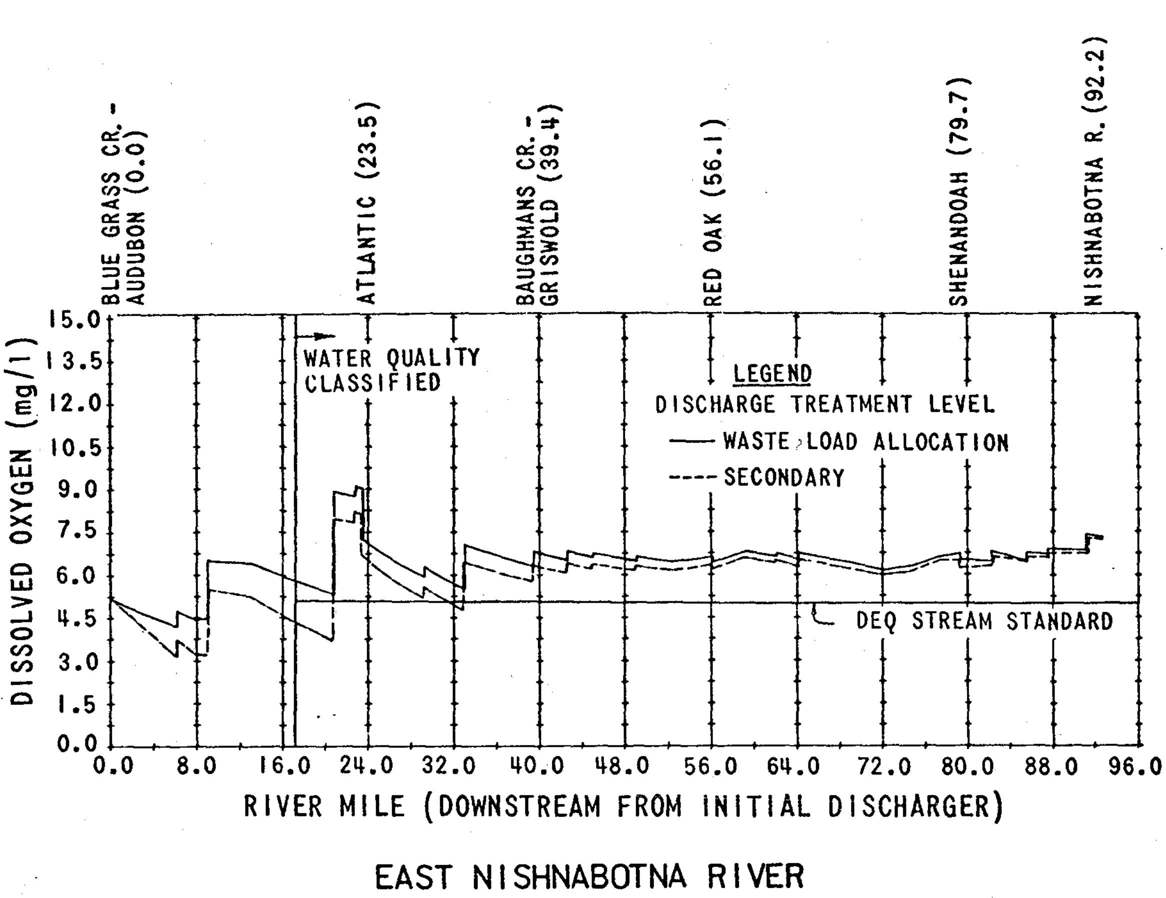


EAST NISHNABOTNA RIVER



WEST NISHNABOTNA RIVER & NISNABOTNA RIVER

FIGURE VI-2
AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS



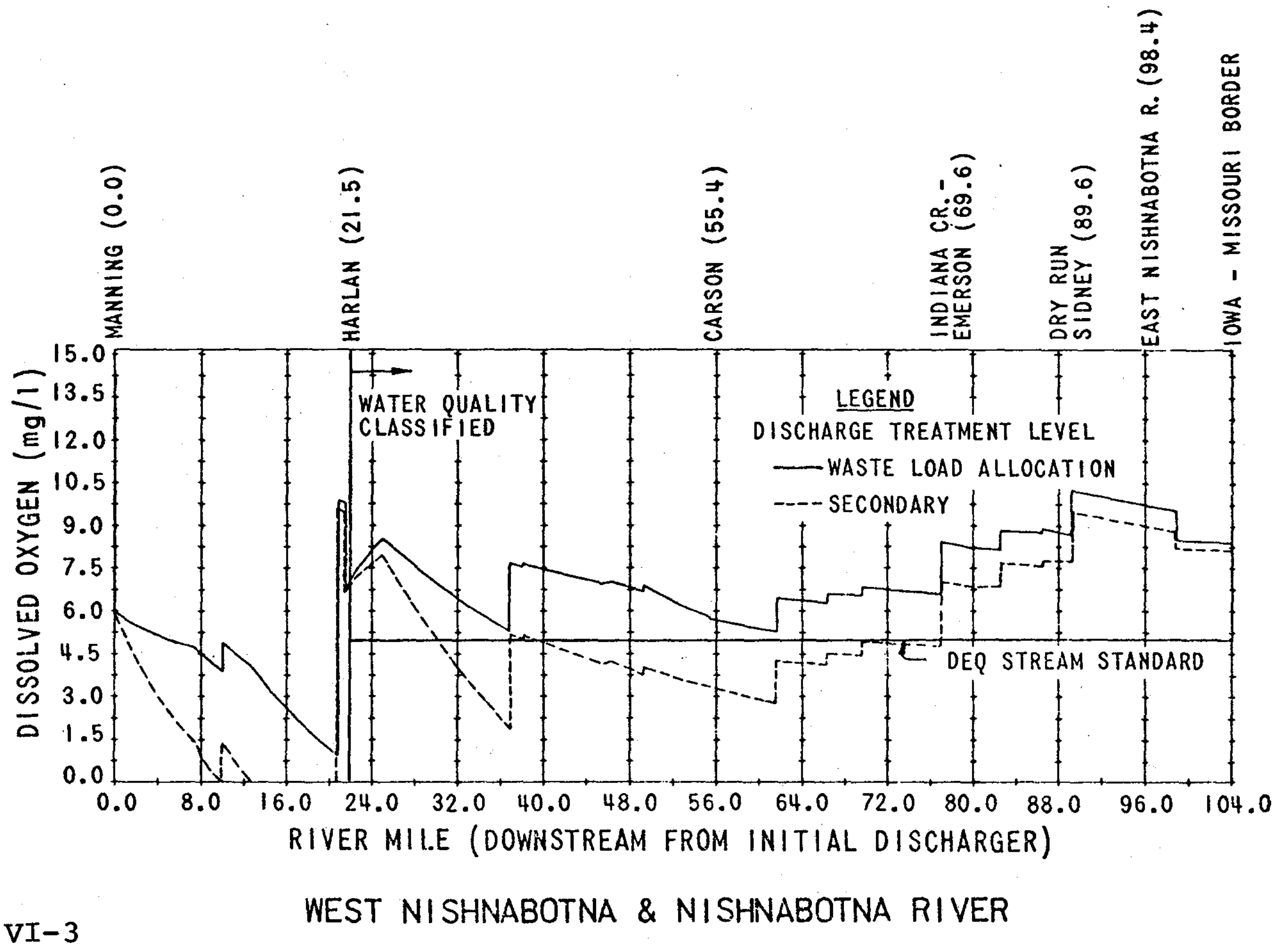
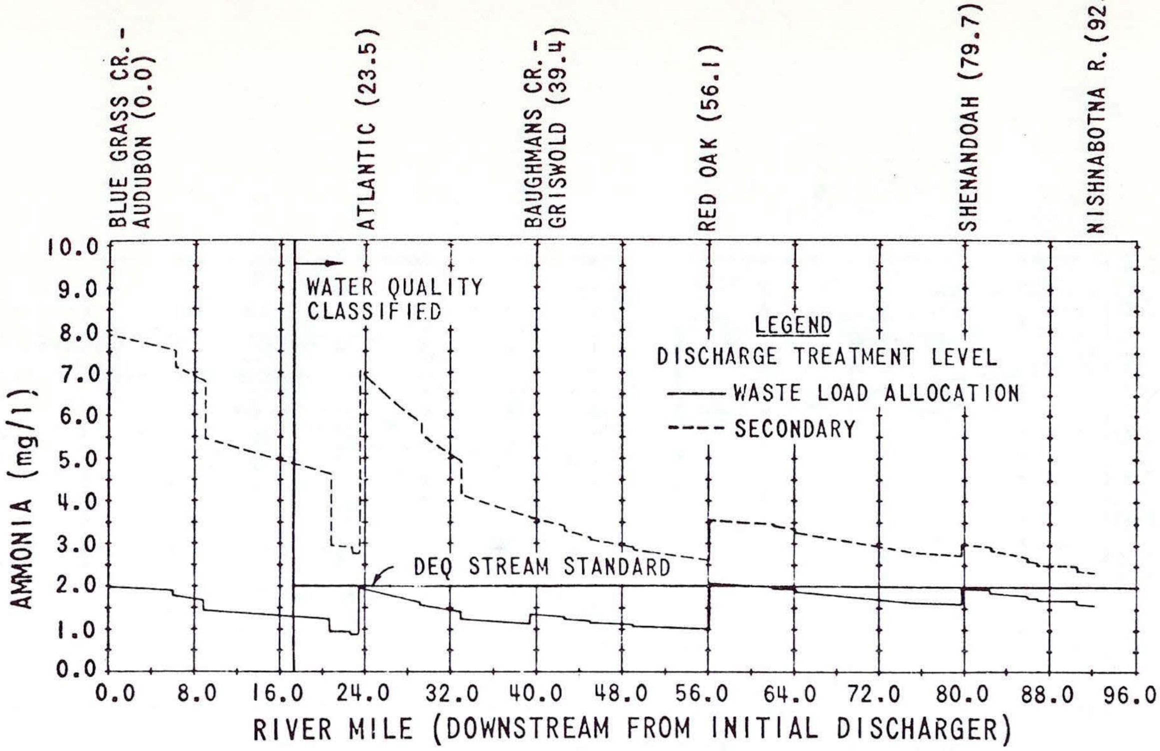
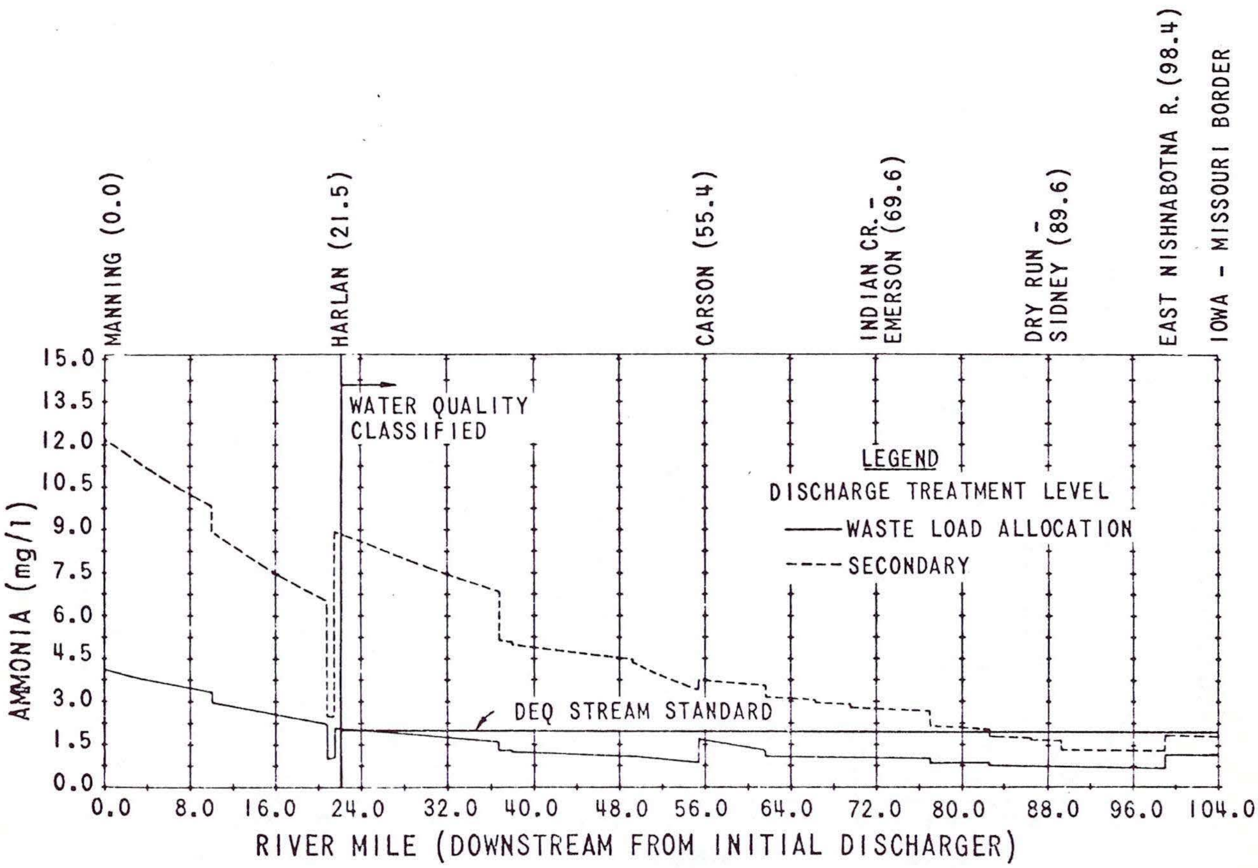


FIGURE VI-3
DISSOLVED OXYGEN
CONCENTRATIONS
WINTER CONDITIONS

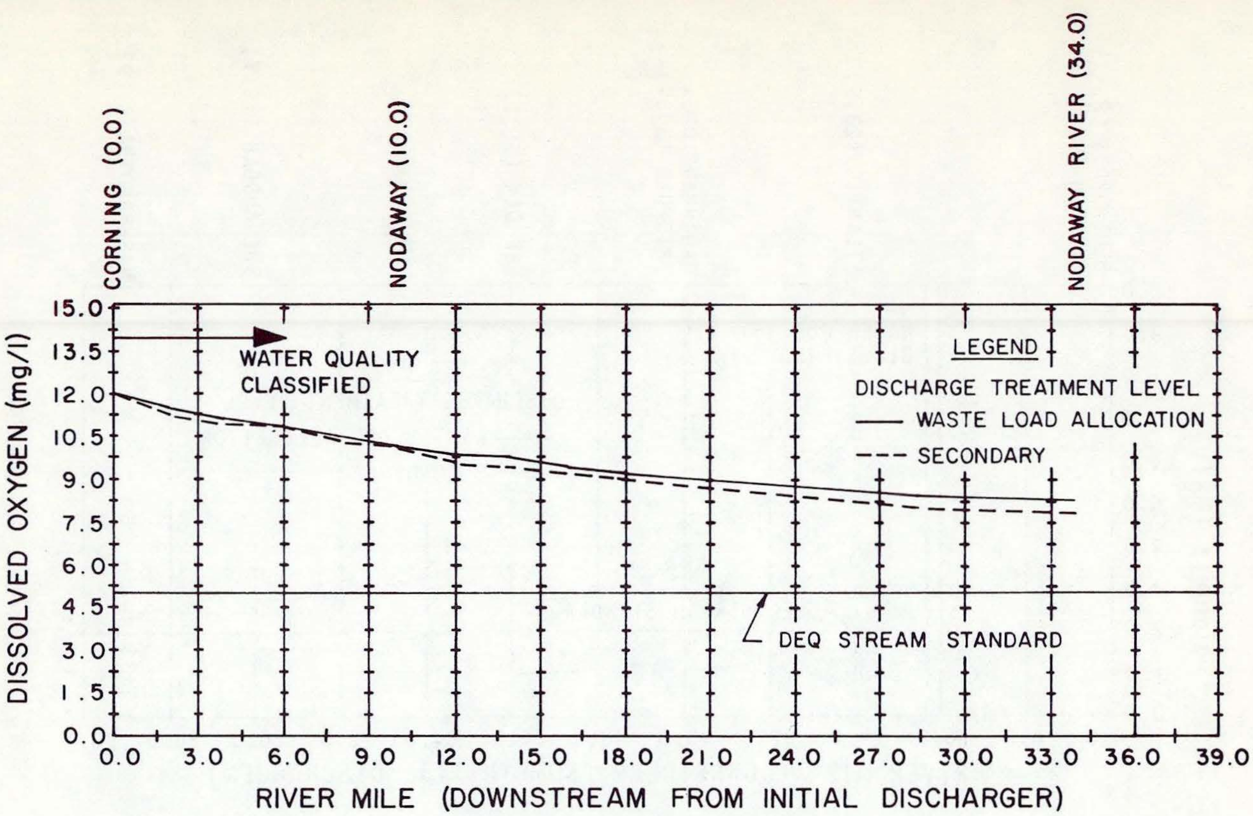


EAST NISHNABOTNA RIVER

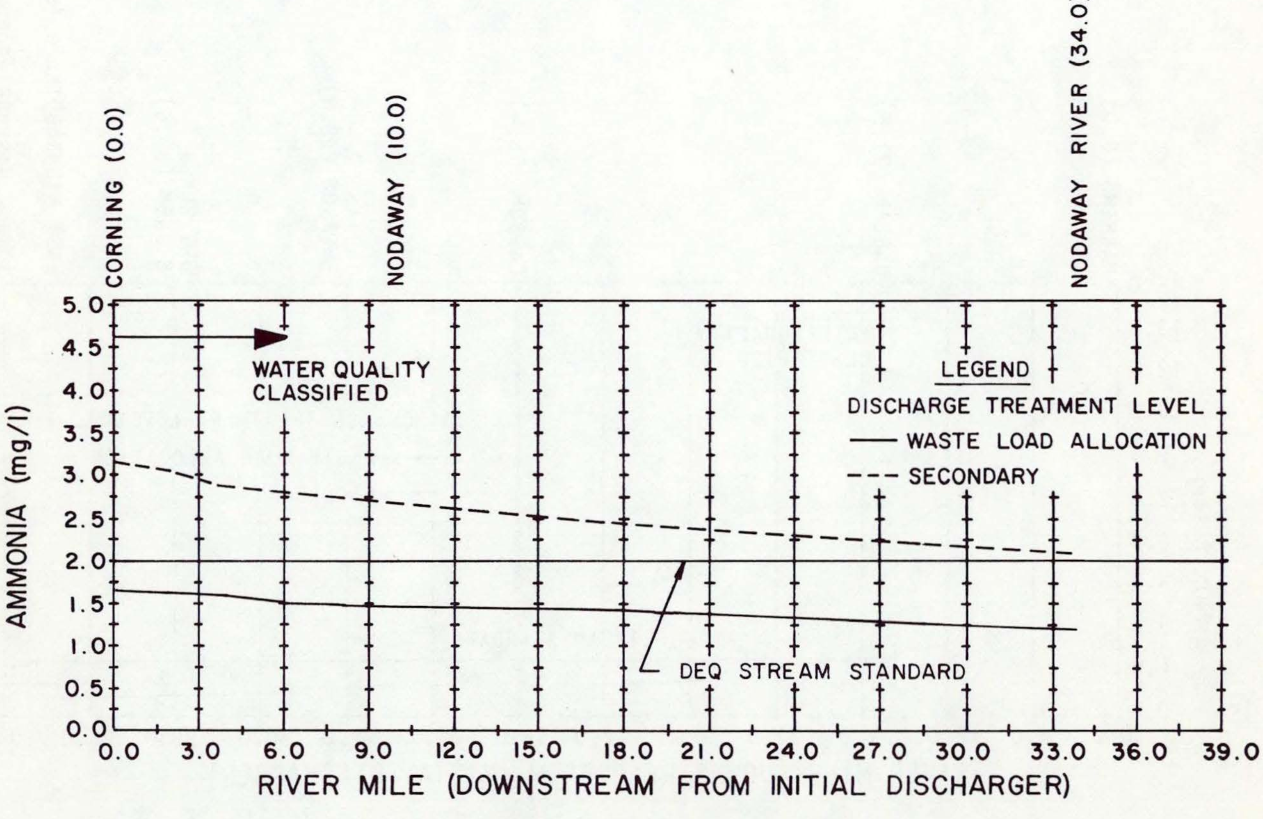


WEST NISHNABOTNA RIVER & NISHNABOTNA RIVER

FIGURE VI-4
AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS

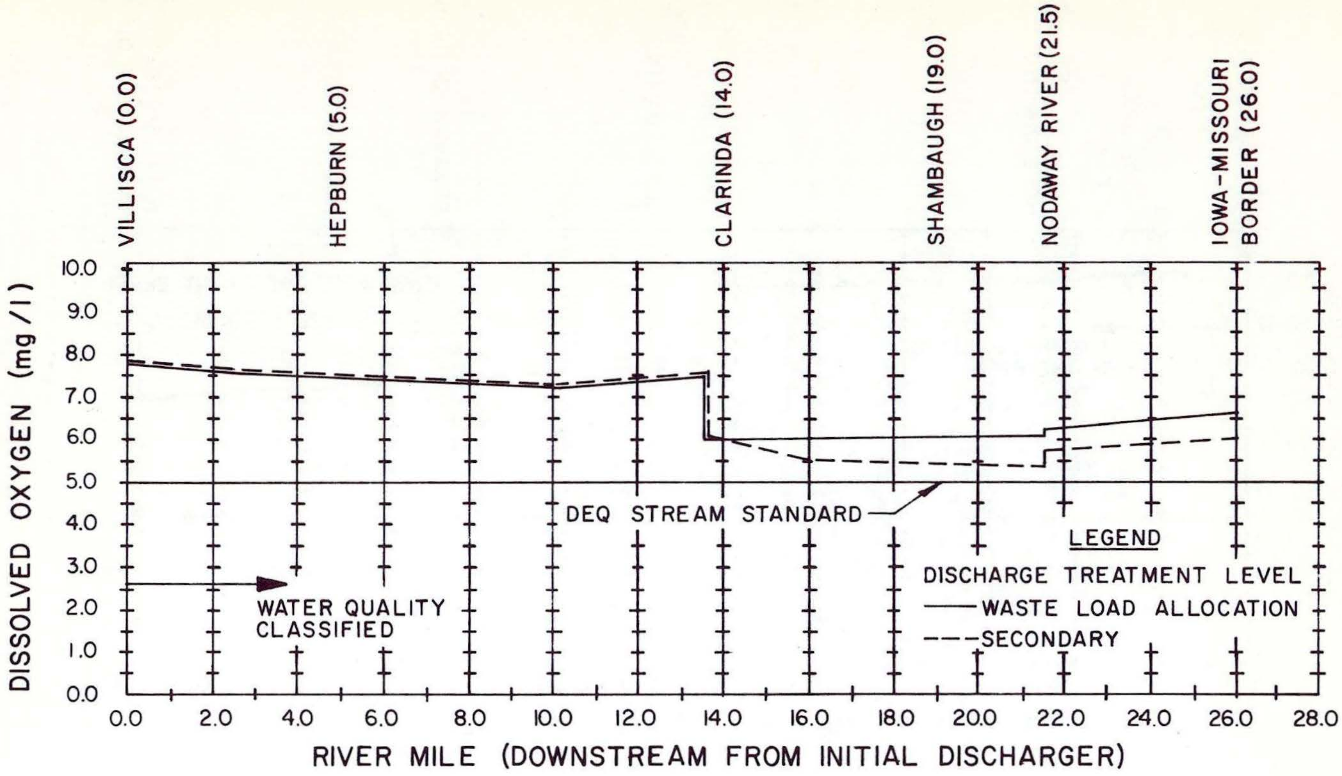


EAST NODAWAY RIVER

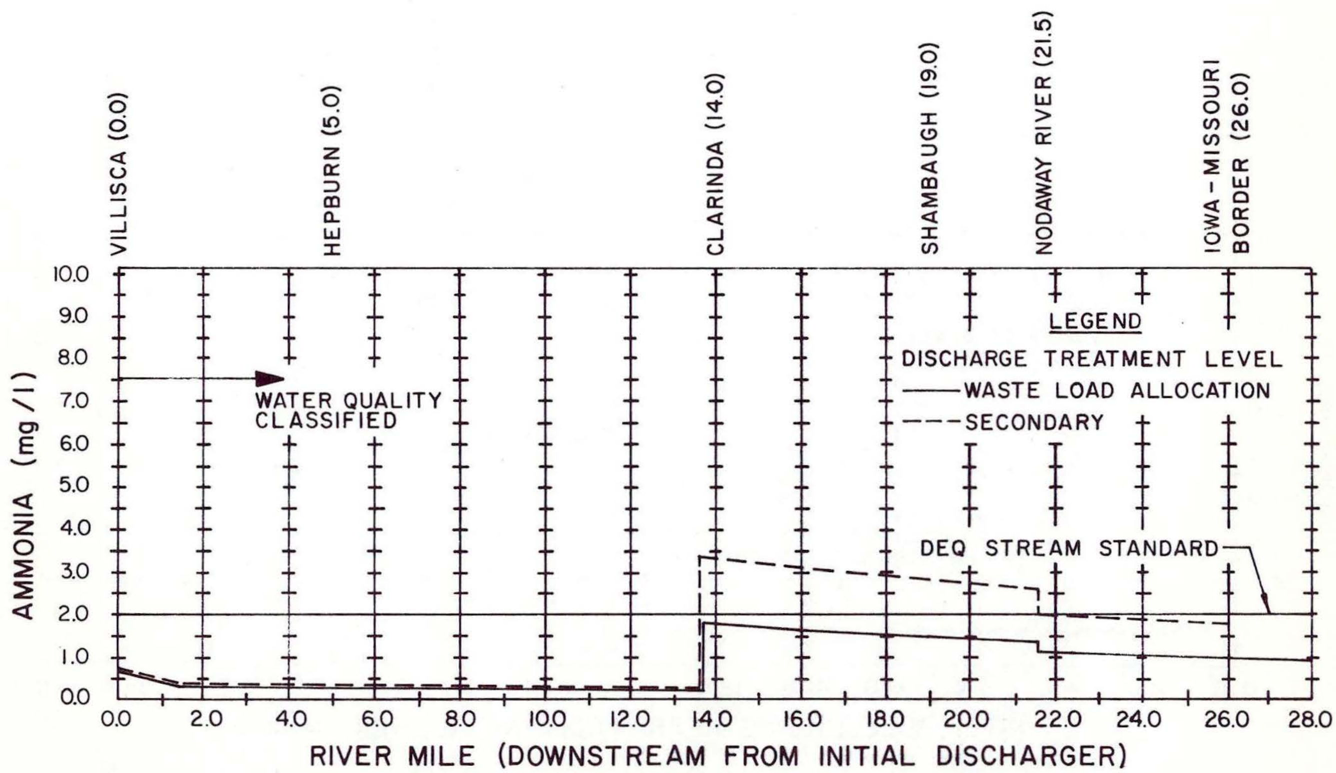


EAST NODAWAY RIVER

FIGURE VI-5
DISSOLVED OXYGEN
AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS

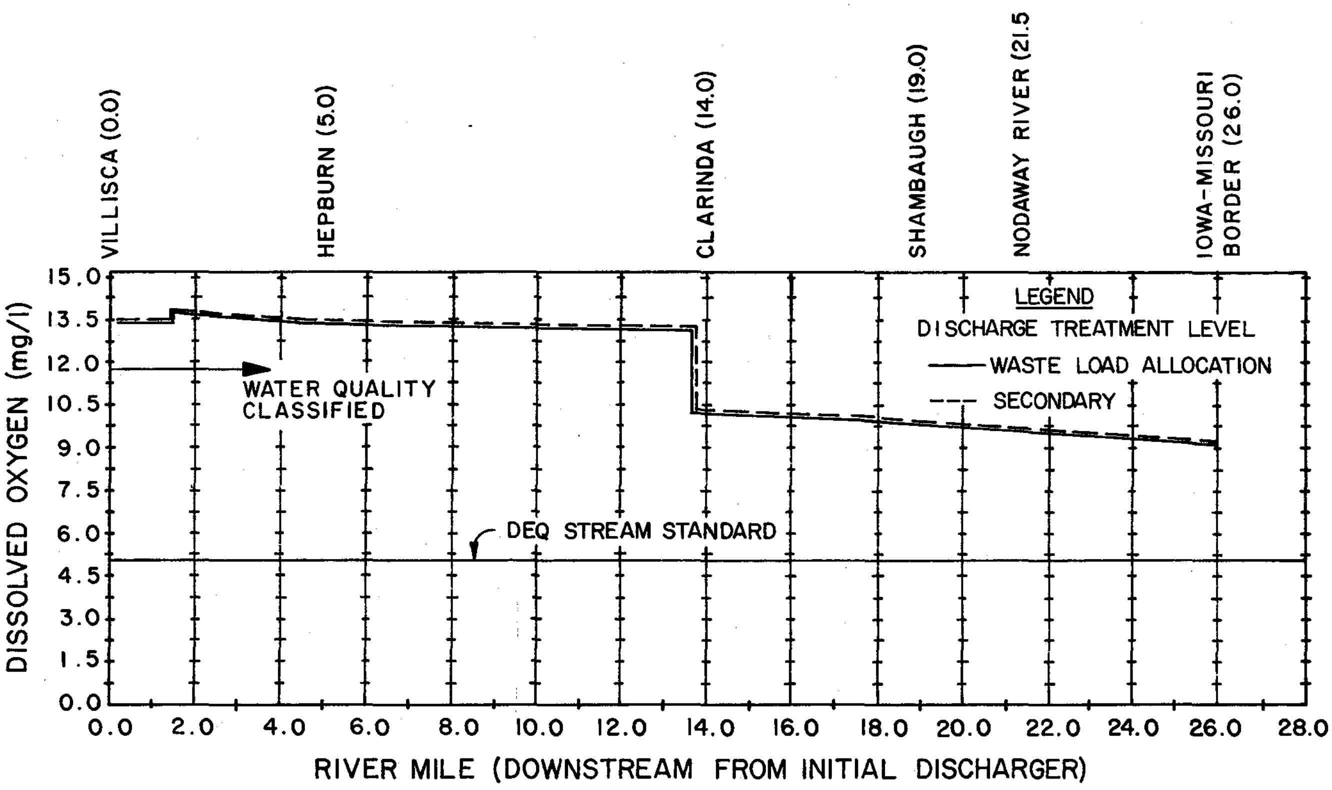


NODAWAY RIVER AND WEST NODAWAY RIVER

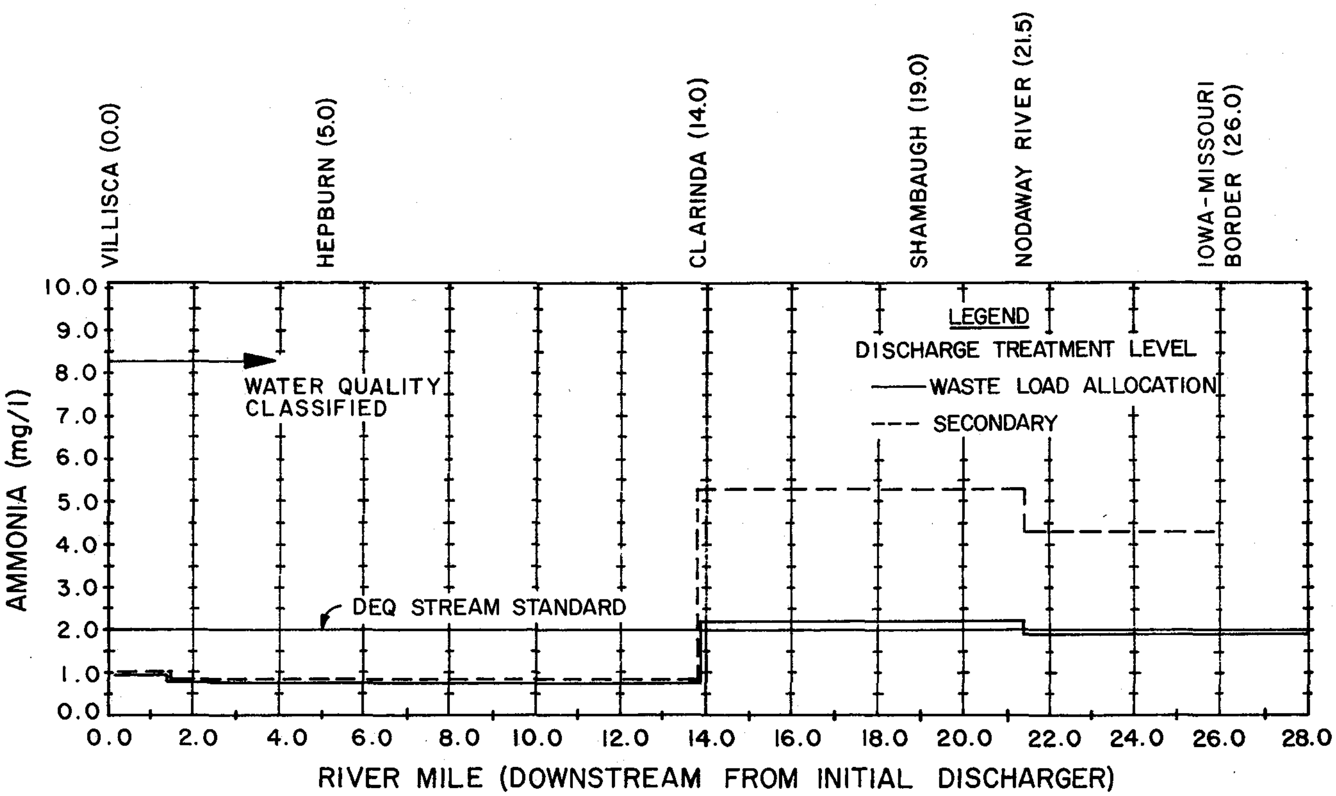


NODAWAY RIVER AND WEST NODAWAY RIVER

FIGURE VI-6
DISSOLVED OXYGEN
AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS

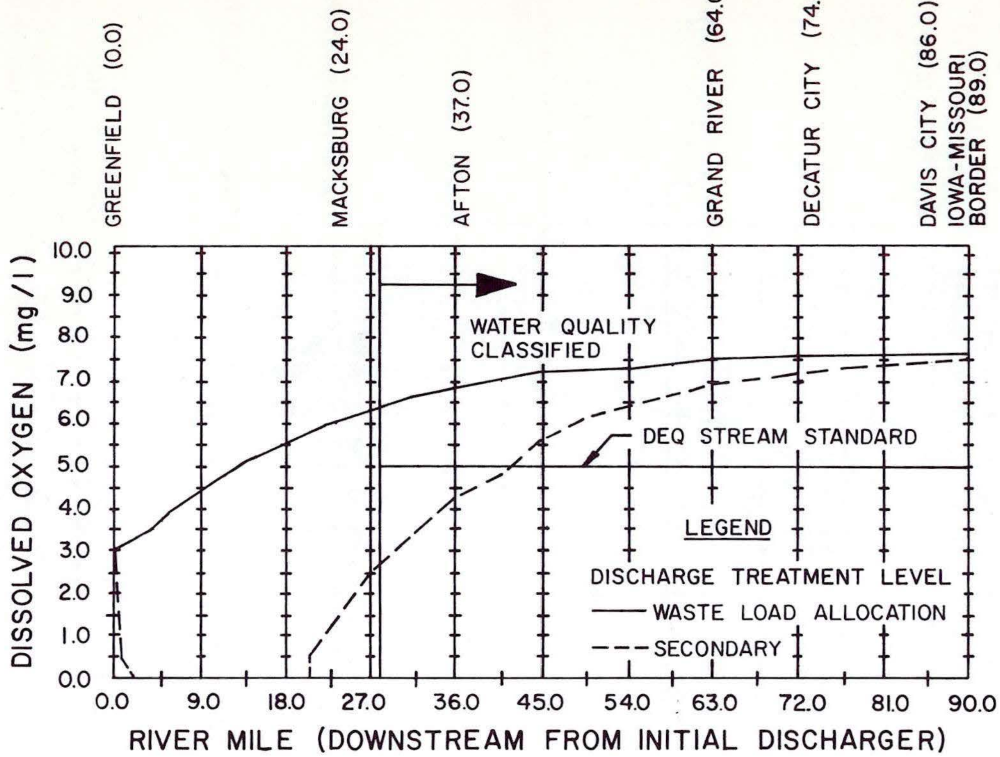


NODAWAY RIVER AND WEST NODAWAY RIVER

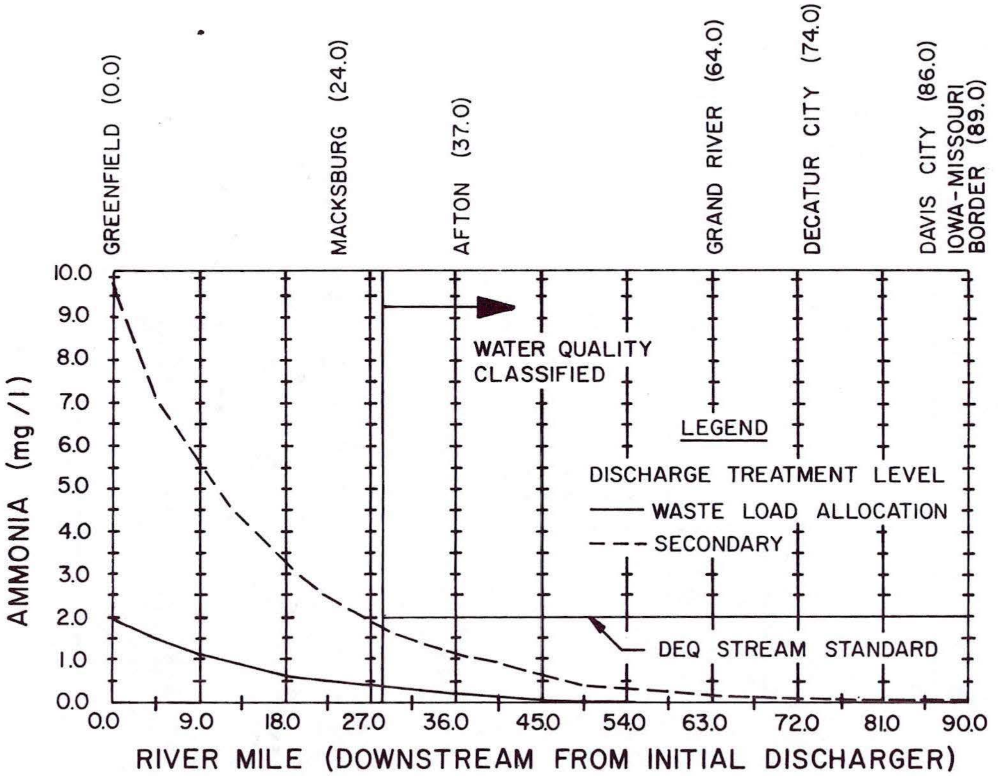


NODAWAY RIVER AND WEST NODAWAY RIVER

FIGURE VI-7
DISSOLVED OXYGEN
AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS

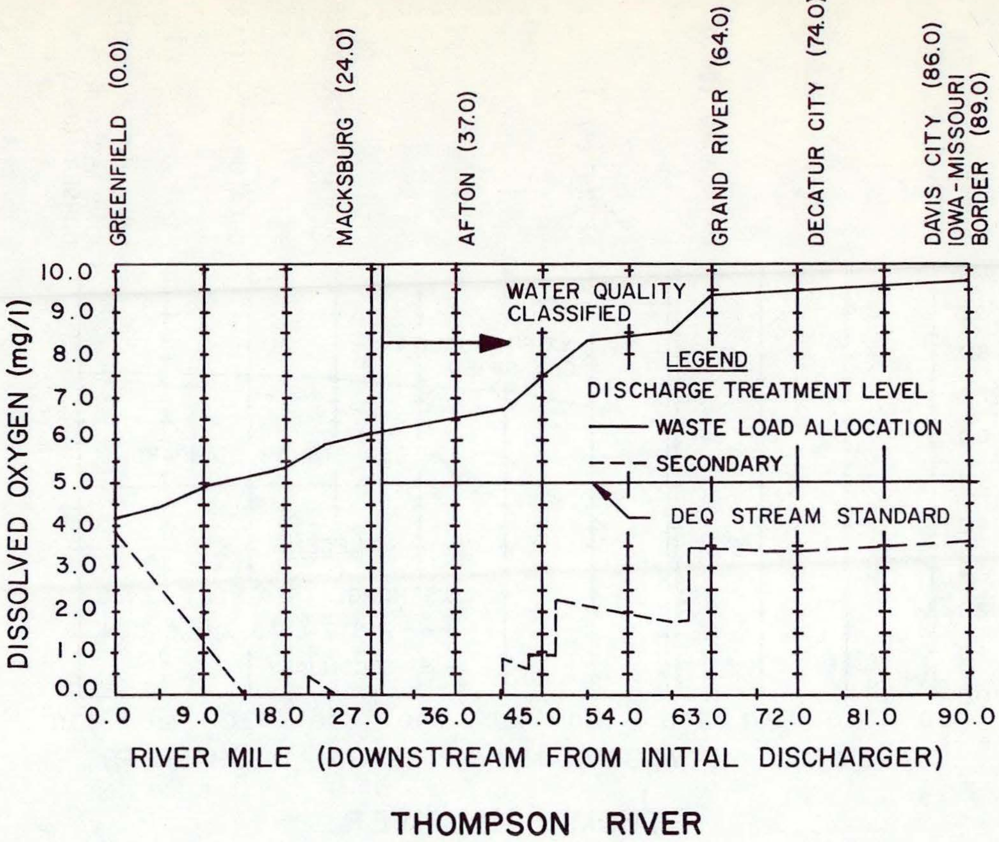


THOMPSON RIVER



THOMPSON RIVER

FIGURE VI-8
DISSOLVED OXYGEN
AND AMMONIA NITROGEN
CONCENTRATIONS
SUMMER CONDITIONS



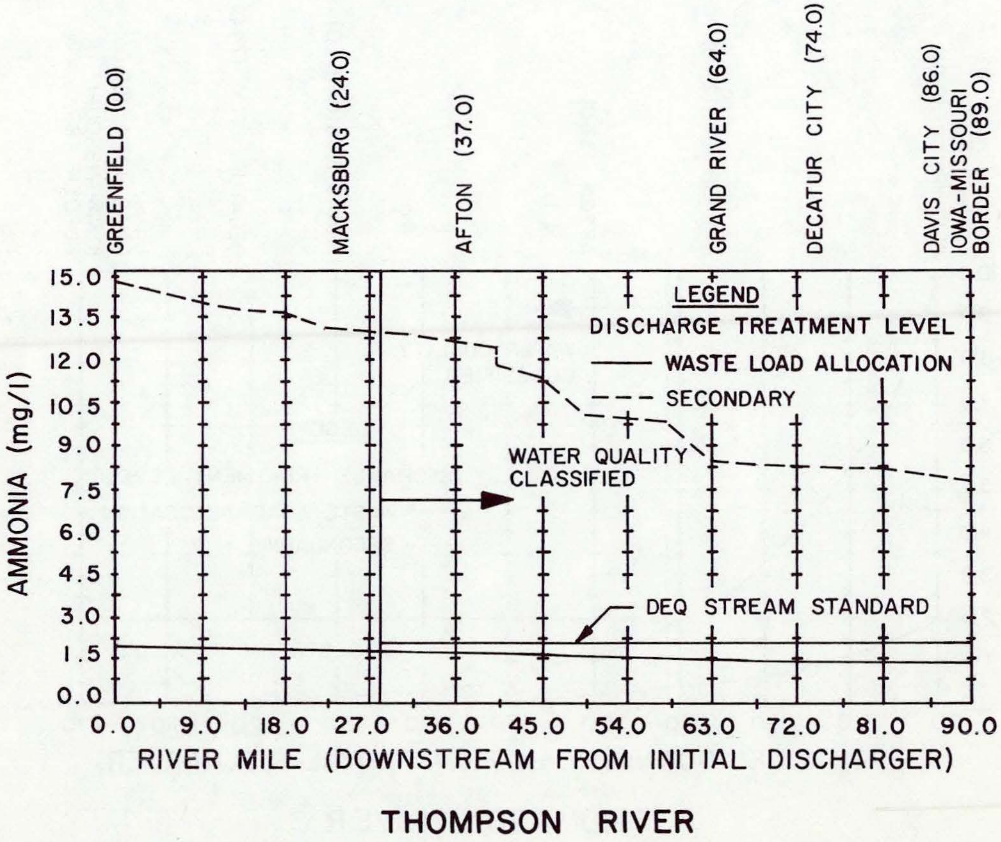


FIGURE VI-9
DISSOLVED OXYGEN
AND AMMONIA NITROGEN
CONCENTRATIONS
WINTER CONDITIONS

Thompson River are shown on Figures VI-1 through VI-9. The stream water quality criteria of at least 5.0 mg/l of dissolved oxygen and less than 2.0 mg/l of ammonia nitrogen are met in all sections of the streams which are water quality classified. Dissolved oxygen concentrations of less than 5.0 mg/l and ammonia nitrogen concentrations of far more than 2.0 mg/l are present in the upper reaches (unclassified portions) of both the East and West Nishnabotna Rivers. Dissolved oxygen concentrations of less than 5.0 mg/l are also present in the upper reaches (unclassified portion) of the Thompson River.

CONSIDERATIONS

Four basic considerations are involved in the selection of the effluent limitations for any discharge. These include secondary treatment, best practical control technology currently available (BPT), applicable standards, and antidegradation.

Secondary Treatment - The Act requires that all publicly owned treatment works shall achieve secondary treatment as a minimum by July 1, 1977. Therefore, no municipal discharger is allowed an effluent limitation less stringent than secondary treatment. Secondary treatment has been defined by EPA and DEQ as having the following concentrations in the effluent: 30 mg/l BOD_5, 30 mg/l suspended solids; or not less than 85 percent removal at BOD_5 and suspended solids; and 200 most probable number/ 100 ml fecal coliforms.

conditions, respectively.

<u>BPT</u> - The Act requires that all point sources, other than publicly owned treatment works, achieve "best practicable control technology currently available" (BPT) as a minimum by July 1, 1977. BPT for various industrial processes is defined by EPA in its industrial development documents.

<u>Applicable Standards</u> - The ultimate reason for requiring any effluent limitation is the protection of water quality. The Iowa Water Quality Standards are designed to ensure a reasonable degree of protection. All dischargers are required to meet effluent limitations stringent enough to assure that water quality standards will be met. If secondary treatment or BPT are not sufficient to meet the applicable water quality standards, a higher level of treatment is required.

<u>Antidegradation</u> - A policy on antidegradation has been adopted by DEQ to assure that in those streams where water quality significantly exceeds that of the standards, the condition shall not be degraded. New dischargers locating in areas of high quality water may be required to meet effluent limitations more stringent than secondary treatment or BPT, even though a lesser degree of treatment might be sufficient to meet water quality standards.

SEGMENT CLASSIFICATION

Based upon the waste load allocation analyses, a classification of stream segments has been made. Segment classification is a contributing factor in the determination of the segment ranking, discharger ranking, and compliance scheduling. The two segment classifications are described as follows:

1. An Effluent Limited (EL) segment is any segment where it is known that water quality is meeting and will continue to meet standards, or where there is adequate demonstration that standards will be met after application of secondary treatment or BPT to all point discharges to the segment.

2. A Water Quality Limited (WQ) segment is any segment where it is known that water quality does not currently meet applicable standards and it is not expected that standards would be met even after application of secondary treatment or BPT to all point discharges to the segment.

The classification of the stream segments in the Southern Iowa Basin are listed in Table VI-2. The water quality limited segments are shown on Figure VI-10. All segments not designated as water quality limited are currently considered to be effluent limited.

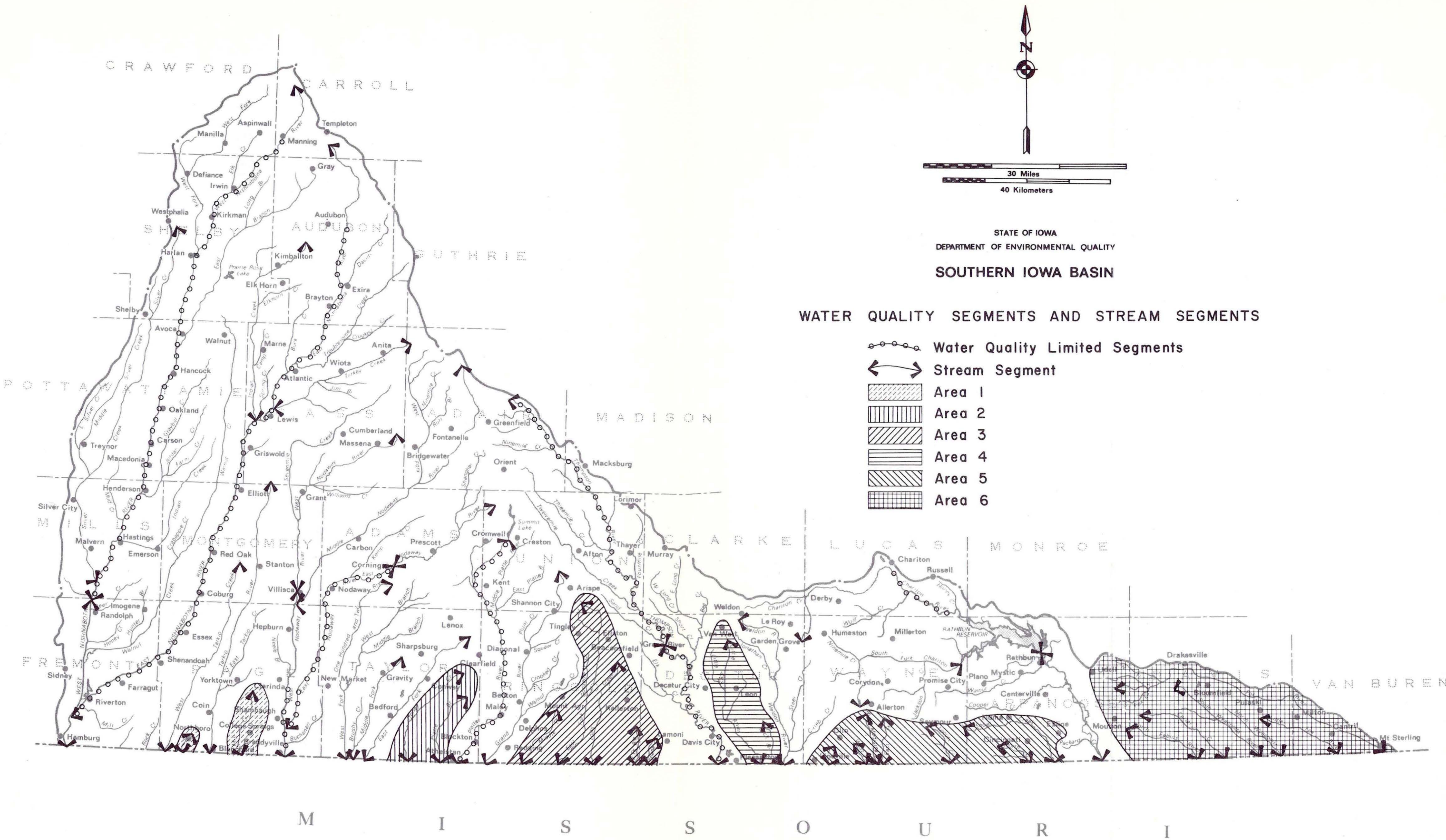

STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
WATER QUALITY SEGMENTS AND STREAM SEGMENTS
Water Quality Limited Segments
Stream Segment
Area 1
Area 2
Area 3
Area 4
Area 5
Area 6
30 Miles
40 Kilometers
N
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
MISSOURI

FIGURE VI-10

PRIORITY RANKINGS

STREAM SEGMENT RANKING

The Southern Iowa Basin has been divided into various stream segments. Each stream segment consists of surface waters that have common hydrologic characteristics and natural, physical, chemical, and biological processes. The segments have been ranked in order of abatement priority. The ranking methodology has attempted to take into account: (1) severity of pollution problems, (2) population affected, (3) need for preservation of high quality waters, and (4) national priorities.

The total points for a segment are determined from a product of the points earned in each of two factors. The formula weighs both the degree of usefulness of a segment and the severity of the pollution problem. The specific details and rationale used for the segment ranking methodology have been described in Chapter I.

Table VI-2 lists the stream segments selected, their respective priority points, and their final ranking in the basin. Figure VI-10 shows the stream segments.

MUNICIPAL DISCHARGER RANKING METHODOLOGY

The significant municipal dischargers in the basin have been ranked to be consistent with the segment priority ranking and to be used subsequently in establishing priorities and estimates for

TABLE VI-2
SOUTHERN IOWA BASIN
STREAM SEGMENT RANKING

Rank	Stream Segment	Description	WQ/ EL*	Priority Criteria								Total Points	Priority Points
				A	B_c	B_w	C	BC	AES	POP	SQ		
1	Chariton River	Rathbun Reservoir and above Rathbun Reservoir	WQ	2	0	1	0	1	1	1.0	4.0	26.00	30
2	East Nishnabotna River	Entire Length	WQ	0	0	1	0	1	0	2.0	5.0	22.50	29
3	Nodaway River and West Nodaway River	Iowa-Missouri Border to Villisca	WQ	0	0	1	2	1	0	1.0	4.0	22.00	28
4	West Nishnabotna River	Above Fremont County Line (North)	WQ	0	0	1	0	1	0	1.5	4.0	16.00	27
5	Thompson River	Iowa-Missouri Border to Grand River	WQ	0	0	1	0	1	0	0.5	4.0	12.00	26
6	East Nodaway River	Mouth to Corning	WQ	0	0	1	0	1	0	0.5	4.0	12.00	25
7	Nishnabotna River and West Nishnabotna River	Iowa-Missouri Border to Fremont County Line (North)	EL	0	0	1	0	1	0	1.0	3.0	10.50	24
8	Platte River	Above Iowa-Missouri Border	WQ	0	0	1	0	0	0	1.0	4.0	10.00	23
9	Chariton River	Iowa-Missouri Border to Rathbun Reservoir	EL	0	0	1	0	1	0	1.0	2.5	8.75	22
10	Thompson River	Above Grand River	WQ	0	0	1	0	0	0	0.5	4.0	8.00	21
11	Silver Creek	Entire Length	EL	0	0	1	0	1	0	0.5	2.5	7.50	20
12	East Fork 102 River	Above Iowa-Missouri Border	EL	0	0	0	2	0	0	0.5	2.5	7.50	19
13	West Nodaway River	Above Villisca	EL	0	0	1	0	1	0	0.5	2.5	7.50	18
14	Middle Nodaway River	Entire Length	EL	0	0	1	0	0	0	0.5	2.5	5.00	17
15	West Fork 102 River	Above Iowa-Missouri Border	EL	0	0	1	0	0	0	0.5	2.5	5.00	16
16	Tarkio River	Above Iowa-Missouri Border	EL	0	0	1	0	0	0	0.5	2.5	5.00	15
17	Turkey Creek	Entire Length	EL	0	0	1	0	0	0	0.5	2.5	5.00	14
18	Indian Creek	Entire Length	EL	0	0	1	0	0	0	0.5	2.5	5.00	13
19	Grand River	Above Iowa-Missouri Border	EL	0	0	1	0	0	0	0.5	2.5	5.00	12
20	Weldon River	Above Iowa-Missour Border	EL	0	0	1	0	0	0	0.0	2.5	3.75	11
21	West Tarkio Creek	Above Iowa-Missouri Border	EL	0	0	1	0	0	0	0.0	2.5	3.75	10

TABLE VI-2 (Continued)

Rank	Stream Segment	Description	WQ/ EL*	Priority Criteria A	B_c	B_w	C	BC	AES	POP	SQ	Total Points	Priority Points
22	Area 6 North Fabius River Carter Creek South Wyaconda River North Wyaconda River Little Fox River Fox River	Above Iowa-Missouri Border	EL	0	0	0	0	0	0	0.0	2.0	1.00	9
23	Area 3 Middle Fork Grand River East Fork Grand River Lotts Creek West Fork Big Creek Shane Creek	Above Iowa-Missouri Border	EL	0	0	0	0	0	0	0.0	2.0	1.00	8
24	South Fork Chariton River	Entire Length	EL	0	0	0	0	0	0	0.0	2.0	1.00	7
25	Area 4 Little River Lick Creek	Above Iowa-Missouri Border	EL	0	0	0	0	0	0	0.0	2.0	1.00	6
26	Area 5 Little Muddy Creek West Fork Medicine Creek Middle Fork Medicine Creek East Fork Medicine Creek Locust Creek North Creek Shoal Creek	Above Iowa-Missouri Border	EL	0	0	0	0	0	0	0.0	2.0	1.00	
27	Area 1 Middle Tarkio Greek Mill Creek	Above Iowa-Missouri Border	EL	0	0	0	0	0	0	0.0	2.0	1.00	4
28	East Nodaway River	Above Corning	EL	0	0	0	0	0	0	0.0	2.0	1.00	3
29	Middle Fork 102 River	Above Iowa-Missouri Border	EL	0	0	0	0	0	0	0.0	2.0	1.00	2
30	Area 2 Honey Creek Platte Branch	Above Iowa-Missouri Border	EL	0	0	0	0	0	0	0.0	1.0	0.50	1

*WQ = Water Quality Limited
EL = Effluent Limited

municipal facilities construction. The relative significance of each discharger is determined by the point total calculated from the discharger ranking formula. The specific details and rationale used for the municipal discharger ranking methodology have been described previously in Chapter I.

Table VI-3 lists the municipalities in the basin, their priority points and their final ranking.

TABLE VI-3
SOUTHERN IOWA BASIN
MUNICIPAL DISCHARGER RANKING

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
1	Manilla	60	60	0.63	0.63	12	12	27	117.72
2	Irwin	60	60	0.67	0.58	9	9	27	113.25
3	Harlan	40	40	0.72	0.84	16	14	27	112.68
4	Kimballton	60	60	0.67	0.63	9	9	13	102.70
5	Chariton	20	20	0.58	0.83	14	14	30	77.94
6	Creston	20	20	0.61	0.85	14	14	23	72.64
7	Atlantic	20	20	0.56	0.68	14	14	29	71.16
8	Brayton	30	30	0.57	0.57	3	3	29	66.62
9	Defiance	50	40	0.36	0.34	7	7	27	63.50
10	Lenox	60	30	0.61	0.00	14	9	16	61.14
11	Greenfield	20	20	0.55	0.82	9	9	21	60.73
12	Manning	30	30	0.00	0.65	9	9	27	52.35
13	Centerville N.E.	40	40	0.27	0.27	14	14	22	51.16
14	Carson	50	40	0.21	0.24	9	9	27	51.15
15	Farragut	50	1	0.32	0.00	9	1	29	47.88

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
16	Audubon	20	20	0.00	0.56	12	12	29	46.92
17	Clarinda	20	20	0.00	0.55	14	14	28	46.70
18	Red Oak	30	30	0.17	0.23	14	14	29	46.60
19	Corydon N.E.	50	40	0.36	0.36	9	9	7	45.88
20	Elk Horn	40	40	0.31	0.32	9	9	13	43.87
21	Shenandoah	20	20	0.00	0.43	14	14	29	43.62
22	Leon	40	40	0.36	0.36	12	12	6	43.44
23	Macedonia	50	30	0.24	0.00	7	7	27	40.68
24	Mount Ayr	50	40	0.27	0.27	12	12	8	38.78
25	Corning	20	20	0.00	0.36	9	9	25	35.44
26	New Market	30	30	0.25	0.25	7	7	16	34.50
27	Braddyville	30	30	0.09	0.09	5	5	28	34.30
28	Exira	30	30	0.06	0.06	9	9	29	33.68
29	Oakland	40	20	0.11	0.00	12	9	27	32.72
30	Treynor N.W.	40	40	0.13	0.13	7	7	20	32.22

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
31	Shelby	30	30	0.15	0.15	7	7	20	31.10
32	Russell	30	30	0.00	0.00	7	7	30	30.00
33	Derby	0	0	0.00	0.00	0	0	30	30.00
34	Millerton	0	0	0.00	0.00	0	0	30	30.00
35	Griswold	20	20	0.00	0.00	9	9	29	29.00
36	Essex	20	10	0.00	0.00	7	5	29	29.00
37	Elliott	30	1	0.00	0.00	7	1	29	29.00
38	Lewis	20	20	0.00	0.00	7	7	29	29.00
39	Riverton	0	0	0.00	0.00	0	0	29	29.00
40	Templeton	20	20	0.00	0.00	5	5	29	29.00
41	Coburg	0	0	0.00	0.00	0	0	29	29.00
42	Seymour E.	30	30	0.09	0.09	7	7	22	28.66
43	Massena	30	30	0.14	0.14	7	7	18	28.36
44	Shambaugh	0	0	0.00	0.00	0	0	28	28.00
45	Hepburn	0	0	0.00	0.00	0	0	28	28.00

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria						Segment Points	Priority Points
		A_1	A_2	B_1	B_2	D_1	D_2		
46	Avoca	20	20	0.00	0.00	9	9	27	27.00
47	Emerson	30	30	0.00	0.00	7	7	27	27.00
48	Hancock	30	30	0.00	0.00	5	5	27	27.00
49	Hastings	0	0	0.00	0.00	0	0	27	27.00
50	Henderson	0	0	0.00	0.00	0	0	27	27.00
51	Kirkman	0	0	0.00	0.00	0	0	27	27.00
52	Aspinwall	0	0	0.00	0.00	0	0	27	27.00
53	Gray	0	0	0.00	0.00	0	0	27	27.00
54	Cumberland	30	30	0.12	0.12	7	7	18	26.88
55	Humeston	30	30	0.25	0.25	9	9	7	26.50
56	Lamoni	30	30	0.00	0.00	12	12	26	26.00
57	Murray	0	0	0.00	0.00	0	0	26	26.00
58	Davis City	0	0	0.00	0.00	0	0	26	26.00
59	Grand River	0	0	0.00	0.00	0	0	26	26.00
60	Decatur City	0	0	0.00	0.00	0	0	26	26.00

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
61	Pleasanton	0	0	0.00	0.00	0	0	26	26.00
62	Beaconsfield	0	0	0.00	0.00	0	0	26	26.00
63	Nodaway	0	0	0.00	0.00	0	0	25	25.00
64	Allerton N.	30	30	0.25	0.25	5	5	7	24.50
65	Hamburg	30	30	0.00	0.00	12	12	24	24.00
66	Walnut	30	30	0.00	0.00	9	9	24	24.00
67	Sidney	30	20	0.00	0.00	9	9	24	24.00
68	Randolph	0	0	0.00	0.00	0	0	24	24.00
69	Imogene	0	0	0.00	0.00	0	0	24	24.00
70	Allerton S.	30	30	0.25	0.25	7	7	5	23.50
71	Clearfield	0	0	0.00	0.00	0	0	23	23.00
72	Blockton	0	0	0.00	0.00	0	0	23	23.00
73	Cromwell	0	0	0.00	0.00	0	0	23	23.00
74	Kent	0	0	0.00	0.00	0	0	23	23.00
75	Athelstan	0	0	0.00	0.00	0	0	23	23.00
76	Maloy	0	0	0.00	0.00	0	0	23	23.00

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
77	Centerville W.	30	30	0.00	0.00	12	12	22	22.00
78	Mystic	0	0	0.00	0.00	0	0	22	22.00
79	Promise City	0	0	0.00	0.00	0	0	22	22.00
80	Rathbun	0	0	0.00	0.00	0	0	22	22.00
81	Plano	0	0	0.00	0.00	0	0	22	22.00
82	Afton	20	20	0.00	0.00	7	7	21	21.00
83	Lorimor	0	0	0.00	0.00	0	0	21	21.00
84	Orient	0	0	0.00	0.00	0	0	21	21.00
85	Macksburg	0	0	0.00	0.00	0	0	21	21.00
86	Thayer	0	0	0.00	0.00	0	0	21	21.00
87	Malvern	30	30	0.00	0.00	9	9	20	20.00
88	Silver City	0	0	0.00	0.00	0	0	20	20.00
89	Treynor S.E.	20	20	0.00	0.00	3	3	20	20.00
90	Westphalia	0	0	0.00	0.00	0	0	20	20.00
91	Gravity	30	30	0.25	0.25	5	5	2	19.50

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
92	Bedford	20	10	0.00	0.00	9	9	19	19.00
93	Sharpsburg	0	0	0.00	0.00	0	0	19	19.00
94	Conway	0	0	0.00	0.00	0	0	19	19.00
95	Grant	0	0	0.00	0.00	0	0	18	18.00
96	Villisca	20	20	0.00	0.00	9	9	17	17.00
97	Fontanelle	20	1	0.00	0.00	7	1	17	17.00
98	Bridgewater	0	0	0.00	0.00	0	0	17	17.00
99	Carbon	0	0	0.00	0.00	0	0	17	17.00
100	Stanton	30	1	0.00	0.00	7	0	15	15.00
101	Coin	0	0	0.00	0.00	0	0	15	15.00
102	Blanchard	0	0	0.00	0.00	0	0	15	15.00
103	Yorktown	0	0	0.00	0.00	0	0	15	15.00
104	Anita	20	20	0.00	0.00	9	9	14	14.00
105	Wiota	0	0	0.00	0.00	0	0	14	14.00

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
106	Marne	0	0	0.00	0.00	0	0	13	13.00
107	Diagonal	0	0	0.00	0.00	0	0	12	12.00
108	Redding	0	0	0.00	0.00	0	0	12	12.00
109	Shannon City	0	0	0.00	0.00	0	0	12	12.00
110	Arispe	0	0	0.00	0.00	0	0	12	12.00
111	Benton	0	0	0.00	0.00	0	0	12	12.00
112	Delphos	0	0	0.00	0.00	0	0	12	12.00
113	Garden Grove	0	0	0.00	0.00	0	0	11	11.00
114	Weldon	0	0	0.00	0.00	0	0	11	11.00
115	Le Roy	0	0	0.00	0.00	0	0	11	11.00
116	Bloomfield	30	30	0.00	0.00	12	12	9	9.00
117	Moulton	20	20	0.00	0.00	7	7	9	9.00
118	Milton	20	20	0.00	0.00	7	7	9	9.00
119	Pulaski	0	0	0.00	0.00	0	0	9	9.00
120	Cantril	20	20	0.00	0.00	5	5	9	9.00

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
121	Udell	0	0	0.00	0.00	0	0	9	9.00
122	Drakesville	0	0	0.00	0.00	0	0	9	9.00
123	Mt. Sterling	0	0	0.00	0.00	0	0	9	9.00
124	Kellerton	0	0	0.00	0.00	0	0	8	8.00
125	Tingley	0	0	0.00	0.00	0	0	8	8.00
126	Ellston	0	0	0.00	0.00	0	0	8	8.00
127	Corydon S.	20	10	0.00	0.00	9	7	7	7.00
128	Corydon S.E.	30	30	0.00	0.00	3	3	7	7.00
129	Corydon S.W.	30	30	0.00	0.00	3	3	7	7.00
130	Van Wert	0	0	0.00	0.00	0	0	6	6.00
131	Cincinnati	0	0	0.00	0.00	0	0	5	5.00
132	Lineville	0	0	0.00	0.00	0	0	5	5.00
133	Seymour S.W.	20	20	0.00	0.00	5	5	5	5.00
134	Exline	0	0	0.00	0.00	0	0	5	5.00
135	Numa	0	0	0.00	0.00	0	0	5	5.00

TABLE VI-3 (Continued)

Rank	Municipality	Discharge Criteria A_1	A_2	B_1	B_2	D_1	D_2	Segment Points	Priority Points
136	Clio	0	0	0.00	0.00	0	0	5	5.00
137	College Springs	0	0	0.00	0.00	0	0	4	4.00
138	Northboro	0	0	0.00	0.00	0	0	4	4.00
139	Prescott	20	20	0.00	0.00	5	5	3	3.00

WASTE LOAD REDUCTION

A summary of the waste load reduction required by the waste load allocation analysis for municipal dischargers in the Southern Iowa Basin is summarized in Table VI-4. The table includes present and projected flows, the pounds of BOD_5 and ammonia nitrogen presently in the effluent at critical periods, the pounds of BOD_5 and ammonia nitrogen projected for the 1990 discharger flow, as allowed by the waste load allocation, and the load reduction required, where applicable.

Due to a lack of available data, the BOD_5 and ammonia nitrogen values listed as being in the present discharge at critical periods have been estimated for some dischargers. These estimates may differ from the operational data shown in Table V-2 of Chapter V because all BOD_5 and ammonia nitrogen values shown in Table V-2 are yearly averages computed from operation reports of the Effluent Quality Analysis Program (EQAP) data. The values presented in the load reduction column of Table VI-4 reflect the effluent load reduction to the stream during the winter discharge period.

As shown in Table VI-4, some municipalities do not show a load reduction. This may be due to one of the following:

TABLE VI-4
SOUTHERN IOWA BASIN
WASTE LOAD REDUCTIONS

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Nishnabotna River						
West Nishnabotna River						
Silver Creek						
Westphalia	M-1	NEMTF		---	---	---
Shelby	M-2	Partial Storage		Controlled Discharge		
Treynor N.W.	M-3	Partial Storage		Controlled Discharge		
Treynor S.E.	M-4	Partial Storage		Controlled Discharge		
Silver City	M-5	NEMTF		0.035	9/4	a
Malvern	M-6	Partial Storage		Controlled Discharge		
TOTAL		---	---	0.035	9/4	a
West Nishnabotna River						
Manilla	M-7	Partial Storage		Controlled Discharge		
Defiance	M-8	Partial Storage		Controlled Discharge		
Aspinwall	M-9	NEMTF		---	---	---
Irwin	M-10	Partial Storage		Controlled Discharge		

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Manning	M-11	0.150	43/18	0.173	29/7	14/11
Kirkman	M-12	NEMTF		---	---	---
Harlan	M-13	0.632	248/127	1.038	87/26	161/101
Avoca	M-14	Partial	Storage	Controlled	Discharge	
Gray	M-15	NEMTF		---	---	---
Hancock	M-16	Partial	Storage	Controlled	Discharge	
Oakland	M-17	Partial	Storage	Controlled	Discharge	
Carson	M-18	0.119	68/29	0.150	38/19	30/10
Macedonia	M-19	Partial	Storage	Controlled	Discharge	
Henderson	M-20	NEMTF		0.027	7/3	a
Emerson	M-21	0.036	8/5	0.038	10/5	a
Hastings	M-22	NEMTF		0.030	8/4	a
TOTAL		0.937	367/179	1.456	179/64	188/115
West Nishnabotna River						
Randolph	M-23	NEMTF		0.026	7/3	a
Walnut	M-24	Partial	Storage	Controlled	Discharge	

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Imogene	M-25	NEMTF		0.024	6/3	a
Sidney	M-45	0.054	17/7	0.060	15/8	a
Hamburg	M-46	Partial	Storage	Controlled	Discharge	
TOTAL		0.054	17/7	0.110	28/14	a
East Nishnabotna River						
Indian Creek						
Kimballton	M-26	Partial	Storage	Controlled	Discharge	
Elk Horn	M-27	Partial	Storage	Controlled	Discharge	
Marne	M-28	NEMTF		---	---	---
TOTAL		---	---	---	---	---
East Nishnabotna River						
Templeton	M-29	Partial	Storage	Controlled	Discharge	
Audubon	M-30	0.354	74/12	0.038	86/11	a
Exira	M-31	Partial	Storage	Controlled	Discharge	
Brayton	M-32	Partial	Storage	Controlled	Discharge	
Atlantic	M-33	0.753	170/88	0.945	79/32	91/56

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Lewis	M-36	Partial Storage		Controlled Discharge		
Griswold	M-37	0.120	30/11	0.124	31/16	a
Elliott	M-38	Partial Storage		Controlled Discharge		
Red Oak	M-39	0.775	252/136	0.800	200/100	52/36
Coburg	M-40	NEMTF		---	---	---
Essex	M-41	Partial Storage		Controlled Discharge		
Shenandoah	M-42	0.575	134/72	0.800	200/47	a
Farragut	M-43	Partial Storage		Controlled Discharge		
Riverton	M-44	NEMTF		0.040	10/5	a
TOTAL		2.577	660/319	2.747	606/211	54/108
Turkey Creek						
Anita	M-34	Partial Storage		Controlled Discharge		
Wiota	M-35	NEMTF		---	---	---
TOTAL		---	---	---	---	---

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Tarkio River						
West Tarkio Creek						
No Discharger						
Area 1						
Northboro	M-47	NEMTF		---	---	---
College Springs	M-52	NEMTF		0.033	8/4	a
TOTAL		---	---	0.033	8/4	a
Tarkio River						
Stanton	M-48	Partial Storage		Controlled Discharge		
Yorktown	M-49	NEMTF		---	---	---
Coin	M-50	NEMTF		0.033	8/4	a
Blanchard	M-51	NEMTF		---	---	---
TOTAL		---	---	0.033	8/4	a
Nodaway River						
West Nodaway River						
Cumberland	M-53	0.039	11/NA	0.051	13/6	a
Massena	M-54	0.025	7/NA	0.051	13/6	a

TABLE VI-4 (Continued)

Discharger		Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Grant		M-55	NEMTF		0.026	7/3	a
	TOTAL		0.064	18/NA	0.128	33/15	a
West Nodaway River							
Hepburn		M-60	NEMTF		---	---	---
Clarinda		M-61	1.287	268/NA	1.660	415/69	a
Shambaugh		M-62	NEMTF		---	---	---
Braddyville		M-66	Partial	Storage	Controlled	Discharge	
	TOTAL		1.287	268/NA	1.660	415/69	a
Middle Nodaway River							
Villisca		M-56	NA	NA	0.180	45/23	a
Fontanelle		M-57	Partial	Storage	Controlled	Discharge	
Bridgewater		M-58	NEMTF		---	---	---
Carbon		M-59	NEMTF		---	---	---
	TOTAL		---	---	0.180	45/23	---
East Nodaway River							
Prescott		M-63	Partial	Storage	Controlled	Discharge	
	TOTAL		---	---	---	---	---

TABLE VI-4 (Continued)

Discharger	Reference Number	Present: Flow (mgd)	Present: lbs. Eff. BOD_5/NH_3	Projected (1990): Flow (mgd)	Projected (1990): lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
East Nodaway River						
Corning	M-64	0.281	63/NA	0.310	78/21	a
Nodaway	M-65	NEMTF		---	---	---
TOTAL		0.281	63/NA	0.310	78/21	a
One Hundred and Two River						
West Fork 102 River						
New Market	M-67	Partial	Storage	Controlled	Discharge	
Lenox	M-68	Partial	Storage	Controlled	Discharge	
TOTAL		---	---	---	---	---
Middle Fork 102 River						
Gravity	M-69	Partial	Storage	Controlled	Discharge	
TOTAL		---	---	---	---	---
East Fork 102 River						
Sharpsburg	M-70	NEMTF		---	---	---
Conway	M-71	NEMTF		---	---	---
Bedford	M-72	0.179	39/10	0.400	100/50	a
TOTAL		0.179	39/10	0.400	100/50	a

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Platte River Area 2						
No Discharger						
Platte River						
Creston	M-73	1.474	369/NA	1.828	152/31	217/NA
Cromwell	M-74	NEMTF		---	---	---
Kent	M-75	NEMTF		---	---	---
Clearfield	M-76	NEMTF		0.041	10/5	a
Maloy	M-77	NEMTF		---	---	---
Blockton	M-78	NEMTF		0.026	7/3	a
Athelstan	M-79	NEMTF		---	---	---
TOTAL		1.474	369/NA	1.895	169/39	200/NA
Grand River						
Arispe	M-80	NEMTF		---	---	---
Shannon City	M-81	NEMTF		---	---	---

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Diagonal	M-82	NEMTF		0.032	8/4	a
Benton	M-83	NEMTF		---	---	
Delphos	M-84	NEMTF		---	---	---
Redding	M-85	NEMTF		---	---	---
TOTAL		---	---	0.032	8/4	a
Area 3						
Mount Ayr	M-86	0.200	93/NA	0.215	54/27	39/NA
Tingley	M-87	NEMTF		0.024	6/3	a
Ellston	M-88	NEMTF		---	---	---
Kellerton	M-89	NEMTF		0.029	7/4	a
TOTAL		0.200	93/NA	0.268	67/34	26/NA
Thompson River						
Greenfield	M-90	0.430	93/NA	0.525	44/9	49/NA
Macksburg	M-91	NEMTF		---	---	---
Orient	M-92	NEMTF		0.032	8/4	a

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Lorimor	M-93	NEMTF		0.034	9/4	a
Thayer	M-94	NEMTF		---	---	---
Afton	M-95	Partial Storage		Controlled Discharge		
TOTAL		0.430	93/NA	0.591	61/17	49/NA
Thompson River						
Grand River	M-96	NEMTF		---	---	---
Murray	M-97	NEMTF		0.076	19/10	a
Decatur City	M-98	NEMTF		---	---	---
Beaconsfield	M-99	NEMTF		---	---	---
Davis City	M-100	NEMTF		0.025	6/3	a
Lamoni	M-101	Controlled Discharge		Controlled Discharge		
Pleasanton	M-102	NEMTF		---	---	---
TOTAL		---	---	0.101	25/13	a

TABLE VI-4 (Continued)

Discharger		Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Weldon River Area 4							
Van Wert		M-103	NEMTF		0.020	5/3	a
Leon		M-104	0.187	73/NA	0.230	58/29	15/NA
	TOTAL		0.187	73/NA	0.250	63/32	10/NA
Weldon River							
Weldon		M-105	NEMTF		---	---	---
Le Roy		M-106	NEMTF		---	---	---
Garden Grove		M-107	NEMTF		0.024	6/3	a
	TOTAL		---	---	0.024	6/3	a
Weldon River Area 5							
Clio		M-108	NEMTF		---	---	---
Lineville		M-109	NEMTF		0.036	9/5	a
Allerton S.		M-110	Partial Storage		Controlled Discharge		
Cincinnati		M-112	NEMTF		0.066	17/8	a

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Seymour S.W.	M-113	0.009	2/NA	0.045	11/6	a
Numa	M-115	NEMTF		---	---	---
Exline	M-116	NEMTF		0.026	7/3	a
TOTAL		0.009	2/NA	0.128	44/22	a
Chariton River						
Derby	M-117	NEMTF		---	---	---
Chariton	M-118	0.621	140/NA	0.642	54/11	86/NA
Russell	M-119	Partial Storage		Controlled Discharge		
Millerton	M-120	NEMTF		---	---	---
TOTAL		0.621	140/NA	0.642	54/11	86/NA
Chariton River – South Fork Chariton River						
Allerton N.	M-111	Partial Storage		Controlled Discharge		
Humeston	M-121	Partial Storage		Controlled Discharge		
Corydon N.E.	M-122	Partial Storage		Controlled Discharge		
Corydon S.E.	M-123	Partial Storage		Controlled Discharge		

TABLE VI-4 (Continued)

Discharger		Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Corydon S.W.		M-124	Partial Storage		Controlled Discharge		
Corydon S.		M-125	Partial Storage		Controlled Discharge		
	TOTAL		---	---	---	---	---
Chariton River							
Seymour E.		M-114	0.027	7/NA	0.045	11/6	a
Rathbun		M-126	NEMTF		---	---	---
Plano		M-127	NEMTF		---	---	---
Promise City		M-128	NEMTF		---	---	---
Mystic		M-129	NEMTF		0.081	20/10	a
Centerville N.E.		M-130	0.783	327/NA	1.152	288/144	39/NA
Centerville W.		M-131	0.291	83/NA	0.237	59/30	24/NA
	TOTAL		1.101	417/NA	1.434	378/190	39/NA
Fox River Area 6							
Udell		M-132	NEMTF		---	---	---
Moulton		M-133	Partial Storage		Controlled Discharge		

TABLE VI-4 (Continued)

Discharger	Reference Number	Present Flow (mgd)	Present lbs. Eff. BOD_5/NH_3	Projected (1990) Flow (mgd)	Projected (1990) lbs. Eff. BOD_5/NH_3	Load Reduction BOD_5/NH_3
Drakesville	M-134	NEMTF		---	---	---
Bloomfield	M-135	0.284	76/40	0.360	90/45	a
Pulaski	M-136	NEMTF		0.028	7/4	a
Milton	M-137	Partial Storage		Controlled Discharge		
Cantril	M-138	Partial Storage		Controlled Discharge		
Mt. Sterling	M-139	NEMTF		---	---	---
TOTAL		0.284	76/40	0.388	97/49	a

a = Minor load increase due to increased population or new treatment plant being constructed with increased flows.

1. A city presently not having a discharge (e.g. individual septic systems) has been projected to construct a sewer system and sewage treatment facilities.

2. A substantial increase in population or industrial flow has been forecast which would increase the present discharge.

Either of these factors could cause an increase in the BOD_5 and/or ammonia nitrogen in the projected plant effluent.

REFERENCES

1. Supporting Document for Iowa Water Quality Management Plan; Iowa Department of Environmental Quality, Des Moines, Iowa, 1976.

CHAPTER VII

NONPOINT POLLUTION SOURCES

Flow contributions into surface waters from sources other than readily identifiable domestic, industrial, commercial and institutional point discharges may have a substantial impact on water quality. The water resource may be adversely affected by nonpoint discharges associated with combined sewer overflows, urban and rural runoff, and agricultural waste.

GENERAL RURAL RUNOFF

Approximately 97 percent of the Southern Iowa Basin is classified as agricultural land. The pollution potential of general rural runoff has been developed and related to specific conditions in the basin.

Estimated land use in each drainage area was developed using the 1970 Iowa Conservation Needs Inventory, (4). Land use acreages are listed in Table VII-1.

A detailed analysis was conducted to estimate nutrient losses within the study area. Nutrient loads in the basin were estimated based on sampling conducted below the Rathbun Dam (prior to closing). Actual nutrient loadings were measured. A significant relationship was found to exist between the flow and the nutrient

TABLE VII-1
SOUTHERN IOWA BASIN
LAND USE CLASSIFICATIONS

Hydrologic Unit	Cropland	Pasture	Range	Forest	Federal	Urban	Small Water	Other	Total
	Land Use in Acres								
Chariton River	302,661	142,393	0	70,802	22,087	22,915	1,142	22,123	584,123
Nodaway River	550,270	129,256	193	31,674	460	25,678	2,295	19,622	759,448
Nishnabotna River	1,455,145	189,959	2,861	78,093	772	71,906	5,684	52,742	1,857,162
Sub-total	2,308,076	461,608	3,054	180,569	23,319	120,499	9,121	94,487	3,200,733
All Other River Basins	1,285,766	1,333,025	1,197	184,058	2,442	76,297	4,830	47,111	2,934,726
TOTAL	3,593,842	1,794,633	4,251	364,627	25,761	196,796	13,951	141,598	6,135,459

concentration. The total annual nutrient load was then estimated based on the sampling analysis and the flow duration curve for the Chariton River at Rathbun Reservoir. Point source loadings, based on EQAP data, were subtracted from the total loadings, yielding the nonpoint nutrient contribution.

The results of this analysis are shown in Table VII-2. Annual nitrogen and phosphorus losses were 4.56 and 2.43 lbs./acre respectively. Nonpoint runoff accounted for 98.4 percent of the nitrogen and 94.5 percent of the phosphorus in the river. The estimated nutrient loading for the other hydrologic units in the basin was then estimated based on the average annual loss per acre calculated for the Chariton River above Rathbun Reservoir (Table VII-3).

The 1970 Conservation Needs Inventory (4) was used to summarize treatment measures necessary to reduce surface runoff and limit soil losses to levels established by the Soil Conservation Districts (Table VII-4). The associated implementation costs were then developed based on these needs and cost estimates provided by the Soil Conservation Service (Table VII-5). The cost of treatment measures to reduce runoff from cropland is by far the largest cost segment since cropland is more susceptible to runoff due to limited soil cover. Annual costs developed by Stanley Consultants for the various types of treatment are also listed

TABLE VII-2

SOUTHERN IOWA BASIN

ESTIMATED* ANNUAL NUTRIENT LOAD IN THE CHARITON RIVER AT RATHBUN RESERVOIR

Nutrient	Estimated Lbs./Year Stream	Estimated Lbs./Year Point Sources	Estimated Lbs./Year Nonpoint Sources	Drainage Area in Acres	Annual Runoff Lbs./Acre	Nonpoint Sources Percent of Total
Phosphorus	879,916	48,203	831,713	340,360*	2.43	94.5
Nitrogen	1,585,427	24,795	1,560,632	342,400	4.56	98.4

*Based on Water Quality and Flow Data.

TABLE VII-3

SOUTHERN IOWA BASIN

ESTIMATED NUTRIENT LOADINGS FROM NONPOINT SOURCES

Hydrologic Unit		Nitrogen Lbs./Year	Phosphorus Lbs./Year
Chariton River		2,663,601	1,419,419
Nodaway River		3,463,083	1,845,459
Nishnabotna River		8,468,659	4,512,904
	Sub-total	14,595,343	7,777,782
All Other River Basins		13,382,351	7,131,384
	TOTAL	27,977,694	14,909,166

*Deducting 11,000 acres in the reservoir.

TABLE VII-4

SOUTHERN IOWA BASIN

RUNOFF CONTROL MEASURES REQUIRED

	Cropland Acres		Pasture Acres				Acres
Hydrologic Unit	Terracing Stripcropping	Grade Stabilization	Diversions	Land Conversions	Critical Area Planting	Grassland Management	Woodland Management
Chariton River	128,663	13,119	9,746	94	71,910	5,183	34,897
Nodaway River	215,473	49,284	24,248	8	22,859	10,072	17,586
Nishnabotna River	658,056	53,111	12,580	454	49,192	7,505	43,778
Sub-total	1,002,192	115,514	46,574	556	143,961	22,760	96,261
All Other River Basins	487,611	99,872	60,867	943	118,246	52,760	98,566
TOTAL	1,489,803	215,386	107,441	1,499	262,207	75,520	194,827

TABLE VII-5

SOUTHERN IOWA BASIN

UNIT COSTS FOR STATEWIDE CONTROLS

Land Use	Total Cost	Total Acres	Capital Cost/Acre	Annual Cost/Acre
Cropland				
Stripcropping and Terracing	$ 824,677,000	7,932,499	$ 103.96	$5.00
Grade Stabilization	638,440,000	1,873,037	340.86	1.50
Pasture				
Diversions	7,003,000	610,660	11.47	5.00
Land Conversions	29,647,000	16,682	1,777.18	2.00
Critical Area Planting	8,002,000	715,003	11.19	1.00
Grassland Management	9,296,000	229,332	40.54	1.00
Woodland				
Woodland Management	160,080,000	2,055,435	77.88	2.00
TOTALS	$1,677,145,000	13,432,648		

TABLE VII-6

SOUTHERN IOWA BASIN

RUNOFF CONTROL COSTS BY SUBBASIN

	Cropland		Pasture					
Hydrologic Unit	Terracing Stripcropping	Grade Stabilization	Diversions	Land Conversions	Critical Area Planting	Grassland Management	Woodland Management	Total
Chariton River	$ 13,376,038	$ 4,471,718	$ 111,766	$ 167,055	$ 804,785	$ 210,094	$ 2,717,825	$ 21,859,281
Nodaway River	22,400,963	16,798,855	278,074	14,217	255,828	408,270	1,369,621	41,525,828
Nishnabotna River	68,412,693	18,103,319	144,266	806,842	550,535	304,216	3,409,489	91,731,360
Sub-total	$104,189,694	$39,373,892	$ 534,106	$ 988,114	$1,611,148	$ 922,580	$ 7,496,935	$155,116,469
All Other River Basins	50,692,922	34,042,188	698,018	1,675,885	1,323,357	2,138,633	7,676,451	98,247,454
TOTAL	$154,882,616	$73,416,080	$1,232,124	$2,663,999	$2,934,505	$3,061,213	$15,173,386	$253,363,923

in Table VII-5. Estimated capital costs of the runoff control measures for the Southern Iowa Basin are shown in Table VII-6.

The total cost for the basin is approximately $253 million.

ANIMAL FEEDING OPERATIONS

To determine the size and location of livestock facilities in the study area, information was gathered on feeding operations registered with the Department of Environmental Quality. Livestock census information was obtained from the Iowa Annual Farm Census, 1971 (3) to establish the number and distribution of animals in the study area (Table VII-7). The inventory information obtained is representative of conditions at a particular time. A detailed account of livestock feeding operation capacity is not feasible. The number of livestock on feed and the number of feeding operations are subject to many variables, the most significant of which is livestock marketing conditions. The inventory data accumulated for the basin does indicate livestock feeding as a significant potential source of water pollution. The locations of registered animal feeding operations in the basin are shown on Figure VII-1. The number of animals at each operation is identified by reference number in Table VII-8.

TABLE VII-7
SOUTHERN IOWA BASIN
LIVESTOCK DISTRIBUTION BY SUBBASIN

Hydrologic Unit		Hogs	Cattle	Sheep	Poultry
Chariton River		110,613	11,636	10,699	143,514
Nodaway River		351,483	67,395	6,766	80,412
Nishnabotna River		909,081	330,313	11,355	378,846
	Sub-total	1,371,177	409,344	28,820	602,772
All Other River Basins		638,697	79,803	28,439	174,683
	TOTAL	2,009,874	489,147	57,259	777,455

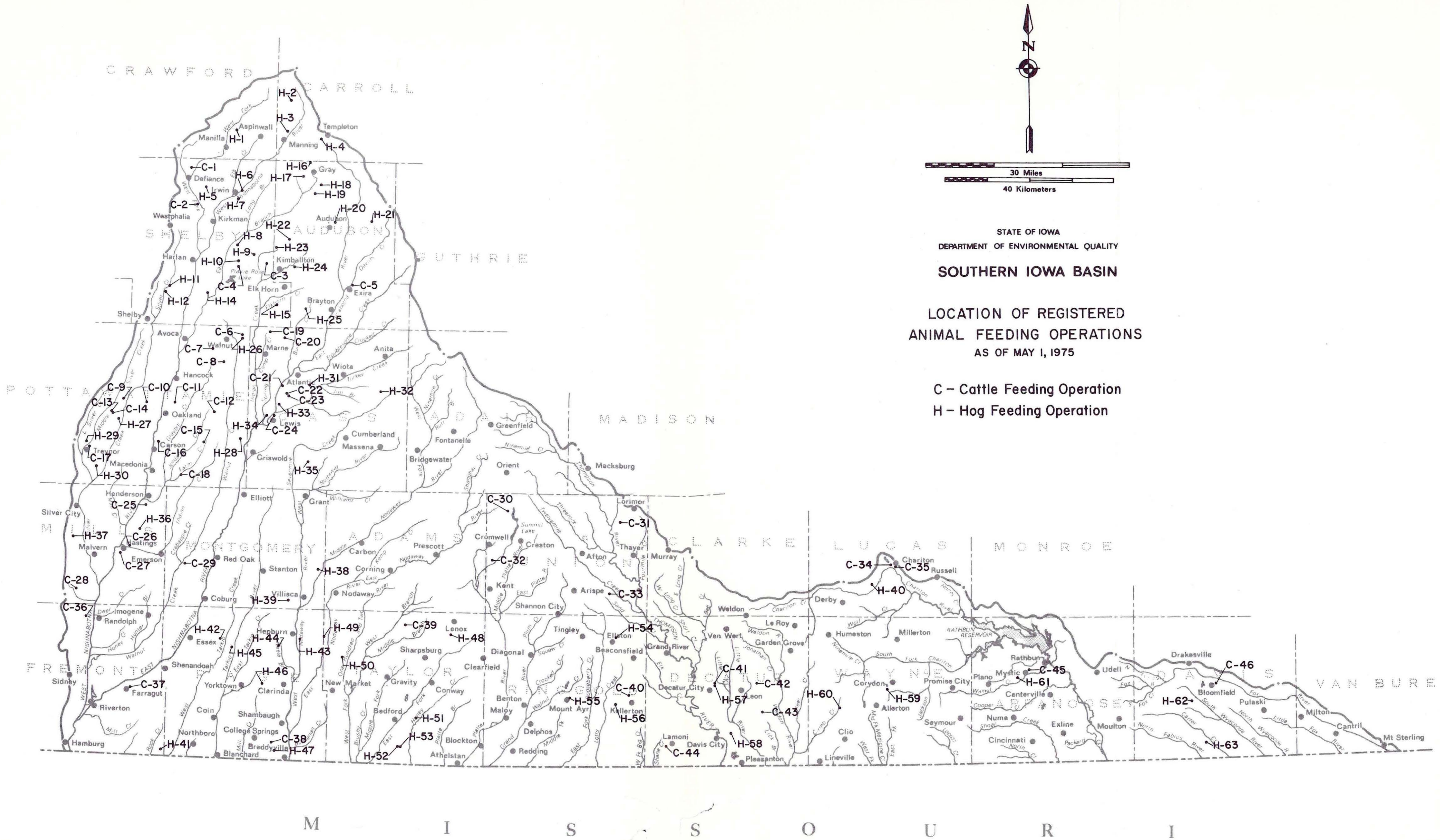

N
30 Miles
40 Kilometers
STATE OF IOWA
DEPARTMENT OF ENVIRONMENTAL QUALITY
SOUTHERN IOWA BASIN
LOCATION OF REGISTERED
ANIMAL FEEDING OPERATIONS
AS OF MAY 1, 1975
C – Cattle Feeding Operation
H – Hog Feeding Operation
CRAWFORD
CARROLL
SHELBY
AUDUBON
GUTHRIE
POTTAWATTAMIE
CASS
ADAIR
MADISON
MILLS
MONTGOMERY
ADAMS
UNION
CLARKE
LUCAS
MONROE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
VAN BUREN
M I S S O U R I

FIGURE VII-1

TABLE VII-8
SOUTHERN IOWA BASIN
ANIMAL FEEDING OPERATIONS

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
Hog Feeding Operations				
Nishnabotna River Basin				
2-05-00-4-01	Audubon	600	H-23	RC
-02		380	H-21	RC
-03		500	H-19	ST
-04		2,700	H-22	SL
-05		2,630	H-18	SL
-07		600	H-17	SL
-08		280	H-25	ST
-11		220	H-16	ST
-12		330	H-20	ST
-13		600	H-24	NA
2-14-00-4-03	Carroll	160	H-3	ST
-04		250	H-4	ST
-11		3,335	H-2	SB
2-15-00-4-01	Cass	400	H-34	SL
-02		200	H-31	SL
-03		1,064	H-33	SL
2-15-00-4-02	Crawford	5,675	H-1	SL
2-36-00-4-01	Fremont	12	H-41	ST
2-65-00-4-02	Mills	700	H-37	ST
-03		2,300	H-36	SL
2-78-00-4-01	Pottawattamie	1,855	H-29	SL
-02		650	H-30	SL
-03		400	H-28	SL
-06		2,300	H-26	SL
-07		390	H-27	NC
2-83-00-4-04	Shelby	600	H-12	ST
-05		2,035	H-6	SL
-06		500	H-9	RC

TABLE VII-8 (Continued)

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
2-83-00-4-07	Shelby	500	H-7	ST
-08		500	H-14	ST
-09		2,035	H-8	SL
-10		600	H-11	ST
-11		500	H-5	RC
-12		480	H-15	ST
-13		300	H-10	NC
-14		720	H-13	ST
Nodaway River Basin				
2-15-00-4-04	Cass	924	H-32	RC
-05		3,800	H-35	RC
2-69-00-4-01	Montgomery	1,135	H-38	SL
-02		500	H-39	SL
2-73-00-4-01	Page	150	H-43	ST
-02		300	H-44	ST
-04		1,135	H-46	SL
-05		300	H-47	SL
2-87-00-4-02	Taylor	390	H-49	RC
-05		200	H-50	RC
Chariton River Basin				
2-04-00-4-02	Appanoose	670	H-61	RC
2-59-00-4-01	Lucas	624	H-40	ST
2-93-00-4-02	Wayne	360	H-59	RC
All Other River Basins				
2-26-00-4-01	Davis	250	H-62	ST
-02		560	H-63	ST
2-27-00-0-01	Decatur	225	H-57	RC
2-27-00-4-01		100	H-58	ST

TABLE VII-8 (Continued)

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
2-73-00-4-03	Page	1,135	H-42	SL
-06		720	H-45	ST
2-80-00-4-01	Ringgold	500	H-56	RC
-02		300	H-54	SB
-03		NA	H-55	NA
2-87-00-4-01	Taylor	1,000	H-53	ST
-03		600	H-52	ST
-04		1,000	H-48	SL
-06		240	H-51	SB
2-93-00-4-01	Wayne	700	H-60	RC
	Cattle Feeding Operations			
Nishnabotna River Basin				
2-05-00-0-01	Audubon	2,000	C-5	NC
2-15-00-0-01	Cass	900	C-19	RC
-02		NA	C-24	RC
-03		1,800	C-21	RC
-04		1,000	C-20	RC
-05		1,500	C-22	RC
-06		2,500	C-23	RC
2-36-00-0-01	Fremont	4,200	C-36	RC
-02		NA	C-37	NA
2-65-00-0-01	Mills	1,600	C-28	RC
-02		NA	C-27	NA
-04		3,000	C-26	RC
-06		640	C-25	ST
2-69-00-0-01	Montgomery	1,200	C-29	RC
2-78-00-0-04	Pottawattamie	NA	C-17	RC

TABLE VII-8 (Continued)

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
2-78-00-0-05	Pottawattamie	1,000	C-8	RC
-06		225	C-18	RC
-07		200	C-7	RC
-08		500	C-10	RC
-09		500	C-12	RC
-10		600	C-16	RC
-11		600	C-13	RC
-12		200	C-9	RC
-13		600	C-6	RC
-14		6,060	C-11	RC
-16		4,000	C-15	SL
-17		1,000	C-14	RC
2-83-00-0-01	Shelby	500	C-1	ST
-02		3,000	C-2	RC
-03		250	C-3	RC
-06		900	C-4	NC
Nodaway River Basin				
2-73-00-0-01	Page	500	C-38	NC
Chariton River Basin				
2-04-00-0-01	Appanoose	NA	C-45	RC
2-59-00-0-03	Lucas	NA	C-34	RC
-04		NA	C-35	NA
All Other River Basins				
2-26-00-0-01	Davis	750	C-46	RC
2-27-00-0-01	Decatur	50	C-41	RC
-02		NA	C-44	NA
-03		NA	C-42	RC
-04		1,200	C-43	RC
2-80-00-0-01	Ringgold	700	C-40	RC
2-87-00-0-01	Taylor	125	C-39	RC

TABLE VII-8 (Continued)

Registration No.	County	No. Of Animals	Ref. No.	Type Controls*
2-88-00-0-01	Union	NA	C-33	RC
-02		600	C-30	RC
-03		NA	C-31	RC
-04		200	C-32	NC

*SB-Storage Basin
SL-Lagoon
RC-Runoff Controls
ST-Below Building Storage or Tank
NC-No Control
NA-Not Available

Cattle densities in the basin range from a low of 0.02 head per acre in the Chariton River Subbasin to a high of 0.18 in the Nishnabotna River Subbasin. Swine densities vary between 0.20 head per acre in the Chariton River Subbasin to 0.49 in the Nishnabotna River Subbasin.

Because of insufficient data, quantitative estimates of potential pollution loads from feeding operations were not calculated. As indicated in Table VII-8, there are 46 registered cattle feeding operations with a cumulative capacity for 44,600 cattle. The remaining 444,547 cattle in the basin are dispersed throughout the basin. Similar dispersion of swine, sheep and poultry populations occurs in the basin. Because of the areal distribution of animals, misleading conclusions could result from a projection of total pollution potential for each watershed.

[illegible]ON ABATEMENT COSTS

To indicate the relative magnitude of treatment costs for feeding operations in the basin, capital cost estimates have been developed for treatment systems for both cattle and swine operations. Most registered feeding operations in the basin presently have adequate treatment facilities. For purposes of estimating costs, it is necessary to approximate the number of unregistered beef cattle and swine which are in confined feeding operations that require treatment facilities. Testimony given before a U.S. House of Representatives subcommittee (1) indicates that 22 percent of the swine feeding operations and 26 percent of the beef cattle feeding operations in the United States have pollution problems requiring remedial measures. Treatment costs presented in Table VII-9 reflect the above percentages of unregistered animals in the basin and treatment costs from EPA (2).

TABLE VII-9
SOUTHERN IOWA BASIN
LIVESTOCK TREATMENT COST*

	Capital Cost		
Hydrologic Unit	Cattle	Swine	Total
Nishnabotna River	$1,286,600	$2,400,000	$3,686,600
Nodaway River	262,500	927,950	1,190,450
Chariton River	45,350	292,050	337,400
Sub-total	$1,594,450	$3,620,000	$5,214,450
All Other River Basins	310,850	1,686,200	1,997,050
TOTAL	$1,905,300	$5,306,200	$7,211,500

*1974 Dollars.

No treatment costs are provided for sheep since no confined sheep feeding operations are identified in the basin. Costs have not been determined for poultry operations. Most poultry in the basin are located in a relatively small number of large egg-laying or turkey raising operations. Waste handling facilities are normally provided during the design of the operation, and most facilities presently spread the dry waste on agricultural land.

URBAN RUNOFF

In urbanized areas, surface runoff and combined sewer overflows can adversely affect the utility of the water resource. Contaminants discharged to a watercourse are the result of debris, animal droppings, eroded soil, tire and vehicular exhaust residues, deicing compounds, pesticides, fertilizers, air pollution fallout, and decayed vegetation contained in the urban runoff. These materials can be discharged into the stream during periods of precipitation or snow melt.

The impact of urban runoff upon the aquatic environment is difficult to quantify based upon present information. There is little or no data in the basin identifying specific pollution contributions and the resulting impact from urban runoff. Available technical literature has not resolved the impact of these sources upon streams.

Corrective measures applicable for urban storm water runoff pollution abatement may be classified as preventive or curative. Preventive practices may consist of proper conservation techniques on land development projects to reduce sediment erosion. Also, improved collection of material through normal municipal street cleaning operations should reduce the waste load that currently reaches the streams. Curative solutions may require substantial physical facilities and result in large capital expenditures.

Generalized cost curves which were developed for the 1974 Survey of Needs of Municipal Wastewater Treatment Facilities were used to give an indication of the cost to treat and/or control urban storm water runoff in the basin. The curves were based upon a composite of estimates by local consulting engineers for treating urban runoff. The cost estimate developed for the Southern Iowa Basin, shown in Table VII-10, exceeds $130 million.

TABLE VII-10
SOUTHERN IOWA BASIN
URBAN STORM WATER TREATMENT AND/OR CONTROL COSTS

Hydrologic Unit		Cost*
Nishnabotna River		$ 58,850,000
Nodaway River		14,720,000
Chariton River		19,930,000
	Sub-total	$ 93,500,000
All Other River Basins		36,620,000
	TOTAL	$130,120,000

*1974 Dollars.

REFERENCES

1. "Control of Pollution from Animal Feedlots." A hearing before a subcommittee of the Committee on Government Operations, House of Representatives, 93rd Congress, November 29-30, 1973.

2. David, M. L., Seltzer, R. E., and Eickhoff, W. D., "Economic Analysis of Proposed Effluent Guidelines - Feedlot Industry." Environmental Protection Agency, 1973.

3. Iowa Annual Farm Census, 1971, compiled by the Iowa Crop and Livestock Reporting Service, published by State of Iowa, Des Moines, Iowa.

4. Iowa Conservation Needs Inventory, Iowa Conservation Needs Committee, United States Department of Agriculture, Des Moines, Iowa, 1970.

CHAPTER VIII

NEEDS AND COMPLIANCE SCHEDULES

ASSESSMENT OF NEEDS

MUNICIPAL NEEDS

Physical needs for effective municipal wastewater control can be classified as follows:

1. New sewer systems and treatment facilities for certain unsewered communities.

2. Upgrading to adequate secondary treatment where the present treatment level is either primary or inadequate secondary.

3. Infiltration and/or inflow (I/I) removal.

4. Advanced treatment under selective circumstances.

5. Adequate sludge disposal.

An estimate of these needs and the related costs has been developed for the municipalities in the Southern Iowa Basin. The waste load allocations listed in Table VI-1 have been compared to the present discharges (Table V-2. Treatment facilities which cannot meet the waste load allocation have been evaluated for additional treatment capacity.

Several sources have been used to estimate costs. The principal sources are listed below in order of priority:

1. Grant applications, based on preliminary engineering estimates or final construction costs.

2. 1974 Needs Survey.

3. EPA cost curves supplied for the 1974 Needs Survey.

4. State cost curves based on comparable construction costs.

The cost estimates have been updated to September, 1974, dollars based on EPA construction indices (1).

<u>New Systems</u> - Of the 132 incorporated municipalities in the basin, 70 do not have sewerage systems. These communities are presently served by individual residence septic tanks and tile drain fields. Some of these communities have a disposal problem causing either water pollution, or a health hazard, or both. The problems are due to old systems in need of repair or replacement, or unsuitable site conditions such as a high ground water table, local limestone deposits, or poor soil conditions.

It is difficult to estimate whether it is cost-effective to construct a sewer system and treatment facility or to replace or repair existing individual septic tank systems without a detailed engineering analysis.

For the purpose of this study it was assumed to be cost-effective to continue using individual residence septic tank systems in those communities with projected 1990 populations of less than 200. It may also be cost-effective for certain cities with populations greater than 200 to continue the use of individual septic systems. However, the increased potential for ground water contamination and related health problems must also be weighed in a cost-effectiveness evaluation. For this study, communities with projected 1990 populations greater than 200 were assumed to have a need for a sewer system and treatment facilities; communities with projected populations of less than 200 were assumed to have no needs.

Upgrade to Secondary Treatment - No communities in the Southern Iowa Basin have primary treatment only. All municipal facilities provide what is commonly referred to as secondary treatment. The Act requires that all municipalities shall have the equivalent of secondary treatment by July 1, 1977. Many municipal secondary plants, cannot presently, or with projected 1990 flows, meet the new EPA and DEQ requirements for secondary treatment. These municipalities need to upgrade their facilities to the equivalent of secondary treatment.

Upgrade to Advanced Treatment - The waste load allocation analyses have pointed out several locations where treatment more stringent than secondary will be required if water quality standards are to be met. Because the new waste load allocations will be incorporated into discharge permits, several municipalities will need advanced treatment facilities.

Infiltration and/or Inflow Removal - Many municipalities have infiltration and/or inflow (I/I) problems. To estimate the cost to correct I/I problems requires detailed information concerning the systems. Without such information an accurate cost estimate is difficult. Some municipalities have been studied by consulting engineers and correction costs estimated. In addition, the 1974 Needs Survey of Municipal Wastewater Treatment Plants provides the estimated cost to study and correct I/I for a 20 percent random sampling of Iowa municipalities. For those municipalities for which an I/I correction cost estimate was available, the cost for study and correction was updated and included in the costs column of the table of needs. For those municipalities where no estimate was available for I/I correction, no costs are included because of the difficulty in making an accurate estimate without detailed information about the system. It should be realized that the total municipal needs for the basin will be greater than the estimate shown in Table VIII-4.

Most cost estimates assume that it is cost-effective to remove I/I rather than treat it. If it is known from engineering studies that it is cost-effective to treat I/I, those costs have been included with treatment plant costs.

Sludge Disposal - Sludge disposal is a major concern at any wastewater treatment plant. A secondary municipal treatment plant produces approximately 1,726 pounds of dry solids per million gallons of water treated, or approximately 173 pounds per 1,000 people per day. When an additional contribution comes from industrial wastes, sewage sludge can become the second largest disposal problem facing a municipality, next only to garbage disposal.

Most municipal treatment facilities in the Southern Iowa Basin handle their sludge in similar manners. After settling to concentrate solids, the sludge is stabilized either by aerobic or anaerobic digestion. Digested sludge is then usually dried mechanically or on drying beds and hauled to a landfill or farmland.

Farmland is more often used for sludge disposal than landfills since many landfills are not suitably located or do not have proper handling equipment. There are eight approved landfills in the Southern Iowa Basin where sludge can be accepted in accordance with Section 455B of the Code of Iowa. In the remainder of the basin, sludge must be applied to farmland or illegally deposited in abandoned gravel pits or unapproved landfills. Greater effort should be made to educate the farmer to the benefits of accepting treated sewage sludge for land application.

Land disposal of sludge has the advantage of being one of the simplest methods during winter months. It is also one of the most cost-effective methods.

Table VIII-1 summarizes average sludge disposal costs reported in Ohio (2).

TABLE VIII-1

AVERAGE DISPOSAL COSTS

Sludge Handling Method	Cost per ton of Dry Solids*
Vacuum filters, centrifuges	$34.41
Direct land application of liquid (Hauling by contract)	31.93
Drying beds (On-site storage for private individual hauling may reduce cost)	14.34
Direct land application of liquid (By City-owned trucks)	7.73

*Does not include digestion.

Costs to upgrade or to add additional sludge handling capacity that may be required under the basin plan have not been estimated for the municipalities in the basin. This is because a detailed knowledge of the existing facilities, not presently available, is needed for an accurate estimate. Also, in many cases the cost should be small when compared with that to upgrade the existing treatment.

Summary of Municipal Needs - Table VIII-2 is a compilation of municipal treatment facility needs for the Southern Iowa Basin. In this table, projected (1990) flow is shown along with the concentrations (mg/l) and pounds of BOD_5 and ammonia-N (NH_3-N) allowed by the final waste load allocations, and a compliance schedule for meeting the waste load allocations. A permit will be issued by DEQ to the municipalities which will assure compliance with the basin plan.

Table VIII-3 summarizes the basin municipal treatment facility needs and the related investment requirements for the basin.

TABLE VIII-3

SOUTHERN IOWA BASIN
SUMMARY OF MUNICIPAL TREATMENT NEEDS

Treatment Facility Needs	Number of Treatment Facilities	1974 Dollars
Advanced Treatment	2	$ 1,900,000
Upgrade to Advanced Treatment	9	9,670,000
Secondary Treatment	26	4,037,000
Upgrade to Secondary Treatment	13	5,748,000
Add Third Lagoon Cell	33	3,715,000
Add Two Lagoon Cells	6	655,000
Upgrade Lagoons	2	460,000
Improve Operation	2	---
No Need	1	---
Maintain Septic Tanks	44	---
TOTAL		$26,185,000

TABLE VIII-2
SOUTHERN IOWA BASIN
MUNICIPAL ASSESSMENT OF NEEDS AND SCHEDULE OF COMPLIANCE

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation: Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation: lbs. Eff. BOD_5/NH_3	Needs: Treatment	Needs: 1974 Dollars	Needs: Collection	Needs: 1974 Dollars	Schedule of Compliance: Facility Plans	Schedule of Compliance: Final Plans	Schedule of Compliance: Completion Date
1	Manilla (M-7)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	115,000	None	---	4/5/77	4/5/78	7/9/79
2	Irwin (M-10)		Controlled Discharge		Add two lagoon cells and Infiltration/Inflow analysis	115,000	None	---	4/6/76	1/2/77	4/6/78
3	Harlan (M-13)	1.038	10/3	87/26	Advanced treatment	1,400,000	None	---	---	---	---b/
4	Kimballton (M-26)		Controlled Discharge		Upgrade to secondary treatment and disinfection	240,000	None	---	a	a	a
5	Chariton (M-118)	0.642	10/2	54/11	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	900,000	None	---	1/1/76	7/9/76	4/6/78
6	Creston (M-73)	1.828	10/2	152/31	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	1,500,000	None	---	7/8/76	7/8/77	4/4/79
7	Atlantic (M-33)	0.945	10/4	79/32	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	1,500,000	Improvements	1,000,000	1/1/76	10/10/76	7/7/78
8	Brayton (M-32)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	75,000	None	---	a	a	a
9	Defiance (M-8)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	90,000	None	---	a	a	a
10	Lenox (M-68)		Controlled Discharge		Upgrade to secondary treatment, disinfection and Infiltration/ Inflow analysis	220,000	None	---	a	a	a
11	Greenfield (M-90)	0.525	10/2	44/9	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	1,000,000	Improvements and Additions	400,000	7/8/76	4/5/77	1/2/79
12	Manning (M-11)	0.173	20/5	29/7	Advanced treatment	500,000	None	---	4/5/76	1/2/77	7/8/78
13	Centerville N.E. (M-130)	1.152	30/9	288/96	Upgrade ammonia reduction treatment plant, disinfection and infiltration/inflow analysis	1,170,000	None	---	10/10/75	7/7/76	7/7/78
14	Carson (M-18)	0.150	30/15	38/19	Upgrade to secondary treatment and disinfection	700,000	None	---	a	a	a
15	Farragut (M-43)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	100,000	None	---	a	a	a

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation lbs. Eff. BOD_5/NH_3	Needs: Treatment	Needs: 1974 Dollars	Needs: Collection	Needs: 1974 Dollars	Schedule of Compliance: Facility Plans	Schedule of Compliance: Final Plans	Schedule of Compliance: Completion Date
16	Audubon (M-30)	0.380	27/3.5	86/11	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	1,000,000	Improvements	500,000	1/2/76	10/12/76	7/9/78
17	Clarinda (M-61)	1.660	30/5	415/69	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	900,000	Infiltration/ Inflow correction	400,000	10/11/75	10/10/76	7/7/78
18	Red Oak (M-39)	0.800	30/15	200/100	Upgrade to secondary treatment	1,000,000	Additions	50,000	10/12/75	7/9/76	1/3/78
19	Corydon N.E. (M-122)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	110,000	None	---	7/9/76	7/9/77	1/3/79
20	Elk Horn (M-27)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	105,000	None	---	10/11/76	7/8/77	10/11/78
21	Shenandoah (M-42)	0.800	30/7	200/47	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	1,200,000	None	---	7/8/76	4/6/77	7/8/79
22	Leon (M-104)	0.230	30/15	58/29	Upgrade to secondary treatment, disinfection and Infiltration/ Inflow analysis	500,000	None	---	---	---	---b/
23	Macedonia (M-19)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	95,000	None	---	4/4/77	4/4/78	4/6/79
24	Mount Ayr (M-86)	0.215	30/15	54/27	Upgrade to secondary treatment, Disinfection and Infiltration/ Inflow analysis	800,000	Infiltration/ Inflow correction	400,000	4/4/77	4/4/78	10/12/79
25	Corning (M-64)	0.310	30/8	78/21	Upgrade to advanced treatment, disinfection and Infiltration/ Inflow analysis	500,000	None	---	a	a	a
26	New Market (M-67)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	95,000	None	---	a	a	a
27	Braddyville (M-66)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	85,000	None	---	a	a	a
28	Exira (M-31)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	140,000	None	---	a	a	a
29	Oakland (M-17)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	220,000	None	---	4/4/77	1/2/78	4/4/79
30	Treynor N.W. (M-3)		Controlled Discharge		Add two lagoon cells and Infiltration/Inflow analysis	85,000	None	---	4/4/77	4/4/78	10/10/79
31	Shelby (M-2)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	100,000	None	---	a	a	a
32	Russell (M-119)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	100,000	None	---	1/2/77	1/1/78	4/5/79

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation: Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation: lbs. Eff. BOD_5/NH_3	Needs: Treatment	Needs: 1974 Dollars	Needs: Collection	Needs: 1974 Dollars	Schedule of Compliance: Facility Plans	Schedule of Compliance: Final Plans	Schedule of Compliance: Completion Date
33	Derby (M-117)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
34	Millerton (M-120)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
35	Griswold (M-37)	0.124	30/15	31/16	Disinfection and Infiltration/ Inflow analysis	100,000	None	---	a	a	a
36	Essex (M-41)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	110,000	None	---	1/1/76	7/9/76	10/11/77
37	Elliott (M-38)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	115,000	None	---	a	a	a
38	Lewis (M-36)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	115,000	None	---	a	a	a
39	Riverton (M-44)	0.040	30/15	10/5	Secondary treatment	181,000	Complete sewer system	603,000	a	a	a
40	Templeton (M-29)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	90,000	None	---	7/14/65	12/14/69	10/11/75
41	Coburg (M-40)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
42	Seymour E. (M-114)	0.045	30/15	11/6	Upgrade plant, disinfection and Infiltration/Inflow analysis	210,000	None	---	10/11/75	7/9/76	1/2/78
43	Massena (M-54)	0.051	30/15	13/6	Improve operation	---	None	---	1/3/77	1/3/78	10/11/79
44	Shambaugh (M-62)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
45	Hepburn (M-60)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
46	Avoca (M-14)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	150,000	None	---	a	a	a
47	Emerson (M-21)	0.038	30/15	10/5	Upgrade to secondary treatment and disinfection	278,000	None	---	10/10/75	4/6/76	10/10/76
48	Hancock (M-16)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	85,000	None	---	a	a	a
49	Hastings (M-22)	0.030	30/15	8/4	Secondary treatment	131,000	Complete sewer system	438,000	a	a	a
50	Henderson (M-20)	0.027	30/15	7/3	Secondary treatment	121,000	Complete sewer	404,000	5/15/72	2/11/75	10/11/76

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation lbs. Eff. BOD_5/NH_3	Needs: Treatment	Needs: 1974 Dollars	Needs: Collection	Needs: 1974 Dollars	Schedule of Compliance: Facility Plans	Schedule of Compliance: Final Plans	Schedule of Compliance: Completion Date
51	Kirkman (M-12)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
52	Aspinwall (M-9)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
53	Gray (M-15)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
54	Cumberland (M-53)	0.051	30/15	13/6	Improve operation	---	None	---	1/1/77	1/1/78	7/7/79
55	Humeston (M-121)		Controlled Discharge		Add two lagoon cells and Infiltration/Inflow analysis	180,000	None	---	7/8/76	4/5/77	7/8/78
56	Lamoni (M-101)		Controlled Discharge		Increase capacity	600,000	Improvements and Additions	800,000	7/1/74	7/9/75	1/1/77
57	Murray (M-97)	0.076	30/15	19/10	Secondary treatment	341,000	Complete sewer system	1,137,000	a	a	a
58	Davis City (M-100)	0.025	30/15	6/3	Secondary treatment	113,000	Complete sewer system	378,000	---	---	---b/
59	Grand River (M-96)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
60	Decatur City (M-98)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
61	Pleasanton (M-102)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
62	Beaconsfield (M-99)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
63	Nodaway (M-65)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
64	Allerton N. (M-111)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	75,000	None	---	a	a	a
65	Hamburg (M-46)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	175,000	None	---	a	a	a
66	Walnut (M-24)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	135,000	None	---	a	a	a
67	Sidney (M-45)	0.060	30/15	15/8	Upgrade to secondary treatment, disinfection and Infiltration/Inflow analysis	400,000	None	---	7/8/76	4/6/77	7/8/79

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation: Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation: lbs. Eff. BOD_5/NH_3	Needs: Treatment	Needs: 1974 Dollars	Needs: Collection	Needs: 1974 Dollars	Schedule of Compliance: Facility Plans	Schedule of Compliance: Final Plans	Schedule of Compliance: Completion Date
68	Randolph (M-23)	0.026	30/15	7/3	Secondary treatment	117,000	Complete sewer system	390,000	a	a	a
69	Imogene (M-25)	0.024	30/15	6/3	Secondary treatment	105,000	Complete sewer system	350,000	a	a	a
70	Allerton S. (M-110)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	100,000	None	---	a	a	a
71	Clearfield (M-76)	0.041	30/15	10/5	Secondary treatment	184,000	Complete sewer system	612,000	a	a	a
72	Blockton (M-78)	0.026	30/15	7/3	Secondary treatment	117,000	Complete sewer system	389,000	a	a	a
73	Cromwell (M-74)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
74	Kent (M-75)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
75	Athelstan (M-79)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
76	Maloy (M-77)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
77	Centerville W. (M-131)	.41	30/15	103/51	Upgrade to secondary treatment, disinfection and Infiltration/Inflow analysis	250,000	None	---	10/10/75	7/7/76	7/7/78
78	Mystic (M-129)	0.081	30/15	20/10	Secondary treatment	364,000	Complete sewer system	1,214,000	a	a	a
79	Promise City (M-128)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
80	Rathbun (M-126)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
81	Plano (M-127)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
82	Afton (M-95)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	115,000	None	---	a	a	a
83	Lorimor (M-93)	0.034	30/15	9/4	Secondary treatment	153,000	Complete sewer system	509,000	a	a	a

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation: Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation: lbs. Eff. BOD_5/NH_3	Needs: Treatment	Needs: 1974 Dollars	Needs: Collection	Needs: 1974 Dollars	Schedule of Compliance: Facility Plans	Schedule of Compliance: Final Plans	Schedule of Compliance: Completion Date
84	Orient (M-92)	0.032	30/15	8/4	Secondary treatment	144,000	Complete sewer system	479,000	a	a	a
85	Macksburg (M-91)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
86	Thayer (M-94)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
87	Malvern (M-6)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	140,000	None	---	a	a	a
88	Silver City (M-5)	0.035	30/15	9/4	Secondary treatment	141,000	Complete sewer system	596,000	a	a	a
89	Treynor S.E. (M-4)		Controlled Discharge		Add two lagoon cells and Infiltration/Inflow analysis	75,000	None	---	4/4/77	4/4/78	10/10/79
90	Westphalia (M-1)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
91	Gravity (M-69)	0.03	30/15	8/4	Secondary treatment	130,000	Complete sewer system	340,000	---	---	---b/
92	Bedford (M-72)	0.400	30/15	100/50	Upgrade plant	200,000	None	---	a	a	a
93	Sharpsburg (M-70)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
94	Conway (M-71)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
95	Grant (M-55)	0.026	30/15	7/3	Secondary treatment	115,000	Complete sewer system	383,000	a	a	a
96	Villisca (M-56)	0.180	30/15	45/23	Adequate	---	None	---	4/5/77	1/2/78	7/8/79
97	Fontanelle (M-57)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	110,000	None	---	a	a	a
98	Bridgewater (M-58)	---	---	---	Three cell lagoon	---	None	---	b	b	b
99	Carbon (M-59)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
100	Stanton (M-48)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	115,000	None	---	a	a	a

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation lbs. Eff. BOD_5/NH_3	Needs Treatment	1974 Dollars	Collection	1974 Dollars	Schedule of Compliance Facility Plans	Final Plans	Completion Date
101	Coin (M-50)	0.033	30/15	8/4	Secondary treatment	147,000	Complete sewer system	491,000	a	a	a
102	Blanchard (M-51)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
103	Yorktown (M-49)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
104	Anita (M-34)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	125,000	None	---	10/10/76	10/10/77	1/1/79
105	Wiota (M-35)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
106	Marne (M-28)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
107	Diagonal (M-82)	0.032	30/15	8/4	Secondary treatment	144,000	Complete sewer system	480,000	a	a	a
108	Redding (M-85)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
109	Shannon City (M-81)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
110	Arispe (M-80)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
111	Benton (M-83)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
112	Delphos (M-84)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
113	Garden Grove (M-107)	0.024	30/15	6/3	Secondary treatment	107,000	Complete sewer system	357,000	a	a	a
114	Weldon (M-105)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
115	Le Roy (M-106)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
116	Bloomfield (M-135)	0.360	30/15	90/45	Upgrade plant	500,000	None	---	10/11/76	10/10/77	10/12/78
117	Moulton (M-133)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	110,000	None	---	a	a	a

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation Conc. (mg/l) BOD_5/NH_3	lbs. Eff. BOD_5/NH_3	Needs: Treatment	1974 Dollars	Collection	1974 Dollars	Schedule of Compliance: Facility Plans	Final Plans	Completion Date
118	Milton (M-137)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	100,000	None	---	a	a	a
119	Pulaski (M-136)	0.028	30/15	7/4	Secondary treatment	125,000	Complete sewer system	417,000	a	a	a
120	Cantril (M-138)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	85,000	None	---	a	a	a
121	Udell (M-132)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
122	Drakesville (M-134)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
123	Mt. Sterling (M-139)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
124	Kellerton (M-89)	0.029	30/15	7/4	Secondary treatment	131,000	Complete sewer system	438,000	a	a	a
125	Tingley (M-87)	0.024	30/15	6/3	Secondary treatment	108,000	Complete sewer system	359,000	a	a	a
126	Ellston (M-88)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
127	Corydon S. (M-125)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	150,000	None	---	7/9/76	7/9/77	1/3/79
128	Corydon S.E. (M-123)		Controlled Discharge		Add two lagoon cells and Infiltration/Inflow analysis	100,000	None	---	7/9/76	7/9/77	1/3/79
129	Corydon S.W. (M-124)		Controlled Discharge		Add two lagoon cells and Infiltration/Inflow analysis	100,000	None	---	7/9/76	7/9/77	1/3/79
130	Van Wert (M-103)	0.020	30/15	5/3	Secondary treatment	92,000	Complete sewer system	306,000	a	a	a
131	Cincinnati (M-112)	0.066	30/15	17/8	Secondary treatment	298,000	Complete sewer system	995,000	a	a	a
132	Lineville (M-109)	0.036	30/15	9/5	Secondary treatment	163,000	Complete sewer system	545,000	a	a	a
133	Seymour S.W. (M-113)	0.045	30/15	11/6	Upgrade plant, disinfection and Infiltration/Inflow analysis	210,000	None	---	10/11/75	7/9/76	1/2/78

TABLE VIII-2 (Continued)

Rank	Discharger (Ref. No.)	1990 Flow (mgd)	Waste Load Allocation Conc. (mg/l) BOD_5/NH_3	Waste Load Allocation lbs. Eff. BOD_5/NH_3	Needs Treatment	Needs 1974 Dollars	Needs Collection	Needs 1974 Dollars	Schedule of Compliance Facility Plans	Schedule of Compliance Final Plans	Schedule of Compliance Completion Date
134	Exline (M-116)	0.026	30/15	7/3	Secondary treatment	117,000	Complete sewer system	390,000	a	a	a
135	Numa (M-115)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
136	Clio (M-108)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
137	College Springs (M-52)	0.033	30/15	8/4	Secondary treatment	148,000	Complete sewer system	492,000	a	a	a
138	Northboro (M-47)	---	---	---	Maintain septic tanks	---	None	---	---	---	---
139	Prescott (M-63)		Controlled Discharge		Add third lagoon cell and Infiltration/Inflow analysis	85,000	None	---	a	a	

a = At such time as deemed necessary.

b = Under construction.

INDUSTRIAL NEEDS

Iowa has become increasingly more industrialized. Many industries are agriculturally oriented, including meat packing and processing, dairy and cheese processing, fertilizer and pesticide production, wet grain milling, and rendering. All of these are "wet" industries (using large quantities of water) and produce large amounts of waste which are difficult to treat by conventional methods.

Some industries have their own treatment facilities such as Western Iowa Pork Company (I-6) and American Beef Packers, Inc. (I-7). These industries have anaerobic/aerobic lagoon systems which reduce BOD in the system by more than ninety percent. The waste load from these industries is still so great that controlled discharges of their effluent must be maintained.

The majority of industrial dischargers in the Southern Iowa Basin are either quarries or dry industries using little or no water.

DEQ, through the State Operation Permit Program, in coordination with the Federal NPDES Discharge Permit Program will regulate industrial dischargers. BPT is the minimum allowable allocation.

Due to lack of available data, no cost estimates have been developed for industries in the Southern Iowa Basin that may have a need for providing new or additional treatment facilities.

SEMIPUBLIC NEEDS

The major semipublic wastewater disposal problem is water treatment plants. Many of these plants use lime (calcium hydroxide) to soften the water before distribution. The sludge created poses a significant disposal problem.

Many facilities utilize lagoons for lime sludge disposal. This does not answer the final disposal problem of what to do when the lagoons are full. Some plants discharge lime sludge directly to the river. These plants are currently studying methods to eliminate such discharges.

Lime sludge does have an economic value if handling problems can be overcome. The sludge can be used for landfill, or as a pH buffer on farmland which has acidic soil. Recently, cement manufacturers have expressed an interest in the material since it is one of the major ingredients in their product.

As pressure is brought to bear on water treatment plants from governmental agencies and land owners located adjacent to sludge lagoons, lime sludge disposal will receive greater attention.

An estimate of semipublic needs and related costs has not been prepared due to lack of detailed information.

NONPOINT SOURCE NEEDS

Nonpoint sources of pollution have been divided into three main areas: urban nonpoint sources, animal feeding operations and general rural runoff. Each of these areas have been discussed in Chapter VII of this basin plan.

Urban Nonpoint Sources - An estimate of the physical needs and costs involved in the correction, containment, and/or treatment of urban runoff was presented in Chapter VII of this basin plan. The estimated capital investments amounted to approximately $130 million.

Animal Feeding Operations - The major pollutants from animal feeding operations are suspended solids, nutrients, and organics. Physical needs to control these sources of pollution have been summarized as including debris basins and retention basins, with land application for final disposal. These methods have been discussed in Chapter VII of this basin plan. The cost to implement such control measures in the Southern Iowa Basin is estimated at approximately $7 million.

General Rural Runoff - The major pollution parameters in general rural runoff have been classified as sediment, nutrients, and organics. Sediment is usually the most significant parameter.

Nutrients can also be of major significance especially if they affect nearby lakes or impoundments. Runoff from cropland is a major source of nutrients. Nutrient pollution abatement is accomplished through improved methods of fertilizer application and implementation of the same measures used to control soil losses.

Except where runoff occurs from animal feeding operations, organics are usually of relatively minor importance, particularly when compared with the contribution from municipalities.

Physical needs for abating general rural runoff pollution reduce to those methods employed for controlling soil losses. These methods have been discussed in Chapter VII of this basin plan. The cost to implement control measures in the Southern Iowa Basin is estimated at approximately $253 million.

SUMMARY OF NEEDS

The total dollar need to meet the objectives of this plan developed for the Southern Iowa Basin is estimated to exceed $432 million. The needs are summarized in Table VIII-4.

TABLE VIII-4
SOUTHERN IOWA BASIN
SUMMARY OF NEEDS

Need		Approximate Cost*
Municipal Treatment		$ 26,185,000
Municipal Collection		17,042,000
Urban Storm Water Treatment		130,120,000
Animal Feeding Operation Controls		7,211,500
Runoff Control		253,363,923
	TOTAL	$433,922,423

*1974 Dollars.

REFERENCES

1. Sewage Treatment Plant and Sewer Construction Cost Index, U.S. EPA Office of Water Program Operations, Municipal Construction Division.

2. Manson, R. J. and Merrit, C.A., "Land Application of Liquid Municipal Wastewater Sludges", Water Pollution Control Federation Journal, Vol. 47, No. 1, January, 1975.

CHAPTER IX

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Several significant conclusions have arisen throughout the development of this basin plan. Some of these include:

1. The Southern Iowa Basin currently has 132 incorporated municipalities with a total population of 115,064. The population of these mucicipalities is projected to increase by 24 percent to 143,102 by 1990.
2. Of the 132 incorporated municipalities, 62 currently have collection and treatment facilities and 70 communities have no central sewage systems. Many of the treatment facilities are not presently achieving secondary treatment.
3. Waste stabilization lagoons serve nearly 51 percent of the municipalities and a large number of industries within the basin.
4. A number of water quality violations have been documented in the basin due to point source discharges. Most of these violations have occurred at stream flows well above the 7-day 1-in-10 year low flow.
5. Water Quality violations have been documented during high stream flows. These pollution problems can probably be attributed to agricultural and urban runoff.

6. Sediment, which often carries other pollutants with it, is a significant pollution parameter in Iowa. Proper land and water management can minimize soil erosion. Effort should be made to continue and increase the use of established soil conservation practices. Pesticides in the environment can be reduced by using soil conservation practices and fertilizer loss can be minimized by application methods which assure efficient uptake by crops.
7. All lakes and reservoirs in the basin are subject to potential eutrophication from rural and urban runoff.
8. Land disposal of digested municipal sewage sludge is the most economical ultimate disposal method currently being used in the planning area.
9. Waste load allocations have shown that a significant number of dischargers will be required to provide advanced waste treatment to meet water quality standards at the 7-day, 1-in-10 year low streamflow. This is particularly true in the Nishnabotna River Subbasin.
10. The water quality strategy for point sources, as outlined in the plan, should result in the maintenance of acceptable surface water quality for designated uses.
11. The Southern Iowa Basin Plan has demonstrated (Chapter VIII) a need for municipal treatment and collection facilities which may exceed a cost of 42 million dollars.

12. Most industries should be able to meet the July 1, 1977, requirements of the Act. A high percentage of municipalities will also meet this deadline, however, long construction schedules and lack of adequate grant funding will result in some municipalities not meeting the deadline. The 1983 goals requiring all streams to be of suitable water quality to be fishable and swimmable can be met if Federal funding is continued.

RECOMMENDATIONS

As stated in the Foreword, the objective of this basin plan is to provide the framework for achieving the protection and maintenance of surface and groundwater quality in the Southern Iowa Basin. The implementation of this basin plan will help in attaining that objective, however, several possibilities exist that would further aid this effort. It is therefore recommended that the following topics be given further consideration and study.

1. The State Water Plan, which is currently under development, should give careful consideration to water quality. Consideration should also be given to restricting future water uses in water quality limited segments.
2. Non-structural management measures that can enhance and protect water quality should be given careful consideration by all levels of government, business interests and private citizens.

   Examples include:

   a. Improved operation should be initiated at all waste treatment systems. Small communities may be able to accomplish this goal by sharing qualified operators and laboratory facilities.

   b. Land use planning and zoning decisions should include considerations of water quality. This is particularly important when development around lakes may occur.

c. Local government should give consideration to the impact on water quality before making commitments for new development or industry.

d. Tillage practices should be selected that will minimize soil erosion.

e. Woodland management practices should be selected that will minimize soil erosion.

f. Agricultural chemicals should be applied at rates and times that will minimize runoff fertilizers and herbicides.

g. The design of any new or expanded industrial or commercial facilities should give careful consideration to minimize the amount of waste products that will be discharged from that facility.

h. Recycling should be encouraged and selected even when marginally cost-effective on the assumption that the cost of all natural resources will increase in the future.

i. Strict enforcement of local ordinances should be practiced. Such ordinances should include provision for rigid inspection of all new sewer construction and connections.

j. County Boards of Health should adopt and enforce individual waste disposal system regulations promulgated by the State Health Department.

k. Sanitary districts should be established to provide sewerage services to unincorporated areas.

l. Although thermal discharges are not considered to be a major problem in the study area, they are significant enough that further studies are warranted to determine specific thermal limits.

m. Land disposal of wastewater should be considered where soil and other conditions permit, and complete retention lagoons rather than small mechanical treatment plant should be considered where applicable, in view of the national goal of zero discharge of pollutants by 1985. The communities, assisted by the Department of Environmental Quality are responsible for considering this in their plan alternatives.

n. It is known that urban runoff contains metals and other pollutants, but their impact on downstream water uses needs further studies. Urban runoff can be controlled by storage and treatment. Economic feasibility studies should be performed for all major municipalities.

o. Land disposal of digested municipal sewage sludge is the most economical ultimate disposal method presently used. Many communities let sludge drying facilities lie idle much of the time, preferring to wet haul sludge when farmland is available and ready for receipt of the sludge. Departmental policy should address the disposal of municipal sludge. An educational program might be worthwhile to emphasize the economical advantages of using sludge as a soil conditioner and fertilizer supplement.

p. Establishment of specific waste load allocations has indicated certain areas where regionalization of facilities should be considered. In addition to combining industrial discharges with publicly-owned facilities, combinations of municipal facilities are possible.

(1) Facility Planning - It is recommended that detailed evaluations should be performed as an element of the Section 201, Step 1 Facilities Planning for regionalization of waste treatment facilities in the following areas:

Harlan Area - Harlan, Western Iowa Pork Company

Oakland Area - Oakland, American Beef Packers, Inc.

Corydon Area

Centerville Area

Seymour Area

Allerton Area

Treynor Area

(2) Areawide Planning - The four-county area surrounding Rathbun Lake has already been officially designated by the Governor as a 208 areawide planning area. The planning agency for the area is the Chariton Valley Regional Services Agency. No other 208 designation is currently recommended for the Southern Iowa Basin.

(3) <u>Other</u> - At the community and county level zoning and land use planning should be used to assure an orderly and efficient development of unsewered areas.

3. Structural measures will, of course, also help to protect water quality. Many of the structural measures required in the basin are outlined in the needs table.

CHAPTER X - REVIEW AND REVISION

PUBLIC HEARING PROCEDURE

Public hearings are specified by the Federal Water Pollution Control Act Amendments of 1972 as part of the procedure for establishing a water quality management plan for river basins. In accordance with Section 101(e) of the Act, public participation was required on significant elements of the planning process.

Statements or presentations given at public hearings were required to be retained in writing for the record. Verbal comments and written statements were specified to be limited to the Water Quality Management Plan. Written statements were requested to be submitted to DEQ at least one week prior to the hearing. Additional statements, filed within ten days after the scheduled hearing, were also considered part of the record.

"Reasonable Notice" was given to the public by prominent advertisement, indicating time, date, place, and availability of proposed plan, 30 days prior to the date of each hearing. Complete records of such hearings are kept and a transcript made available on payment of fee.

WATER QUALITY STANDARDS REVIEW

The Federal Act specifies that at least every three years, starting from date of enactment of the 1972 Amendments, the Iowa Water Quality Commission hold public hearings for purpose of review, and/or revision, of the Iowa Water Quality Standards. The 303(e) process, including this basin plan developed as part of the process, is used to assist in making any necessary revisions of Iowa Water Quality Standards. The Iowa Water Quality Standards are scheduled for revision in 1976.

BASIN PLAN REVISION

This Basin Plan is Phase I of the annual continuing planning process as required by section 303(3) of the Act. This basin plan will be revised under Phase II in such manner as is necessary to maintain its viability. Thereafter, this Basin Plan will be reviewed annually and revision will be made if warranted. Revision to the wasteload allocations, compliance schedules, or construction grant needs and priorities will be based on the most current and accurate data available.

BASIN PLAN HEARING

A public hearing concerning the adoption of the proposed Southern Iowa Basin Water Quality Management Plan was conducted by the Department of Environmental Quality. The hearing was held January 15, 1976, at 7:30 p.m. in Room 220, Instructional Building, Southwestern Community College, 1501 Town Line Road, Creston, Iowa. A copy of the public notice announcing the hearing appears in this chapter.

Identified in the following list are persons who attended the hearing:

Name	Representing
Anton Hall	City of Greenfield
George W. Hosfelt	Cass Co. Soil Conservation
Ruth B. Henderson	Southern Ia. Council of Governments
Mrs. Gene Livingston	City of Menlo
Leroy Barrett	City of Menlo
Wilma Barrett	City of Menlo
Victor Ziegler	EPA
Art Becker	City of Creston
George Aurain	State Soil Conservation Committee
Alfred Sump	Page I Rural Water
Darrel Isaacson	Page I Rural Water District
Bob Buss	Hall Engineering Co.
William Buss	Hall Engineering Co.
R. I. Viramontes	Uniroyal, Inc.
Paul E. Heckathorn	City of Van Wert
Floyd Seadden	City of Van Wert
Don McCuen	City of Massena
Larry Fry	City of Van Wert
Duane McClelland	Anderson Engineering Company
Burton Simms	City of Harlan
Warren Fye	Chamber of Commerce, Clarinda
Paul Flowers	Adams Rural Water
Jim Kimm	Veenstra & Kimm
Dotti Kimm	Self
Juanita Kinkade	Veenstra & Kimm

Name	Representing
Meredith Levitt	Page I Rural Water
Susan Barisas	INRC
Bob Gee	INRC
Bill Brabham	ICC
John Tibben	Ia. Conservation Commissioner
Herb Kayser	SCS
George G. Groesbeck	City of Lorimor
C. Peter Crawford	H. Gene McKeown & Assoc., Inc.
John Gukema	City of Greenfield
Phillip Ridout	Stanley Well Company
Bill Doran	SCS
Keven Blazek	Adair Co. Conservation Board

NOTICE OF PUBLIC HEARING

The Iowa Department of Environmental Quality (DEQ) will hold a public hearing concerning the adoption of the proposed Water Quality Management Plan for the Southern Iowa Basin on January 15, 1976 at 7:30 p.m. in Room 220, Instructional Building, Southwestern Community College, 1501 Town Line Road, Creston, Iowa. In event of inclement weather condition, the hearing will be held one week later, on January 22, 1976, same time, same place.

The Water Quality Management Plan is specifically directed toward satisfying the requirements of Section 303(e) of the Federal Water Pollution Control Act, as amended, Public Law 92-500, 86 Statute 849 (1972); (33 United States Code Annotated 1313(e)). The purpose of the Water Quality Management Plan is to identify the water quality problems of the Southern Iowa Basin and to set forth a program to correct the problems.

The public hearing (held pursuant to Subsection 455B.32(7)) of the Code of Iowa and 40 Code of Federal Regulation Part 131.502 (Federal Register, Volume 39, 19643, June 3, 1974) will give the public opportunities for expression of views to DEQ as well as provide for total public disclosure of the Water Quality Management Plan.

Oral and written statements presented at the hearing will be retained in the written record of the hearing. Statements should be limited to the subject matter of the Water Quality Management Plan for the Southern Iowa Basin. Time limits may be set on oral presentations at the discretion of the hearing officer so that all wishing to speak may be heard. Written statements may be submitted to DEQ prior to the hearing and at the hearing. Written statements received within ten days after the hearing will also be considered part of the hearing record. Complete records of the hearing will be kept and transcripts will be available upon payment of a duplication fee. The final Water Quality Management Plan will include a description of any major objections raised during the period for public comment and the disposition of such objections. The plan will become effective after approval by the Iowa Water Quality Commission, the Governor of Iowa and the U.S. Environmental Protection Agency.

A copy of the proposed plan will be available for inspection in the City Clerk's Office in the county seat of each county located in, or partially in, the Southern Iowa Basin. Copies will also be available for inspection in the DEQ regional offices located in Manchester, Mason City, Spencer, Washington and Council Bluffs, and in the main office in Des Moines. Written statements and requests for additional information should be addressed to the Water Quality Management Division, Iowa Department of Environmental Quality, 3920 Delaware, P.O. Box 3326, Des Moines, Iowa 50316, telephone 515/265-8134.

WATER QUALITY MANAGEMENT DIVISION

Joseph E. Obr, P.E., Director

The substantive comments (both written and oral) for all six basin plans presented at the hearings and/or directly submitted to the DEQ office in Des Moines, have been compiled. Responses made by the DEQ staff were then presented to the Iowa Water Quality Commission. Those commenting on the plan included federal and state agencies, county and local governments and agencies, industrial organizations, local citizens and special interest groups. Many of these comments have been adopted or substantially justified by change, deletion from, or additions to the basin plans. The Commission approved the plans and copies along with the comments and responses were sent to the Region VII office for EPA's approval. Oral and written statements presented at the hearings are available at the DEQ office for inspection. Copies may be obtained from the DEQ for a reproduction fee.

The DEQ has revised the plans in responses to issues raised, which could be resolved easily and not slow the progress of the study. If, however, it cannot readily be resolved and is a major issue, the issue will be addressed in Phase II of the planning process.

The water quality standards and the stream classifications will be reviewed in 1976. The DEQ, in cooperation with the Iowa Conservation Commission, will evaluate stream use and classification. The chemical and physical parameters listed in the standards will also be subject to review. Public hearings will be held prior to commission approval.

The stream segment and discharger ranking methodology, as required by Sec. 303(e) of the Act, may be the basis for future construction grant funding. Before any future grant priority list is compiled, which may be based on new priority formulas, the methodology will be reviewed and public hearings held. The discharger ranking used in the basin plans basically assumes that dischargers creating the greatest impact on water quality will be addressed more quickly than dischargers with less impact. This methodology will be expanded before it is used for the construction grant ranking.

New data regarding the seven-day ten-year low flow is now available and new population projections are expected. This will necessitate updating many waste load allocations in the Phase II planning program.

As stated earlier, 303(e) basin planning, or Phase I, mainly addressed point source pollution abatement. Under EPA (Phase II) guidelines, states are required to fully address nonpoint source pollution and to develop abatement programs to handle the problem. Phase II planning will continue to include point source waste load allocations and time schedules, and will update the municipal needs tables. Much of this will concern locating errors, or be tied to stream reclassification, new low flow data or standards revision.

The goal of Phase II planning is to reassess controls and needs of combined sewer replacement, feedlot control, urban runoff, and rural nonpoint pollution and to assign implementation programs.

GLOSSARY

Activated sludge is a completely aerobic treatment process by which wastewater is fed continuously into an aerated tank where microorganisms metabolize the organic material. The biological floc is settled in a final clarifier and may be recirculated to the aeration basin. Ninety to ninety-five percent BOD removal can be achieved.

Aerobic denotes biological processes in which oxygen is used for the decomposition of organic material.

Anaerobic denotes biological processes in which organic matter is decomposed in an environment devoid of free oxygen.

Biochemical oxygen demand (BOD) is the quantity of oxygen utilized in the biochemical oxidation of organic matter in a specified time and at a specified temperature.

Combined sewer is designed to carry sanitary sewage, industrial wastes, and storm runoff in a single conduit.

Disinfection of water or wastewater is a method of reducing pathogens or objectionable microorganisms by means of chemicals or other acceptable means.

Dissolved oxygen is the concentration of oxygen dissolved in a liquid. If affects biological changes brought about by aerobic or anaerobic organisms, and is an important environmental factor for growth and reproduction of fish and other aquatic organisms. Determination of dissolved oxygen also serves as the basis of the BOD test.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of gage height or discharge are obtained.

Holding or storage pit is a covered container into which wastewater flows until it can be pumped out and taken to a treatment facility.

Industrial wastewater is the wastewater which originates in industrial processing, cooling, or washing operations.

Infiltration is the groundwater which gains entrance to sewers through joints or improper connections.

Intermediate treatment involves additional settling of the wastewater and may incorporate chemicals to aid the settling process. Normally 50 percent BOD removal may be obtained through this process.

Intermittent stream is a stream with 7-day, 10-year low flow less than 0.1 cubic feet per second.

Lagoon or stabilization pond is generally a shallow geometrical pond which treats pretreated or untreated sewage biologically. Wastewater is retained in the pond for treatment and a clarified effluent is discharged after a specific detention time.

Main sewer is a conduit to which one or more branch sewers are tributary.

Outfall sewer receives the wastewater from a collection system and carries it to a point of final discharge.

pH is the negative logarithm of the hydrogen ion concentration. A pH below 7 indicates an acid condition and a pH above 7 indicates an alkaline condition.

Population equivalent measures the strength of a wastewater in terms of an equivalent number of persons, using an average 0.17 pounds of oxygen demand per person per day in domestic wastewater.

Pretreatment of industrial waste refers to treatment, usually primary, given to the wastewater before it is discharged into a sanitary sewer for secondary treatment.

Primary treatment involves only screening and physical settling of the wastewater. Approximately 30 percent of the BOD can be removed through this process.

Sampling station is a particular site on a stream, lake, canal, or reservoir where systematic samples of water are taken for analysis for physical, chemical, or biological parameters.

Sanitary sewer is a conduit designed to carry sanitary sewage. However, in many cases, it will also carry industrial wastes produced in the area it serves.

Secondary treatment conventionally involves biological treatment of wastewater to reduce the BOD by 85 percent or more. These biological processes usually involve trickling filters, stabilization ponds, or activated sludge processes. Recently, straight physical-chemical processes have been considered secondary treatment on the basis of their BOD removal efficiency.

Septic tank allows solids to settle out of a waste and permits a clarified effluent to be discharged to a ground seepage system. The solids are broken down anaerobically, and the residue must be pumped out periodically.

Sewage disposal applies to the act of disposing of sewage by any method. It may be done with or without any previous treatment of the wastewater.

Sewage treatment refers to any artificial process to which wastewater is subjected in order to remove or alter its objectionable constituents so as to render it less dangerous or offensive.

Sewage treatment plant is a comprehensive term encompassing an arrangement of devices and structures for treatment domestic and industrial wastewater and sludge.

Sewerage is a system of sewers and appurtenances for the collection, transportation, pumping, and treatment of domestic and industrial wastewaters.

Solids are all matter except water contained in a liquid. They may be suspended or dissolved solids.

Storm runoff is the wastewater flowing due to rain water, snowmelt, or other surface runoff.

Trickling filter systems consist of a bed of crushed rock, or other media, coated with biological films, through which primary effluent is passed for secondary treatment. The filter may be followed by a final settling basin, and recirculation through the filter may be employed for better removal. Up to 90 percent BOD removal can be achieved through trickling filter systems in ideal situations.

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