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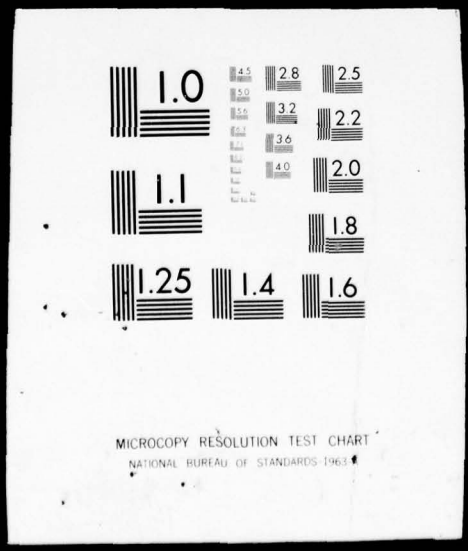

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ANNEX L - INTASA RECREATION PAPER

REVIEW REPORT ON THE MISSOURI RIVER AND TRIBUTARIES

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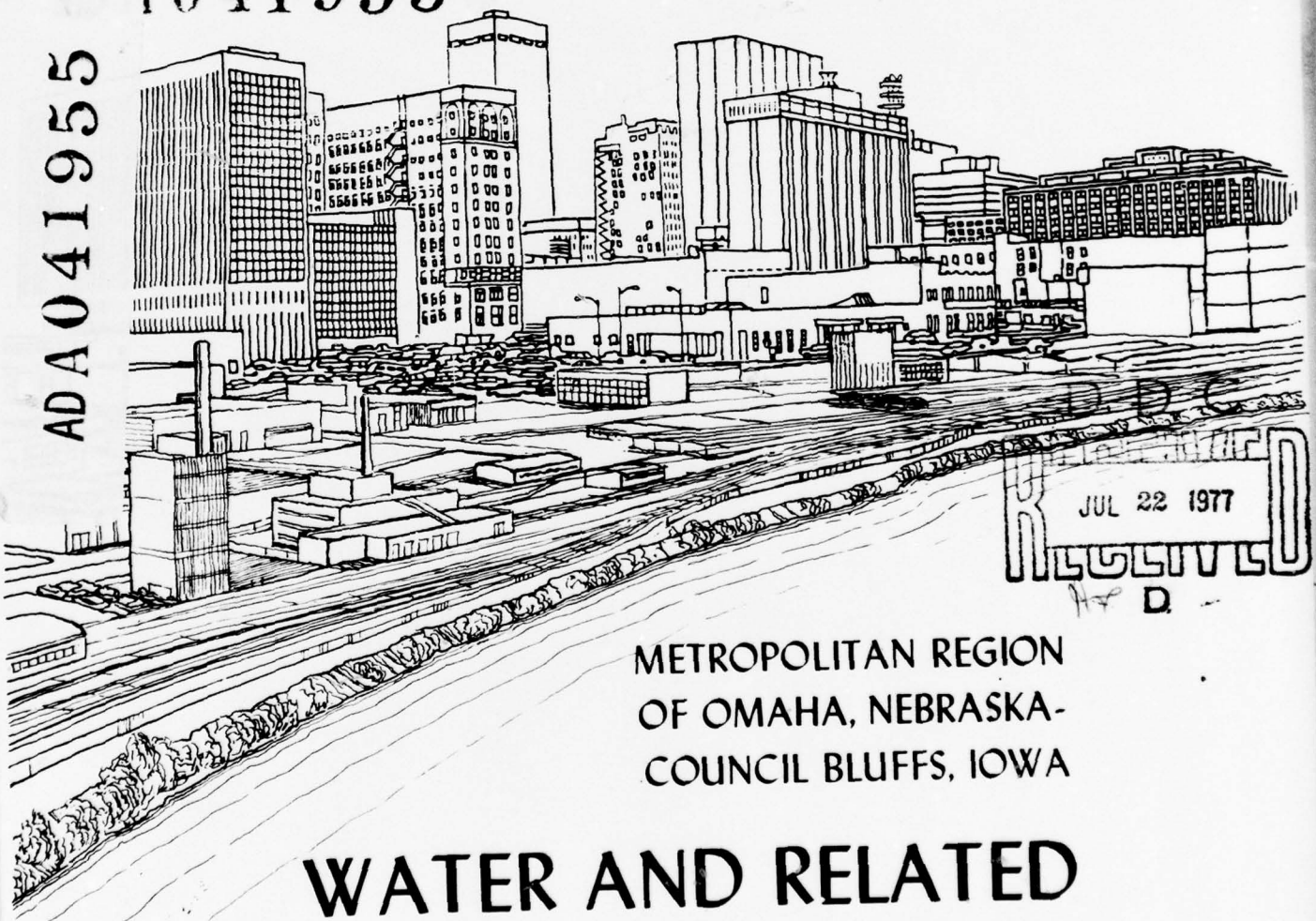

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PLANNING FOR RECREATION AND OPEN SPACE IN THE CONTEXT OF THE URBAN STUDIES PROGRAM: WATER-BASED RECREATION AND THE PAPIO SYSTEM

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Chapter I

PROJECT SUMMARY

A. Background

In July 1972, the Omaha District of the U.S. Army Corps of Engineers completed the first phase of the Urban Studies Program centered on the Omaha-Council Bluffs SMSA. In order to surface the problems encountered in developing water and related resources plans, the District prepared a set of issue papers concerned with the major functional areas encompassed by the program. As part of contract DACW45-73-C-0027, INTASA assisted the District by preparing two issue papers: "A Comparative Analysis of Alternative Land Use Patterns for the Omaha-Council Bluffs SMSA" (Ref. 1), and "Recreation Planning for Flood Control Reservoirs: A Case Study in the Papillion Creek Basin" (Ref. 2). Results, conclusions and recommendations were presented in a meeting on July 2 and 3, 1973, attended by Col. C.H. Charles, and Messrs. G.J. Karabatsos and J.D. Auburg of the Missouri River Division; Messrs. C.F. Thomas, J. Velehradsky and D. Kisicki of the Omaha District; Mr. D. Dillon of the Southwestern Division; Mr. R. Hensley of the Tulsa District; Messrs. J.F. Johnson, D.W. McCully and W.B. Schilling of the Office of the Chief of Engineers; and Dr. G.E. Dickey of the Office of the Secretary of the Army. Based on an agreement to extend the case study presented in the second paper, and influenced by comments and suggestions made during the above-mentioned meeting, research was undertaken aimed at considering the full recreational potential of the Papio System within the context of the Urban Studies Program. This report presents the work performed for this research effort from the first of July to the end of August, 1973.

B. Synopsis of the Forerunner to this Report: Issue Paper No. 2 (Ref. 2)

Issue paper No. 2 addressed the tradeoffs between recreation and flood-control in the 20-reservoir Papio System, a system of valley reservoirs in close proximity to each other within the Papillion Creek Basin, primarily located in the Omaha-Council Bluffs SMSA. This system, as yet unconstructed,

consists of lakes ranging in size from 40 to 650 acres and forms an important component in any urban studies plan to be developed for the Omaha-Council Bluffs SMSA; its recreational implications in particular may be far reaching. Thus, objectives of Issue Paper No. 2 were to assess the system's sufficiency and flexibility with respect to recreation opportunities for the area, to develop a methodology for the analysis of tradeoffs between flood control and recreation, and to gain insight into specific needs of the SMSA. In accord with these objectives, a "one-reservoir" case study was performed which focused on the recreational and flood control aspects of one particular reservoir in order to make an assessment regarding the many intricacies that accompany an analysis of tradeoffs between these two functional areas.

The research effort presented in Issue Paper No. 2 closely followed the objectives. In order to analyze tradeoffs, a case was built where significant tradeoffs could be expected. After a preliminary analysis of the needs for water-based recreation in the SMSA, it was found that lack of opportunities for power boating in close proximity to Omaha is significant enough to warrant the search for additional supply. One possible alternative for providing this supply is by initiating reservoir-design changes aimed at increasing the surface acres available for boating. To decide on such an alternative, the associated tradeoff problem is to determine if the potential loss in flood control benefits and/or the increase in construction cost outweigh the increase in recreation benefits. In order to resolve the tradeoff problem, site 16, which is closest to Omaha, was selected and preliminary models were developed to assess changes in recreation benefits, flood control benefits, and in construction cost. Thus the scope of the research was narrowed down to the point where a meaningful assessment could be made as to the extent which analysis can provide answers to important tradeoff questions.

Generally, contributions made by any research effort can be categorized as methodological or practical; the emphasis in the issue paper was on the former. Besides the approach toward tradeoff analysis, the major methodological improvements include the cost model used to assess cost changes related to changing the designs of valley reservoirs, and the recreational visitation model used to assess changes in recreation benefits. It is noted that both models have a wider range of applications then exhibited in the paper. The

cost model allows estimation of cost differences without complete evaluation of actual designs; as such it is considered useful for the process of planning and designing reservoirs. The recreation model supersedes the "similar project" approach and permits estimation of the change in visitation due to redistribution of visitors over available sites as well as due to "new" visitors attracted to recreation activities as a result of the increased supply. In a strict sense, only the latter group accounts for the increase in recreation benefits.

Due to problems surrounding the estimation of demand and supply, and the actual measurement of recreation benefits, the paper's practical contributions are of lesser significance. That is, the results and conclusions reached for the case study at site 16 hinge upon many assumptions which have to be validated before practical significance can be attached to them.

C. Study Objectives and Scope.

The general objective of the research presented in this report is to broaden the scope of the recreation analysis initiated in Issue Paper No. 2 and to consider the role of the Papio System in meeting recreational deficiencies for the Omaha-Council Bluffs SMSA, within the context of the Urban Studies Program. As discussed, the major contributions of the research presented in Issue Paper No. 2 are in the methodological category. Thus, the scope of the research presented in this paper is aimed at ascertaining the practical aspects of recreation planning for the area on the basis of experience gained in performing an actual case study and an understanding of the Urban Studies Program objectives.

Specific study objectives are: (1) identification of recreation need categories within the realm of the Urban Studies Program; (2) analysis of demand and supply for water-based recreational activities in close proximity to the city of Omaha; (3) identification of water-based recreation deficiencies; (4) analysis of the Papio System's capability to meet such deficiencies.

In accord with these objectives, the scope of this report encompasses the following:

- Development of a comprehensive assessment of recreation and open space problems in the Omaha-Council Bluffs SMSA as well as an evaluation of the continuing efforts toward their resolution.

- Development of a procedure to estimate the demand and supply for water-based recreation activities in light of problems surrounding present data availability.

- Structuring of an approach towards incorporating plans for the Papio System into the overall Urban Studies Program.

D. Report Summary

Chapter 2 provides an overview of the general recreation and open space problems in the Omaha-Council Bluffs SMSA in which four major components are considered: (1) the physical system providing opportunities for recreation and open space, (2) the resultant supply of opportunities, (3) the demand for opportunities, and (4) the deficiencies. Based on this general assessment, five need categories which the Urban Studies Program has the potential of responding to are identified as follows: (1) preservation of land and water areas devoted to recreational use and open space, (2) provision of opportunities for passive recreational pursuits, (3) provision of opportunities to engage in water-based recreational activities in close proximity to the City of Omaha, (4) improvement of facilities for land-based urban recreation which is characterized by the large investments required for its realization, (5) improvement of the existing recreation system in terms of quality and quantity of the opportunities provided. Subsequently, Chapter 2 reviews recreation planning efforts that are underway in the SMSA which include plans developed by the Metropolitan Area Planning Agency (MAPA), the Riverfront Development Program (RPD) and the Recreation Planning Department of the city of Omaha. Finally, Chapter 2 identifies a number of water resource system components which are included in the Urban Studies Program and may be used to realize the program's potential to affect the above-stated need categories.

Chapter 3 presents an analysis of demand and supply for water-based recreation activities in close proximity of the City of Omaha. The chapter focuses on identifying problems underlying estimation of demand and supply and on formulating a practical procedure to arrive at demand and supply projections for swimming, water skiing, boating and fishing. The demand estimation procedure emphasizes the importance of answering the following questions in as much detail as possible given the present state-of-the-art. (1) Who or what percentage of the population desires to participate? (2) How may days of the year will people participate? (3) When will participation take place in the

year? (4) Where and for how long do people participate during any one trip? (5) What quantity of natural resources is necessary to support participation? Subsequently, based on data available for the SMSA, projections of recreational demands emanating from the SMSA population are provided for the years 1972 and 1990 in terms of the total number of participants expected during the summer peak day and the minimum number of surface-water acres required to satisfy these demands. With respect to assessing the available supply of opportunities, the attempt is made to identify current problems, to establish a format for supply estimation and to inventory the existing opportunities based on review of available documents. Subsequently, a first estimate is provided for the number of surface acres available within the SMSA to engage in swimming, water skiing, boating and fishing.

Chapter 4 synthesizes the report by considering the Papio System as one means to resolve deficiencies within the Urban Studies Program. First, based on the results of Chapter 3, deficiencies are analyzed. Planning requirements for water-based recreation are formulated on the basis of existing and future deficiencies and on the recognition that the objectives and scope of the Urban Studies Program include the mandate to meet recreational deficiencies. Next, the Papio System is considered in more detail since this alternative will be a major impetus towards improving opportunities for water-based recreation. Emphasis is placed on the role that different reservoirs can play in meeting recreational demands. The allocation of surface acres at various reservoirs to different activities and the idea of recreation zoning are discussed. Throughout this discussion, the attempt is made to consider recreation planning for the system as a whole in order to achieve harmonious recreational development throughout the SMSA. Finally, the last section contains conclusions and recommendations based on the results of this research effort. Particular emphasis is placed on subsequent tasks recommended for Phase II of the Urban Studies Program to be performed by the Omaha District.

CHAPTER II

PLANNING FOR RECREATION AND OPEN SPACE IN THE CONTEXT OF THE OMAHA-COUNCIL BLUFFS URBAN STUDIES PROGRAM

A. Introduction

Lack of suitable recreation opportunities and available open space is generally recognized as a prime problem that accompanies development in most urban areas in the United States; the Urban Studies Program is an important vehicle to reverse this trend. The general program objective, stated in Reference 3, is:

> "To develop water and related resources plans for specified urban areas of the United States that not only offer realistic prospects for solving specific urban problems, but, equally important, also have the potential to serve as a catalyst for solving other related problems."

The purpose of this chapter is to present a general overview of recreation and open space problems specific to the Omaha-Council Bluffs SMSA in an effort to outline the role of the Urban Studies Program, presently underway in this area, toward their resolution. To this end, Section B circumscribes the existing problems while Section C discusses ongoing and primarily local planning efforts. Finally, Section D outlines some opportunities inherent in the Urban Studies Program and focuses on major determinants for a more detailed analysis of recreation and open space to be presented in subsequent chapters; i.e., the analysis of demand and supply for the major water-related activities and the identification of alternative means for alleviating deficiencies.

B. A Profile of Urban Recreation and Open Space in the Omaha-Council Bluffs SMSA

A key issue related to planning for recreation and open space is the difficulty of defining problems in operational terms; the problems are so numerous and multifaceted that frequently only symptoms of the problem can be surfaced. This is reflected in Omaha-Council Bluffs where there is evidence that

uncontrolled urbanization endangers the quantity and quality of recreational opportunities and open space. For example, a study aimed at analysis of natural resources in the Missouri Valley between the Platte River and the city of Blair, which was undertaken by the School of Architecture of the University of Nebraska, contains the following observation (Ref. 4):

> "One of the principle results of mapping existing and proposed recreation and open spaces was the realization of the total amount of open space in the urban area but at the same time its fragmentation and lack of relationship to natural features. The principle implication of the finding would seem to be this: If we expect to preserve the character of the valley as a stimulating visual element in urban design we must plan now against the piecemeal breaking up of the valley floor and the consequent loss of large green and open areas. Unless there is some recognition of this problem soon - the entire urban area will become an indistinguishable "grey" mass."

With regard to existing urbanization on the Nebraska side of the Missouri River the study notes:

> ". . . there are two basic types of urbanized areas: first, Omaha, a large exploding city with haphazard residential suburbs and suburban business, and second, the small towns of Blair and Plattesmouth. In regard to Omaha there is a further complication, namely that, having expanded considerably, it has become continuous with several towns of the second type (Ralston, Bellevue, LaVista)."

These quotations, symptomatic of the problems surrounding recreation and open space, illustrate that past resource planning procedures did not assign high priority to providing recreation opportunities and open space (the same situation is often the case in present procedures). Frequently, resource planning was subservient to, and reinforced development in, the search for cheap, accessible land to convert to a "higher and best" urban use while failing to take into account the persistent needs of urbanized people for space to move around in and to enjoy at leisure. Because planning for recreation has not generally been integrated with planning for other resource needs, a potentially important impact of the Urban Studies Program would be to provide for such integration.

As a first step toward such integration, a representation of urban recreation in a planning framework is given in Figure 2.1 where the variables influencing area-wide recreation are depicted in relationship to each other. On the left, the figure depicts the physical recreation and open space system which supplys recreation opportunities. A recreation opportunity is

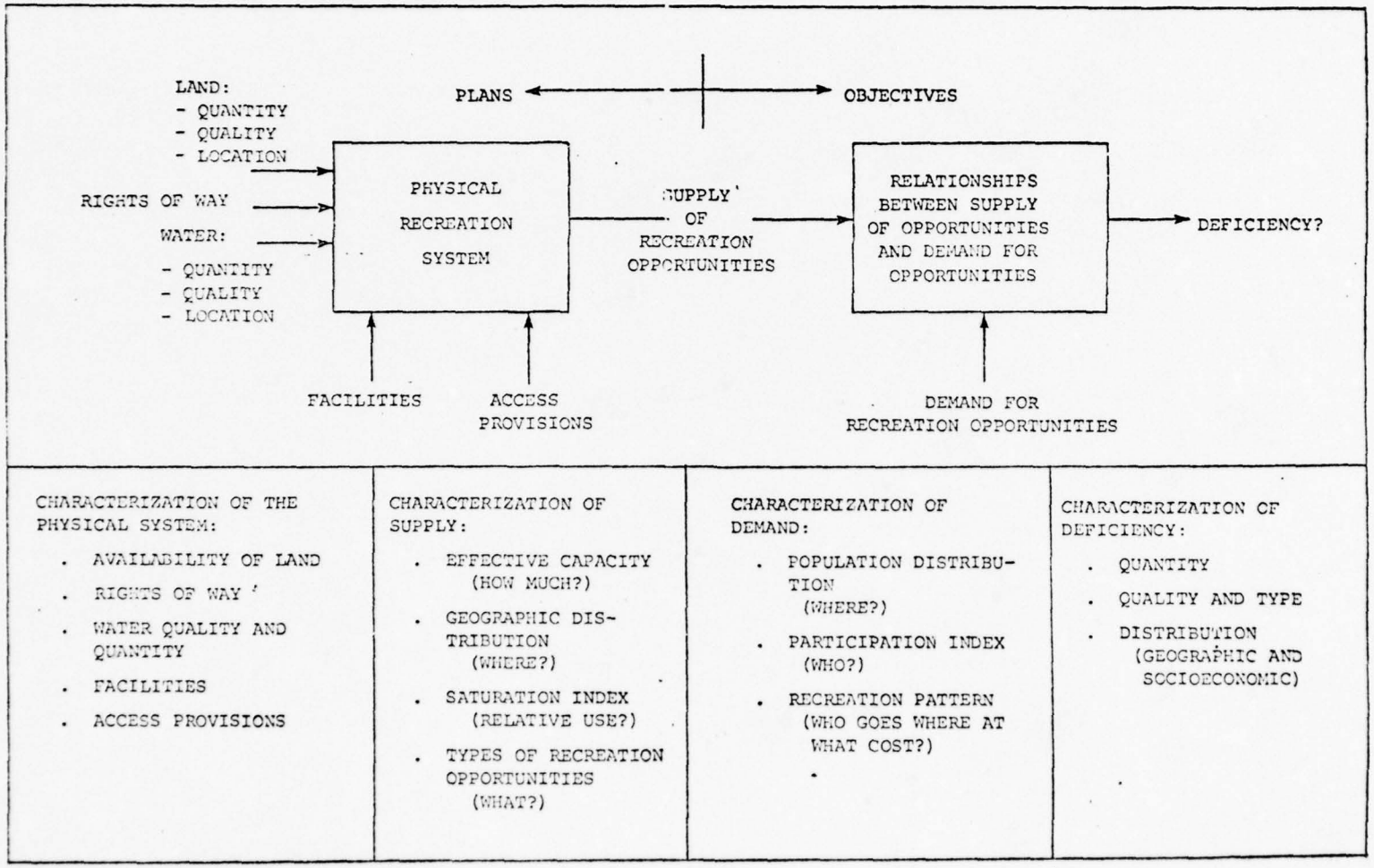


FIGURE 2.1 REPRESENTATION OF URBAN RECREATION IN A PLANNING FRAMEWORK

created when all physical requirements for an individual to engage in a particular activity are met. For example, a boating opportunity is created when the water area is large enough for boating, the water quality permits boating, the water is free of floating debris, boat ramps and/or mooring facilities are provided and there is an access road to the area. The physical system as depicted is an abstraction of the actual lands and waters available or planned for recreation; if components of the actual system are altered, there is a change in the supply of opportunities. Generally when the supply of opportunities is compared with the demand for opportunities, a determination can be made concerning relative deficiencies in the area. In addition to characterizing the physical system, Figure 2.1 indicates the main determinants for characterizing deficiency, i.e., the relationships between demand and supply. The figure is used in combination with Figure 2.2, which provides a map of most of the existing recreation system in the Omaha-Council Bluffs SMSA, to surface some major problems related to recreation and open space.

1. The Physical System

In order to provide a certain supply of recreation opportunities and suitable open space, several of the system's components (indicated in Figure 2.1) are required simultaneously; lack of any one component may prevent realization of opportunities. Frequently it is this interdependency between components that creates the complexity of physical recreation planning. With respect to the Omaha-Council Bluffs SMSA, the following observations are made:

- The quantity of land that is potentially available for recreation and/or open space is quite abundant. Table II-1 indicates that the balance between developed urban land and rural land is still largely in favor of rural areas. However, the quality of the land is such that only a small percentage allows for a high quality recreational experience, i.e., the wooded areas north of Omaha, the bluffs along the Missouri River, and so forth, form a small percentage as compared to the vast areas of corn fields or other types of flat lands. Clearly, this observation, not atypical for midwestern areas, severely limits the area's potential for recreation and open space.

- Public access to large water recreation areas along the lower Platte River in Sarpy County is limited due to private ownership of the

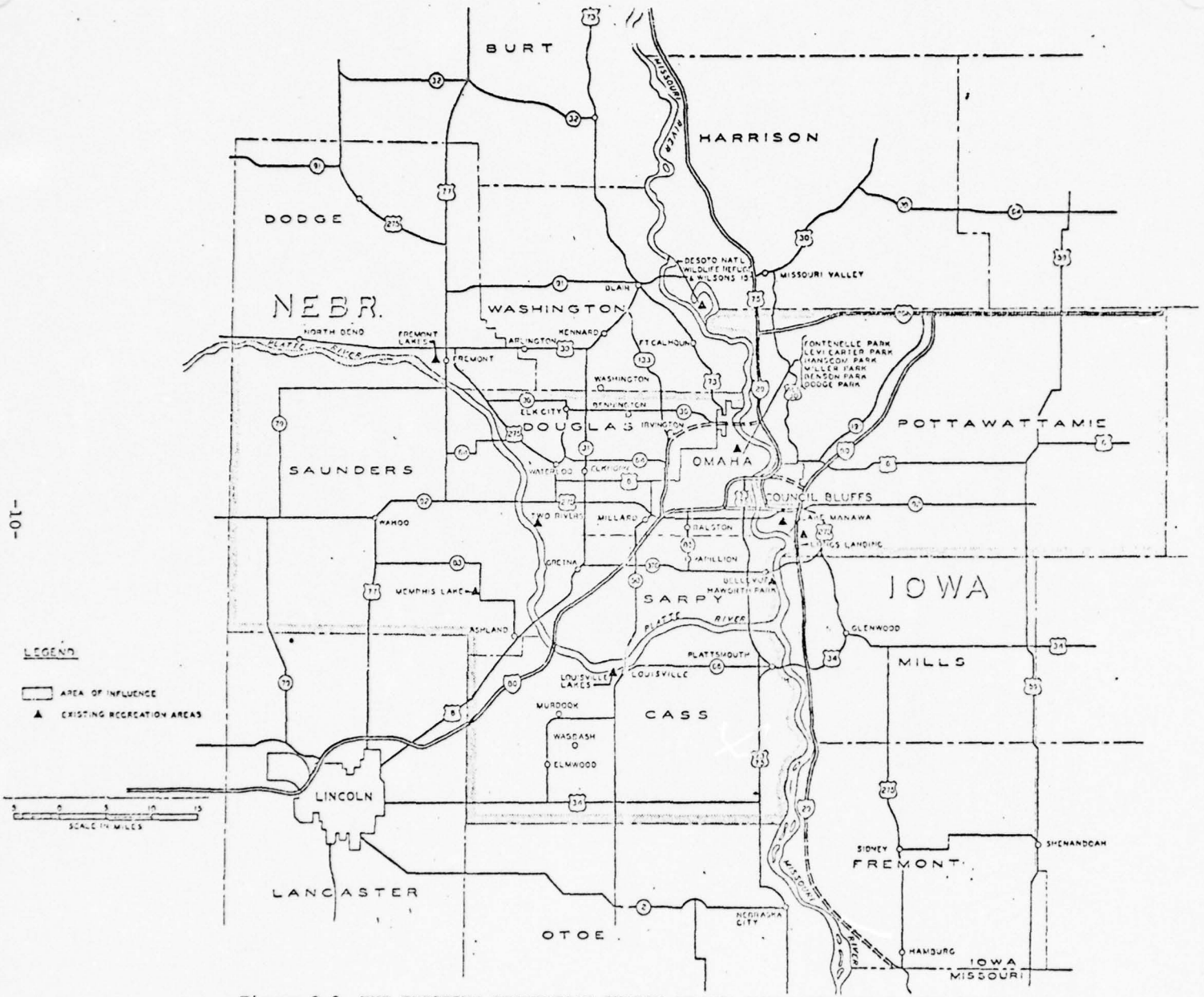


Figure 2.2 THE EXISTING RECREATION SYSTEM OF THE OMAHA-COUNCIL BLUFFS SMSA

Table II-1 1968 INVENTORY OF LAND AND WATER IN ACRES
(Reference 5)

	URBAN LAND			RURAL LAND			TOTAL URBAN AND RURAL
	Developed Urban Land	Undeveloped Urban Land	Total Urban Land	Water	Agricultural etc.	Total Rural Area	
Douglas County	66,389	9,578	75,967	4,032	138,241	142,273	218,240
Sarpy County	11,237	845	12 082	6,016	140,622	146,638	158,720
Pottawattamie County	22,922	7,863	30,785	3,712	585,665	589,377	620,162
SMSA	100,548	18,286	118,834	13,760	864,528	878,288	997,122

surrounding lands. In other instances, access to, and therefore use of, water areas is limited due to lack of recreational development or to the access area's unsuitability for development. A case in point is the access to the Missouri River where along approximately a 50-mile stretch, primarily in the SMSA, there are only 4 river access areas: Wilson Island, Longs Landing, Haworth Park and N.P. Dodge Park (Ref. 6). Wilson Island with 488 land acres is limited in its suitability for development because much of the area is low and swampy. Longs Island and Haworth Park are relatively small, 21 and 80 land acres respectively, which inherently constrains the use of the river. Finally, N.P. Dodge Park in Omaha, while already heavily used, is still under development.

- The depth of surface waters in the area is another major factor that constrains recreational use, e.g., water in the Two Rivers State Recreation area is frequenly only a few feet deep which allows for the use of airboats but restricts more general boating; the Platte River exhibits low flow conditions not favorable for recreational use. In respect to depth of surface waters, it should be mentioned that even with the 20-reservoir Papio System, considered a major addition to the recreational system, there is concern whether the depth in the reservoirs can be sufficiently maintained for the anticipated uses. Notably, successful fisheries require sufficiently deep water while, more generally, shallow waters tend to limit recreational use for activities such as boating and water skiing.

- Quality and flow characteristics of surface water may be a deterrent to recreational use. With respect to pollution, a notable example is Levi Carter Park where swimming has not been allowed and recreational use has been declining due to pollution conditions (Ref. 6). There are similar concerns for the planned Papio System, which in the absence of stringent water quality control measures, faces pollution problems related to sedimentation, and agricultural and urban runoff. With regard to flow characteristics, the velocity and turbidity of the Missouri River is such that only restricted boating is possible, i.e., the flow is frequently too fast to allow for any type of boating.

2. Supply of Recreational Opportunities and Open Space

The above observations indicate the general constraints that the physical recreation system imposes on the supply of recreation opportunities and open space. Based on discussions with personnel of local planning agencies and on review of recreation reports pertinent to the area, the following specific observations regarding the available supply are made:

- With regard to active recreation activities, there is a lack of opportunities for water-based activities in close proximity to the city of Omaha. In particular, most opportunities for power boating are beyond a one-hour driving distance from downtown Omaha. Furthermore, as a result of water quality problems, the opportunities for swimming and fishing are severly impaired even at places where sufficient quantities of water are available. Because the supply is limited for these activities, areas close to Omaha, such as Lake Manawa and Levi Carter Lake, are generally overcrowded which decreases the quality of the recreational experience.

- With regard to active but non-water based recreation activities, a situation exists in the Omaha-Council Bluffs SMSA which is similar to other cities in this Country: the demand for facilities is growing at a faster rate than local agencies are financially capable of satisfying. In particular, this concerns facilities such as tennis courts, swimming pools, local parks and recreation centers (Ref. 7).

- In the area of passive recreation, e.g., sightseeing, picnicking and pleasure driving, the SMSA exhibits the most severe shortages in supply. This is partly because the area's physical characteristics are not easily rendered to accomodating these activities, but also because scattered urban development, and low recreation and open space priorities have made it difficult to develop scenic driveways, etc. In sharp contrast with the lack of supply are the findings regarding the demand for these activities. A 1969 survey of outdoor recreation in southwest Iowa, where Council Bluffs is the major population center, mentions that four activities in this group - driving for pleasure, walking for pleasure, motorcycling and picnicking - account for over half of all participation (man days) in outdoor recreation (Ref. 8). Similar observations are made for the Nebraska side of the study area. For example, Reference 9 estimates the supply of designated hiking and nature trails in the area around Omaha at 0 and 6 miles respectively. Although it is recognized that more areas have the potential to be converted to such uses, it is clear that for a population of over half a million people, the supply for passive recreational pursuits is limited.

3. Demand for Recreation Opportunities and Open Space.

Inherent in the above observations concerning available supply is the realization that there is demand for opportunities, because conceptually there are no supply problems unless there is pressure from the demand side. In addition, since demand for activities can be considered a function of the supply provided, it is difficult to consider one without the other. Disregarding for the moment this demand-supply relationship, the purpose of the

following is to consider some observations regarding recreational use in the area so as to infer probable demand pressures.

- One of the few, and quite accurate, statistics regarding water-based recreation relates to those activities for which licenses are necessary in order to engage in them, e.g., fishing and boating. Table II-2 is developed to provide some insight into such statistics for boating by presenting data for the San Jose SMSA in California and for Douglas and Sarpy Counties, the major part of the Omaha-Council Bluffs SMSA. Although there are definite differences between the two SMSAs which make a close comparison difficult, some observations can be made. First, there is a noticable increase in registrations from 1970 to 1971 in Douglas and Sarpy which will result in heavier pressure on recreation resources then has been experienced in the past. Second, the absolute boat density as well as its annual increase tends to fall below values measured in other parts of the Country. For water-rich areas, values of 30 boats/1000 have been experienced while for heavily populated metropolitan areas, 20 boats/1000 seems to be the saturation value. Although no definite conclusion can be drawn, the data indicates that with the supply currently assumed (present facilities plus Papio System) a sharp rise in demand for boating may be expected.

- Information on recreational demand, or better, on recreational use of resources, is generally very spotty and no visitation data exist at the SMSA level. Therefore, trends in visitation, indicative of recreation demand, are not easily determined and future projections are surrounded by uncertainty. In the absence of data pertinent to the Omaha-Council Bluffs SMSA, the major trends in water-based recreation are determined from information supplied by the Bureau of Outdoor Recreation (BOR) and the Nebraska Game and Parks Commission. It is noted that for all practical purposes these are the only two sources available. BOR survey information is broken down into Census Divisions which cover significantly larger areas then SMSAs, e.g., the Omaha-Council Bluffs SMSA is part of the West North-Central Division covering North Dakota, Minnesota, Nebraska, Iowa, Kansas and Missouri. Table II-3 contains all major available BOR statistics regarding participation in water-based recreation activities. The table is based on surveys taken in 1962, 1965 and 1970 and contains information for the contiguous U.S., the North Central Census Region, and the West North Central Division (Refs. 12, 13, and 14). Preliminary data from the Nebraska Game and Parks Commission is contained in the first two columns of Table II-4 (Ref. 15). Since the data for BOR surveys applied to the population of 12 years and older, the Nebraska information has been adjusted - column 3 in Table II-4 - so as to be comparable with BOR information (1970 census data indicates that approximately 75% of the total SMSA population is 12 years and older). In addition, since Nebraska information applies to 1972, BOR estimates have been extrapolated -

Table II-2

BOAT REGISTRATIONS IN SAN JOSE (CALIF) AND OMAHA (NEBR) SMSA
(References 10, 11)

	SAN JOSE SMSA (Santa Clara County)			NEBRASKA PART OF OMAHA-COUNCIL BLUFFS SMSA (Douglas and Sarpy Counties)					
	1960	1962	1965	1966	1967	1968	1969	1970	1971
Population (1,000's)	659	760	891	424	432	443	449	455	464
Total Registered Boats	7,101	10,041	14,260	4,586	5,094	5,413	5,729	5,910	6,649
Annual Increase	-	+17%	+11%	-	+11%	+6%	+6%	+3%	+12.5%
Boat Density (Boats/1000 Cap.)	10.8	13.2	16.0	10.8	11.8	12.2	12.8	13.0	14.3

Table II-3

SUMMARY OF BOR-SURVEY INFORMATION FOR SPECIFIC WATER-BASED ACTIVITIES

	% Participating in Selected Activities for the Whole U.S. and Days per Participant (Population base is 12 years and older) During				% Participating in Selected Activities for the North Central Census Region and Days per Participant (Population base is 12 years and older) During				% Participating in Selected Activities for the West North Central Division and Days per Participant (Population base is 12 years and older) During			
	June* July Aug. 1960	Sept.* through August 1965	June* July Aug. 1965	Dec.** 1970 to Jan. 1972	Summer* 1960	Sept.* 1964 - Aug. 1965	Summer* 1965	Dec.70** Jan. 1972	Summer* 1960	Sept.* 1964 - Aug. 1965	Summer* 1965	Dec.70** - Jan. 72
Sailing	- / -	3% / -	3% / 6.2	- / -	- / -	3% / -	3% / 4.4	- / -	- / -	- / -	- / -	- / -
Canoeing	- / -	4% / -	3% / 4.5	- / -	- / -	5% /	5% / 3.7	- /	- / -	- / -	- / -	- /
Swimming	45% / 11.5%	49% / -	48% / 14.3	43.6% / 21.0	42% / 11.1	45% / -	45% / 13.5	44.1% / 19.0	- / -	41% / -	41% / 14.6	41.3% / 18.0
Water Skiing	6% / 5.1%	7% / -	6% / 6.6	- / -	6% / 3.8	8% / -	8% / 6.9	- / -	- / -	8% / -	8% / 7.3	/ -
Boating	22% / 5.5	26% / -	24% / 6.5	24.5%o / 10.2	27% / 5.6	31% / -	30% / 7.0	28.5% / 10.2	- / -	37% / -	34% / 7.2	30.3%o / 9.1
Fishing	29% / 6.9	33% / -	30% / 7.6	29.4% / 11.4	33% / 6.2	36% / -	33% / 7.7	31.7% / 11.3	- / -	43% / -	38% / 7.7	39.3%o / 11.1

\- indicates no data recorded

o includes sailing, canoeing and water skiing

* References 12 and 13

** according to the write-up for this survey, the results are not too accurate in Reference 14

Table II-4

PRELIMINARY PARTICIPATION ESTIMATES FOR SPECIFIC WATER-BASED ACTIVITIES BY NEBRASKANS IN 1972

	Nebraska Participation as % of total Population (Ref. 15)	Nebraska Average No. of Days per Participant (Ref. 15)	Nebraska Adjusted Part. Rate (Population base 12 years & older)	BOR Estimate for Part. Rate & Part. Days based on Table II-3
1. Swimming	-	-	-	45%; 17
-Outdoor Pools	36.5	15.8	48.7	-
-Beach	30.3	6.8	40.4	-
2. Water Skiing	9.8	7.2	13.1	10%; 8
3. Boating	-	-	-	38%; 8
-Power Boating	20.3	7.94	27.0	-
-Other Boating	9.4	5.38	12.5	-
4. Fishing	-	-	-	40%;8
-Stream and River	19.0	6.60	25.3	-
-Lake and Reservoir	34.7	7.92	46.2	-

column 4 in Table II-4 - to allow a comparison for the same year. Clearly, as can be inferred from the type of data in Table II-3, extrapolation based on at most 2 data points for each statistic may not be expected to yield very reliable results. However, a likely value can be assumed, and with the above disclaimer, columns 3 and 4 in Table II-4 allow the following observations:

-Swimming. Swimming in outdoor pools in Nebraska has a higher than average participation, probably because beach swimming is lower than average. The number of participation days falls slightly below the average.

-Water skiing. According to the data for Nebraska, water skiing is more popular than may be inferred from BOR information. The number of participation days based on both information sources is approximately the same: 7 to 8 days.

-Boating. If the estimates for power boating and other boating refer to independent boating activities and if they are added together, boating in Nebraska is slightly more popular than the average for the West North Central Division. It is noted that power boating is by far the most popular.

-Fishing. Lake and Reservoir fishing enjoys a better than average popularity in Nebraska while, most likely, the lower participation in stream and river fishing indicates the lack of supply. The number of participation days as estimated by both sources is approximately equal: 7 to 8 days.

Demand for recreation opportunities and open space originates where people live, and depends on socioeconomic characteristics of the population, i.e., different socioeconomic groups exhibit different recreation patterns. Generally, people of higher socioeconomic status are willing and able to travel further to satisfy their needs for recreation and open space than people of lower socioeconomic status. Within the latter group there is frequently no visitation at all; however, this should not be construed as meaning that demand is nonexistent. Rather, it has been observed that once recreation facilities (e.g., parks, swimming pools) are provided in low socioeconomic areas, they are generally heavily used, sometimes regardless of the cost to participate. It can be concluded that there is a significant latent demand in such areas which due to socioeconomic and physical barriers remains latent until recreation is brought to the area. This phenomenon can be observed in the Omaha-Council Bluffs SMSA, which, similar to many other areas in the U.S., contains a number of census tracts in Omaha where 20% or more families received incomes below the poverty level (Ref. 1). In these areas the population is declining, housing is generally inferior, and the percentage of blacks is significantly larger and unemployment higher than the rest of the SMSA. These census tracts are located in the older parts of Omaha, close to the Missouri River,

where opportunities for recreation are scarse. Consequently, one important recreation problem in the Omaha-Council Bluffs SMSA is to estimate latent demand, and subsequently to plan for satisfying the recreational needs of those areas.

4. Deficiencies

Based on the above overview of problems related to the physical recreation system, and of the supply and demand for recreation opportunities and open space, it can be observed that deficiencies clearly exist. To analyze deficiencies in more detail, it is necessary to carefully evaluate the demand and supply situation for each recreation activity and for open space. This evaluation for a number of activities is performed in subsequent chapters. In this section, devoted to surfacing the main recreation and open space problems, deficiencies are categorized by specific needs in order to assess the role of the Urban Studies Program. These need categories are as follows:

(1) Preservation of land and water areas devoted to recreational use and open space. This is the most pressing need as indicated by the results of a Nebraska Game and Parks Commission statewide inventory of all land and water areas devoted to urban and nonurban recreation, including all open space areas (Ref. 9); Tables II-5 and II-6 contain the results of this inventory. In the study, the state was divided into 14 socioeconomic areas (SEA) as illustrated in Figure 2.3. The Omaha SEA contains, in addition to the Omaha SMSA, five surrounding counties covering essentially all recreation opportunities open to residents of the SMSA. The most important observation in support of this need category, illustrated in Table II-6, is that while the Omaha SEA is by far the most populous one, it ranks among the lowest in the amount of recreational land and waters per capita. Furthermore, combining the indicated values for urban and nonurban recreational lands and waters yields open space standards of 6.4 and 23.2 acres per 1000 respectively. These values are not only below values suggested in the literature (Ref. 17) but also compare unfavorably with open space standards recommended by Nebraska and Iowa (see Table II-7).

(2) Provision of opportunities for passive recreational pursuits. This category overlaps the previous one in the sense that land and/or water are a first requirement for passive recreation. However, here the focus is on aesthetic requirements for recreational lands and waters, e.g. development of trails and scenic driveways, in an effort to link differently located recreational areas together so that they blend harmoniously, thereby making opportunities available for passive recreation.

Table II-5

1966 LAND AND WATER INVENTORY FOR NONURBAN AND URBAN RECREATION IN THE STATE OF NEBRASKA (Ref. 8)

		LAND						WATER					
		NONURBAN		URBAN		TOTAL		NONURBAN		URBAN		TOTAL	
Area	Central City	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total	Acreage	% of Total
1	South Sioux City	923	0.2	119	0.9	1,042	0.2	22	0.0	8	1.4	30	0.0
2	Omaha	10,970	1.8	3,340	26.3	14,310	2.4	1,757	1.7	188	34.0	1,945	1.8
3	Lincoln	9,466	1.6	2,695	21.2	12,161	2.0	4,317	4.1	196	35.4	4,513	4.2
4	Beatrice	2,955	0.5	406	3.2	3,361	0.6	259	0.2	26	4.7	285	0.3
5	Norfolk	6,227	1.0	618	4.9	6,845	1.1	7,438	7.0	12	2.2	7,450	7.0
6	Columbus	344	0.1	463	3.6	807	0.1	931	0.9	15	2.7	946	0.9
7	Grand Island	4,252	0.7	467	3.7	4,719	0.8	3,079	2.9	4	0.7	3,083	2.9
8	Hastings	2,094	0.3	505	4.0	2,549	0.4	30	0.0	72	13.0	102	0.1
9	Kearney	20,470	3.4	410	3.2	20,880	3.4	13,188	12.4	-	-	13,188	12.4
10	McCook	18,853	3.2	479	3.8	19,332	3.2	12,255	11.6	-	-	12,255	11.5
11	North Platte	3,420	0.6	479	3.8	3,889	0.6	7,389	7.0	27	4.9	7,416	7.0
12	Ogallala	56,763	9.5	65	0.5	56,828	9.4	36,620	34.5	-	-	36,620	34.3
13	Valentine	296,521	49.8	1,558	12.3	298,079	49.1	14,913	14.1	1	0.2	14,914	14.0
14	Scottsbluff	161,716	27.2	1,093	8.6	162,809	26.8	3,894	3.7	4	0.7	3,898	3.7
	TOTAL	594,924	100.0	12,697	100.0	607,621	100.0	106,092	100.0	553	100.0	106,645	100.0

Table II-6

1966 LAND AND WATER DENSITIES FOR NONURBAN
AND URBAN RECREATION IN THE STATE OF NEBRASKA
(Reference 9)

Area	Central City	1966 SEA POPULATION AS % OF TOTAL	LAND DENSITY Acres/1000		WATER DENSITY Acres/1000	
			NONURBAN	URBAN	NONURBAN	URBAN
1	South Sioux City	1.85	32.9	4.2	0.8	0.3
2	Omaha	36.16	20.0	6.1	3.2	0.3
3	Lincoln	16.31	38.3	10.9	17.5	0.8
4	Beatrice	4.18	46.7	6.4	4.1	0.4
5	Norfolk	6.67	61.6	6.1	73.5	0.1
6	Columbus	3.51	6.5	8.7	17.5	0.3
7	Grand Island	6.16	45.6	5.0	33.0	0.0
8	Hastings	4.13	32.6	8.1	0.5	1.1
9	Kearney	3.55	380.5	7.6	245.1	-
10	McCook	2.66	468.0	11.9	304.2	-
11	North Platte	4.40	51.3	7.2	58.5	0.4
12	Ogallala	1.24	3,009.5	3.4	1,941.6	-
13	Valentine	3.39	5,769.0	30.3	290.1	-
14	Scottsbluff	5.79	1,841.7	12.4	44.3	-
	TOTAL	100	392.4	8.4	70.0	0.4

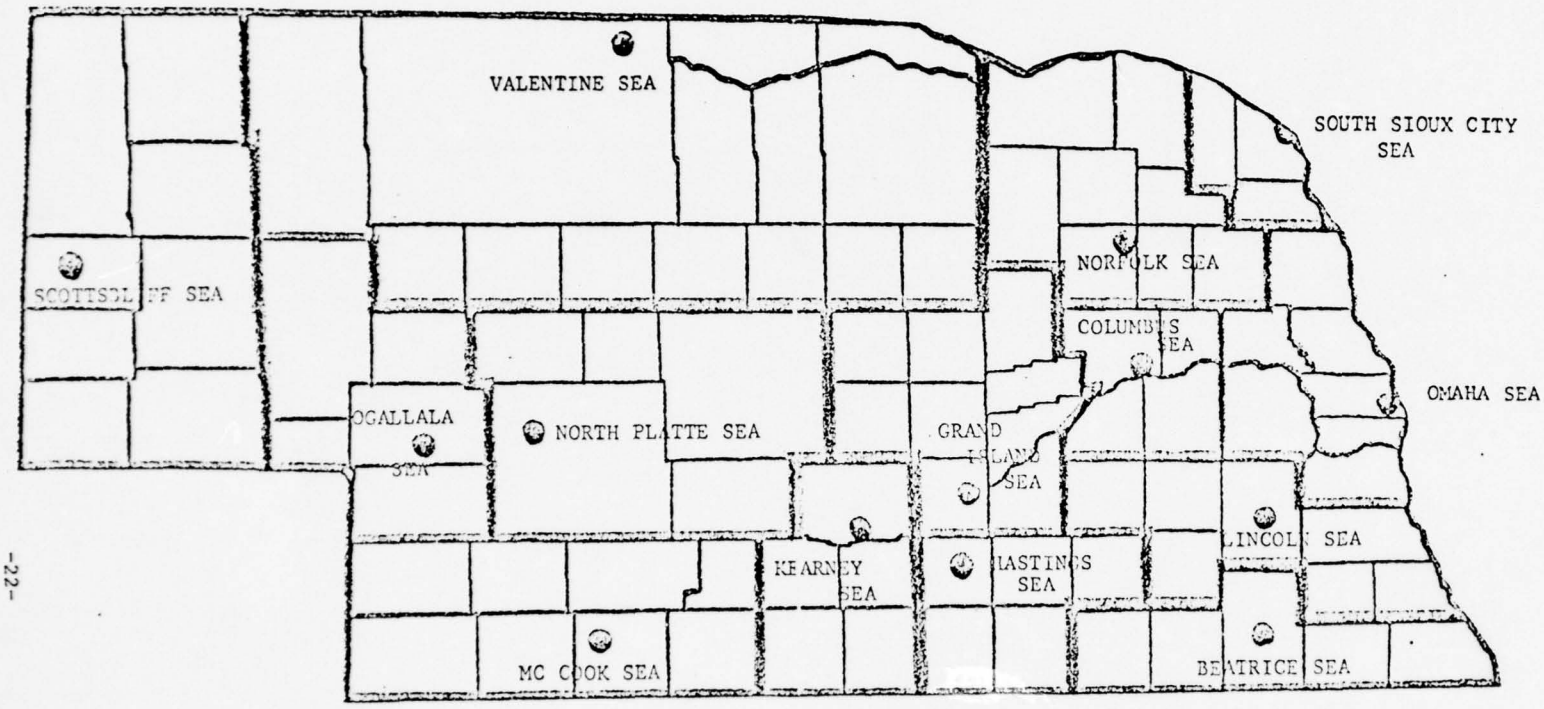


Figure 2.3 SOCIOECONOMIC AREAS OF NEBRASKA WITH THEIR CENTRAL CITIES, 1960 (Ref. 8)

Table II-7

RECOMMENDED OPEN SPACE STANDARDS

FOR

NEBRASKA AND IOWA

(Ref. 17)

NEBRASKA STANDARDS FOR OUTDOOR RECREATION (1980)

Urban	Metropolitan Areas	15 ac/1000 persons
	1 Class Cities (5000-25000	15 ac/1000 persons
	2nd Class Cities (1000-5000)	20 ac/1000 persons
Nonurban	Villages (less than 1000)	25 ac/1000 persons
	Regional	40 ac/1000 persons

IOWA STANDARDS FOR OUTDOOR RECREATION (1965)

Urban	Municipal	15 ac/1000 persons
	County	20 ac/1000 persons
Nonurban	State	80 ac/1000 persons
	Federal	100 ac/1000 persons

(3) Provision of opportunities to engage in active water-based recreation activities in close proximity to the city of Omaha. This category focuses on provision of boating, fishing and swimming opportunities by developing new opportunities, e.g., lakes, reservoirs and impoundments. Thus, the emphasis is on augmenting the supply for these activities in order to satisfy the growing demand which can not be accommodated by the existing physical recreation system.

(4) Improvement of facilities for land-based urban recreation. This category focuses on activities which primarily require a considerable investment for the necessary facilities, e.g., tennis courts and ice skating rinks. As previously mentioned, provision of such facilities strongly hinges on the financial aspects involved, i.e., the public nature of these activities and the limited financial capabilities of the responsible agencies are among the most important deterrents for satisfying the needs in this category.

(5) Improvement of the existing recreational system in terms of quality and quantity of opportunities provided. This category focuses on (1) elimination of those characteristics of the physical system that inhibit full utilization of the existing capacity, and (2) determination of measures to regulate visitation to existing recreation areas in order to control the quality of the recreational experience. Thus this category is directed towards problems such as degraded water quality, lack of parking facilities and overcrowding.

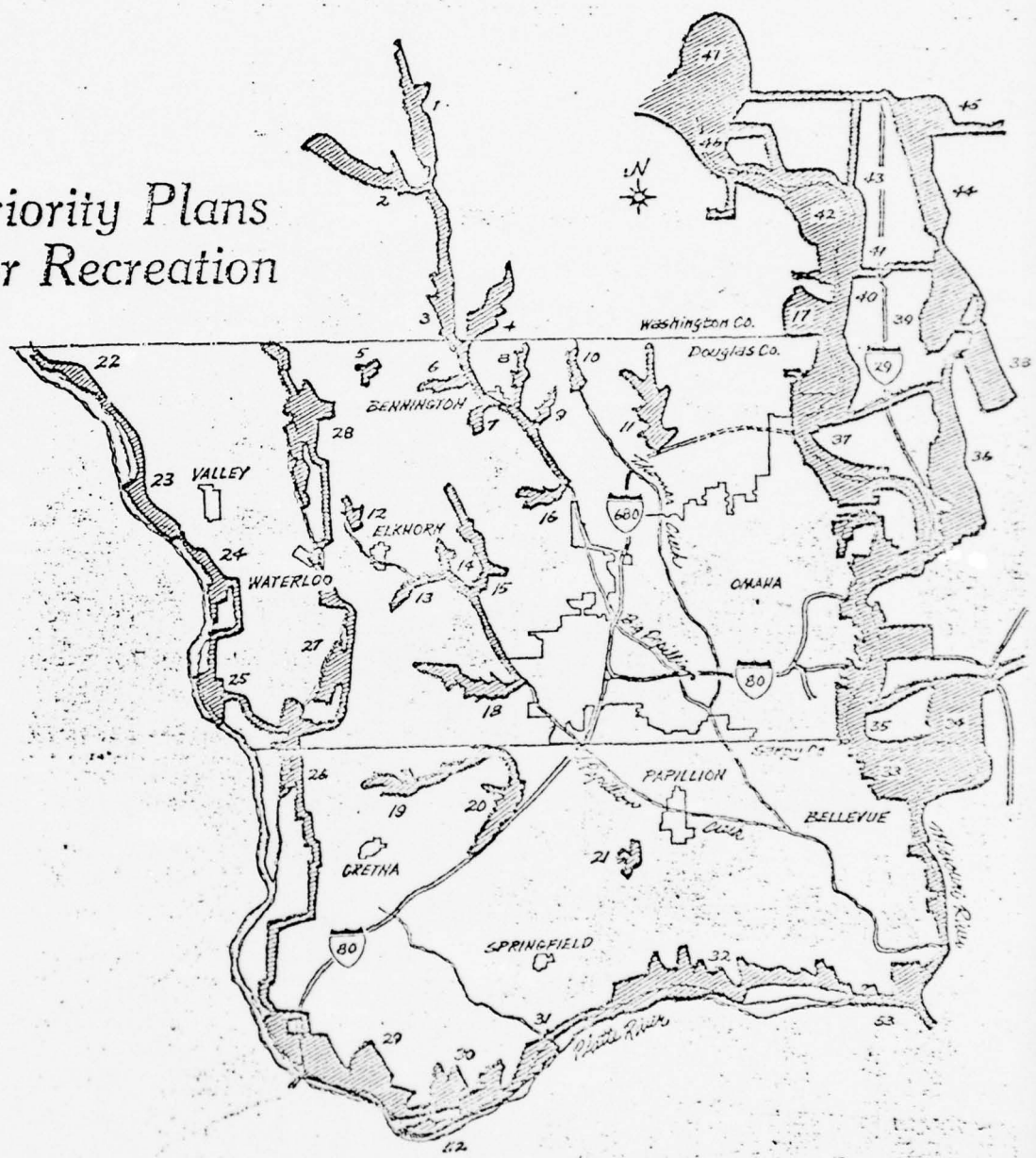
C. Recreational Planning Efforts related to the Omaha-Council Bluffs SMSA.

Different agencies are planning for various aspects of the overall recreation and open space problem for the SMSA; a number of planning efforts are reviewed in the following subsections.

1. MAPA

In June, 1972 MAPA published the Omaha-Council Bluffs Metropolitan Area Open Space Plan and Program (Ref. 17). The plan recommends an open space system, illustrated in Figure 2.4, to preserve the region's natural resources as well as enhance the recreational opportunities in the three-county planning area that constitutes the SMSA. In the report the term "open space" is an all embracing term used to define land areas which are retained in, or restored to, a condition in which nature predominates. Thus open space may mean areas where valuable resources are conserved or protected as well as areas provided for all forms of recreational use.

Priority Plans For Recreation



Priority I, by 1980

Nos. 1-14 and 16-21 — The 29 proposed Papillion Creek flood control general recreation areas, ranging in size from 10 to 75 acres, are located at Omaha. No. 16 is already under construction.

No. 17 — A 1,000-acre natural environment area 2½ miles northwest of the Martha bridge.

No. 22 — A 1,500-acre general recreation area seven miles south of Elkhorn.

No. 31 — A 500-acre landscape recreation area 2½ miles south of Springfield.

No. 32 — A 1,000-acre general recreation area five miles south of Papillion.

No. 34 — A 1,000-acre expansion of the recreation area south of Lake Standing, Ia.

No. 35 — A 4-acre public access area west of Lake Manawa in the Glenn H. Hyde Park.

No. 48 — A 215-acre general recreation area two miles south of Irving, Ia., expanding Carpenter Park.

No. 50 — A 1,000-acre general recreation area two miles west of Crescent, Ia.

Priority II, by 1990

No. 27 — A 2,000-acre natural environment area along the bluffs north of U.S. Highway 275, and the Elkhorn River south of Elk River.

No. 28 — A 1,300-acre natural environment area one mile west of Elk City.

No. 29 — A 2,000-acre historic, natural environment area three miles east of the Grand Pre interchange.

No. 30 — A 2,500-acre general recreation and scenic drive along the bluffs between Crescent, Ia., and Council Bluffs, including the present Lewis and Clark Monument.

No. 37 — A 1,000-acre public access area to the Missouri River east of the Mormon Bridge.

Nos. 40, 41, 43 — Three 100-acre public access areas to the Missouri west of Honey Creek, Ia.

No. 54 — A 500-acre general recreation area along the Platte 1½ miles south of Valley.

Priority III, by 2000

No. 22 — A 1,200-acre natural environment area five miles northwest of Valley.

No. 33 — A 400-acre public access area 2½ miles west of Valley.

No. 36 — A 2,000-acre general recreation area over the Douglas-Sarpy County line along the Elkhorn River.

No. 39 — A 1,000-acre general recreation area and scenic drive in the bluff area east of Crescent, Ia.

No. 42 — A 1,500-acre natural environment area south of Honey Creek, Ia.

No. 45 — A 2,500-acre primitive outdoor area along the Missouri 2½ miles west of Honey Creek, Ia.

No. 46 — A 2,500-acre natural environment area two miles east of Honey Creek.

No. 49 — A 200-acre general recreation area two miles south of Underwood, Ia.

No. 52 — A 500-acre public access area to the Nishnabotna River a half mile south of Hancock, Ia.

No. 53 — A 1,000-acre natural environment area 12 miles east of Carson, Ia.

Figure 2.4 MAPA OPEN SPACE PLAN (COURTESY OMAHA WORLD-HERALD, SEPT 14, 1972)

The requirements for open space in the report, are based on environmental and recreational considerations. Responsive to the first set of considerations, an attempt is made to determine the region's natural suitability to sustain various uses. Following the methodology developed by Ian L. McHarg, subareas are identified within the SMSA which should be considered for preservation as open space on the basis of their natural characteristics. Consideration is given to flood plains, surface waters, areas with soils unsuitable for urban development, areas with slopes in excess of 10 percent, forested land, areas with a variety of different habitats to produce and sustain wildlife, locations with unique cultural features, and areas which due to their present development carry a significant threat to the aforementioned areas. Composite maps are drawn on the basis of each "factor" identified, which indicate concentration of factors, and based on this concentration, primary and secondary environmental corridors are identified.

MAPA's methodology for determining the future recreation requirements for open space is discussed in detail in Appendix A where it is asserted that the estimates provided in the plan are overestimated by at least 100 percent. Since the plan presented in Reference 8 appears to be primarily motivated by environmental considerations, there is not necessarily a problem; however, justification of the associated program may be impaired. On the other hand it should be noted that most projections of recreation requirements have been conservative in the past and led to overcrowded recreation areas and facilities. In summary, the MAPA plan can be considered a valuable first step toward coping with the important problem of preserving open space in the Omaha-Council Bluffs SMSA.

2. Riverfront Development Program (RDP)

An integral part of RDP is the recreation development along a 54-mile stretch of the Missouri River (see Figure 2.5). The key concept of this program is to shift emphasis from continued westward development to a "return to the river". Essential features of this planning program include a proposed parkway from the city of Blair to the confluence of the Platte and Missouri River; access to various sites of scenic and historic significance; and linear parks including trails for hiking, bicycling and horseback riding, and wilderness areas. Although the complete program is still mostly in a conceptual

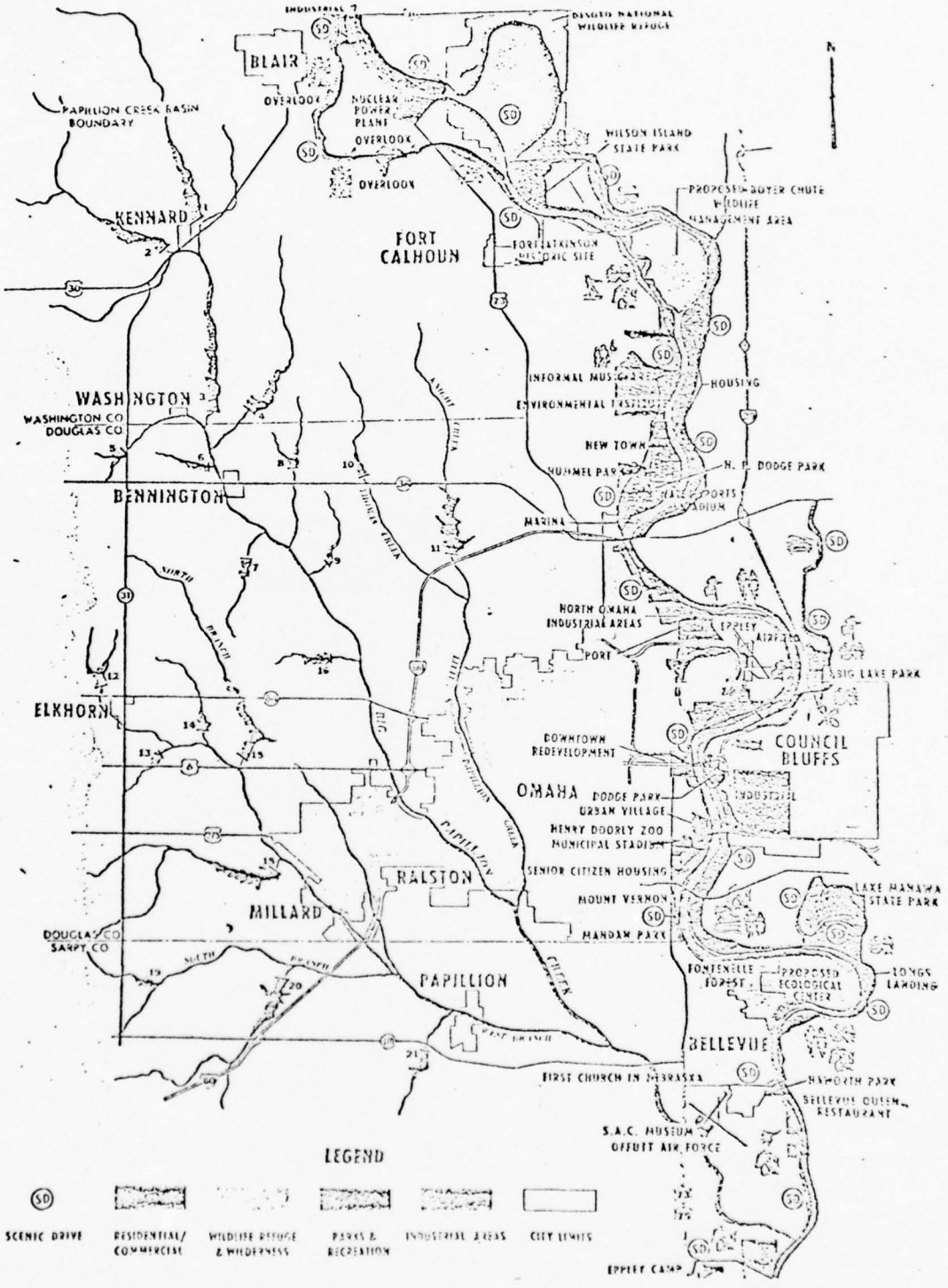


Figure 2.5 RDP PLAN FOR RECREATION DEVELOPMENT ALONG MISSOURI RIVER

stage, its significance for the first two priority areas mentioned in the previous section is clearly established. In particular, the program would make a significant contribution to the need for passive recreation.

3. Omaha Recreation Planning Department.

As in most urban planning departments, the direction for planning in Omaha is determined largely by subjective interpretation of recreational needs rather than by accurate quantitative assessments of deficiencies for all recreation activities. (The latter would significantly increase the burden and cost of data collection, which for local agencies frequently makes subjective assessments the only feasible recourse.) As a result, essentially no attendance figures are kept by the city's recreation planning department. The only use estimates are on activities organized in leagues such as tennis and softball, and on use of certain facilities such as swimming pools. Generally, where membership and/or ticket sale is involved, a record is kept. For many activities, lack of data is substituted by observations such as: parks are overcrowded and lagoons or lakes overused. Thus, urban recreation planning by necessity frequently results in concentrating on facility design where the need for facilities is derived from a master plan adopted in some type of political process. While this statement is intended as a description of the status quo and not as a value judgment, it should be recognized that efficient and equitable resource management is seriously impaired by existing procedures.

The city planning department has prepared a master plan for neighborhood parks, recreation facilities and open spaces within the city limits (Ref. 7). For this purpose, the city is divided in 43 neighborhoods; the location of existing recreation opportunities is identified and future ones anticipated for each neighborhood. Recreation opportunities associated with the following activities are discussed: golf courses, swimming pools, baseball and softball fields, tennis courts, ice skating areas, special purpose areas, e.g., historical sites, community centers, and parks.

The importance of the master plan can be illustrated by its opening paragraphs:

> "The master plan is especially important to undeveloped sections of the city. Proper recreation planning for these areas must occur in the initial phases of development. If sufficient open spaces are not

provided at the time of development, the cost of acquiring these open areas after development tends to complicate and often prohibit creation of adequate recreation facilities.

In developed areas of the city, the master plan provides an evaluation of and points out deficiencies in existing facilities. The future needs of these areas can then be forecasted and facilities to meet those needs planned.

The master plan also provides a central consistency to the planning of recreation facilities. Conformance to the master plan will coordinate the efforts of the various public agencies and private organizations involved in planning and developing recreation facilities and programs. This coordination will prevent costly duplication of facilities in some areas and the absence of facilities in others."

Based on the master plan, design of facilities is coordinated with the people who will most likely be the users: the neighborhood residents. Thus desires and opinions are solicited in public meetings, a preliminary design is prepared and citizen response is incorporated into the final design. The only rather stringent guideline followed is that an attempt is made in new residential developments to set at least 8% of the usable land aside for recreation.

D. Recreation and the Urban Studies Program.

The purpose of this section is to briefly outline the potential inherent to the scope of the Urban Studies Program to contribute to recreational needs in the Omaha-Council Buuffs SMSA. As stated earlier, the general objective of the Urban Studies Program is directed towards two specific goals, i.e., to develop water and related resources plans which (1) solve specific urban problems and (2) serve as a catalyst for solving other related problems.

With respect to the first goal, in the context of recreation specific urban problems that can be resolved by water and related resources plans are the traditional water-based recreation problems (e.g., boating deficiencies and swimming deficiencies) and recreation problems in which the availability of water plays a predominant role (e.g., camping at a reservoir site). With respect to the second goal, the focus is on so called multiplier effects. That is,by developing plans in which the primary emphasis is to resolve specific water-related urban problems, other than recreation, it may be possible to solve recreation problems where the availability of water is not the primary

component. For example, it is well known that one alternative for flood plain management is zoning; this alternative may be favorable if part of the open space problem can be resolved by zoning flood plains as open space. In conclusion, the achievements of the Urban Studies Program are related to (1) specific water-based recreation problems and (2) multiplier effects affecting recreation and open space problems.

The following paragraphs link the need categories described in Section B to the anticipated achievements of the Urban Studies Program in order to identify its role in solving recreation and open space problems.

1. Water-Based Recreation

Responsive primarily to the third and fifth need categories, the Urban Studies Program calls for plans aimed at developing new water-based recreation opportunities in close proximity to the city of Omaha, as well as improving the existing supply. For the former, it will be necessary to identify new sites or to enlarge existing ones; the central planning problem relates to the question of quantity and location for new boating opportunities, fishing opportunities, and so forth. To improve the existing supply, it will be necessary to analyze existing water-based recreation areas. Problems that need to be addressed range from water quality problems at Levi Carter Lake to low flows that may jeopardize fisheries planned for the new Papio System.

2. Multiplier Effects

This group of achievements has the potential of affecting all five categories listed earlier. Whether in reality multiplier effects can be captured in urban studies plans depends to a large extent on the range of urban problems in the Omaha-Council Bluffs SMSA that are addressed as well as on the type of solutions that are proposed. Generally, the planner's creativity and imagination plays a predominant role in identifying problem solutions that will generate multiplier effects; an aid for their identification is provided by current recreation and open space planning efforts (Section C). In each effort a clear indication is given of what is required to improve the recreation and open space situation. This information can serve as input to the planner in order to determine whether these requirements can be met within the scope of the Urban Studies Program. A hypothetical example

of combining efforts to achieve multiplier effects is illustrated in Figure 2.6 (Ref. 18). The figure shows an alternative that (1) solves rural storm water runoff and irrigation problems (both of which are clearly within the realm of the Urban Studies Program) and, (2) contributes to alleviation of the recreation and open space problem. If the size and location of the recreational detention pond is compatible with recreational requirements, the recreational multiplier effects provided by this alternative could justify its adoption.

The following provides additional examples of water resource system components that carry the potential for multiplier effects. As the purpose of these examples is to emphasize the inherent possibilities of the system to provide solutions to water resource problems, the dollar costs involved in fully realizing these possibilities are not considered here.

- Flood Plains. Reference 2 concluded that for those flood plains in the SMSA with little existing development, the use of zoning as a flood plain management alternative to prevent future residential, commercial or industrial development is economically superior to structural flood control alternatives. In another study, MAPA identified certain areas to be retained as open space. A useful link can be made between the two planning efforts which would strengthen the overall open space planning effort.

- Waterwater Treatment Facilities. Conventional waste treatment plants need land for placement of facilities. Innovative designs that locate most facilities underground provide opportunities for open space. A different concept in system design may involve constructing a number of satellite plants to provide partial treatment with one central plant to provide final treatment. Satellite plants can be designed in conjunction with community recreation centers in areas where such facilities are scarce. Imaginative solutions such as these would be responsive to the first and fourth need categories. The large land requirements for land treatment facilities enable provision of opportunities for hunting. In addition, spray irrigation sites of land treatment facilities within close proximity of populated areas may also satisfy demand for the open space.

- Conveyance Networks for Water Supply and Wastewater. The rights of way necessary for conveyance networks can be used for hiking and bike trails. Particularly, in light of the second need category, a system of trails may provide the connection between main recreation areas. This coincides with the concept of linear recreation developed by KPD to increase access to larger recreation

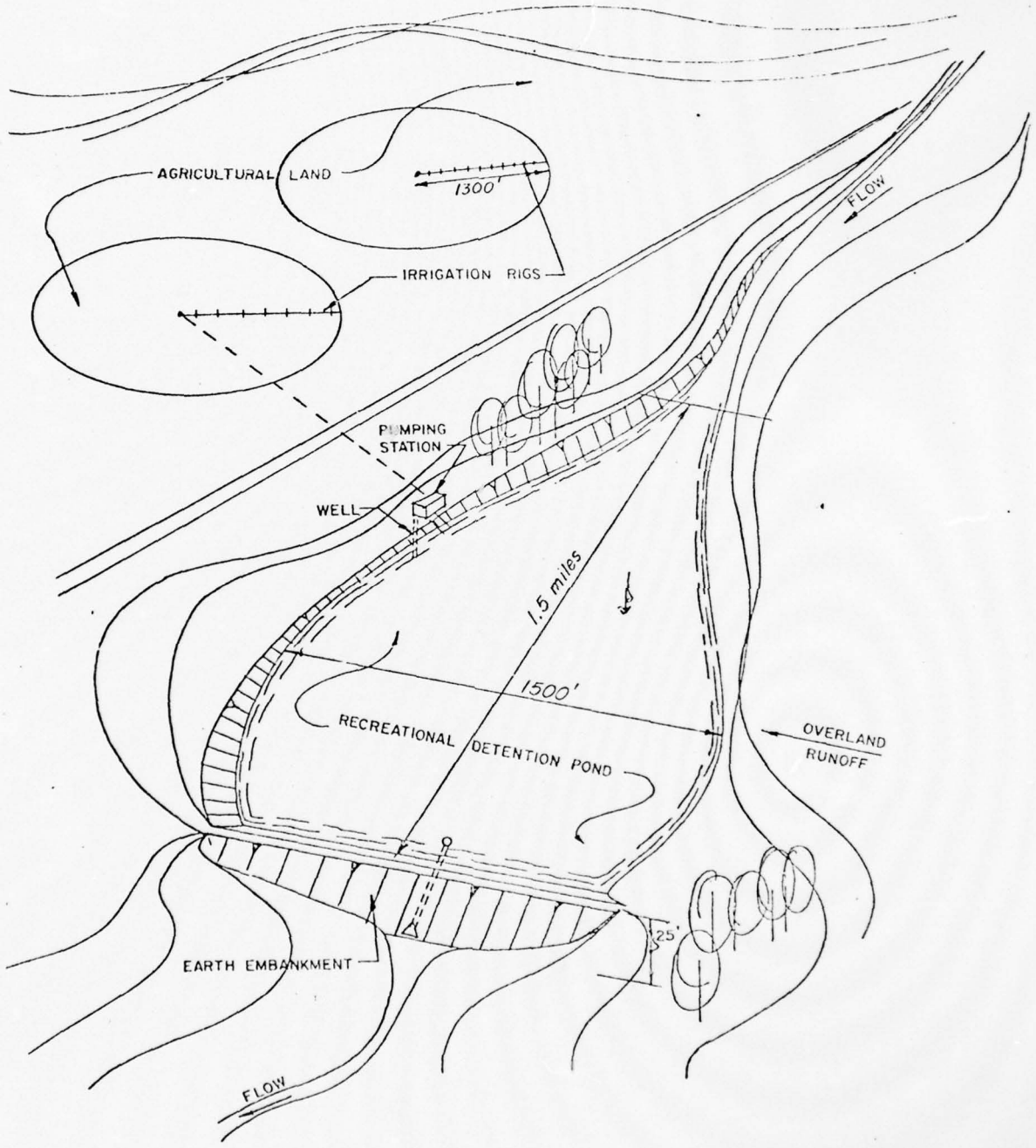


Figure 2.6 MULTIPLIER EFFECTS

sites and to successfully employ the potential of the Missouri River.

- Reuse of Effluent. Under the mandate of no discharge of critical pollutants, modern wastewater management facilities treat large volumes of wastewater which can then be used to stabilize flows in the area. Especially in cases where low flows cause seasonal recreational use of streams, stabilization of the flow can provide a more uniform pattern of the supply of recreation opportunities. In a different application, effluent can be reused in conjunction with development of fishing ponds. In this case, location of fishing ponds is normally contingent upon the location of treatment plants.

3. Conclusion

The role of the Urban Studies Program with respect to recreation and open space in the Omaha-Council Bluffs SMSA is identified in this Chapter. Five need categories are delineated which indicate specific problems that the program can address. It is noted that realization of this potential hinges upon identification of possible multiplier effects, i.e., identification of solutions for urban problems other than for recreation per se. Since there is limited value in additional conceptualizing, further development of multiplier effects must be done in conjunction with planning efforts in other areas of the program, e.g., flood control, provision of water supply and wastewater management.

Planning for water-based recreation can, however, be pursued regardless of other planning efforts. Water-based recreation consists of two groups of recreation activities: (1) activities which are only possible if a body of water is available, and (2) activities which are enhanced by the presence of a body of water, but which are not strictly dependent on it. The first group includes swimming, water skiing, boating (e.g., sailing, canoeing, power boating,) and fishing, while the second group encompasses all kinds of activities that people engage in when visiting a lake or river, e.g., picknicking, camping and nature study. To provide further specification of plans within the Urban Studies Program, subsequent chapters focus on deficiencies in the first group and identify alternative means for their alleviation.

Chapter III

AGGREGATE DEMAND-SUPPLY RELATIONSHIPS FOR SWIMMING, WATER SKIING, BOATING AND FISHING

A. Introduction

In contrast to the general overview of recreation and open space problems in the the Omaha-Council Bluffs SMSA presented in the previous chapter, the purpose of this chapter is to focus exclusively on four water-based recreation activities. Thus, while the previous chapter outlined the Urban Studies Program's role with respect to five need categories, this chapter addresses one category: the need for an increased supply of swimming, water skiing, boating and fishing opportunities in close proximity to Omaha.

The emphasis in this chapter is on problems encountered when attempting to calculate the demand and supply for each of the above-mentioned activities. An outline of what has to be calculated in order to determine demand and supply is given, as well as an identification of what can be calculated given the existing data. As such, this chapter lays the groundwork for more refined analyses in subsequent phases of the Urban Studies Program. Section B addresses the demand for swimming, water skiing, boating and fishing and focuses on a procedure for its estimation. Each factor in the procedure is discussed with respect to the availability of data. Section C focuses on determining the supply for swimming, water skiing, boating and fishing in Douglas, Sarpy and Pottawattamie counties.

B. Estimating Demand

In an economic sense, recreation opportunities may be considered as a commodity, demanded by the public and supplied according to the laws of demand and supply. Under this framework, demand and supply are tied together by a market mechanism, through which the price to enjoy recreation is determined. However, because for many forms of recreation if opportunities are provided to some parts of the public they cannot generally be withheld from others, there is often no market where people pay for the goods they receive. (An obvious

exception is when it is possible to force people to pay as in the case of swimming pools; however, with regard to the enjoyment of streams, lakes and reservoirs, major difficulties are encountered.) For this reason, many recreation opportunities are in the domain of what economists call public goods, and their supply is taken care of by public planning.

The public good aspects of recreation, especially the nonexistence of a market, encumber the procedures to measure what people desire. However, there is the same requirement to identify demand as there is in the case of private goods. Specifically, there are a number of questions to be answered for each recreation activity.

(1) Who or what percentage of the population has the desire to participate?

(2) How many days of the year will people participate?

(3) When in the year will participation take place?

(4) Where and for how long do people participate during any one trip?

(5) What quantity and quality of natural resources is necessary to support participation?

Answers to the above yield the elements necessary to represent the area demand for recreation activities; the accuracy of this representation depends on the accuracy of the answers. The interview or survey approach is generally taken in the search for answers. Surveys may encounter a serious problem when data on visitation is substituted for data on demand for they are different concepts and serve different functions. Visitation data reflects the actual visitation that a particular area experiences and precludes latent demand, i.e., the visitation that is not realized for numerous reasons including socioeconomic characteristics of the target population and quantity, quality and location of the supply provided. While there is no easy way to circumvent this problem, latent demand should be recognized when estimating the demand emanating from an entire population in order to determine where and in what quantities recreation should be provided.

On the other hand, visitation data rather than demand data is required in designing recreation facilities at designated projects or in assessing recreation benefits associated with such project locations. For these tasks, it is

important to ascertain expected visitation given the recreation patterns of the population in the project's area of influence.

In the following subsections an attempt is made to answer each of the five questions postulated above and to present a procedure for demand estimation in order to illustrate the interrelationship between these answers.

1. Demand Estimation Procedure

The underlying reason for demand estimation is to determine deficiencies in the supply of natural resources. Thus demand and existing supply must be measured in one common unit. Since the supply for activities addressed in this chapter is commonly expressed in surface acres, demand estimation can be formulated as determining the required quantity and location of surface acres of a specified water quality. (It is noted that water quality enters as a constraint on quantity and location because it determines whether surface acres can be considered available.) Quantity and location are addressed separately; a procedure for estimating aggregate demand is discussed in this subsection, while Subsection 5 addresses the locational issue.

An important characteristic of demand is the time period under consideration, or so-called analysis period during which acres are required (e.g., year, summer, peak month, etc.). Taking this into account, the demand for acres necessary to support a particular activity can be expressed in the following simplified manner:

$$D_j = X_j \cdot Y \qquad (3.1)$$

where

D_j = minimum number of acres demanded, emanating from a specified target population, during a particular day j in the analysis period;

X_j = number of people within the target population who desire to participate in recreation on day j of the analysis period;

Y = a conversion factor expressing the average number of acres required per participant.

The factor X_j can be further expressed as follows:

$$X_j = (N \cdot U \cdot V)W_j \qquad (3.2)$$

where

N = total target population;

U = percentage of people (i.e. recreationers) within the target population who desire to recreate at least once during the analysis period;

V = average number of days per recreationer;

(N·U·V) = total number of recreation days demanded during the analysis period (this number may also be viewed as the total number of participants counting multiple participation every time it occurs);

W_j = percentage of the total number of recreation days that will coincide with day j of the analysis period.

Equations (3.1) and (3.2) together determine the aggregate demand that exists within the target population; the parameters to be determined for a particular analysis period are U, V, W_j and Y, the subjects of the following subsections.

2. Desired Participation

The purpose of this subsection is to estimate the factors U and V in Equation 3.2 for a specified target population in a particular analysis period. The target population is assumed to be the total population of the Omaha-Council Bluffs SMSA while a year is chosen as the analysis period. Given these assumptions, the problem is to determine the percentage of people in the SMSA who desire to recreate as well as the average number of days per participant that will be demanded during the year.

The area's population consists of various socioeconomic groups whose recreation demands are not necessarily the same. This has been evidenced by national surveys which give the percent participation as well as record the days per participant by socioeconomic characteristics. Table III-1 contains an example of this type of data, assembled by BOR (Ref. 13), and indicates that demand can be expected to be different for each socioeconomic group

The problem of estimating future participation for different socioeconomic groups is not resolved by the above observation. There are no satisfactory models which explain how the participation rate, or the number of days per participant, depends on income, amount of leisure time, place of residence, age, race, and so forth. Attempts have been made at the national level to use multiple regression techniques (Ref. 19); however, the validity of the answers is doubtful because data for two or three points in time is certainly not enough

[illegible] socioeconomic characteristics; summer 1960 and 1965 and winter 1964-65 (nonsummer activities); U.S. totals—continued

	Fishing				Canoeing				Sailing			
	Percent participating		Days per participant		Percent participating		Days per participant		Percent participating		Days per participant	
	1960	*1965*	*1960*	*1965*	*1960*	*1965*	*1960*	*1965*	*1960*	*1965*	*1960*	*1965*
United States total	29	30	6.9	7.6	..	3	....	4.5	..	3	....	6.2
Sex												
Males	40	41	7.6	8.7	..	4	....	4.4	..	3	....	6.9
Females	19	20	5.4	5.6	..	3	....	4.6	..	2	....	5.4
Age by sex												
Males												
12-17	62	59	10.5	10.3	..	9	....	5.1	..	5	....	7.4
18-24	48	43	8.1	7.1	..	8	....	5.4	..	..	....	....
25-44	41	42	6.5	8.1	..	3	....	3.0	..	3	....	7.3
45-64	33	37	6.4	8.7	..	..	....	....	..	..	....	....
65 & over	17	18	6.2	8.8	..	..	....	....	..	..	....	....
Females												
12-17	27	29	3.5	3.9	..	7	....	3.7	..	5	....	5.9
18-24	31	25	3.8	5.1	..	6	....	5.3	..	..	....	....
25-44	21	22	5.6	5.9	..	2	....	2.4	..	..	....	....
45-64	14	16	8.3	6.3	..	..	....	....	..	..	....	....
65 & over	4	6	....	10.8	..	..	....	....	..	..	....	....
Combined age												
12-17	..	44	....	8.2	..	8	....	4.5	..	5	....	6.7
18-24	..	33	....	6.3	..	6	....	5.3	..	5	....	7.1
25-44	..	32	....	7.3	..	2	....	2.8	..	2	....	6.0
45-64	..	26	....	8.0	..	..		....	..	..	....	....
65 & over	..	11	....	9.4	..	..		....	..	..	....	....
Place of residence												
In SMSA	25	27	6.3	7.3	..	4		5.0	..	3	....	6.6
Not in SMSA	35	34	7.5	8.0	..	2		2.8	..	1	....	4.2
Family income												
Under $3,000	22	21	5.5	7.7	..	..		....	..	..	....	....
$3,000-$6,000	..	30	....	7.9	..	3		3.7	..	..	....	....
$6,000-$8,000	32	32	6.8	6.8	..	4		3.5	..	2	....	7.6
$8,000-$10,000	31	36	6.8	8.6	..	4		5.0	..	4	....	5.6
$10,000-$15,000	39	35	5.1	7.1	..	5		4.8	..	5	....	7.6
$15,000-$25,000	27*	31	5.8	7.7	..	..		....	..	..	....	....
$25,000 & over	..	33	....	8.2	..	..		....	..	..	....	....
Education (25 and over)												
8 yrs. or less	..	21	....	7.8	..	..	....	....	..	..	....	....
HS 4 yrs.	26	29	5.9	7.5	..	2	....	4.4	..	..	....	....
Coll. 4 yrs.	27	26	6.6	7.4	..	..	....	....	..	7	....	5.7
Race												
White	29	31	6.8	7.6	..	3	....	4.6	..	3	....	6.2
Negro and other races	28	23	7.4	7.5	..	..	....	....	..	..	....	....
Size of family												
1-2	..	22	....	8.0	..	2	....	4.7	..	2	....	4.0
3-4	..	33	....	7.5	..	3	....	5.9	..	3	....	6.6
5+	..	33	....	7.4	..	4	....	3.3	..	3	....	6.9
Age of youngest child												
Persons with:												
Children under 6	..	32	....	7.3	..	2	....	4.4	..	2	....	6.4
Children 6-11	..	31	....	6.8	..	..	....	....	..	..	....	....
All other persons [1]	..	29	....	7.8	..	4	....	4.7	..	3	....	6.1
Census Regions												
Northeast	21	20	8.5	9.0	..	3	....	5.8	..	3	....	8.3
North Central	33	31	6.7	7.7	..	5	....	3.7	..	3	....	4.4
South	33	35	6.6	7.5	..	2	....	5.5	..	2	....	6.3
West	30	31	6.4	6.0	..	3	....	3.0	..	3	....	5.2
Census Divisions [2]												
New England		25		12.1		..		....		5		11.5
Middle Atlantic		18		7.4		3		3.2		3		6.0
East North Central		31		7.7		5		3.0		3		4.5
West North Central		38		7.7		..		....		..		....
South Atlantic		33		8.3		3		6.1		3		5.9
East South Central		31		7.2		..		....		..		....
West South Central		36		6.6		..		....		..		....
Mountain		33		5.3		..		....		..		....
Pacific		30		6.3		3		3.4		4		5.4

Dashes indicate insufficient sample size.
* 1960 income category was $15,000 and over.
[1] Married and [illegible] married.
[2] 1960 data were obtained only for Census Regions.

Table III-1

EXAMPLE OF AVAILABLE DATA ILLUSTRATING THE INFLUENCE OF SOCIOECONOMIC CHARACTERISTICS

Table III-2

REGIONAL OUTDOOR RECREATION ACTIVITY PATTERNS

(Reprinted From Reference 20)

Activity	Annual (1960) Participation Rates For North Central States (1)	Annual (1960) Participation Rates Adjusted for Pottawattamie County (2)	Annual (1960) Activity Days in Pottawattamie County in 1,000's (3)	Annual Participation Rates Adjusted for Pottawattamie County & for 1985 (4)	Annual Activity Days in Pottawattamie County 1985 in 1,000's (5)
Swimming	5.34	4.06	337	7.85	779
Fishing	4.01	3.05	254	5.90	584
Water Skiing	0.27	0.21	17	0.40	40
Canoeing	0.13	0.10	8	0.19	19
Sailing	0.07	0.05	4	0.10	10
Camping	0.65	0.49	41	0.96	95
Picnicking	3.64	2.77	230	5.35	530
Sightseeing	6.64	5.05	420	9.77	969
Nature Walks	2.42	1.84	153	3.56	353
Hiking	0.36	0.27	22	0.51	50
Ice Skating	0.99	0.75	62	1.46	145
Snow Skiing	0.07	0.05	4	.10	10
Sledding	0.46	0.35	29	0.68	. 67
Hunting	1.79	1.36	113	2.64	262
Bicycling	4.98	3.78	314	7.32	725
Horseback Riding	1.08	0.82	68	1.59	158
Active Playing Games	11.68	8.87	738	17.15	1700
Boating	2.21	1.68	140	3.25	322

(1) ORRRC Study Report 19 - National Recreation Survey, Washington, D. C. 1962.
(2) Based on 1960 Pottawattamie County per capita income of $1,696 as compared to a 1960 North Central States census region per capita income of $2,228 - Population & Economic Trends & Forecasts, HNT&B, August, 1967.
(3) Based on a 1960 Pottawattamie County population of 83,102 - Population & Economic Trends & Forecasts, HNT&B, August, 1967.
(4) Based on a 1985 projected per capita income for Pottawattamie County of $3,280 - Population & Economic Trends & Forecasts, HNT&B, August, 1967.
(5) Based on a 1985 projected Pottawattamie County population of 99,169 - Population & Economic Trends & Forecasts, HNT&B, August, 1967.

to draw conclusions. For example, only observations for 1960 and 1965 are available in Table III-1, and, in addition, the numbers apply to the whole U.S. as contrasted to the Omaha-Council Bluffs SMSA. Efforts have been made at the local level to adjust participation rates in a straightforward way. Table III-2 is an example reprinted from the open space and recreation plan for Council Bluffs (Ref. 20) where an attempt is made to adjust participation (i.e., the product N·U·V) for differences in income. However, the question of validity is the same, especially because the future does not necessarily follow the past.

It can be concluded that there is presently no satisfactory way to estimate future demand without an extensive modelling effort which includes additional data collection. For example, it is not feasible to predict what percentage of blacks in the Omaha-Council Bluffs SMSA will want to recreate in the year 1990, even if it is assumed possible to project the total number of blacks for that point in the future. A practical recourse to this impasse is to use the best estimates for the entire SMSA population provided by people knowledgeable about the area, i.e., informed but subjective judgment must take the place of objective assessment. In this regard, projections provided by the Nebraska Game and Parks Commission appear to be the best ones currently available and hence these values are assumed to hold for the entire Omaha-Council Bluffs SMSA. Table III-3 indicates the values for U and V for the years 1972 and 1990.

Table III-3

PARTICIPATION IN SWIMMING, WATER SKIING, BOATING AND FISHING FOR THE STATE OF NEBRASKA (Ref. 15)

	U		V	
	1972	1990	1972	1990
1. Swimming; Outdoor Pools	36.5	41.2	15.8	15.8
Swimming; Beach	30.3	33.1	6.8	6.6
2. Water Skiing	9.8	14.6	7.2	7.7
3. Boating; Power	20.3	26.5	7.94	7.43
Boating; Other	9.4	11.2	5.38	5.23
4. Fishing; Streams	19.0	19.6	6.60	6.30
Fishing; Lakes	34.7	37.8	7.92	7.86

3. Recreation - Time Pattern

The purpose of this subsection is to determine W_j in Equation 3.2. Since the product (N·U·V) can also be interpreted as the total number of recreation days, the function of W_j is to distribute this total over the individual days in the analysis period. As previously noted, (N·U·V) can also be interpreted as the total number of people that demand recreation if each instance of participation is counted separately; consequently, W_j can be seen as distributing a total number of people demanding recreation over all days in the analysis period.

A key problem in this case is illustrated by the following example. People generally do not swim in January because the water is too cold; however, they might use a boat on a sunny January Sunday. Accordingly, for swimming days in January W_j is zero while for boating days during the same period, W_j is not necessarily zero. In addition to this problem, values for W_j are dependent on the particular characteristics of the area under investigation and vary widely for different parts of the country. It should be noted that resource planning is frequently performed to accomodate the peak demand or some fraction of it; thus for purposes of resource planning the main emphasis in estimating the distribution of W_j is on the accuracy of the peak demand forecast which means that inaccuracy in estimating "off-season" demand can be tolerated. However, accurate estimation of W_j for "off-season" periods is warranted in order to acquire insight into the time periods when existing supply is only partly used.

As indicated earlier, distribution for W_j should be estimated for different activities to account for activity differences and to reflect expected recreation behavior in the Omaha-Council Bluffs SMSA. It would be possible to make these estimates on the basis of visitation statistics applicable to recreation sites in the area; however, these statistics are not available, and an attempt is made here to synthesize demand estimates on the basis of various visitation surveys presented in the literature (e.g., Refs. 9,11,19,21,22). Table III-4 contains the results of this effort for different analysis periods: the year and the summer. Several steps are necessary to derive the statistics presented in this table: (1) distribute visitation over seasons, (2) distribute visitation months within each season and, (3) distribute visitation over days within

Table III-4

PARTICIPATION - TIME DISTRIBUTIONS FOR SWIMMING, BOATING, AND FISHING
(IN % OF TOTAL PARTICIPATION DURING ANALYSIS PERIOD)

	Analysis Period and Activity	YEAR			SUMMER		
	Time Period	Swimming	Boating	Fishing	Swimming	Boating	Fishing
Special Days	Av. Summer Weekday	0.3	0.3	0.25	0.4	0.5	0.5
	Av. Summer Saturday	2	1.5	1.25	2.5	2.5	2.5
	Av. Summer Sunday	2.1	1.6	1.35	2.7	2.7	2.7
	Av. Summer Peak day	2.1	1.6	1.35	2.7	2.7	2.7
Months	January	0	1	1	0	1.7	2
	February	0	2	1	0	3.3	2
	March	1	3	5	1.3	5.0	10
	April	2	4	8	2.5	6.7	16
	May	7	7	10	8.8	11.7	20
	June	25	18	15	31.3	30.0	30
	July	30	25	20	37.5	41.7	40
	August	25	17	15	31.3	28.3	30
	September	8	11	11	10.0	18.3	22
	October	1	7	8	1.3	11.7	16
	November	1	3	5	1.3	5.0	10
	December	0	1	1	0	1.7	2
	Summer	80	60	50	100	100	100
	Annual	100	100	100	125	167	200

each month taking into account the difference between weekdays, Saturdays and Sundays. The results presented in Table III-4 appear to be acceptable; however it will be necessary to validate these distributions by collecting actual visitation data in the Omaha-Council Bluffs SMSA. Such an effort should replace rules of thumb currently used for all visitation irrespective of the particular activity because such measures may grossly overestimate or underestimate the peak day visitation that can reasonably be expected.

4. Recreation Design Standards

The purpose of this subsection is to determine the factor Y in Equation 3.1. This factor is used to convert the recreation demand, in terms of the total number of people who demand recreation, into the minimum number of surface acres required to satisfy this demand. Y is a composite design standard to express how surface acres are expected to be used; it can be formulated in terms of a number of elementary standards which means that it is possible to formulate assumptions regarding expected use more precisely. The following form is suggested:

$$Y = \frac{\sigma_1}{\sigma_2 \sigma_3} \tag{3.3}$$

where

σ_1 = is the activity-unit density (e.g., the average number of surface acres required per boat),

σ_2 = is the standard group size (e.g., the average number of people per boat),

σ_3 = is the turnover rate (e.g., the average number of boats that can use the "same acre" during the day, or, the average number of acres demanded that can be satisfied by one "physical" acre during the day).

To illustrate the measurement units involved in Equations 3.1 and 3.2, the following quasi-dimensional equation demonstrates the application for boating. First, combining 3.1 and 3.3 yields the following:

$$D_j = X_j \frac{\sigma_1}{\sigma_2 \sigma_3} \tag{3.4}$$

In quasi-dimensional form this equation reads

$$[ACRES]/[DAY] = [PEOPLE]/[DAY] \cdot \frac{[ACRES]/[BOAT]}{[PEOPLE]/[BOAT] \cdot [ACRES]/[ACRES]} \quad (3.5)$$

Since no generally accepted standards exist for the Omaha-Council Bluffs SMSA, a literature search was undertaken to determine the values to use for swimming, water skiing,boating and fishing. Appendix B contains a summary of various standards used by different planning agencies in diverse parts of the country; as can be seen from a quick overview of Appendix B, a wide range of values is currently used. It should be recognized that without careful consideration of the standards to be used , a similar problem occurs as mentioned in the previous subsection: serious overestimation or underestimation of the acres required to support a particular recreation activity. In fact, since the accuracy of the final estimation is constrained by the variable with the most variance, all efforts to carefully estimate the number of people demanding recreation may ultimately be fruitless if the proper and equally accurate conversion is not applied. Based on review of the literature, Table III-5 indicates the recommended standards.

Table III-5

RECOMMENDED STANDARDS

	Activity Unit Density	Average Group Size	Turn Over Rate	Recreation Design Standard Y (Average Number of Acres Per Participant Per Day	Inverse Recreation Design Standard $^1/_Y$ (Average Number of Participants Per Acre Per Day)
1. Swimming	0.0034	1	3	0.0011	81
2. Boating					
Power	3	6	2	0.25	4
Other	1	4	2	0.125	8
3. Water Skiing	5	6	2	0.417	2.4
4. Fishing					
Boat	0.068	2	2	0.017	60

5. Recreation - Travel Behavior

Subsections 1 through 4 are directed towards estimating aggregate demand for swimming, water skiing, boating and fishing. The purpose of this subsection is to provide an indication of how the target population's preferences regarding the desired location can be determined, i.e., an indication of recreation opportunities should be provided in order to satisfy the aggregate demand. Normally, this locational issue is not addressed and aggregate demand for a specific target population is compared with the aggregate supply for opportunities existing in some defined area of influence for the target population. Thus, the fraction of total demand that, according to people's preferences, should be satisfied within a certain distance of their homes is difficult to determine and the answer to such problems is frequently preempted by the sites available for development. In addition, in most urban areas the recreation situation is deteriorated to such an extent that whatever sites can be made available at whatever locations will mean an improvement of the status quo.

The locational issue, however, is of considerable importance in deciding how much and what type of recreational development should take place at certain locations given that a choice exists between different locations. A case in point in the Omaha-Council Bluffs SMSA concerns the Riverfront Development Program. Alternative recreational development can be envisioned, especially in light of the planned Papio System. A proxy for people's preferences regarding the place to recreate is provided by data on travel behavior, i.e., travel behavior is an indication of how far people are willing to travel to enjoy recreation. This type of information is considered a rather poor proxy because travel behavior reflects the supply situation that people face at the time they decide to recreate. However, in the absence of any other information it provides some indications that can be used to address the locational issue.

Travel behavior has been recorded by BOR for general recreation travel as experienced in the U.S. (Ref. 13). The following three points describe the available data:

- All travel to satisfy the recreation demand is divided into four categories according to the type of trips made:
  - Vacations away from home.
  - Overnight trips.
  - Outings (defined as "occupying the better part of the day").
  - Few Available hours.

- The percentage of total demand allocated to each category is estimated for each activity. Table III-6 contains the results applicable to the summer of 1965 in the North Central Census Division.

- Data was collected for each type of trip (e.g., vacations, outings, etc.) to determine the distance from home to destination. The resulting distributions are illustrated in Figure 3.1 which indicates the percentage of trips within a certain category made within a certain distance. For example, of all outings during the summer of 1965, 55% were within 20 miles.

As noted before, the above information does not properly reveal preferences of people regarding desired recreation locations. However, it does provide some insight into how total demand can be allocated over distance zones. Additional efforts are necessary to refine such information and to make it applicable to the Omaha-Council Bluffs SMSA. The thrust of such efforts should be to determine precisely what fraction of the total demand will have to be satisfied within a defined planning area and what fraction will be satisfied outside that area.

Table III-6

RECREATION PARTICIPATION BY TYPE
OF RECREATION TRIP FOR THE SUMMER OF 1965

	Days of Participation in % of Total Participation			
	Vacation Away From Home	Overnight Trip	Outing	Few Available Hours
Swimming	10%	11%	64%	15%
Boating	14%	22%	50%	14%
Water Skiing	10%	20%	59%	11%
Fishing	12%	20%	49%	19%

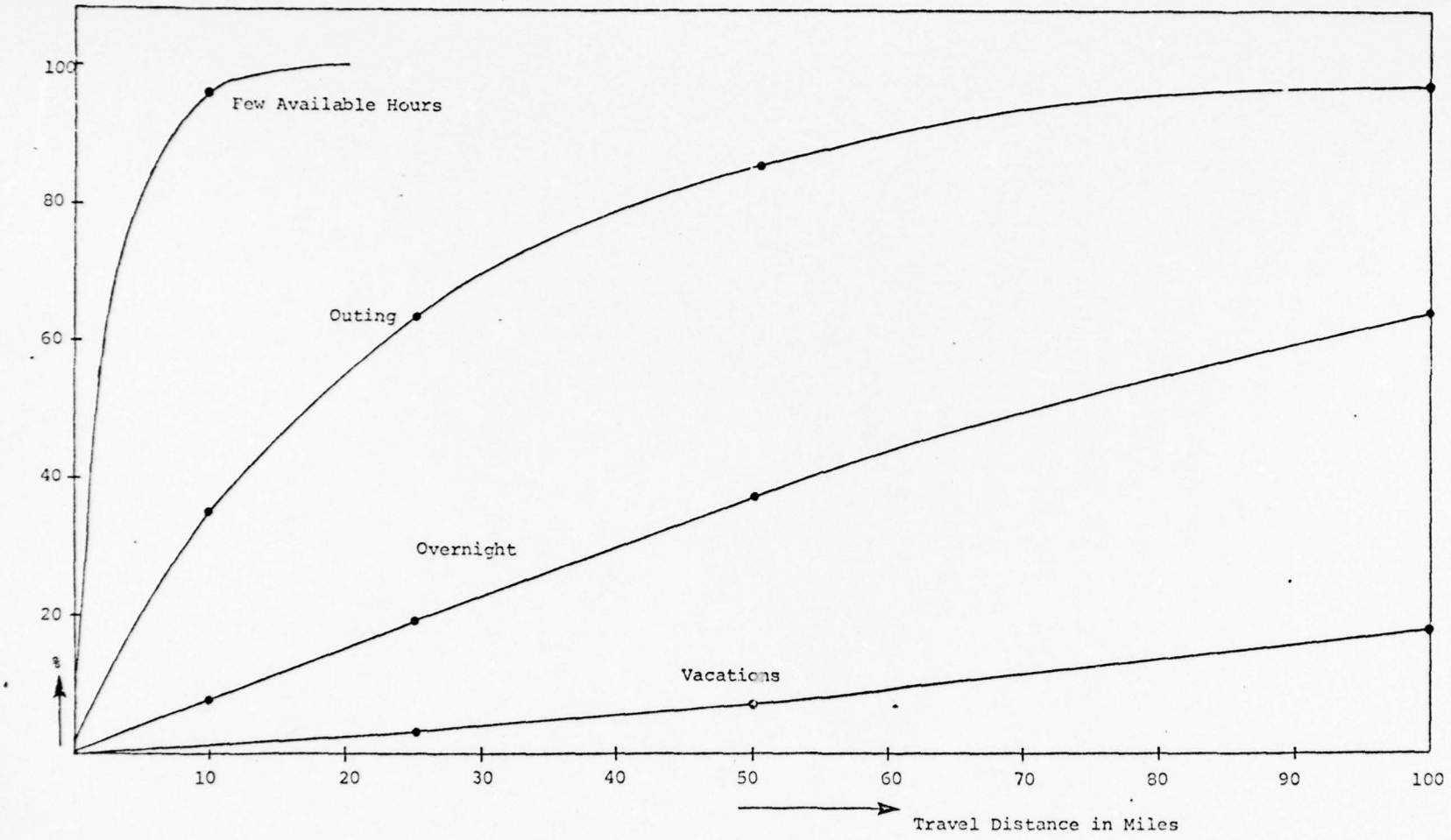


Figure 3.1 TRIP-DISTANCE DISTRIBUTIONS

6. 1970 and 1990 Recreational Demands for Swimming, Water Skiing, Boating and Fishing

The purpose of this subsection is to apply the procedure discussed in Subsection 1 with respect to estimating recreational demands emanating from the entire SMSA population. Three particular days of the year 1990 are selected when the largest demand is expected: the summer peak day or summer Sunday, the summer Saturday and the summer weekday. Table III-7 gives the results of the calculations by displaying projected aggregate participation figures and the minimum acreage required to meet the demand. In Table III-8 the aggregate power boating demand is calculated for the peak summer day in 1990 procedure in order to provide a detailed example of the demand estimation.

Since the results in Table III-7 indicate aggregate demands resulting from considering the entire SMSA population, this total demand does not necessarily have to be satisfied within close proximity of the city of Omaha. Aggregate demand for a recreation activity includes all participation, e.g., participation during vacations away from home, and so forth. The next step therefore, is to determine the fraction of demand that has to be satisfied within a chosen distance of the city.

As indicated in the previous subsection, travel data can be used as a proxy for locational preference. Under the assumptions that (1) the information provided in the previous subsection applies also to the Omaha-Council Bluffs SMSA, (2) the general travel patterns observed for the summer also apply to water ski travel for the peak day, and (3) the demand for water skiing can be thought of as being concentrated in the geographical center of the SMSA, the following calculation provides a first approximation of the fraction of demand for water skiing to be satisfied within the SMSA. The latter may be considered equivalent to determining the demand within approximately a 25-mile distance from the center of Omaha.

Based on Table III-6 and Figure 3.1, the statistics that apply to water ski demand within 25 miles of Omaha are assembled in Table III-9.

Table III-7 (a)

1972 AND 1990 PARTICIPANTS (IN 1000's) FOR SPECIFIC WATER-BASED RECREATION ACTIVITIES EMANATING FROM THE OMAHA-COUNCIL BLUFFS SMSA POPULATION

	Swimming (Outdoor Pools)		Swimming (Beach)		Water Skiing		Power Boating		Other Boating		Fishing (Streams)		Fishing (Lakes)	
	1972	1990	1972	1990	1972	1990	1972	1990	1972	1990	1972	1990	1972	1990
Summer Peak Day (Sunday)	67.8*	103.2	24.2	34.6	8.3	17.8	14.4	23.8	4.5	7.1	9.5	12.6	20.8	30.3
Summer Saturday	64.6	98.3	23.1	33.0	7.9	17.0	13.5	22.3	4.2	6.6	8.8	11.7	19.2	28.0
Summer Weekday	9.7	14.7	3.5	4.9	1.2	2.5	2.7	4.5	0.8	1.3	1.8	2.3	3.8	5.6

Table III-7 (b)

1972 AND 1990 *MINIMUM ACREAGE REQUIREMENTS FOR SPECIFIC WATER-BASED* RECREATION ACTIVITIES EMANATING FROM THE OMAHA-COUNCIL BLUFFS SMSA POPULATION

	Swimming (Outdoor Pools)		Swimming (Beach)		Water Skiing		Power Boating		Other Boating		Fishing (Streams)		Fishing (Lakes)	
	1972	1990	1972	1990	1972	1990	1972	1990	1972	1990	1972	1990	1972	1990
Summer Peak Day (Sunday)	—	—	27	38	3460	7435	3610	5948**	566	885	—	—	353	515
Summer Saturday	—	—	25	36	3295	7081	3385	5577	531	830	—	—	327	477
Summer Weekday	—	—	4	5	494	1062	677	1115	106	166	—	—	65	95

* 1972 population = 560,000; 1990 population = 755,271 (MAPA SERIES D)

** The detailed calculation for this particular demand is given in Table III-8.

Table III-8

ILLUSTRATION OF THE DEMAND ESTIMATION PROCEDURE

	Description	Result
Step 1	Determine 1990 SMSA population. From MAPA (Series D)	N = 775,271
Step 2	Determine 1990 participation rate and days per participant for power boating. From Table III-3	U = 26.5% V = 7.43 days
Step 3	Calculate total number of participation days for power boating during 1990.	N.U.V = 1,487,091
Step 4	Determine fraction of annual demand that can be expected for the summer peak day. From Table III-4	W_j = 1.6%
Step 5	Calculate number of participants on 1990 summer peak day.	$X_j = (N.U.V)W_j$ = 23793
Step 6	Determine recreation design standard Y From Table III-5	$\sigma_1 = 3$; $\sigma_2 = 6$; $\sigma_3 = 2$ $Y = \frac{3}{6.2} = 0.25$
Step 7	Determine minimum surface acres required to support summer peak day power boating demand	$D_j = S_j \cdot Y$ = 5948 acres

Table III-9

TRAVEL FOR WATER SKIING

	Water Ski Demand Allocated Over Different Type of Trips (Table III-6)	Water Ski Demand Within 25 Miles of Omaha. Per Type of Trip (Fig. 3.1)
1. Vacations Away from Home	10%	3%
2. Overnight Trips	20%	18%
3. Outings	59%	63%
4. Few Available Hours	11%	100%

The total water ski demand on the peak day to be satisfied within 25 miles is approximated as follows:

1. Vacation away from Home: (17800) . (0.10) . (0.03) = 53
2. Overnight Trips: (17800) . (0.20) . (0.18) = 641
3. Outings: (17800) . (0.59) . (0.63) = 6616
4. Few Available Hours: (17800) . (0.11) . (1.00) = 1958

Total 9268

Thus, approximately half of the total demand may have to be satisfied within the boundaries of the SMSA. It is emphasized that the above procedure is intended to provide an illustration; further research is necessary to develop a procedure for allocating demand over various distance zones.

C. Estimating Supply

The purpose of this section is to estimate the supply for swimming, boating, water skiing and fishing opportunities in the Omaha-Council Bluffs SMSA. Subsection 1 focuses on the conceptual problems in estimating supply. The practical problems encountered in evaluating the recreation potential of water resources are addressed in Subsection 2, while Subsection 3 provides an estimation of the supply of surface acres in the Omaha-Council Bluffs SMSA, based on sources available during this study.

1. Conceptual Problems

Supply estimation is used in order to make a comparison with existing and future demands. The resultant deficiencies over time constitute the requirements to which the planning process in the Urban Studies Program should be responsive. It is noted that in addition to making a statement regarding presently existing supply, it is important to carefully delineate what can be expected in the future as a result of efforts outside the recreational scope of the Urban Studies Program. Thus, it is necessary to determine the factors external to recreation planning in the Urban Studies Program that will influence the future supply situation, thereby changing deficiencies.

Recognition of the external factors is critical to planning and may make the difference between realistic and implementable plans and plans which are shelved after preparation. In order to determine these factors it is necessary to make assumptions regarding (1) other planning efforts outside the Urban Studies Program, and (2) planning efforts in other areas of the program, as illustrated by the following two examples:

- With respect to estimating the future supply of recreation opportunities in Omaha, it will be necessary to take into account the Riverfront Development Program which may add a considerable amount of recreation opportunities to the existing supply, thereby changing planning requirements for the Urban Studies Program. Thus it is necessary to assess the viability of the RDP Program and the probability of its implementation, the subject of Issue Paper No. 1 (Ref. 1). In this case definition of these factors is largely conceptual and must be resolved by making the appropriate assumptions. It is noted that assumptions can always be made, however their appropriateness may be doubtful, e.g., it could be assumed that nothing will happen without the Urban Studies Program, which is a questionable assumption.

- There are a number of planning areas within the Urban Studies Program. Therefore, in estimating the future supply for recreation opportunities, it is necessary to make assumptions regarding the supply-constraining factors that will be addressed within the context of the total program. For example, improving the water quality in lakes and streams will improve the quality of the existing supply for recreation opportunities, and surface acres currently unavailable for recreation because of degraded water quality will become available as a result of efforts in the Urban Studies Program not directly related to recreation. Or, as indicated in the previous chapter, it is possible that low flows in the area may seriously impair the opportunities for any type of water-based recreation. If in the context of a regional wastewater management system high quality of effluent is used to augment flows, it can be assumed that low flows will no longer constrain recreational use.

2. Measuring the Recreation Potential of Water Resources

Generally, measuring the recreation potential of water resources is accomplished in a two-step process. First an inventory is made of all water resources in the area. This inventory must contain information on parameters that affect recreational potential such as surface area, length of shoreline, depth, flow, water quality, access and ownership. Subsequently recreation requirements or standards are applied to the inventory in order to determine the usable supply provided by the various water resources. These requirements are essentially threshold standards for depth, flow, access, water quality, and so forth, which are applied to determine whether, in fact, the resources can be used given the water's characteristics and the requirements of various activities.

With respect to the first step there are currently serious practical problems that make it close to impossible to present more than a mere listing of water resources. These stem from lack of the appropriate data as can be inferred from the following problem summary:

- Some parameters associated with water resources, such as depth and flow, must be measured for various points in time in order to determine recreation potential throughout the year. Data on surface area, length of shoreline, average depth and ownership does exist, but it is either aggregated at too comprehensive a level (Ref. 9) or given by individual lake or river, as provided by the Geological Survey. A great deal of work will be required to put this data into a format useful for recreation planning. In addition, the basic measure of recreational water quality is the coliform concentration; data on this is very spotty and there are problems associated with using a point estimate to evaluate the potential of a body of water, especially a stream or river.

With respect to the second procedural step for measuring recreation potential, a different set of problems exist, related to the fact that no generally accepted criteria exist to resolve whether or not a water body can be considered suitable for recreational use. For example, Reference 23, entirely devoted to an investigation of recreational water quality, comes to the following conclusions:

"5. Most State standards have no specific experimental foundation for their requirements. Most refer to other standards, to the experience of others, or to one or two classical publications in the literature.

6. Contrary to several published views, Salmonella typhosa is not a significantly more infective pathogen than are the other Salmonella species.

7. The total coliform or fecal coliform concentration in a water must be exceptionally high ($\approx 8X10^5$ MPN/100 ml. water) before a significant level of risk, (1 case/10^5) is faced by a recreationist.

8. In a given polluted water, the virus-coliform ratio, rather than the Salmonella coliform ratio, will probably be the determining parameter in the setting of coliform standards.

9. In general, pesticides cannot be considered significant recreational water hazards. In most cases, and especially for the chlorinated hydrocarbons, the concentrations constituting risks are far in excess of water solubility."

Furthermore, in the recommendations the report mentions:

"Very little is known about the Salmonella and total coliform or fecal coliform ratios in polluted water. Studies to determine the relative distributions of these organisms in different types of waters are recommended."

The above paragraphs show that measuring the recreation potential of water resources is surrounded by nontrivial problems which will require a considerable amount of time and funds if they are to be resolved. However, it should be realized that unless the attempt is made to provide a relatively accurate evaluation of recreation potential associated with water resources, planning tends to become superficial and to lose touch with reality. Thus, there must be some type of assessment which, short of all necessary data, should provide a reasonable representation of the supply of water-based recreation opportunities.

3. Estimating Supply in the Omaha-Council Bluffs SMSA.

The purpose of this subsection is to estimate the supply of opportunities for swimming, boating and fishing in close proximity of Omaha, i.e., within Douglas, Sarpy and Pottawatamie counties, the area covered by the SMSA. References 6, 9, 17, 20, 24 and 25 are data sources which were available during this study. It is noted that no further data collection was undertaken since, based on conversations with Corps personnel, the above references contain what is presently documented regarding the supply in the SMSA.

a. Surface Acres

Table III-10 summarizes the available data concerned with areas suitable for swimming, boating and fishing in the SMSA. Based on the table, a first estimate is made of a number of effective acres that can be allocated to various activities. Table III-11 presents the results for those areas where nominal acreage is known. It is noted that this table is to be augmented by the capacity provided by river access areas, which will require evaluation of the individual areas in terms of facilities provided to engage in individual activities.

In order to determine an estimate of the effective surface acres in Table III-11, the following procedure is followed:

- Water quality improvement is one area of the Urban Studies Program, thus the problem of existing degraded water quality is assumed to be resolved.
- Total effective surface acres are determined on the basis of interviews with Corps personnel.
- It is assumed that total effective capacity can be allocated to various activities as if parts of the lakes are zoned for a particular use.
- Assessment of the effective capacity for swimming is based on consideration of the shoreline of the various areas involved.
- Approximately 60 percent of the remaining area for the lakes is assumed to be used for power boating and/or water skiing except for Carter Lake.
- The remaining effective capacity is approximately distributed over the categories "Other Boating" and "Fishing" in a proportion of 3 to 1. Adjustments are made in cases where the physical characteristics of the area indicated otherwise.

It should be recognized that the above procedure has been applied, virtually, in the absence of actual data. Consequently, the nature of the estimates is preliminary and a subsequent effort must be undertaken to verify or alter the results presented.

b. Fisheries

Reference 9 contains a description of the fishing supply for Nebraska. The inventory is made at too aggregate a level to determine the supply within

Table III-10

EXISTING OPPORTUNITIES FOR SWIMMING, BOATING AND FISHING
IN THE OMAHA-COUNCIL BLUFFS SMSA

County	Area Type	Name	Water Surface Acres	Current Use		
				Swimming	Boating	Fishing
Douglas	1. Lake	Two Rivers	320	X	X	X
		Levi Carter	281			
	2. River Access	N.P. Dodge	---		X	X
	3. Urban Park	Benson Lagoon	2			X
	" "	Fontenelle Lagoon	3			X
	" "	Hanscom Lagoon	2			X
	" "	Hitchcock Lagoon	?			X
	" "	Miller Lagoon	2			X
	" "	Towl Park Lagoon	?			X
Pottawattamie	1. Lake	De Soto National Wildlife Refuge	800	X	X	X
	"	Lake Manawa	660	X	X	X
	"	Arrowhead	16			X
	2. River Access	Gifford Sanctuary	---			
	" "	Wilson Island	10	X	X	X
	" "	Botna Bend	---			X
	" "	Old Towne Park	---			X
	" "	Gifford Site 18	---			
	" "	Long's Landing	---	?	?	?
	3. Urban Park	Lakeview Lagoon	?			X
Sarpy/Cass	1. Lake	Louisville	50	X	X	X
Sarpy	3. Urban Park	Haworth	?	?	?	?

Table III-11

PRELIMINARY ESTIMATE OF EXISTING EFFECTIVE SURFACE ACRES
FOR FISHING, SWIMMING AND BOATING IN THE OMAHA-COUNCIL BLUFFS SMSA.*

	Nominal Water Surface Acres	Effective Capacity	Effective Capacity for Swimming	Effective Capacity for Power Boating and Water Skiing	Effective Capacity for Other Boating	Effective Capacity for Fishing	Distance in miles from Omaha-Missouri River Bridge
1. Two Rivers	320	200	10	---	140	50	25
2. Levi Carter	281	260	--	220	30	10	4
3. Benson Lagoon	2	1	--	---	---	1	7
4. Fontenelle Lagoon	3	2	--	---	---	2	6
5. Hanscom Lagoon	2	1	--	---	---	1	3
6. Miller Lagoon	2	1	--	---	---	1	5
7. De Soto	800	720	10	520	140	50	24
8. Lake Manawa	660	600	7	333	200	60	7
9. Arrowhead	16	10	--	---	7	3	28
10. Wilson Island	10	8	1	---	5	2	25
11. Louisville	50	20	2	---	14	4	23
Total	2146	1823	30	1073	536	184	

* Note: River Access Areas are excluded and water quality is assumed adequate to support the activities.

the SMSA; however, the description is illustrative of the difficulties involved in evaluating the effective capacity for fishing. It is included verbatim as Appendix C in this report in order to indicate the type of considerations that should be included when estimating the supply for fishing. In particular, streams and standing waters are classified for fishing on the basis of conditions concerning aesthetic use, availability and productivity. On the basis of these factors, streams and lakes are placed in classes and assigned appropriate capacities in angler trips. For the Omaha SEA, illustrated in Figure 2.3, the total annual capacity of all fishing resources is estimated at 104,985 fisherman trips. It is noted in considering this number that the Omaha SEA consists of 7 counties while the Omaha SMSA consists of 3 counties; accordingly, the capacity of fishery resources in the SMSA is considerably smaller. Finally, with respect to future capacity, the report indicates:

> "Capacity of streams and natural lakes cannot be expected to increase appreciably in the future. It is apparent that the only substantial potential for significant increased fishing capacity lies in future construction of reservoirs and farm ponds."

D. Conclusion

This chapter presents demand and supply estimation procedures as well as projections for the demand and supply of swimming, water skiing, boating and fishing opportunities for the Omaha-Council Bluffs SMSA population. Emphasis is placed on the identification of problems associated with determining useful and accurate projections in order to lay the groundwork for more refined analyses in subsequent phases of the Urban Studies Program. Demand and supply calculations are needed in order to identify deficiencies and to plan for their resolution. Therefore, based on the results of this chapter, the following chapter focuses on such deficiencies and, in particular, on the role that the Papio System can have in meeting the recreational needs of the areas.

Chapter IV

THE PAPIO SYSTEM AS AN ALTERNATIVE TO MEET RECREATIONAL DEFICIENCIES: CONCLUSIONS AND RECOMMENDATIONS

A. Introduction

The purpose of this chapter is threefold: (1) to analyze the results of Chapter III with respect to deficiencies in opportunities for swimming, water skiing, boating and fishing within the Omaha-Council Bluffs SMSA; (2) to consider the Papio System as an alternative to meet these deficiencies; and (3) to present conclusions and recommendations based on the research performed with respect to subsequent phases of the Urban Studies Program.

Section B deals with the analysis of deficiencies and establishes planning requirements for water-based recreation planning in the Omaha-Council Bluffs SMSA. Section C discusses planning for the Papio System from a systems point of view, i.e., rather than considering each lake separately, recreation planning should consider the combination of lakes. Finally, Section D is devoted to conclusions and recommendations.

B. Deficiencies and Planning Requirements

1. Deficiencies in Supply

The purpose of this subsection is to determine deficiencies in the existing supply of opportunities for swimming, water skiing, boating and fishing within the metropolitan area. Thus, where Chapter III discusses demand and supply separately, here the two are tied together. A deficiency is defined as the difference between the number of surface acres required to satisfy demand for recreation within the geographical area covering the SMSA and the supply provided in the same area.

In order to approximate the fraction of total demand to be satisfied within the SMSA, a procedure is followed which is similar to the one described in Chapter III, Section B.5. Thus, based on travel behavior, it is estimated that a certain percentage of total demand will be satisfied outside the metropolitan area and does not need to be considered in determining

deficiencies; Table IV-1 indicates this percentage based on the data of Chapter III, Section B.4.

Table IV-1

PERCENTAGE OF PARTICIPATION OUTSIDE A 25-MILE ZONE AROUND THE CITY OF OMAHA	
Swimming	42%
Boating	45%
Water Skiing	46%
Fishing	47%

As noted in the previous chapter, there are a number of critical assumptions associated with these estimates. In the following it is assumed that if sufficient supply can be provided these assumptions hold, and that approximately 55% of the total SMSA demand for various activities can be expected to fall within a 25-mile zone around the city of Omaha. (It is noted that this percentage is an assumption which must be verified.)

Table IV-2 combines the results of the demand and supply analysis presented in Chapter III. From this table it can be concluded that while for each activity there is not an excessive amount of opportunities available, the situation is worse for water skiing, power boating and fishing, i.e., the supply for these activities does not meet the minimum acreage requirements to satisfy peak day demands. Minimum requirements are established by considering how surface acres can best be used, based on agreed-upon design standards; thus not meeting requirements can lead to overcrowding of recreation areas or to unrealized demand. On the other hand, a supply in excess of the minimum requirements will improve the quality of the recreational experience. Deficiencies are estimated in the last row of Table IV-2 - 4000 acres for water skiing and power boating and 300 acres for fishing - in order to indicate the order of magnitude of the deficiency rather than the absolute quantity. The latter is presently not warranted given existing uncertainties in the estimates for demand and supply. No deficiencies are

Table IV-2

DEFICIENCIES IN SURFACE ACRES WITHIN THE SMSA
FOR 1972 BY ACTIVITY

	Swimming (Beach)*	Water Skiing	Power Boating	Other Boating	Fishing (Lakes)
Minimum Requirements for Surface Acres to be satisfied within the SMSA, i.e., 55% of total peak day requirements. (See Table III-7)	15 (21)	1903 (4089)	1986 (3271)	311 (487)	194 (484)
Acres Provided in 1972 Within the SMSA, Note: River Access Areas not included. (See Table III-10)	30	1073		536	184
Deficiencies (see text)	---	Approximately 4000 Acres		---	Approximately 300 Acres

*1990 projections are indicated in parentheses.

indicated for swimming and other boating because the existing supply exceeds the minimum requirements. However, as can be seen from Table III-11, most of the existing supply for these activities is on the boundary of the SMSA, and these opportunities are barely sufficient for the peak day demands. Consequently, it can be concluded that in addition to providing surface areas for water skiing, power boating and fishing, planning should be directed towards providing opportunities for swimming and other boating closer to the city of Omaha.

The deficiencies presented in Table IV-2 differ substantially from those included in the Recreation Resources Appendix for Site 20 of the Papio System (Ref 6.), e.g., Section 4.3 of the report states:

> "As discussed in the Nebraska State Plan, lands and facilities will be needed and should be provided in relation to the people, preferably within 1 to 1.5 hours driving time from larger population centers. Table 12 presents the need, in acres, to provide for the listed activities for years 1972, 1980,,and 2000 in the Omaha socioeconomic area.

Table 12

*ACRES OF DEFICIENCY BY ACTIVITY

Activity	1972	1980	2000
Picnicking	1,275**	1,736**	3,672**
Camping	980**	1,442**	3,518**
Boating	30,627	42,048	93,768
Water Skiing	20,784	31,704	83,544
Swimming	18	29	79
Fishing	70,258	87,046	149,185
Ice Skating	145	184	340
**Total Land Acres	22,550	31,780	71,900
Total Water Acres	121,832	161,011	326,916
Total Acres	144,382	192,791	396,816

*Outdoor Recreation for Nebraska - Volume I

Although the Omaha SEA considered in the above calculation is larger then the SMSA (see Figure 2.3), this does not explain why deficiencies for fishing,

boating and water skiing are orders of magnitude larger then those contained in Table IV-2. It is noted that discrepancies this great are of considerable importance, especially in light of the magnitude of the existing supply, because in planning for the sizable deficiences recorded above, it would be necessary to attach a very high priority to developing large water areas.

There are two possible explanations for these differences: (1) the number of participation days estimated in Chapter III is smaller by far than the demand estimates used for calculating the above deficiencies, thereby leading to the smaller deficiencies in Table IV-2, or (2) the design standards used to calculate the deficiencies in Table IV-2 are "tighter" than those used by the Corps. (It is noted that a difference in estimation of existing supply is ruled out because even if the existing supply is set at zero, a major discrepency still exists.) The respective annual demand calculations are compared in Table IV-3 in order to determine which possibility is more likely. On the left of the table, annual participation estimates leading to the above-quoted deficiencies are given; on the right, annual participation estimates leading to the results in Table IV-2 are presented. This table indicates that the difference in estimating annual participation does not explain the difference in deficiencies. Consider, for example, fishing:

> On the left side, the table indicates that for 1972, 1,861,444 annual fisherman days are estimated, which according to Reference 6 requires an additional 70,258 acres. On the right side, the results of Chapter III indicate that for approximately the same sized target population, in the same year, there is only a slightly higher number of annual fisherman days estimated, i.e., 2,241,254. Furthermore, the additional number of acres required to satisfy 55% of the demand for lake fishing, i.e., 846,457 annual fisherman days, is estimated by Table IV-2 as 300 acres.

Therefore, under the assumption that the ratio between peak demand and annual demand is the same in both calculations, it can be inferred that the difference between the deficiencies listed in Reference 6 and those calculated in Table IV-2 stems primarily from a significant difference in design standards. In order to resolve this discrepancy, further investigation of the design standards used in Reference 6 is required.

Table IV-3

EXPECTED NUMBER OF ANNUAL PARTICIPATION DAYS AS GIVEN BY THE OMAHA DISTRICT AND THOSE BASED ON THE PROCEDURE IN CHAPTER III.

Estimates included in the Papio-Site 20 Recreation Appendix, (Ref. 6). Target population includes population in Burt, Washington, Dodge, Douglas Sarpy, Cass and Saunders Counties. The 1970 target population totalled: 548088.

	1972	1980	2000
Swimming	2,541,243	4,829,199	10,540,815
Outdoor Pools	---	---	---
Beach	---	---	---
Water Skiing	636,422	942,173	2,385,296
Boating	1,554,610	2,099,689	4,568,189
Power	---	---	---
Other	---	---	---
Fishing	1,861,444	2,281,127	3,834,620
Streams	---	---	---
Lakes	---	---	---

Estimates based on data provided in Chapter III. Target population includes population in Douglas, Sarpy and Pottawattamie Counties. The 1970 target population totalled: 542646.

	1972	1990
Swimming	---	---
Outdoor Pools	3,229,520	4,916,512
Beach	1,153,824	1,649,965
Water Skiing	395,136	849,076
Boating	---	---
Power	902,619	1,487,090
Other	283,203	442,408
Fishing	---	---
Streams	702,240	932,609
Lakes	1,539,014	2,243,970

2. Planning Requirements for Water-Based Recreation

Based on the results presented in Table IV-2, the purpose of this subsection is to formulate the minimum planning requirements for water-based recreation in the Urban Studies Program as follows:

- The highest priority should be given to surface acres for water skiing and power boating. An attempt should be made to add at least 4000 surface acres within the Metropolitan area to the existing supply for these activities.

- The supply for fishing opportunities should be increased by at least 300 surface acres. Since surface acres alone do not provide fisheries, special efforts should be devoted towards improvement and establishment of effective and intensive fishery management.

- Although existing water areas within the SMSA provide the minimum requirements for swimming and other boating, special efforts should be made to provide an additional supply for these activities in closer proximity of the city of Omaha. For example, an acceptable target is to provide an additional 30 and 500 acres respectively of swimming and boating water within a distance of 15 miles of the Missouri River Bridge.

It is noted that in establishing these planning requirements, current constraints on the physical recreation system are assumed to be resolved. Furthermore, the above planning requirements are tentative in the sense that further analysis of demand and supply is warranted in order to refine the estimated deficiencies. However, it is emphasized that accurate quantitative assessment of planning requirements is vital in order to arrive at a responsive and implementable recreation plan within the context of the Urban Studies Program.

C. The Papio System

The purpose of this section is to consider the role of the Papio System in meeting the planning requirements established in the previous section for water-based recreation in the Omaha-Council Bluffs SMSA.

1. Description of the Papio System

Figure 4.1 indicates the location of the twenty planned reservoirs that make up the Papio System; Table IV-4 contains some of the project statistics. The main purpose of the system is to protect against runoff from high-intensity

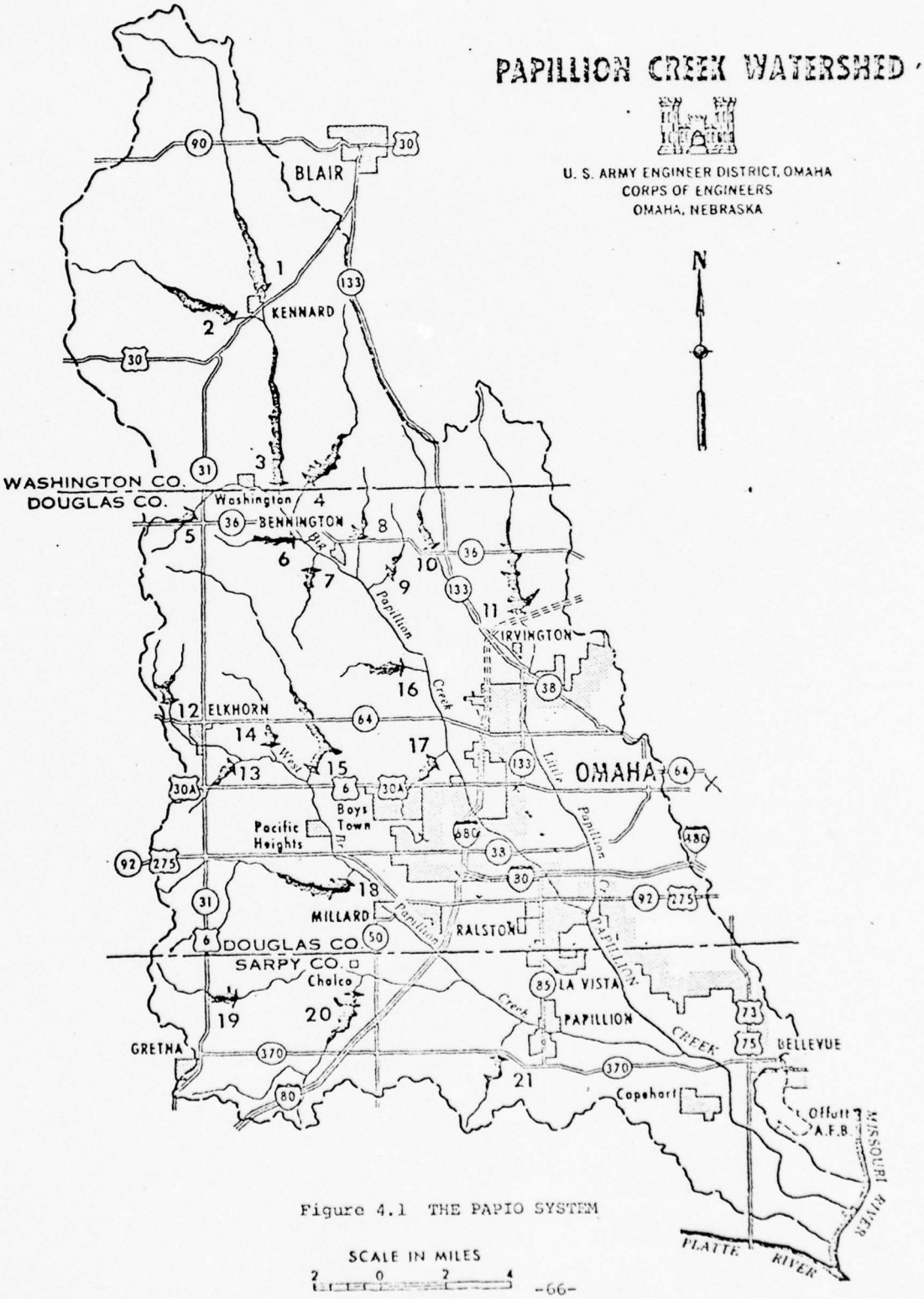


Figure 4.1 THE PAPIO SYSTEM

Table IV-4

THE PAPIO SYSTEM
(Ref. 26)

Site No.	Acerage Land	Acerage Water	Construction as per Aug. 71 Order	Construction as per Aug. 71 Finished	Recreation Operated by City, State	Annual Cost as per June 71	Annual Benefits	Allocated Total Annual Costs F.C.	Allocated Total Annual Costs Rec.	Allocated Total Annual Costs W.Q.	B/C Ratios F.C.	B/C Ratios Rec.	B/C Ratios Total
1	1,827	600	7	Fall 75	X	220,800	585,200	78,000	129,500	1,000	5.6	1.2	2.6
2	1,691	475	10	Fall 76	X	202,900	455,700	69,800	120,700	700	4.5	1.2	2.2
3	2,535	650	12	Fall 77	X	244,500	510,700	75,300	151,400	1,300	4.4	1.2	2.1
4	929	215	15	Fall 78	X	123,700	455,100	50,000	67,900	----	7.6	1.1	3.7
5	393	95	17	Fall 79	X	58,400	167,300	35,600	20,100	----	4.1	1.0	2.9
6	363	60	18	Fall 79	X	65,300	197,700	37,300	25,500	----	4.6	1.0	3.0
7	331	40	19	Fall 80	X	62,000	142,800	45,700	14,300	----	2.8	1.0	2.3
8	312	40	16	Fall 79	X	70,200	210,500	46,000	23,000	----	4.2	1.0	3.0
9	264	45	20	Fall 80	X	51,900	142,800	32,000	17,800	----	3.9	1.0	2.7
10	510	120	2	Dec. 73	X	87,400	730,500	41,800	41,400	800	16.4	1.1	8.4
11	1,570	300	3	Fall 74	X	402,000	1,642,600	148,400	241,500	2,000	8.9	1.3	4.1
12	355	65	4	Fall 74	X	60,700	335,500	31,800	26,500	----	9.7	1.0	5.5
13	296	60	11	Fall 76	X	71,700	320,100	32,600	36,800	----	8.6	1.1	4.5
14	364	70	9	Fall 76	X	91,600	304,800	42,400	46,600	----	6.0	1.1	3.3
15	1,310	260	6	Spr. 75	X	266,000	747,100	102,500	153,500	1,000	5.3	1.3	2.8
16	685	135	1	Fall 72	X	163,100	284,000	56,600	102,900	----	2.8	1.2	1.7
18	1,420	230	8	Sum. 76	X	297,600	848,100	109,500	178,900	900	5.3	1.5	2.8
19	510	115	13	Fall 77	X	99,100	166,800	53,000	42,500	----	2.3	1.1	1.7
20	1,233	245	5	Dec. 74	X	319,500	589,800	109,800	200,100	900	3.2	1.2	1.8
21	381	80	14	Fall 78	X	87,200	190,500	42,400	42,100	----	3.4	1.1	2.2
Total	17,281					3,045,600	9,027,600	1,239,500	1,683,000	7,600			

thunderstorm rainfall commonly called flash flood. Flooding in the Papillion Creek Basin historically occured during the summer months with floods of short duration: in these cases overbank flows lasted 12 hours or less. Current design has allocated storage volumes to protect against the Standard Project Flood and to collect runoff sediment over the life of the project. Although no storage has been allocated to recreation per se, the location of the reservoirs within the SMSA has made them particularly suitable for recreational purposes. Therefore, from the very beginning of the project, special consideration has been given to the potential recreational development at each reservoir site. For example, Appendix V of the first project report mentions that four levels of recreational development were considered. Based on a benefit-cost analysis, the following recreational development was proposed (Ref. 24):

> "The usage of the Papillion Creek project reservoir sites was predicated upon installation of sufficient facilities to maximize the excess benefits over costs. In order to provide well-balanced opportunities for water-based recreation, and recognizing that the smaller reservoirs are not adaptable to high-powered boating and water skiing, it was assumed that different reservoirs would be developed for different usages. It was assumed that: (1) the County Line (Site 5), East Kennard (Site 1), and Irvington Reservoirs (Site 11) would be developed to include all recreational purposes, (2) the West Dodge (Site 15), and Millard (Site 18) Reservoirs would be developed for all purposes except high-powered boating and water skiing, (3) the Chalco (Site 20), Washington (Site 4) and West Kennard Reservoirs (Site 2) would be developed for all purposes except high-powered boating, water skiing, and swimming, and (4) the remaining reservoirs would be developed for fishing, hunting, picnicking, and miscellaneous activities such as primitive camping and nature study."

2. Recreation Planning for the Papio System

The Urban Studies Program has noted the interest in the plans for the Papio System. Since almost all reservoirs in the system are still in the planning and review stage, modifications of the plan are called for if they can contribute to alleviation of the needs of the area addressed by the Urban Studies Program. Thus, the Papio System provides a possible medium though which the general objective of the program, as stated in the introduction to Chapter 2, can be achieved. The following focuses on the system's potential to affect the recreation need categories delineated in Chapter

while at the same time satisfying the water-based recreation planning requirements formulated in the previous section. That is, the following examines not only the satisfaction of planning requirements, but also the system's potential to provide open space, environmental areas, etc., and, if properly planned, to provide opportunities for passive recreation. The latter can become a reality if planning considers the system in its entirety and design is directed towards development of, for example, environmental corridors in line with the concepts developed by MAPA. To realize this potential it is important then to focus upon the relationships between reservoirs, as contrasted to isolated development of individual reservoirs, in the plan for the entire system.

A useful concept in considering plans for physical systems that are responsive to preestablished planning requirements is to specify the system's subcomponents and their characteristics, in accordance with the type of requirements to be met. With respect to the Papio System, it is necessary to identify the subsystems or recreational-type areas within the total system, which are desirable in order to be responsive to the need categories and requirements formulated earlier. Subsequently, these subsystems should be rearranged within the total system in order to fulfill the requirements in varying degrees. For example, subcomponents in the Papio System can be specified as environmental areas, fishing areas, and so forth. The choice of which reservoirs in the total system are to be assigned to each category determines how well various needs and requirements are met.

Identification and specification of subcomponents, or recreation areas in the sense referred to above, is to a large extent subjective, and requires the planner's judgment. In the following, a possible set of subcomponents are formulated and recreation planning of the Papio System is cast in terms of synthesizing the entire plan on the basis of determining the combination of recreation areas that will come closest to meeting the recreation requirements. Since the emphasis in this report is on water-based recreation, the central element in each subcomponent is the surface acreage of the planned reservoirs.

- Type A Recreation Area. The purpose of this subcomponent is to meet the requirement for environmental areas either to provide open space per se, or to provide opportunities for nature study and passive

recreational pursuits. Areas of this type may consist of one or more reservoirs. In the latter case, the combination of reservoirs is the subcomponent; emphasis is on the use of land between reservoirs in order to provide the characteristics defined for this type of recreation area, e.g., reservoirs in a Type A recreation area may be linked together by trails for bicycling, hiking, and so forth. In order to further characterize Type A areas, water surface acreage of the lake(s) within the area is zoned so as to enhance the purpose of this particular subcomponent of the total recreation system. A possible zoning rule is to allocate surface acres as follows: 75 percent is used as an environmental area, i.e., kept in its "natural" state; 7.5 percent is used for fishing; 7.5 percent is used for other boating, i.e., non-power boating; 10 percent is unused capacity. It is noted that swimming, water skiing and power boating are not allowed and shoreline development is restricted.

- Type B Recreation Area. The purpose of this subcomponent is to meet the stringent requirements for power boating and water skiing in the SMSA; i.e., this recreation area is characterized by the requirements that these activities impose on the use of resources. Generally, a Type B recreation area consists of an individual reservoir and the surrounding land both of which must be large enough to warrant economically justifiable recreation development for power boating and water skiing. It is emphasized that since Type B recreation areas are especially planned to be used for these two activities, the associated land development is directed towards realizing the maximum use that can be made of the reservoir surface acres. Thus, rather than having the associated land development determine how the reservoir will be used, the available surface acres and zoning of the lake determine the type and amount of development. A possible zoning rule to enhance the purpose of this subcomponent is to allocate surface acres as follows: 74 percent is used exclusively for power boating and water skiing; 1 percent along the shoreline and of a certain width is used for swimming; 5 percent is used for fishing; 9 percent is used for other boating; 10 percent is unused capacity.

- Type C Recreation Area. The purpose of this subcomponent is to meet the requirements for fishing in the SMSA. The major emphasis in this type of recreation area is on effective resource management to produce the most efficient and productive fisheries. Thus, special efforts are undertaken to stock reservoirs with desired types of game fish and to carefully monitor and control their living conditions. Use of the reservoirs in this sense determines the type and extent of the associated land development just as with Type B areas. A possible zoning rule to enhance the purpose of this subcomponent is to allocate surface acres as follows: 75 percent is used exclusively for fishing; 14 percent is used for the other boating, i.e., primarily fishing boats; 1 percent is used for swimming; 10 percent is unused capacity. The size of reservoirs needed in this category is determined by the size considered optimal for efficient fishery

management. Generally, smaller lakes may be considered advantageous over the large lakes in terms of fishing capacity per acre of surface water.

The above specification of recreation areas is used to consider how the Papio System can be planned in order to fulfill the requirements for water-based recreation and open space. The planning problem is to determine those reservoirs or combinations of reservoirs which should be designated as Types A, B or C, i.e., to determine possible arrangements of subcomponents within the Papio System. An example of a possible arrangement is illustrated in Table IV-5 where the lakes with a nominal acreage larger than 200 acres are designated as Type B areas; the combinations formed by Sites 7, 8, 9 and 10 and by Sites 12, 13, and 14 respectively are designated as Type A areas; the remaining sites are designated as Type C recreation areas. Table IV-5 indicates the total amount of effective surface acres which are added to the supply for various activities by arranging the subcomponents as in the above example. With this arrangement, the Papio system doubles the existing supply for swimming, meets the minimum requirements for fishing, but fails to meet the minimum requirements for power boating and water skiing. Therefore, additional efforts should be undertaken to consider other alternatives to meet deficiencies in these categories.

Although the plan presented in Table IV-5 is considered a valuable first step towards recreation planning of the Papio System, many practical matters that should be considered in deriving an implementable plan have not been taken into account. For example, the physical characteristics of particular sites may be such that the development associated with its designation as a particular type recreation area cannot be realized. However, the planning approach underlying the example of Table IV-5 is of considerable importance, i.e., (1) area requirements for water-based recreation and open space are determined; (2) the type of subcomponents necessary to meet these requirements are carefully defined; and, (3) subcomponents are arranged so as to optimally meet the requirements. When this type of planning is performed, recreation development at individual reservoirs is determined by the specified characteristics and zoning rules of the recreation area which the reservoir is a part of. In this manner, planning and design of recreation facilities at

Table IV-5

EXAMPLE OF ALLOCATING EFFECTIVE SURFACE ACRES
FOR SWIMMING, BOATING AND FISHING SUPPLIED BY THE PAPIO SYSTEM

County	Site No.	Type of Rec. Area	Nominal Acerage	Unused Capacity	Env. Area	Total Effective Surface Acres	Effective Capacity for Swimming	Effective Capacity for Power Boating & Water Skiing	Effective Capacity for Other Boating	Effective Capacity for Fishing	Distance in Miles from Mo. River Bridge
Washington	1	B	600	60	--	540	6	450	54	30	30
	2	B	475	47	--	428	5	356	43	24	30
	3	B	650	65	--	585	6	488	58	33	21
	4	C	215	21	--	194	2	---	31	161	21
Douglas	5	C	85	8	--	77	1	---	12	64	22
	6	C	60	6	--	54	1	---	8	45	18
	7	A	40	4	30	6	-	---	3	3	18
	8	A	40	4	30	6	-	---	3	3	17
	9	A	45	4	35	6	-	---	3	3	16
	10	A	120	12	90	18	-	---	9	9	15
	11	B	390	39	--	351	3	293	35	20	11
	12	A	65	6	49	10	-	---	5	5	20
	13	A	60	6	45	9	-	---	5	4	17
	14	A	70	7	53	10	-	---	5	5	16
	15	B	260	26	--	234	2	195	24	13	16
	16	C	135	13	--	122	1	---	20	101	13
	18	B	230	23	--	207	2	173	20	12	14
Sarpy	19	C	115	11	--	104	1	---	17	86	22
	20	B	245	24	--	221	2	184	23	12	17
	21	C	80	8	--	72	1	---	11	60	16
Total			3,980	394	332	3,254	33	2,139	309	693	

individual reservoirs can be better integrated with the overall requirements for water-based recreation and open space prevailing the the SMSA.

D. Conclusions and Recommendations

The following conclusions are based on the research presented in this report:

- Recreation and Open Space problems in the Omaha-Council Bluffs SMSA can be categorized into five need categories: (1) the need for preserving land and water areas devoted to recreational use and open space; (2) the need for provision of opportunities for passive recreational pursuits; (3) the need for provision of opportunities to engage in water-based recreation activities in close proximity to the city of Omaha; (4) the need for improved facilities for land-based recreation, characterized by the large investments required for their realization; (5) the need for improvement of the existing recreation system in terms of the quality and quantity of the opportunities provided.

- Within the context of the Urban Studies Program, contributions to the above need categories relate to achievements in the area of water-based recreation as well as to multiplier effects resulting from resolving urban problems other than those specifically related to recreation and open space. Ongoing, and primarily local, recreational planning efforts form an import vehicle to identify the type of multiplier effects that are desirable.

- Detailed analysis of demand for and supply of water-based recreation in the Omaha-Council Bluffs SMSA is seriously impaired by lack of sufficient data. However, as illustrated in Chapter III, practical procedures can be developed that will allow an approximation of the order of magnitude of demand and supply. Subsequently, when an estimation of deficiencies is made, priorities can be established as to the direction that planning efforts should take for water-based activities.

- Calculation of the deficiencies for swimming, water skiing, power boating and fishing indicates that within the geographical area covered by the SMSA, an additional 4000 surface acres are required for water skiing and power boating, an additional 300 surface acres are required for fishing, and efforts should be undertaken to plan for an additional supply for lake swimming in close proximity of the city of Omaha.

- Planning to meet water-based recreation requirements can be structured by specifying types of recreation areas concommittant with the requirements to be met. Using this identification of standard recreation areas, or subcomponents, of the entire recreation system,

planning proceeds by arranging these subcomponents to make up the overall physical recreation system.

- The Papio System is an important alternative in the Urban Studies Program to meet water-based recreation requirements. In order to realize its potential, three types of standard recreation areas are defined which reflect high priority requirements: Type A, directed primarily at environmental enhancement; Type B, directed primarily at provision of opportunities for power boating and water skiing; Type C, directed primarily at enhancement of fishing opportunities.

- Based on the above planning procedure, the plan presented as an example in the previous section indicates that the minimum area requirements for swimming, fishing and other boating opportunities can be met. However, to satisfy the minimum requirements for power boating and water skiing it will be necessary to consider additional water-based recreation areas within the Omaha-Council Bluffs SMSA.

Based on the above conclusions, the following recommendations are made:

- An effort should be made to structure a feasible approach towards assessment of recreation preferences emanating from the Omaha-Council Bluffs SMSA population. It is recommended that this effort be integrated with the public involvement phase of the Urban Studies Program in order to circumvent the costly independent-survey approach. Assessment of preferences should be directed towards answering the questions formulated in Chapter II, so that a refined demand analysis is possible.

- It is recommended that a special effort be undertaken to evaluate the recreation potential of streams and rivers in the Omaha-Council Bluffs SMSA. Of particular importance is the determination of recreation capacities for water-based activities associated with river-access areas. Key characteristics to be considered in this evaluation are listed in Chapter III, Section C.

- As indicated in this report, a critical problem in recreation planning relates to the use of specific numerical recreation design standards. It is recommended that consideration be given to the values that are applicable for the SMSA. The standards presented in this report form the basis for informed judgment. It is emphasized that although specification of particular values to be used will remain subjective, lack of attention to standards may result in significant overestimation or underestimation of deficiencies which in turn may lead to unrealistic plans.

- It is recommended that the specification of standard recreation areas, as initiated in the previous section, be refined by considering the applicability of the zoning rules presented as an example of the type of rules to be applied. Rather than abandoning the concept because

it will be difficult to reach concensus with respect to certain rules, it is emphasized that efforts in this direction form the basis for improved recreational planning procedures for water-based recreation.

- Finally, it is recommended that recreation development associated with the Papio System be reconsidered within the context of the Urban Studies Program. As illustrated in the previous section, modifications can be made which will make the system more responsive to the program's objectives. The allocation of surface acres presented in this chapter can be used as a starting point for developing more refined plans for the entire system; subsequently, considerations of costs and benefits should enter. That is, it is recommended that a conceptual master plan be developed first, followed by a search for the most efficient means to implement the plan.

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APPENDIX A

ANALYSIS OF MAPA's RECREATIONAL OPEN SPACE CALCULATION

1. Introduction

The purpose of this appendix is to analyze the methodology for determining open space requirements as presented in MAPA's Open Space Plan and Program. (Ref. 17). Section II is a reprint of the description of MAPA's methodology. Following the notation used by MAPA, Section III introduces some additional variables and Section IV addresses an alternative application of the basic methodology employed by MAPA to determine the number of acres that will be required in the year 2000 to support recreational activities. It is noted that this revised application is not intended to represent the "best" methodology, but rather the emphasis is on the correct application of MAPA's methodology through the utilization of consistent assumptions in deriving the final results. Finally, Section V illustrates the resulting discrepancies between following MAPA's methodology and the methodology developed in Section IV.

2. Methodology for Estimating the Increase in Outdoor Recreational Demand for the Omaha-Council Bluffs SMSA (Reproduced from Ref. 17, pp. 70-72)

Outdoor recreational trends for the Omaha-Council Bluffs SMSA from 1970 to the year 2000 were estimated by using the increase in national population and demand projections by ORRRC as a basis, and relating the SMSA's population for the same period to the national estimates. A straight line relationship was assumed.

$$\frac{A}{B} = \frac{C}{D}$$

$$AD = DB \qquad (A.1)$$

$$D = \frac{CB}{A}$$

where

A = % increase in national population,

B = % increase in national recreational demand (ORRRC),

C = % increase in SMSA population,

D = % increase in SMSA recreational demand.

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The Outdoor Recreation Resources Review Commission Report No. 22 indicated that the activity occasions were expected to increase from 4.4 billion in 1960 to 6.9 billion in 1976 and 12.6 billion by the end of the year 2000. This information was plotted on a graph in order to determine the percent increases given in Table A-1.

Table A-1

NATIONAL RECREATIONAL DEMAND

Year	Increase In Recreational Demand	Increase In National Population	Increase In Omaha-Council Bluffs SMSA Population
1970-1980	30%	18%	20%
1970-1990	60%	33%	45%
1970-2000	106%	48%	75%

The equation $D = \frac{CB}{A}$ was then used to determine the estimated outdoor recreation demand for the SMSA given in Table A-2.

Table A-2

INCREASED OMAHA-COUNCIL BLUFFS SMSA RECREATIONAL DEMAND

Year	A (% increase in National Population)	B (% increase in National Recreational Demand)	C (% increase in SMSA Population)	D (% increase in SMSA Recreational Demand)
1970-1980	18%	30%	20%	33%
1970-1990	33%	68%	45%	93%
1970-2000	48%	106%	75%	165%

Table A-3 gives the recommended open space minimum standards for the SMSA.

Table A-3

RECOMMENDED OPEN SPACE MINIMUM STANDARDS
FOR THE OMAHA-COUNCIL BLUFFS SMSA
(ACRES/1000 POPULATION)

Type of Open Space	1970	1980 33% Increase	1990 93% Increase	2000 165% Increase
Local Parks	5	7	10	13
Urban Parks	5	7	10	13
Regional Parks	25	33	48	66

Recommended standards for outdoor recreation from the Nebraska and Iowa Outdoor Recreation Plans are listed in Tables A-4 and A-5. After examining the recommendations for the Nebraska and Iowa Outdoor Recreation Plans the recommended minimum standards for the SMSA appear valid.

Table A-4

NEBRASKA STANDARDS FOR OUTDOOR RECREATION (1980)

Metropolitan Areas	15 ac/1,000 persons
1 Class Cities (5,000 - 25,000)	15 ac/1,000 persons
2nd Class Cities (1,000 - 5,000)	20 ac/1,000 persons
Villages (less than 1,000	25 ac/1,000 persons
Regional	40 ac/1,000 persons

Table A-5

IOWA STANDARDS FOR OUTDOOR RECREATION (1985)

Municipal	15 ac/1,000 persons
County	20 ac/1,000 persons
State	80 ac/1,000 persons
Federal	100 ac/1,000 persons

3. Definitions of Additional Variables

$$Y_2 \triangleq (1+C)Y_1 \qquad (A.2)$$

where

Y_1 = 1970 SMSA population,

Y_2 = 2000 SMSA population,

C = % increase in SMSA population.

$$U_2 \triangleq (1+A)U_1 \qquad (A.3)$$

where

U_1 = 1970 national population,

U_2 = 2000 national population,

A = % increase in national population.

$$V_2 \triangleq (1+D)V_1 \qquad (A.4)$$

where

V_1 = # of activity occasions demanded in 1970, SMSA,

V_2 = # of activity occasions demanded in 2000, SMSA,

D = % increase in occasions for SMSA.

$$Z_2 \triangleq (1+B)Z_1 \qquad (A.5)$$

where

Z_1 = # of activity occasions demanded in 1970 in nation,

Z_2 = # of activity occasions demanded in 2000 in nation,

B = % increase in occasions for nation.

$$X_2 \triangleq (1+E)X_1 \qquad (A.6)$$

where

X_1 = 1970 recreation standard in acres/1000,

X_2 = 2000 recreation standard in acres/1000,

E = % increase in standard.

and let

W_1 = 1970 standard for # occasions/acre (Local & National),

W_2 = 2000 standard for # occasions/acre (Local & National).

4. Alternative Methodology for Estimating Land Requirements for Recreation

The problem addressed is to estimate the number of acres that will be required in any one year in the future to satisfy the increased recreational demands. To keep the presentation illustrative of the points to be made, this discussion focuses on determining the land required in the year 2000. Using the notation from the previous section the land required should satisfy the following equation:

$$\text{\# of acres in 2000} = Y_2X_2 = (1+C)Y_1 \cdot (1+E)X_1 \qquad (A.7)$$

The only factor unknown in this equation is (1+E). To determine this factor, one relationship is necessary, which may be derived from equating demand and supply as is shown in the following:

Under the assumption that

$$\frac{V_i}{Z_i} = \frac{Y_i}{U_i} \tag{A.8}$$

holds for any year i, which holds only under the assumption that national and local participation rates are the same in each year, although not necessarily between years; the following demand equations can be formulated.

$$\left.\begin{aligned} V_1 &= \frac{Y_1}{U_1} \cdot Z_1 \\ V_2 &= \frac{Y_2}{U_2} \cdot Z_2 \end{aligned}\right\} \tag{A.9}$$

From the previous section it is noted that

$$\frac{V_2}{V_1} = 1+D = \frac{Y_2 Z_2 U_2}{Y_2 Z_2 U_2} = \frac{(1+C)\ (1+B)}{(1+A)} \tag{A.10}$$

or

$$D = \frac{(1+C)\ (1+B)}{(1+A)} - 1 \tag{A.11}$$

This result clearly differs from MAPA's calculation presented in Section II. Under the assumption that supply for occasions should match the demand, the following supply equations may be derived.

$$\left.\begin{aligned} V_1 &= Y_1 \cdot X_1 \cdot W_1 \\ V_2 &= Y_2 \cdot X_2 \cdot W_2 \end{aligned}\right\} \tag{A.12}$$

Combining A.9 and A.12 yields:

$$\frac{Y_1}{U_2} Z_1 = Y_1 \cdot X_1 \cdot W_1 \qquad X_1 = \frac{Z_1}{U_1 W_1} \tag{A.13}$$

$$\frac{Y_2}{U_2} Z_1 = Y_2 \cdot X_2 \cdot W_2 \qquad X_2 = \frac{Z_2}{W_2 W_2} , \tag{A.14}$$

which in turn leads to

$$\frac{X_2}{X_1} = \frac{Z_2 U_1 W_1}{Z_1 U_2 W_2} \tag{A.15}$$

Finally if the assumption is made that $W_2 = W_1$, then (1+E) can be found by solving the following equations.

$$\frac{X_2}{X_1} = \frac{Z_2}{Z_1} \frac{U_1}{U_2} = \frac{(1+B)}{(1+A)} \tag{A.16}$$

By definition,

$$\frac{X_2}{X_1} = 1+E \tag{A.17}$$

Thus,

$$1+E = \frac{1+B}{1+A} \tag{A.18}$$

With this value for (1+E) the number of acres required in the year 2000 equals $Y_1 X_1 \frac{(1+C)}{(1+A)} \frac{(1+B)}{}$ or $Y_2 X_1 \frac{(1+B)}{(1+A)}$.

5. Conclusions

With the values for A and B presented in Section II, Equation A.18 yields

A = 0.48
B = 1.06

$$(1+E) = \frac{2.06}{1.48} = 1.392$$

Table A-6

ALTERNATIVE REQUIREMENTS FOR RECREATIONAL ACRES

	Y_2 (Series D)	MAPA Requirements (Ref. 8)	Alternative Requirements (Section IV)	Existing Plus Proposed (Ref. 8)	MAPA Needs	Alternative Needs
Douglas	563,310	7,349	3,935	2,376	4,973	1,559
Sarpy	191,336	2,487	1,332	492	1,995	840
Pottowattamie	113,062	1,470	787	464	1,006	323
Douglas	563,310	7,349	3,935	7,844	-495	-3,909
Sarpy	191,336	2,487	1,332	76	2,411	1,256
Pottawattamie	113,062	1,470	787	884	586	-97
Douglas	563,310	37,310	19,673	964	36,346	18,709
Sarpy	191,336	12,628	6,658	---	12,628	6,658
Pottawattamie	113,062	7,462	3,935	9,782	-2,320	-5,847
Totals		80,012	42,374	22,882	57,130	19,492
				*	59,945	25,835 *

* These totals for additional recreational acres needed assumes that the proposed urban parks in Douglas and Sarpy counties and the regional parks in Sarpy county are redistributed to categories where a surplus does not exist. If these facilities cannot be changed, then a total of 25,835 acres are needed to satisfy the requirements for each category in each county. Under either assumption this revision in the analysis reduces the acres needed by at least 34,000 or over 50%.

This value, applied to calculating the standard X_2, yields a significantly different standard than proposed by MAPA as can be seen from the following:

	X_1 (1970)	Alt. Methodology X_2	MAPA Standard
Local Parks	5	6.96	13
Urban Parks	5	6.96	13
Reg. Parks	25	34.80	66

Finally, the result from the previous section is used to calculate the new requirements using the MAPA D population projections for 2000 shown in Table A-6. From the results in this table it may be concluded that, using MAPA's methodology, the requirements for recreational lands are overestimated as compared to the revised application of basically the same methodology as presented in Section 4. This conclusion is justified if the assumptions made in Section 4 are valid. However, this is not necessarily true. In particular, it is not clear why national and local participation rates should be equal. Rather these rates are expected to be different as a result of the particular socioeconomic characteristics of the Omaha-Council Bluffs SMSA. In summary, the results in this appendix in terms of absolute numbers may be questioned on justifiable grounds. However, they illustrate the danger associated with superficially manipulating numbers and not carefully applying a methodology, because the resulting resource requirements may be far off and if used to design open space systems would, in this case, appear to lead to substantial over design.

Appendix B

STANDARDS FOR SPECIFIC WATER BASED RECREATION ACTIVITIES

The sole purpose of this appendix is to demonstrate the variety of design standards found in the literature for swimming, boating, water skiing and fishing. Table B.1 presents the results of this literature search. The table is self explanatory. It suffices to mention that the turnover rate indicates the numbers of parties that are assumed to use the same surface acre during a day. Thus a turnover rate of 2 means that an acre is used by 2 parties.

Table B-1

DESIGN STANDARDS

I Swimming Source:	Qualification	Daily Average or Standard Group Size	Activity Unit Density	Water Use	Turn Over Rate
1. Ralph Stone Inc. (Ref.27)	Lake	-	-	2180 persons/acre	2
2. Referred to in "Outdoor Recreation Space Standards" (BOR) (Ref.26)					
as Ref: 63	Lake	-	-	850 persons/acre	3
as Ref. 119	Swimmable Water	-	-	290 persons/acre	5
as Ref. 135	-	-	-	-	3
as Ref. 97	-	4 persons	-	-	2
3. State of Nebraska (Ref. 9)	Lake	-	-	290 persons/acre	3
4. Santa Clara Flood Control District (Ref.11)	-	-	-	200 persons/acre	2
II Boating Source:					
1. Ralph Stone Inc. (Ref.27)	Power Non Power	4.21 persons/boat 4.86 persons/boat	1 boat/acre 1 boat/acre	4.21 persons/acre 4.86 persons/acre	2 2
2. Referred to in "Outdoor Recreation Space Standards" (BOR) (Ref.28)					
as Ref. 115	Boat Density:	(30 persons/boat			
as Ref. 23	Water Planning :	(400 people/ acre)			
as Ref. 31	-	4 persons/boat	1 boat/acre	4 persons/acre	-
as Ref. 110	-	-	1/5 boat/acre	-	-

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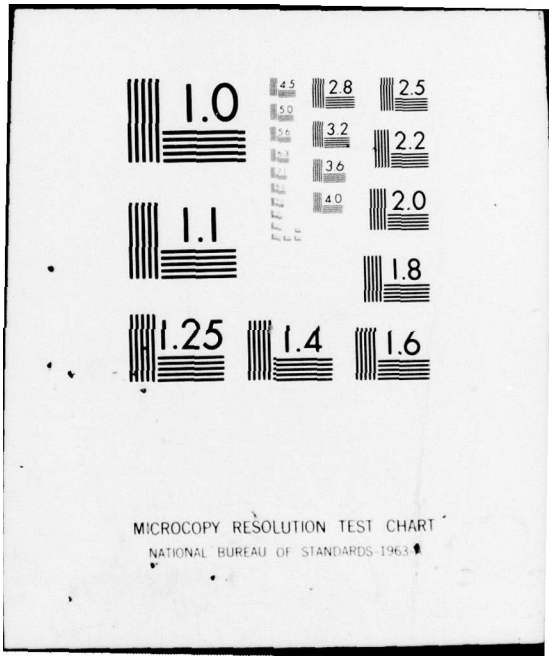
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table B.1 (continued)

Boating (cont.)					
as Ref. 119	Power	-	1/3 boat/acre	-	-
as Ref. 106	Water Planning:	(4000 people/acre)			
as Ref. 16	-	3 persons/boat	-	-	2
as Ref. 97	Trailered	3 persons/boat	-	-	1
as Ref. 135	-	2.5 persons/boat	1/20 boat/acre	1/8 person/acre	-
as Ref. 63	Power	2.5 persons/boat	1/20 boat/acre	1/8 person/acre	-
3. State of Nebraska (Ref.9)		3 persons/boat	1/2 boat/acre	1 1/2 person/acre	1.25
4. North Atlantic Water Resources Study (Ref.19)	Class 1 Inboards and Outboards and > 20 HP				
	N.E. obj.	5 persons/boat	1/3 boat/acre	1.67 persons/acre	4
	R.D. obj.	5 persons/boat	1/6 boat/acre	0.83 persons/acre	3
	E.Q. obj.	5 persons/boat	1/9 boat/acre	0.55 persons/acre	2
	Class 2 Outboards < 20 HP				
	N.E. obj.	3 persons/boat	1 boat/acre	3 persons/acre	4
	R.D. obj.	3 persons/boat	0.66 boat/acre	1.98 persons/acre	3
	E.Q. obj.	3 persons/boat	0.5 boat/acre	1.5 persons/acre	2
	Class 3 Non Powered				
	N.E. obj.	3 persons/boat	3 boats/acre	9 persons/acre	4
	R.D. obj.	3 persons/boat	1.5 boats/acre	4.5 persons/acre	3
	E.Q. obj.	3 persons/boat	1 boat/acre	3 persons/acre	2
5. Santa Clara Flood Control District (Ref.11)		8 persons/boat	1/3 boat/acre	2.6 persons/acre	2

Table B.1 (continued)

Boating (cont.)					
6. Corps of Engineers OMAHA (Ref. 6)		3 persons/boat	-	-	2
7. Corps of Engineers OMAHA (Ref.24)	High Power Low Power	- -	1/20 boat/acre 5 boat/acre	- -	- -
III Water Skiing					
Source:					
1. Ralph Stone Inc. (Ref.27)		4 persons/boat	1 boat/acre	4 persons/acre	2
2. Referred to in "Outdoor Recreation Space Standards" (BOR) (Ref. 28)					
as Ref. 31		4 persons/boat	1 boat/acre	4 persons/acre	-
as Ref. 119		-	1/5 boat/acre	-	-
as Ref. 135		3 persons/boat	1/20 boat/acre	3/20 persons/acre	-
as Ref. 63		3 persons/boat	1/40 boat/acre	-	-
3. State of Nebraska (Ref.9)		3 persons/boat	1/5 boat/acre	3/5 persons/acre	2
4. North Atlantic Water Resources Study (Ref.19)	N.E. obj. R.D. obj. E.Q. obj.	5 persons/boat 5 persons/boat 5 persons/boat	0.22 boat/acre 0.14 boat/acre 0.1 boat/acre	1.1 persons/acre 0.7 persons/acre 0.5 persons/acre	4 3 2
5. Corps of Engineers OMAHA (Ref.24)		-	1/20 boat/acre	-	-

Table B.1 (continued)

IV Fishing Source:					
1. Ralph Stone Inc. (Ref.27)	Shore	-	-	0.137 persons/ linear ft.	2
	Boat	4.21 persons/boat	15 boat/acre	63 persons/acre	2
2. Referred to in "Outdoor Recreation Space Standards" (BOR) (Ref.)					
as Ref. 119	Anchored Boat	-	4-7 boats/acre	-	-
as Ref. 119	Trolling Boat	-	2-4 boats/acre	-	-
as Ref. 31	Boat	2.5 persons/boat	20 boats/acre	50 persons/acre	-
as Ref. 16	Boat	2 persons/boat	-	-	1.5
as Ref. 135	Boat	2.2 persons/boat	1/8 boat/acre	0.275 persons/acre	-
as Ref. 63	Boat	2.2 persons/boat	1/8 boat/acre	0.275 persons/acre	-
3. Corps of Engineers OMAHA (Ref.6)		2 persons/boat	-	-	2
4. State of Nebraska (Ref.9)	See Appendix C for Capacity Estimates				

Appendix C

SUPPLY FOR FISHING IN THE STATE OF NEBRASKA

The following description of the fishing supply is reprinted verbatim from Reference 9. It illustrates in an excellent manner the intricacies of estimating the supply for fishing. The associated table summarizes the 1966 capacity of fishery resources by socioeconomic areas which are illustrated in Figure 2.3.

Fisheries

The five major types of water that contribute to the sport fishery in Nebraska are reservoirs, natural lakes, streams, farm ponds and, grade stabilization structures, and gravel pits. Nearly all reservoirs, about half the natural lakes and a small per cent of the gravel pits are open to public fishing. The great majority of streams, farm ponds and grade stabilization structures are private.

Reservoirs furnish fair to excellent fisheries for walleye, white bass, channel catfish, crappie, largemouth bass, bluegill, and yellow perch. Selected reservoirs furnish some fishing for trout and smallmouth bass. Nearly all reservoirs contain high populations of rough fish including carp, carpsucker, and gizzard shad. The primary management problems involve fluctuation of the water level.

Natural lakes which have sufficient depth and chemical characteristics are highly productive and can support excellent populations of northern pike, largemouth bass, bluegill and yellow perch along with bullhead and carp. Major problems stem from the shallow nature of the lakes plus heavy vegetative growth, which results in occasional winter kill. The high productivity of these lakes has resulted in some summer kill.

Streams primarily support a warmwater fisheries. Trout fishing is a popular activity but highly restricted in potential. Coldwater fisheries for rainbow, brown and brook are limited and confined primarily to the northern and western portion of the State. Warmwater streams support mainly channel catfish, carp and bullhead fisheries with various limited streams supporting walleye, sauger, white bass, northern pike and largemouth bass. Factors which affect production are siltation and other pollutants, channelization, direct diversions, irrigation return flow, and storage in and releases from reservoirs.

Farm ponds and grade stabilization structures are managed primarily for largemouth bass, bluegill and channel catfish; however, many ponds are over-populated with carp and bullheads.

Most gravel pits are being managed for production of largemouth bass, bluegill, and channel catfish or smallmouth bass, rock bass and channel catfish. Other pits contain mixed populations of game and rough fish. The major factor limiting production is stratification.

Supply and Capacity. Fishery resources were inventoried in 1966 by socio-economic area, Appendix B.1. The inventory is lacking private gravel pits and reservoirs created under the P.L. 566 program. Streams and standing waters were classified for fishing on the basis of present conditions concerning esthetics, use, availability and productivity. On the basis of these factors, streams and lakes were placed in classes and assigned appropriate capacities in angler trips. Estimated capacities for each class are shown in Table 7.1 and a definition of each class is provided in Appendix B.2.

Table 7.1. Capacity in annual fishing trips for various waters by class.

Class	Capacity Per Mile Streams	Capacity Per Acre			
		Reservoirs Over 1,000 Acres	Reservoirs Under 1,000 Acres	Natural Lakes	Farm Ponds
1	500	25	40	60	25
2	250	25	40	60	25
3	150	25	40	60	25
4	25	25	40	60	25
5	None	None	None	None	None

Capacity as used in Table 7.1 is an estimate of the angler use in fisherman trips water could sustain and still provide a quality fishery under a reasonable level of management. Capacity of a particular body of water in man days of fishing is a relative measure and is dependent upon how much success or lack of success the average fisherman will or should be expected to tolerate. Lowered productivity, and thus, lowered capacity occurs on stream systems which are overgrazed, subjected to siltation, diverted for irrigation and power production, polluted and channelized. Production of some standing waters is variously affected by siltation, water level fluctuation, pollution, stratification and eutrophication.

Estimated capacity of the fishery resources by type and socio-economic area is summarized in Table 7.2. The totals in this summary serve to point out the relative importance of the different types of water. Reservoirs over 1,000 acres and natural lakes are of major importance, comprising 44 per cent and 33 per cent of the total estimated capacity respectively. Farm ponds account for 8.6 per cent of the total estimated capacity, reservoirs less than 1,000 acres for 7.6 per cent, and streams for 7.15 per cent.

Table 7.2. Summary of estimated annual capacity of fishery resources by socio-economic area (expressed as fisherman trips).

Socio-Economic Area	Streams	Reservoirs Over 1,000 Acres	Reservoirs and Public Pits Under 1,000 Acres	Private Farm Ponds	Natural Lakes	Private Gravel Pits	Total
So. Sioux City	20,625	None	20,000	10,525	None	No Estimate	51,140
Omaha	43,375	None	28,960	32,650	None	No Estimate	104,985
Lincoln	17,325	45,000	103,440	70,300	None	No Estimate	236,065
Beatrice	26,250	None	10,200	57,875	None	No Estimate	94,325
Norfolk	37,975	183,725	2,400	58,225	None	No Estimate	282,325
Columbus	9,125	None	44,560	13,050	None	No Estimate	66,735
Grand Island	16,425	67,000	6,960	34,950	None	No Estimate	127,335
Hastings	10,975	None	2,320	38,350	None	No Estimate	51,645
Kearney	5,950	336,700	14,560	20,150	None	No Estimate	377,360
McCook	20,175	257,000	4,800	7,825	None	No Estimate	289,790
North Platte	10,800	191,525	53,800	6,450	None	No Estimate	278,855
Ogallala	8,300	875,000	12,800	1,650	202,320	No Estimate	1,090,070
Valentine	71,400	67,500	14,800	47,825	1,366,500	No Estimate	1,568,025
Scottsbluff	44,325	84,500	47,680	15,900	None	No Estimate	202,405
Totals	345,035	2,117,950	367,280	415,725	1,568,820		4,821,060

Distribution of estimated capacity by socio-economic areas is of particular importance. Over 55 per cent of the capacity occurs in the Valentine and Ogallala SEA's, accounting for 32.6 per cent and 22.6 per cent of the capacity, respectively. Approximately 80 per cent of the estimated capacity in the Ogallala SEA is derived entirely from one body of water, Lake McConaughy.

Capacity of streams and natural lakes cannot be expected to increase appreciably in the future. It is apparent that the only substantial potential for significant increased fishing capacity lies in future construction of reservoirs and farm ponds.