CORALVILLE LAKE
IOWA RIVER, IOWA
RESOURCE MASTER PLAN
VOLUME I
DESIGN MEMORANDUM
NO. 15C, REVISION NO. 2
APRIL 1977

U.S. ARMY
CORPS OF ENGINEERS
ROCK ISLAND DISTRICT
ROCK ISLAND, ILLINOIS

Revisions in April 77 version: (FROM THE APRIL 1976 VERSION)

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CORALVILLE LAKE
IOWA RIVER, IOWA

RESOURCE MASTER PLAN

VOLUME I

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

DESIGN MEMORANDUM
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U.S. ARMY
CORPS OF ENGINEERS
ROCK ISLAND DISTRICT
ROCK ISLAND, ILLINOIS

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CORALVILLE LAKE
IOWA RIVER, IOWA

RESOURCE MASTER PLAN

VOLUME I

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DESIGN MEMORANDUM
NO. 15C, REVISION NO. 2
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ROCK ISLAND DISTRICT
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PREFACE

Interest in outdoor recreation and tourism development has been keen in recent years. Recognizing the impact that large, multipurpose lakes have on regional development and the fact that recreation participation patterns change over time, the Rock Island District, Corps of Engineers, asked MRI to update the Coralville Master Plan. Each Corps district is required to develop a continuing schedule, to completely reevaluate and update master plans for completed projects (ER 1120-2-400, Par. 13, P. 8, 1 November 1971). This report (Corps of Engineers Contract No. DACW 25-75-C-0015, MRI Project No. 3984-BII) is part of a two-volume master plan detailing how project lands, water, forests, and other resources should be conserved, enhanced, developed and managed to serve the public interest throughout the life of the project. Volume II contains the detailed site plans.

During the course of the project, MRI combined its talents with that of HLM. MRI's staff, having a solid grasp on outdoor recreation demand--a most important planning factor--provided the broad, comprehensive input necessary in preparing the master plan. HLM concentrated on the detailed design portions of the area and site plans. Our firms not only enjoyed an excellent relationship, but we found that a team approach combining complementary planning capabilities enabled us to produce a total land use plan for the Coralville Lake project.

The MRI project leader for the master plan was Mr. Raymond M. Mischon. He was assisted by Ms. Marcia Corbett, Ms. Cheryl Fellhauer, and Ms. Margaret Thomas. COMPATRAX analyses were performed by Mr. Jim Miller. Mr. Ralph Warner of the Biological Sciences Division also provided valuable input. The project team for HLM included Messrs. Brian Gutheinz, Brian Larsen, Robert Satter, Steven Victor and John Wallace. John Storey and Gary Thompson of the Coralville operations staff and Jack Adamski and Doug Blount of the Rock Island District Office of the Army Corps of Engineers, provided extremely helpful assistance throughout the project.

Approved:

Gary R. Nuss, Director
Economics and Management
Science Division

SUMMARY

This Master Plan provides guidelines for achieving optimum use of the natural and accrued resources of the Coralville Lake project.

Resources of the project area are described. Influences and constraints exerted by environmental components upon resources use are identified and evaluated.

Recreation needs in the project area are identified. Site plans for recreation facilities have been prepared based on a careful weighing of public needs and the capability of project resources to accomodate development and use.

During preparation of the Master Plan, recommendations on resources development and management were obtained from concerned local, state and Federal authorities.

Current policy requires cost-sharing by a non-Federal public agency for expansion of existing recreation areas or for development of new recreation areas at Coralville Lake. A sponsor for cost-sharing in recreation development at Coralville Lake has not been identified. Because of this, development proposed in this Master Plan may not be accomplished within the time frames indicated. However, the Master Plan identifies the capabilities of project resources to accomodate recreation needs and provides a framework for possible future cost-share development.

Pending identification of a non-Federal cost-share sponsor or a policy change allowing new recreation development by other means, the following management principles shall be applied at Coralville Lake:

1. Existing facilities will be operated and maintained, as in the past, to provide the highest quality recreation experience to visitors that available funding and personnel spaces will permit.

2. Rigid control of facility loading will be instituted in the interest of public health and safety and to prevent overuse of basic resources.

3. Continuing efforts will be made to obtain a non-Federal cost-share sponsor for needed recreation facility development.

MULTIPLE-PURPOSE PROJECT
CORALVILLE RESERVOIR
PREVIOUS DESIGN MEMORANDA

No.	Subject	Date
1	Spillway - Hydraulic Design	17 September 1954
2	Spillway - Structural Design	1 October 1954
3	Service Bridge	5 October 1954
4	Relocations - Johnson County Routes E and O	31 March 1955
5	Relocations - Chicago, Rock Island and Pacific Railroad	5 May 1955
6A	Relocations - Utilities - Natural Gas Pipe Line	1 April 1955
6B	Relocations - Underground Telephone Cable	5 May 1955
6C-1	Electric Transmission Lines (Iowa Electric Light and Power Company)	24 April 1956
6C-2	Electric Transmission Lines (Linn County Rural Electric Cooperative Association)	20 July 1956
6-D	Telephone Lines	29 May 1957
7	Diversion	11 May 1955
8	General Design Memo - Lake Macbride State Park and Cottage Reserve	27 July 1955
8A	Lake Macbride State Park - Dam	23 August 1955
8B	Lake Macbride State Park - Remedial Works	19 September 1955
8C	Lake Macbride State Park - Utilities	6 January 1956
8D	Lake Macbride State Park - Roads	18 October 1955

MULTIPLE-PURPOSE PROJECT
CORALVILLE RESERVOIR
PREVIOUS DESIGN MEMORANDA

No.	Subject	Date
9	Protection for Amana, Iowa	16 December 1955
10	Remedial Works for Chicago, Milwaukee, St. Paul and Pacific Railroad	17 January 1956
11	Johnson County Route E at Swisher Creek	16 March 1956
12	Reservoir Clearing	14 December 1955
12A	Reservoir Clearing Supplement	12 September 1957
13	Housing for Dam Tenders	11 August 1955
14	Soil Erosion Control	31 January 1957
15	Recreational Development	2 August 1957
15A	Recreational Development Supplement	6 October 1958
16	Administration Building	7 June 1957
18	REAL ESTATE MEMORANDUM - REAL ESTATE REQUIREMENTS FOR AUTOMATIC REPORTING GAGES AND RADIO TELEMETERING EQUIPMENT	17 May 1957
1	Mehaffey Bridge	7 December 1962

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I. INTRODUCTION

A. Project Autorization

Coralville Lake was authorized by Section 4 of the Flood Control Act of 28 June 1938 (Flood Control Committee Document No. 1, 75th Congress, First Session) and was placed in operation in 1958.

B Project Purpose

The Coralville Lake project is a unit of the comprehensive plan for flood control in the Upper Mississippi River Basin. Although originally authorized for flood control, the project is managed to fulfill a multi-purpose role with benefits to recreation and fish and wildlife as well.× From the beginning of project operation in 1958, through FY 1976, the estimated benefits from flood damage prevention amount to $16,771,300. Recreation benefits attributable to the project through CY 1975 are estimated to exceed $14,000,000.

C. Purpose of the Master Plan

This Master Plan provides guidelines for achieving optimum use of the natural and accured resources of the Coralville Lake project. The plan was developed in support of specific resource use objectives for Coralville Lake, which are as follows:

1. To provide high quality diversified public outdoor recreation opportunities.

2. To maintain a balance between public use levels and the capability of project resources to support development and use.

3. To achieve a compatible mix of programs for public use and programs for management of fish, wildlife, timber, soil, archaeologic and historical resources.

4. To assure long term maintenance of a high quality environment for project visitors.

D. Prior Pertinent Design Memoranda

A master plan for the Coralville project was approved 24 July 1961. A revision of the Master Plan was approved 29 July 1968 (Design Memorandum No. 15C, Revision No. 1). That document provides the most recent approved guidelines for the orderly development and management of land and water areas of the project. Other pertinent design memoranda are listed at the beginning of this report.

E. Application of Public Laws

The Coralville Lake project is subject to a number of public laws which provide for consideration of various aspects of water and related land resource management. The principal laws impacting upon master planning and project management are summarized below:

1. Section 4 of the Flood Control Act of 1944 (P.L. 78-534) authorized the Secretary of the Army, acting through Chief of Engineers, to construct, maintain and operate public parks and recreational facilities in reservoir areas under the control of the Secretary of the Army, and to permit the construction, maintenance and operation of such facilities by others.

2. The Federal Water Project Recreation Act of 1965 (P.L. 89-72) as amended by Section 77 of the Water Resources Development Act of 1974 (P.L. 93-251) imposes requirements of non-Federal cooperation and cost sharing for recreation and fish and wildlife enhancement at reservoir projects authorized after 1 January 1965. Similar requirements are being applied administratively to reservoir projects, like Coralville, authroized before 1 January 1965.

3. P.L. 93-303 (1974) provides that fair and equitable fees will be assessed the users of specialized sites, facilities, equipment or services provided at substantial Federal expense. That law is the authority for the fees charged at family and group camping facilities at Corps managed areas.

4. The Fish and Wildlife Coordination Act of 1958 (P.L. 85-624) states the general policy that fish and wildlife conservation shall receive equal consideration with other project purposes. The law requires coordination with the Fish and Wildlife Service, Department of Interior, and with State Fish and Wildlife Agencies in matters related to Fish and Wildlife management.

5. P.L. 86-717 (1960) directs that the Chief Engineers, under the supervision of the Secretary of the Army, shall provide for the protection and development of the forest or other vegetative cover and the establishment and maintenance of other conservation measures on reservoir areas under his jurisdiction, so as to yield the maximum public benefit and otherwise improve such areas.

6. The Endangered Species Act of 1973 (P.L. 93-205) is currently the principle law in regard to threatened and endangered species. The act requires Federal agencies to consider the impact of their actions on the threatened and endangered species listed on the Federal Register and prohibits any Federal action that would damage habitat deemed critical to those sepcies.

7. The Preservation of Historic and Archaeological Data Act of 1974 (P.L. 93-291) permits the expenditure of up to one percent of the amount appropriated for a Civil Works project for survey, recovery, analysis and reporting of important (scientific, historical, archaeological and paleontological) data which may be lost as the result of Civil Works under Corps jurisdiction, including non-Federal lands provided by local interests for certain types of projects. The authorities of P.L. 93-291 apply to operating projects as well as those in the planning or design stages.

8. The National Environmental Policy Act of 1969 (P.L. 91-190) declares a continuing policy of the Federal Government to use all practicable means and measures to create conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

9. Section 234 of the Flood Control Act of 1970 (P.L. 91-611) directs that persons designated by the Chief of Engineers shall have the authority to issue a citation for violation of the regulations adopted by the secretary of the Army, requiring any person charged with violation to appear before the United States Magistrate.

F. Current Policy

The current Administration policy, as provided by the Office of Management and Budget (OMB), is that all new recreation development at projects like Coralville Lake will require at least 50 percent cost-sharing by a non-Federal public agency. The non-Federal sponsor is required to enter into a cost-sharing contract with the Corps prior to construction and must agree to assume operation and maintenance reponsibilities for the completed recreation area. A sponsor for cost-sharing in new recreation development at Coralville Lake has not been identified. Due to this constraint, development proposed in this Master Plan may not be accomplished within the time frames indicated.

However, the constraint does not preclude the demand for such development. The master plan identifies the capabilites of project resources to accommodate recreation needs and provides a framework for possible future cost-share development.

G. Scope

This revised master plan for Coralville Lake presents an analysis and evaluation of recreation resources from the dam to U.S. Highway 218. A unique MRI planning to the COMPATRAX recreation demand model, was utilized to forecast user demands. The demands are converted to acreage and facility needs. New areas with recreation development potential are considered with regard to present and future user demands. However, special attention is given to adapting the existing recreation areas to accommodate present and future demand. Estimated costs for construction of basic facilities, roads, parking areas, and landscaping are presented. Site designs are included in Volume II of this Master Plan. Land use classifications are established to guide resource management of project lands.

Coordination with other Federal, state, and local agencies has been continuous throughout the planning process and is discussed in Section VII of this report.

Master plan appendices are briefly summarized in this document. Appendices to be prepared at a later date include:

A. - Resource Management Plan

B. - Forest Management Plan

C. - Fire Protection Plan

D. - Fish and Wildlife Management Plan

E. - Project Safety Plan

F. - Lakeshore Management Plan

II. PROJECT DESCRIPTION

A. Location

Coralville Lake is located in the south central part of the Iowa River Basin in east central Iowa. The dam is situated about 9.0 river miles upstream from Iowa City, Iowa, the nearest large population center. The lake lies primarily in Johnson County but extends into Iowa County and one tributary reaches into Linn County. The location of the project is shown in Figures 1 and 2.

Coralville Dam is constructed at mile 83.3 upstream from the junction of the Iowa and Mississippi rivers, and controls runoff from a watershed area of 3,084 square miles. The major streams entering Coralville Lake drain the eastern and northern shores and include the following: Price, Knapp, Plum, Swisher, McAlister, West Hoosier, Lingle, and Turkey creeks. Jordan and Mill creeks also drain the eastern shore, but these streams first flow into 950-acre Lake Macbride, which adjoins the northeastern corner of Coralville Lake.

Four U.S. highways come close to the lake. Interstate 80 crosses the Iowa River just north of Iowa City and about 6 miles south of the dam; this highway provides Des Moines (116 miles west) and Davenport (55 miles east) with easy access to Coralville Lake. U.S. 6 crosses the Iowa River as it runs through Iowa City. U.S. 218 runs north and south crossing Coralville Lake near the upper reaches, then follows the river through Iowa City and for several miles downstream. Interstate 380, which intersects Interstate 80 just west of Iowa City, links the area with Cedar Rapids (27 miles north) and crosses the lake near the U.S. 218 bridge. Several state highways (220, 382, 151, 1, and others) are major transportation routes, while numerous secondary and farm-to-market roads provide fairly easy access to the project area. There is also a county road which crosses the lake in a northeast/southwest direction upstream from U.S. Highway 218, near Hawkeye Wildlife Area. Figure 1 shows major highways, waterways, and political subdivisions near the project area. Figure 2 shows Coralville Lake, Lake Macbride, and Hawkeye Wildlife Management Area.

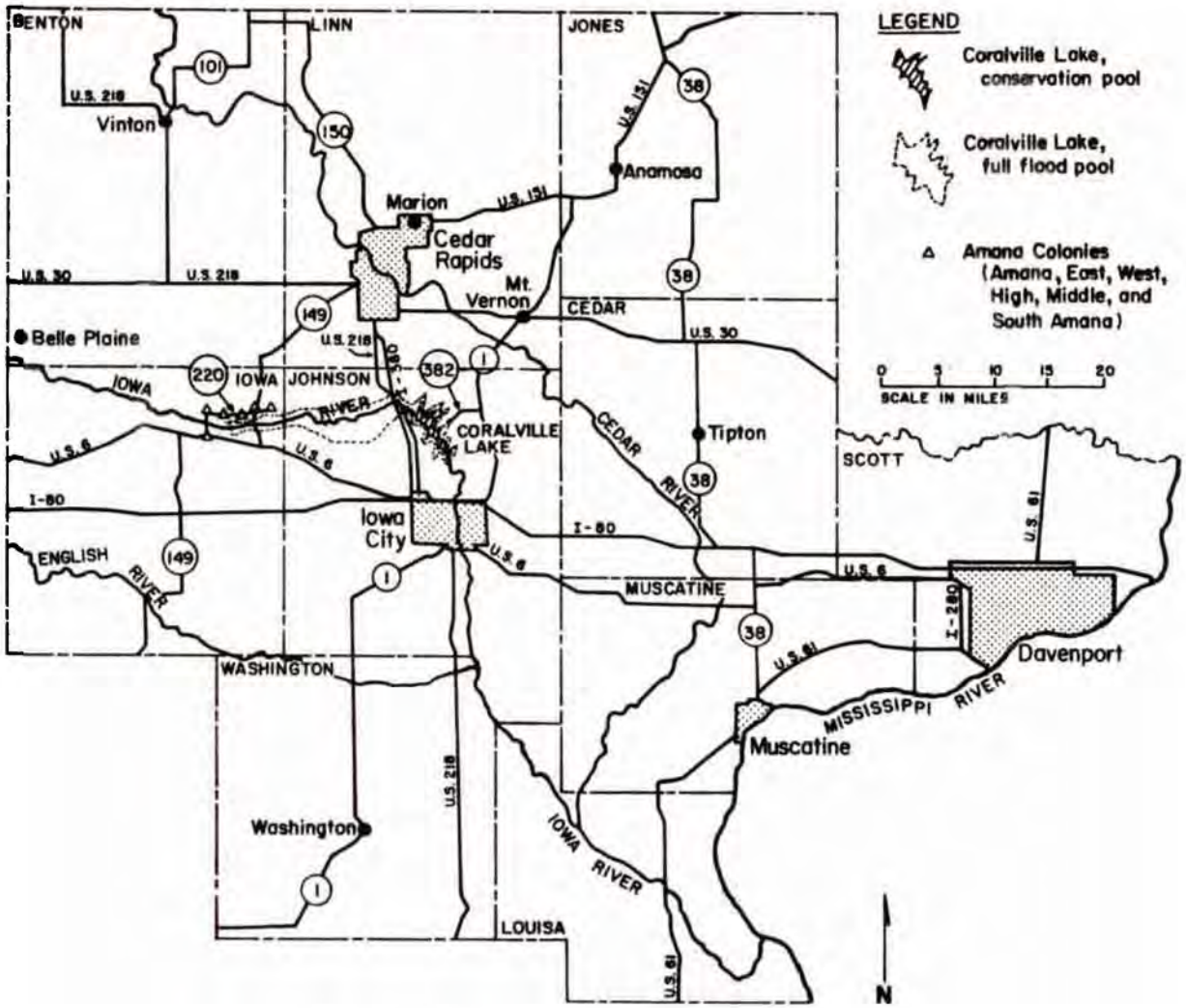


Figure 1 - Project Area and Vicinity

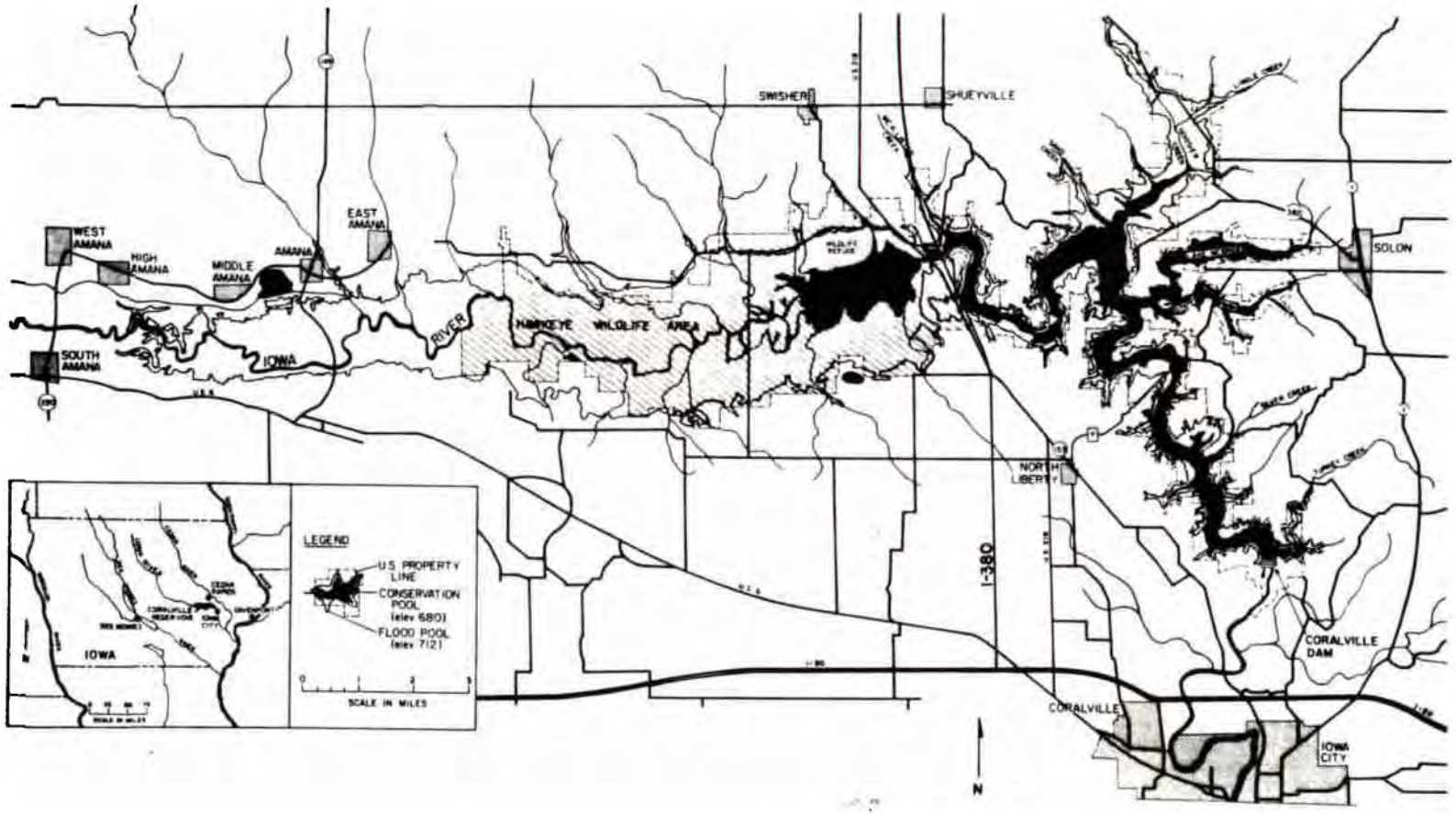


Figure 2 - Coralville Lake, Iowa

B. Project Data

1. Hydrologic Elements: The basin of the Iowa River is generally long and narrow, and the average slope of the river is 1.9 feet per mile. At Wapello, near the mouth, the river has a bank-full capacity of 29,000 cubic feet per second; at bank-full stage, the river is about 740 feet wide with a mean depth of 10.7 feet.

Three U.S. Geological Survey stream gaging stations are maintained along the Iowa River near the planning area. One station is located approximately 35 miles upstream from Coralville Lake at Marengo, Iowa, while two are located downstream, one at Iowa City and the other near Lone Tree, Iowa. Table 1 compares various discharge data for the three stations.

Floods on the Iowa River at Iowa City have been well documented since the establishment of the gaging station there in 1903. Figure 3 gives peak flows at Iowa City for the years 1851, 1881, and 1903-1974. However, because of the construction of Coralville Lake in 1958, the Iowa City gage is no longer an effective indicator of natural flood peaks.

The flood of 1851 is the highest known flood of record on the Iowa River at Iowa City. Discharge for this flood was estimated at 70,000 cubic feet per second and was greater than the estimated 100-year unregulated flood flow of 55,000 cubic feet per second. The second highest known flood in Iowa City occurred in July 1881, with a discharge of 51,000 cubic feet per second. (The unregulated 50-year flood flow at Iowa City is 45,000 cubic feet per second.) Since installation of a gage at Iowa City, the greatest flood recorded occurred in 1918 when discharge was 42,500 cubic feet per second.

Since the construction of Coralville Lake in 1958, peak flows downstream at Iowa City appear to have been significantly reduced (see Figure 3). Even in 1969, when very heavy rains fell in the upper Iowa River Basin, the peak flow at the Iowa City station was only 15,000 cubic feet per second.

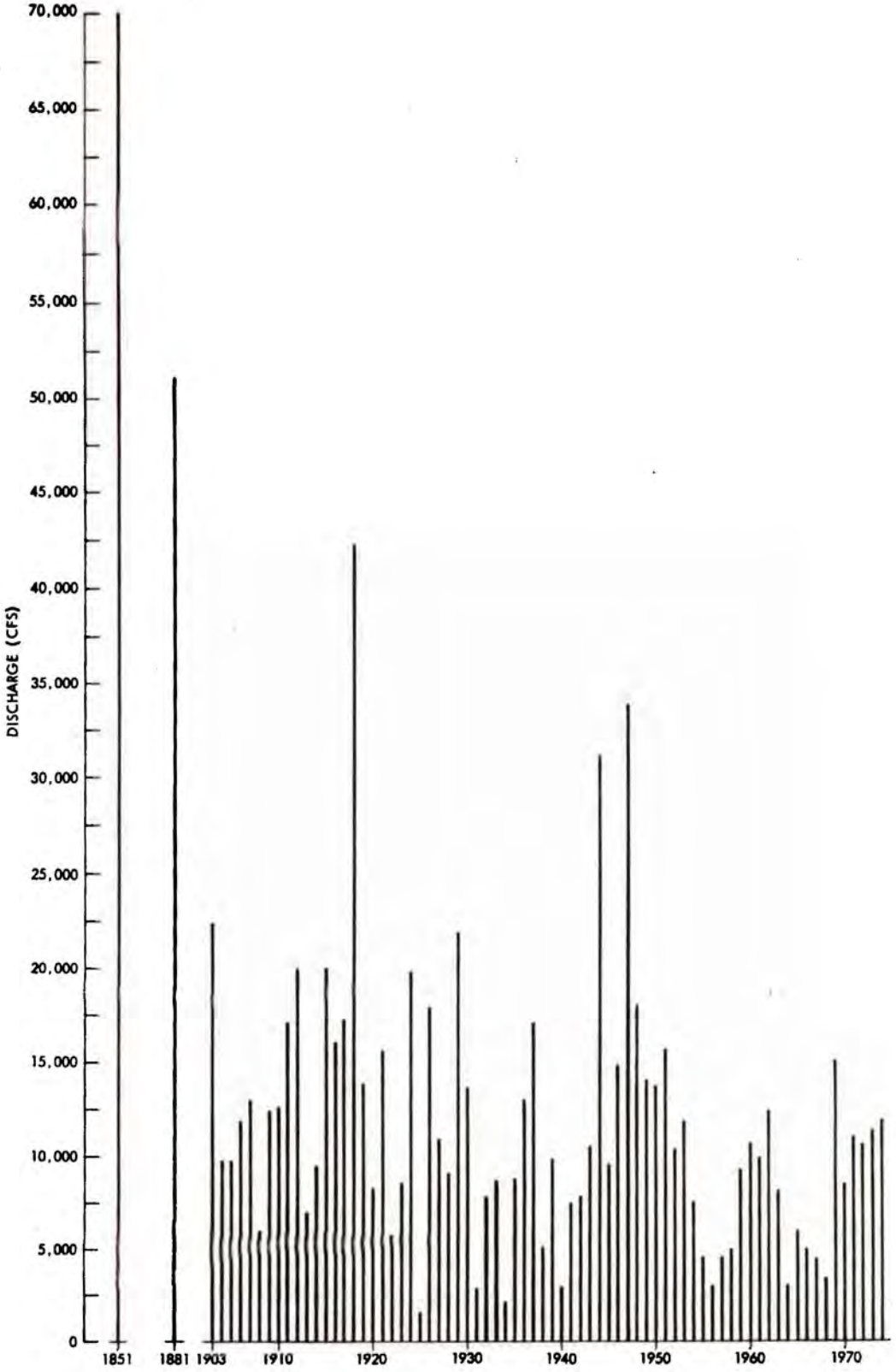
2. Climate Summary: The climate of the Coralville Lake area is of the extreme mid-continental type. The spring season may fluctuate from wet to fairly dry. Hot winds and periods of prolonged high temperatures are characteristics of the summer season. The mean annual temperature is 48°F with a

TABLE 1

DISCHARGE DATA FOR U.S.G.S. GAGING STATIONS
AND CONTENTS DATA FOR CORALVILLE LAKE

Station	Drainage Area (sq. mile)	Average Discharge (cfs)	Maximum Discharge (cfs)	Date	Gage Height (ft)	Minimum Daily Discharge (cfs)	Date
05-4531.00 Iowa River at Marengo, Iowa	2,794	1,730	30,800	3-31-60	19.21	54	10-11,12-56
05-4545.00 Iowa River at Iowa City, Iowa	3,271	1,638	42,500	6-8-18	19.6	29	10-21,22-16
05-4557.00 Iowa River near Lone Tree, Iowa	4,293	2,842	35,700	5-19-74	18.97	75	12-8-56

Source: Water Resources Data for Iowa, U.S. Department of the Interior, Geological Survey (1974).



Source: "Magnitude and Frequency of Iowa Floods," Iowa Highway Research Board Bulletin No. 28, Part II, 1966, and U.S. Geological Survey records.

Figure 3 - Peak Discharges of the Iowa River at Iowa City

range of extremes from -37°F to 122°F. The average summer temperature is approximately 72°F while the average winter temperature is about 22°F. Almost half of the 33 inches of average annual rainfall occurs during the 160-day growing season which extends from May through August.3/ The year 1881 was the wettest year on record in Iowa with a statewide average rainfall of 44.2 inches.

3. Reservoir Shoreline, Length and General Character: The topography of the river valley which was inundated is varied. Elevations in the Coralville Lake vicinity range from 645 feet mean sea level in the river valley to 900 feet mean sea level in the uplands. Downstream from U.S. Highway 218, the lake at all levels occupies a narrow sinuous valley. Upstream from Highway 218, the river meanders through a flat floodplain 1 to 2 miles wide. This area now provides the major part of the lake's floodwater storage capacity.

At maximum flood control elevation, Coralville Lake extends approximately 41.5 river miles up the Iowa River; including Lake Macbride there are 100.1 miles of shoreline. At the summer conservation pool elevation (680 feet mean sea level), Coralville Lake is 21.7 river miles long, and the shoreline of the conservation pool is 68 miles long.4/ At elevation 670 feet mean sea level, the lake is 17.4 river miles in length with a shoreline 34.6 miles long.5/

The general shoreline is fairly irregular and broken by several large and many small inlets and coves. Downstream from U.S. Highway 218, there are fairly steep ridges and valley slopes which are partially stabilized with mixed stands of upland hardwoods interspersed with small clearings. There are also frequent areas of gently rolling, open land with isolated clumps of upland hardwoods. Upstream from U.S. Highway 218, the terrain is much broader and flatter on the first and second levels of the Iowa River floodplain. Most of the lower woodlands in the flood pool have died off as a result of frequent extended periods of inundation. The result has been a transition from bottomland hardwoods to marsh-type areas and much of the land is nearly devoid of woody vegetation. Some willows which apparently were large trees at the time of impoundment have survived at elevations of 680 to 685 feet mean sea level, even though partially inundated for up to 10 months in some years. However, there is no long-term willow reproduction in this area and eventually the older trees will be eliminated. Between 685 and

695 feet mean sea level, perennial vegetation is partially established. It appears that the silver maple (Acer saccharinum) may become the dominant species in this higher flood community if it is able to gain sufficient height to photosynthesize during flood periods.

4. Project Structures (Operational): The Coralville project consists of four basic components: The spillway, the earth embankment, the outlet works, and the reservoir. The concrete overflow spillway is located directly west of the dam, and is 500 feet wide at the base. If reservoir levels ever exceed an elevation of 712.0 feet mean sea level, the spillway will automatically release water thereby protecting the earth embankment against overtopping. The dam is 1,400 feet long and 100 feet high. Its top elevation is 743.0 feet mean sea level. The outlet works are comprised of a control tower which is capable of operating the three gated conduits which allow water to pass through the dam, and a stilling basin which serves to reduce the velocity and turbulence of the water as it is released below the dam. Original project data are summarized in Table 2.

C. Reservoir Operation

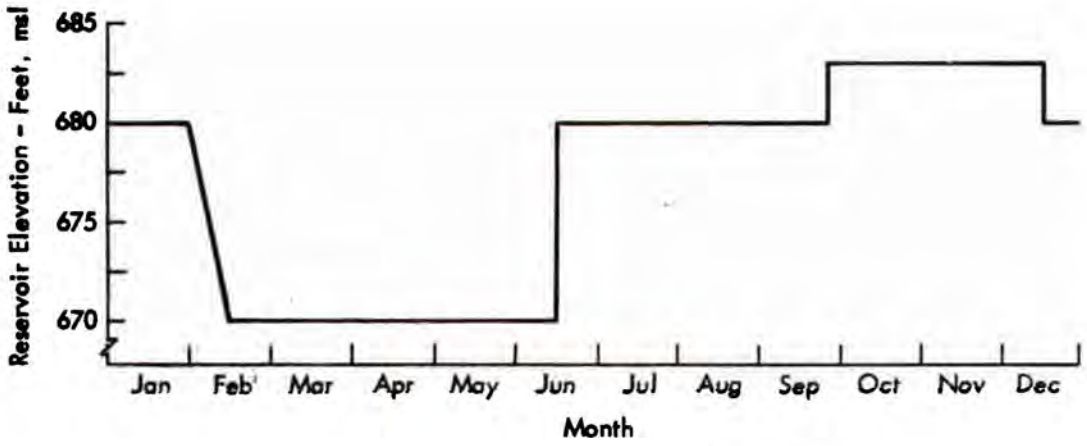
Coralville Lake was constructed for purposes of flood control in the Upper Mississippi River Basin. Since its primary purpose is to temporarily retain excess flood flows, lake levels are subject to change. The schedule of lake levels is given in Figure 4 and shown diagramatically in a rule curve.

The original capacity for several lake levels is listed in Table 3, as well as the updated capacity determined from a Corps of Engineers sedimentation survey in the lake in 1968. Figure 5 shows the area-capacity curves for Coralville Lake, based on 1949 data.[6/] Figure 6 presents the elevation-frequency curve. This curve was prepared by simulating the period of streamflow history from 1903 through 1963 in a reservoir model; actual operational data was used from 1964 to 1974.

TABLE 2

PROJECT DATA
CORALVILLE LAKE AND DAM

Location of Dam	
Stream	Iowa River, Iowa
River mile above mouth	93.3
County	Johnson
Nearest town	Iowa City, Iowa
Location of Pool	
River mile above mouth	93.3 - 128.3
Counties	Johnson, Linn, and Iowa
Drainage Area	
Upstream from damsite	3,115 sq miles
Upstream from mouth	12,637 sq miles
Pool	
Elevation of top of flood control pool (spillway crest)	712.0 msl
Elevation of top of conservation pool 15 February-15 June	670.0 msl
Elevation of top of conservation pool 15 June-15 February	680.0 msl
(For wildlife purposes 25 September-15 December)	683.0 msl
Five year flood contour	696.0 msl
Storage capacity for flood control	475,000 acre-feet
Storage capacity, conservation pool at elevation 670.0	17,000 acre-feet
Storage capacity, conservation pool at elevation 680.0	53,750 acre-feet
Area of flood control pool	24,800
Area, conservation pool at elevation 670.0	1,820 acres
Area, conservation pool at elevation 680.0	4,900 acres
Area, conservation pool at elevation 683.0	6,000 acres
Length (river miles) of flood control pool	35.0 miles
Length (river miles) of conservation pool at elevation 670.0	17.4 miles
Length of shoreline of flood control pool including enlarged Lake Macbride	100 miles
Length of shoreline of conservation pool at elevation 680.0	68 miles
Dam	
Type	Earth embankment
Total length	1,400 feet
Top elevation	743.0 msl
Top width	22 feet
Maximum Height	100 feet
Outlet works	
Type	Concrete conduit
Length of conduit	350 feet
Size of conduit (diameter)	23 feet
Control gates	
Number	3
Size of each	8.33 x 20 feet
Spillway	
Type	Concrete overflow section
Total length	500 feet
Crest elevation	712.0 msl



	Elevation (ft msl)
15 June to 25 September	680
25 September to 15 December	683
15 December to 1 February	680
1 February to 15 February	670
15 February to 15 June	varies in relation to flood waters
Spillway Elevation	712

Figure 4 - Rule Curve and Schedule of Lake Levels For Coralville Lake

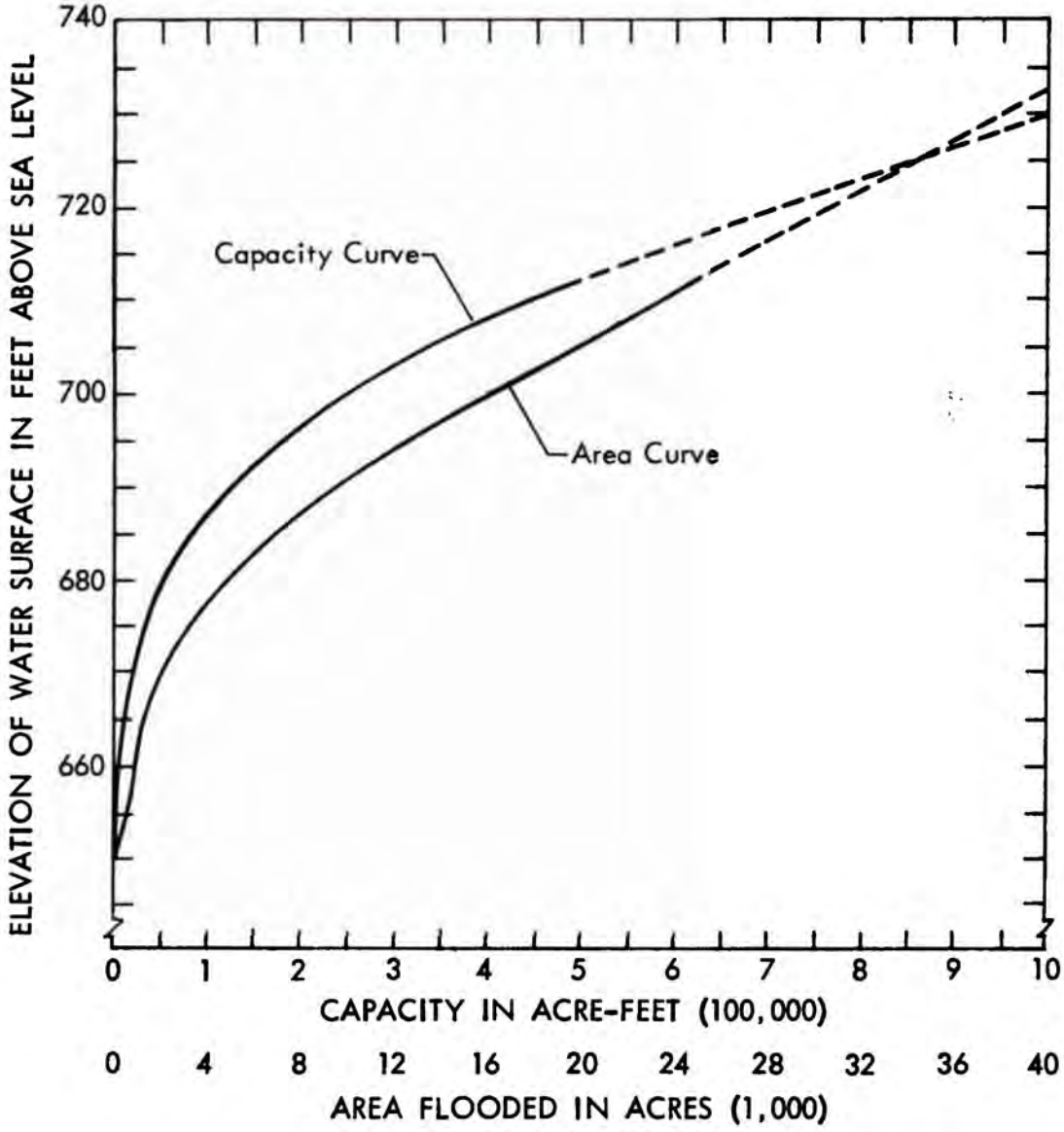


Figure 5 - Area-Capacity Curve for Coralville Lake

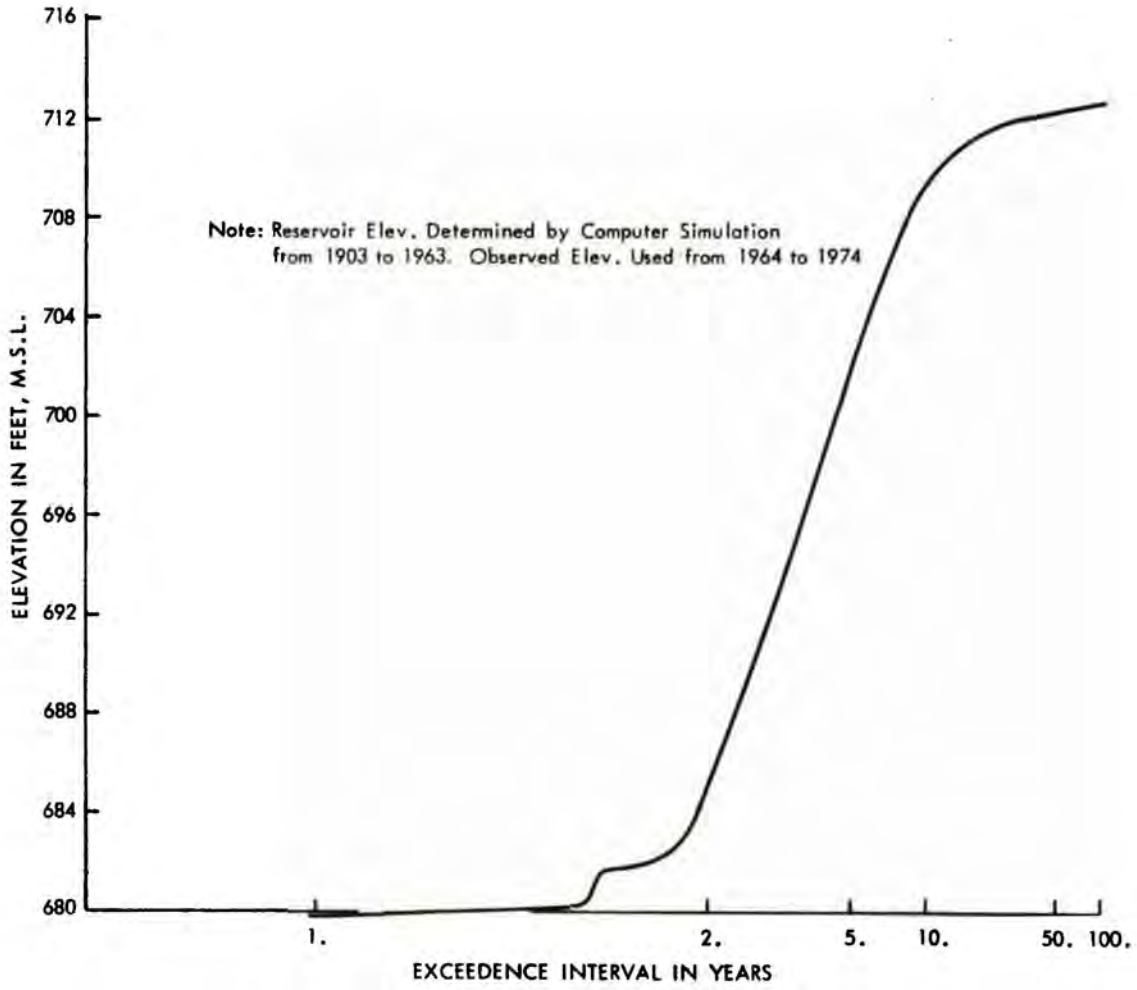


Figure 6 - Elevation-Frequency Curve for Coralville Lake

TABLE 3

VOLUME CONTENT IN RELATION TO SURFACE ELEVATION

Water Surface (feet above MSL)	Contents Before October 1968 (acre-feet)	Contents as of October 1968 (acre-feet)
659	4,000	--
665	9,300	4,360
670	16,900	7,900
675	31,100	18,600
680	52,600	38,700
685	82,300	67,800
690	120,000	108,000
695	172,000	162,000
700	244,000	232,000
712	489,000	476,000

Source: U.S. Department of the Interior, Geological Survey.

Figure 7 illustrates the downstream effect of floodwater storage in Coralville Lake. Daily discharges at the three USGS gaging stations have been plotted for the period between 1 January 1969 and 31 August 1969. Corresponding lake levels are also shown. Peak flows downstream are reduced as a result of floodwater retention in the lake, and the excess water is released gradually to minimize flooding downstream.

Variations in the water storage of Coralville Lake from 1958 to 1973 are shown in Figure 8. The maximum volume occurred on 21 July 1969, when 472,000 acre-feet of water had accumulated and the lake level elevation was 711.85 feet mean sea level. On 10 March 1959, a minimum volume of 3,800 acre-feet was recorded at a lake level elevation of 658.77 feet mean sea level.7/ The effects of sedimentation in the lake can be seen in this figure. The low points on the chart from approximately the late 1960's to the present are lower than in the earlier days of the lake's existence.

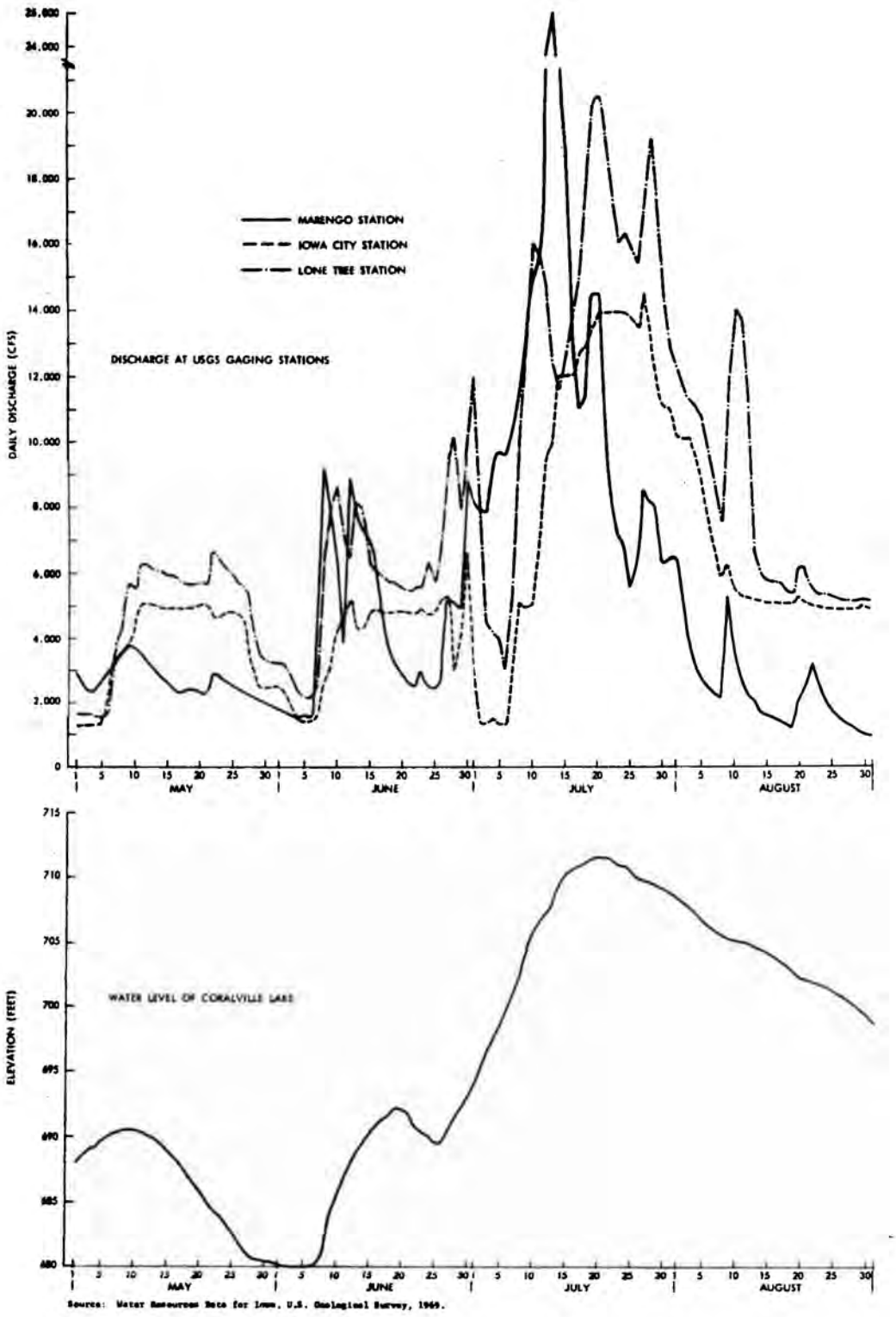
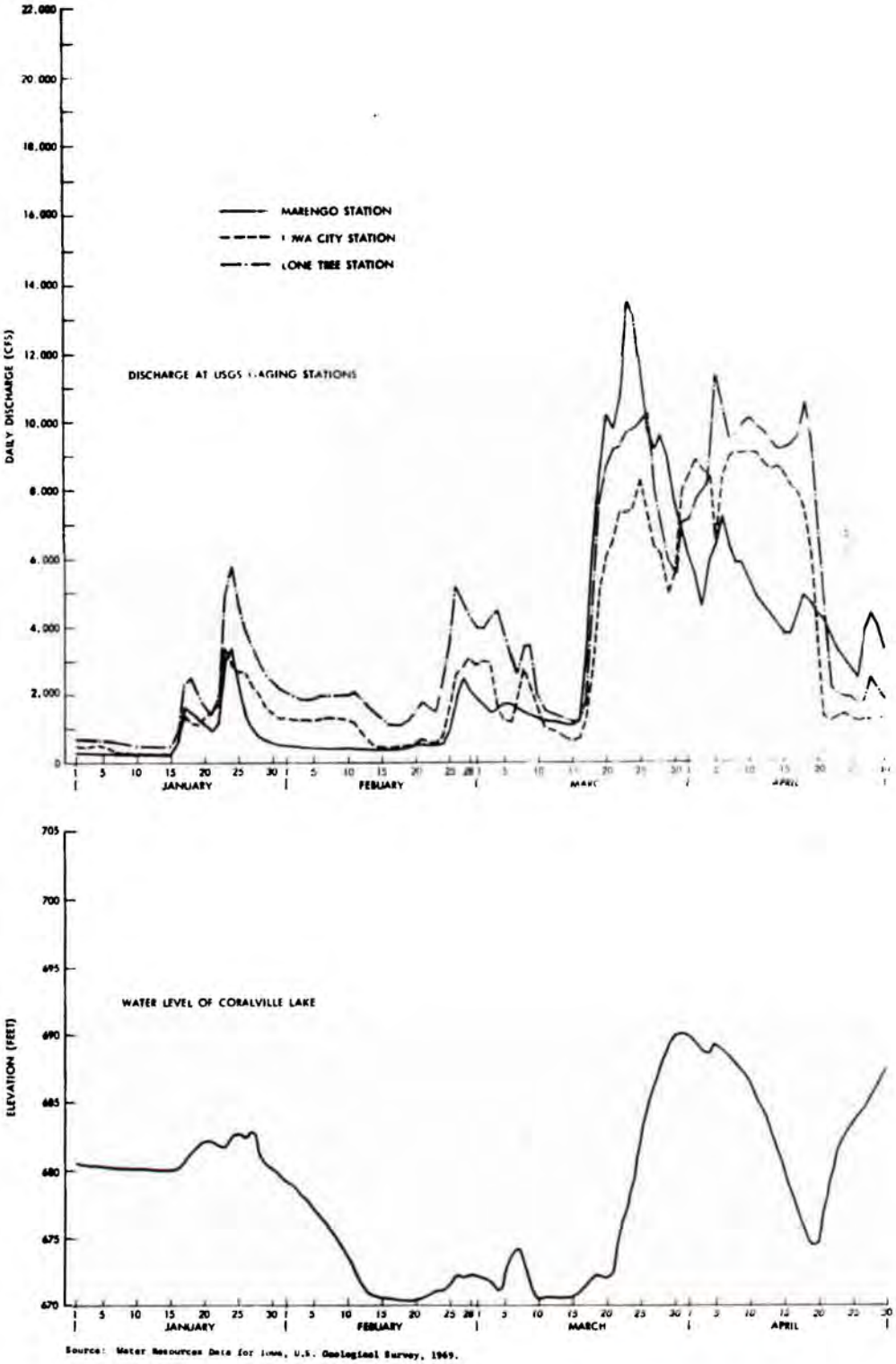
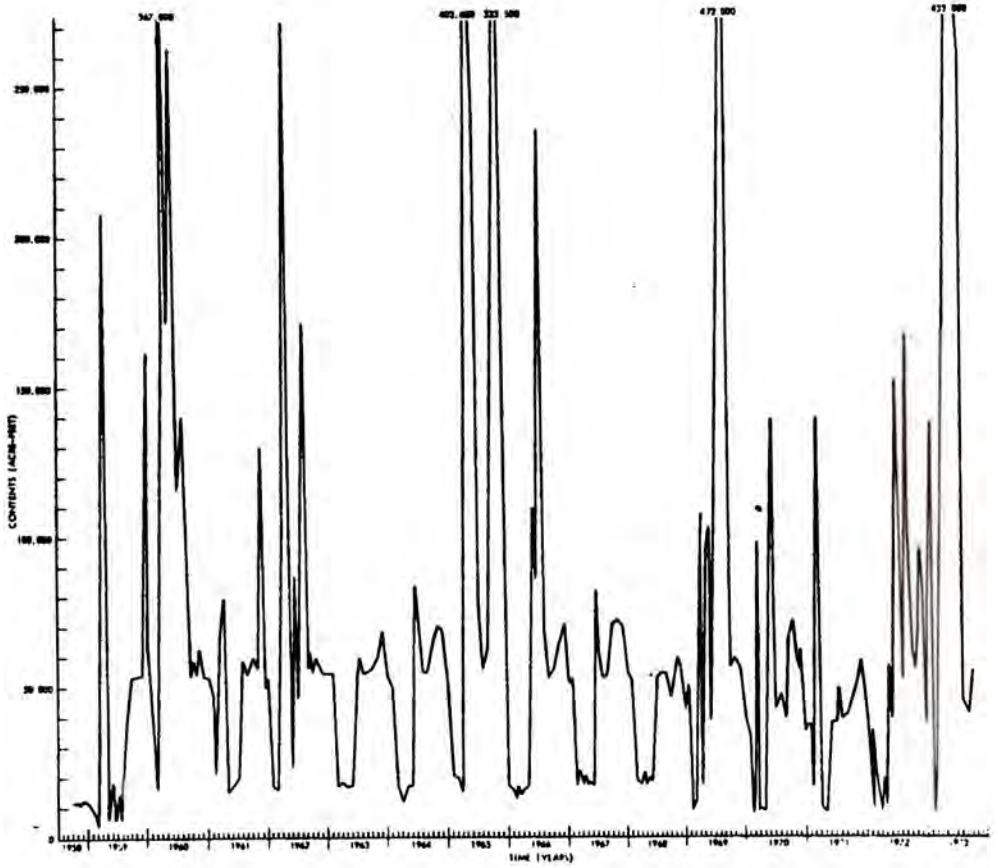


Figure 7 - Daily Discharge at U.S.G.S. Gaging Stations, and Daily Water Level of Coralville Reservoir, January 1 to August 31, 1969.



Source: Water Resources Data for Iowa, U.S. Geological Survey, 1969.

Figure 7 (Concluded)



Source: "Surface Water Supply of the United States, 1966-1970," Part 5, Hudson Bay and Upper Mississippi River Basins, Vol. 3, Upper Mississippi River Basin Below Keokuk, Iowa (1973).
Water Resources Data for Iowa, Surface Water and Water Quality Records, Parts 1 and 2, U.S. Department of the Interior, Geological Survey (1971-74).
Water Resources Data for Iowa, U.S. Geological Survey (1969).

Figure 8 - Variations in Content of Coralville Lake, 1958-1973

D. Visitation

Nearly 80 percent (1,349,500) of the 1974 visits were to eight semideveloped recreation areas at Coralville Lake. The rest of the recreation use (369,800 visits) could be classified as dispersed visitation occurring on Corps properties outside of the established recreation areas. Approximately one-tenth of this annual dispersed use (around 30,000 visits) was recorded at the Hawkeye Wildlife Area above the U.S. Highway 218 bridge.

The most heavily used recreation areas are several sites located near the dam and Sugar Bottom on the east side of the lake near Lake Macbride State Park. The areas near the dam include West Overlook, Turkey Creek, Linder Point, and the Tailwater Areas; in 1973 a total of 676,200 visits were recorded in these areas (53 percent of the visits to developed area). The listing below presents the total number of visits and percent distribution by recreation area:

Recreation Area	Number of Visits (1974)	Percent Distribution
West Overlook[a/]	515,000	38
Sugar Bottom	333,900	25
Mid River	139,900	10
Tailwater Areas[a/]	136,000	10
Sandy Beach	108,400	8
Turkey Creek[a/]	65,000	5
Curtis Bridge	27,600	2
Linder Point[a/]	23,700	2
	1,349,500	100

a/ Recreation areas near the dam.

In discussions with reservoir management personnel, it was ascertained that present recreation visitation could be classified as about 60 percent day use and 40 percent camping. It is also estimated that around half of the visitation comes during the three summer months. Although limited data were available for analysis, it appears probable that as many as 40,000 persons may visit the project lands on a peak summer weekend day. Including the visitation to Lake Macbride State

Park, managed by the Iowa Department of Conservation (1,497,100 visitors in 1973), the Coralville Recreation Complex provides recreation land, water and facilities for approximately 3 million visitors annually.

A unique MRI planning tool, the COMPATRAX recreation participation/allocation model, was used to forecast the recreation demand for Coralville Lake over the next 10-year period. This model treats recreation demand as a function of participation in 13 key outdoor activities. These activities include: attending outdoor events, boating, camping, driving for pleasure, fishing, hiking, hunting, nature walking, sailing, sightseeing, snow skiing, swimming and water skiing. Aggregate participation generated from population centers is allocated on a simultaneous basis among competing recreation resource complexes. Thus, total visitation at a complex (i.e., Coralville Lake) depends on the distance to population centers and the quality and quantity of the recreation resources at the complex. In the Coralville Lake analysis, the COMPATRAX model allocated participation from 143 population areas among 232 recreation/destination complexes in a 24-state area. A detailed description of the COMPATRAX model is presented in Appendix G.

The MRI COMPATRAX projection for Corps-managed land and water is graphically presented in Figure 9. By 1980, the number of recreation visits forecasted is approximately 2 million; by 1985, visitation may reach the 3 million level. These forecasts are presented by activity day classifications in a later section and are converted by space standards to provide a basis for area and facility needs at Coralville Lake.

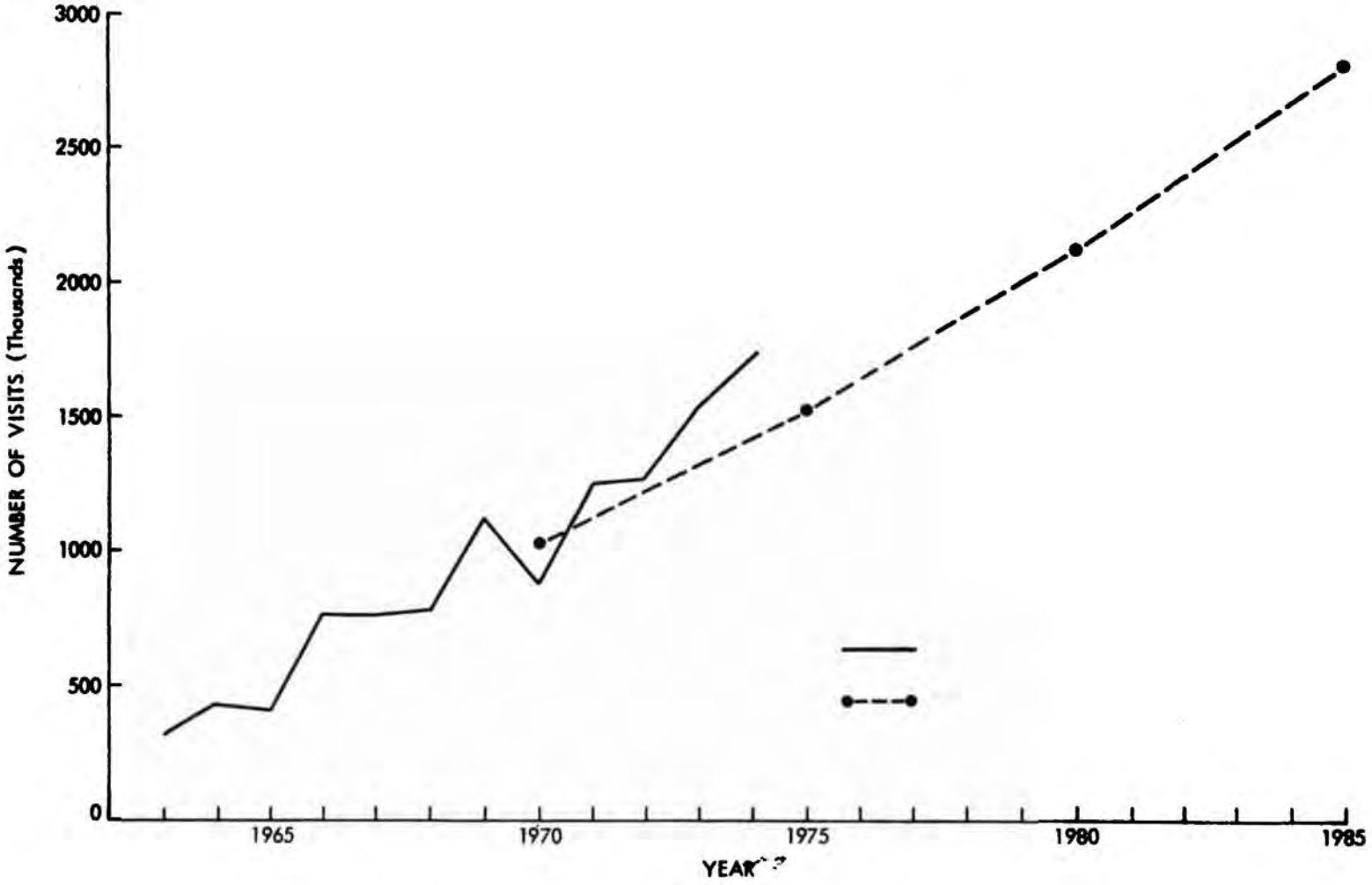


Figure - Trend in Visitation at Coralville Lake

III. OPERATING PROJECTS--STATUS

The recreation facilities at Coralville Lake during the first 17 years of operation have continually evolved in reponse to increased visitation and changing patterns of recreation use. New roads, restroom facilities, and beach areas have been either constructed or expanded to accommodate the growing public demand. Unfortunately, adequate funding has not been available to provide sufficient facilities (quantity and quality) or the desirable level of resource management. Existing recreation developments at Coralville Lake, both public and private, are described in the section that follows.

A. Federal Recreation Development

At the present time, the Rock Island District, Corps of Engineers, operates several recreation areas at Coralville Lake. All areas include vault toilets; potable water is available at all but the Curtis Bridge area. Brief descriptions of the areas are given below:

1. East Overlook Area and Administration Building - Located on the east side of the dam, the East Overlook area provides a view of the lake and surrounding shoreline. The site lies just north of the Administration Building. At the present time, development consists of a road and a parking area.

2. Turkey Creek Heights - This day-use area lies south of the east access road and adjacent to the east abutment of the dam. The topography of the area is steeply rolling with fairly wide ridge tops. Facilities include picnic tables and a picnic shelter.

3. Tailwater East - The East Bank Tailwater area is below the dam and provides users with a launching ramp into the Iowa River. Although sites are not designated, this area is heavily used for camping and picnicking during overflow periods.

4. Tailwater West - The most prominent facility at this site is the road providing access to the Tailwater area and a boat launching ramp which provides access to the waters below the dam. The most prominent uses of this area are picnicking and fishing.

5. West Overlook - This area, adjacent to the west abutment of the dam, provides an excellent view of the lake and dam. The area is extensively used for both day use and camping. Over 200 camping units have been recorded in the area during peak season use periods. The area, in addition to roads and parking spaces, has a beach, launching ramp, and picnicking shelters.

6. Linder Point - This area is located on the right bank of the reservoir approximately 1 mile from the dam. The eastern boundary joins the West Overlook area, while the western boundary joins Squire Point. Roads provide access to the central and western portion of Linder Point. Much of the use is limited to casual recreation users driving in and out of the area. The site is popular as a place to "party."

7. Sugar Bottom - The most extensively developed and utilized area on the entire lake is Sugar Bottom. The area offers abundant room for expansion and diversification of recreational activities. The terrain is gently rolling with a vegetative cover of widely scattered groups of upland hardwood, deciduous shrubs and a planted pine plantation. Sugar Bottom presently contains a beach, launching area and a road providing access for picnickers and campers. Restroom facilities are presently the vault type; showers and flush toilets were installed during the summer of 1975. A sanitary dump station and sewage lagoon is also located at Sugar Bottom. A thousand camping units have been recorded in the area on a peak day. Sugar Bottom has high visitation--333,900 visitors in 1974.

8. Mid River Park - This area contains one of the more attractive views of the lake. Being adjacent to Marina 218, the area provides the recreation user with concession facilities and services. The area contains facilities for day use and overnight visits. Mid River Park is the only extensively developed and utilized area that is located on the northern end of the lake and on the western shore.

9. Curtis Bridge - This development is located on the west shore of Coralville Lake approximately 1/4 mile downstream from the relocated U.S. Highway 218 bridge. Access to the area is by old Highway 218. Facilities include an access road, a boat launching ramp, and a parking area for both trailers and cars. The site was designed and has primary utility for the fisherman, boater, and waterfowl hunter.

10. Sandy Beach - The Sandy Beach area is located just west of the confluence of Sandy Creek with the lake. The site is about 3 miles east of U.S. Highway 218. Formerly a farmstead, Sandy Beach has a scattered tree and shrub cover that enhances the potential of the site. Although camping is presently permitted, the existing facilities are primarily for the day user. The area contains a beach, a launching ramp, and picnic tables. This area has a commanding view of the lake. The area is approximately 18 miles from the Corps Administration Office, and a major problem at Sandy Beach is the difficulty in providing adequate surveillance.

Although Squire Point is listed in the Coralville project brochure, the area was closed to the public several years ago. The roads were difficult to maintain because of the steep grades. Therefore, as the roads washed out, they were not replaced. Today the area is only accessible by four-wheel drive vehicles. Most of the roads have deep ruts cut by erosion.

The facilities available for public use in the above described sites are presented in Table 4. Although this table lists camping and picnic units for nearly every site, the facilities at Coralville Lake do not provide individually designed picnic and camping units. The visitor is allowed to choose where he wishes to have his picnic or set up his camp.

B. Nonfederal Recreation Development

In addition to the federally developed (Corps of Engineers) recreation areas, the Corps leases land to a number of different organizations for a variety of purposes. At the present time, there are nine long-term leases making a total of 15,104 acres available for various forms of public use. The leasing agencies, the total lease acreage and the year of lease expiration for each of these organizations are listed below:

TABLE 4

EXISTING RECREATION FACILITIES AT CORALVILLE LAKE

Recreation Areas[b/]	Picnic Units	Camping Units	Picnic Shelters	Toilet Buildings	Grills	Tables	Wells	Boat Ramps (Lanes)	Swimming Areas	Roads (miles) Asphalt	Roads (miles) Gravel
West Overlook	38	90	3	12	31	110	2 (Hand)	2	1	2.8[a/]	4.5[a/]
Mid River	13	8	1	2	5	15	1 (Hand)	-	-		1.0
Curtis Bridge	--	5	-	2	-	5	-	2	-		
Sandy Beach	6	24	1	6	5	30	2 (Hand)	1	1		1.0
Sugar Bottom	32	143	2	18	36	215	2(H)1(Elec)	3	1	3.3	3.0
Turkey Creek	15	30	1	2	-	39	1 (Hand)	2	-		
Tailwater	5	5	1	4	9	10	1 (Hand)	1	-		
Linder Point	-	15	-	2	5	15	1 (Hand)	-	-		

Source: Corps of Engineers.

a/ Roads throughout the dam complex.

b/ For fiscal year 1976, $829,000 was budgeted for operation and maintenance costs of the above facilities.

Leasing Agency or Group	Total Acreage (Acres)	Expiration Date (Year)
Hawkeye Wildlife Area (Iowa Conservation Commission)	13,048	1984
Lake Macbride State Park (Iowa Conservation Commission)	1,118	1999
Macbride Field Campus (University of Iowa)	620	1984
Hawkeye Area of Boy Scouts	108	1989
Cardinal Council of Girl Scouts	106	1991
Water Patrol Station (Iowa Conservation Commission)	49	1997
Geological Preserve and Study Area (Johnson County Conservation Board)	32	1979
Radar Tracking Station (University of Iowa)	18	1991
Jonco Jills Picnic Area (Isaac Walton League)	5	1984
Total	15,104	

The Corps of Engineers at Coralville Lake also provide six active community dock areas where private boat owners may locate a dock for their own personal use. These community docks house approximately 50 boats. There are no permits issued for personal docks.

C. Private Concessionaire Development

Public demand for boating and fishing opportunities on Coralville Lake has encouraged leasing of land for commercial recreation developments. The three private concessions located on the lake include:

1. Coral Marina - This commercial marina is located on the south shore of Turkey Creek embayment and is the largest dock on the lake. Facilities and services include a boat launching ramp, docks for privately owned boats, sale of gasoline and oil, boat and motor rental, and sale of various types of refreshments, fishing tackle and fish bait. This concession is open throughout the year.

2. 218 Marina - Located on the right bank of the reservoir just south of the Highway 218 bridge, this facility provides a boat launching ramp, private docks, maintenance and repair of privately owned boats, boat and motor rental, and sale of various concession services. This private concession provides a large amount of on-land enclosed boat storage and is also open throughout the year.

3. Coralville Docks - This development is located directly across the lake from the Sandy Beach recreation area. To supplement income, the dock owner has developed a camping area. Facilities and services provided at Coralville Docks include docks for privately owned boats, sale of gasoline and oil, boat and motor rental, and sale of refreshments, fishing tackle, fish bait and other supplies. Public facilities include potable water, sanitary facilities, a boat launching ramp and picnic facilities.

Table 5 summarizes the facilities and services provided at the three commercial concessions.

TABLE 5

COMMERCIAL CONCESSIONS AT CORALVILLE LAKE

	Total Acreage	Boat Storage Spaces (wet and dry)	Gross Receipts 1974 ($000)	Launching Lanes	Picnic Area	Camping Area	Sanitation Facilities	Drinking Water	Food Service	Tackle & Bait	Gas & Oil	Boat & Dock	Cabin Rental	Lease Expiration Date
Coral Marina	22.3	302	307	2				X	X	X	X	X	X	1985
218 Marina	6.7	250	225	2				X	X	X	X	X		1984
Coralville Docks	22.3	80	28	1		X	X	X	X	X	X	X		1985
Total	51.3	632												

Source: Corps of Engineers.

IV. CONSTRUCTION PROJECTS -- STATUS

Current policy requires cost-sharing by a non-Federal public agency for expansion of existing recreation areas or for development of new recreation areas at Coralville Lake. The one exception to the cost-sharing policy is for upgrading sanitary facilities in existing Corps managed recreation areas. If a non-Federal sponsor cannot be obtained and upgrading of existing facilities is needed to meet urgent sanitation needs in accordance with the provisions of applicable State and Federal laws, the Corps may develop the needed sanitation facilities at 100 percent Federal cost.

The facilities in recreation areas at Coralville currently meet minimum State and Federal Standards as they relate to general welfare of the visiting public and to control of water and air quality. However, meeting minimum standards at the present does not reasonably assure continued safe use by project visitors. Upgrading of existing sanitation facilities in some recreation areas is deemed appropriate to accomodate ever increasing visitation and to prevent near future overloading of sanitation systems. This reasoning is the basis for a proposal to upgrade sanitation facilities in the West Overlook, Mid River and Sugar Bottom recreation areas with Code 710 funds in FY 77 and FY 78.

The proposed upgrading will provide waterborne toilet facilities in the West Overlook, will enlarge existing waterborne facilities in Sugar Bottom and will provide additional (backup) vault toilets in both the West Overlook and Mid-River areas.

V. RECREATIONAL AND ENVIRONMENTAL RESOURCES OF THE PROJECT AREA

A. Geologic Resources

At the base of the stratigraphic section of this region are Precambrian metamorphic and igneous rocks; these are buried by an extensive sequence of nearly flat-lying Paleozoic sedimentary rocks. Overlying the Precambrian are Cambrian dolomites and sandstones, and Ordovician dolomites, sandstones, limestone, and shales. These rocks are not exposed at the surface in this region and are known only through well records.

Sedimentary rocks of Silurian, Devonian, Mississippian, and Pennsylvanian age comprise the bedrock surface in the area. Dolomites of the Niagaran Series comprise the Silurian System in this region and are overlain by Devonian limestones, dolomites, and shales. Several of the Devonian formations are highly fossiliferous, containing well-preserved brochiopods, bryozoans, and coral. Overlying the Devonian formations are occasional remnants of Mississippian and Pennsylvanian limestones.

Unconsolidated glacial clay, silt, sand, gravel and wind-deposited loess cover most of the project area. The entire Iowa River Basin has been covered by deposits of two early ice sheets, the Nebraskan and the Kansan. In addition, three lobes of younger Wisconsin-Age drift (Iowa substage) extend into northern Johnson County, overlying the older glacial deposits. Stream-deposited alluvium of Recent Age underlies the floodplain.

The mineral resources of the project area consist of sand, gravel, and limestone. Sand and gravel resources are found in glacial drift or in the alluvial materials of the river floodplain and terraces. Carbonate rocks of Devonian and Mississippian ages are excavated in limestone quarries within the project area.

Two areas near Coralville Lake have been established as geologic preserves. The Stainbrook Geologic Preserve is located by Mehaffey Bridge on the east side of Coralville Lake along County Highway Y. Here the richly fossiliferous Cedar Valley Limestone is exposed along a roadcut. A smoothed and

striated glacial surface that was developed on the State Quarry Limestone by the Iowan Glacier is also located in this area. The Old State Quarry Geological Preserve is located on the western shore of Coralville Lake, 1/3 mile east of County Highway Y. In the quarry wall, 15-20 feet of State Quarry Limestone is exposed. Building stone was obtained from this quarry for the Old Capitol building at Iowa City, the foundation for the new Capitol at Des Moines, and abutments for the old Burlington Bridge at Iowa City.[8]

There are two other sites of unusual geologic formations near Coralville Lake which have not been established as geologic preserves. They are south of the lake, near the junction of Clear Creek and the Iowa River, and include a "Coralville limestone member" and a "rapid limestone formation," both representative of the Devonian system. They are located at the River Products Quarry west of Iowa City in Johnson County in the northeast half of the southwest quarter of Section 32, T80N, R6W. These sites are on privately owned land and no plans for exhibit to the public are proposed.

B. Archeologic Resources

The activities of man may have obliterated much of the visible evidence of former aboriginal habitation within the southcentral Iowa River Valley, which includes the Coralville Lake area. Much of the original geomorphic setting within the river valley has been modified by extensive urban and commercial developments, and many of the archeological sites are disturbed so badly as to be relatively valueless for research and/or preservation. However, where lands have not been subject to substantial alteration, the probability of encountering an undisturbed archeological site in the south-central Iowa River Valley is relatively high.

In floodplain areas, alluvial sedimentation often occurs quite rapidly and to a substantial thickness. Several components, each representing a different culture separated by several feet of sediment, can be located within the same area. Archeological sites are often present in such areas even when there are no surface indications of their existence.

Undisturbed areas within the dissected bluffs north of the Amana Colonies and adjacent to Coralville Lake are highly

probable sources of archeological sites. Below Iowa City, undisturbed areas within the dissected bluffs west of the Iowa River are also likely to contain archeological resources. Furthermore, alluvial terraces which adjoin these bluffs are potential site areas.

There are numerous known archeological sites located within or near the Coralville Lake project area. Habitational, mound group, rock shelter, shell midden, stone weir, and other sites have been found in Iowa, Johnson, and Louisa counties. The exact location, elevation, site type, association (if known), and description of artifacts or materials which have been found at the sites and reported in the literature are included in the recently compiled environmental assessment of Coralville Lake.9/ At least nine sites are known to exist on federally owned land near Coralville Lake. A summary of these sites and their location on a map are presented in Appendix H.

One of the known sites, stone fish weir, has been identified as potentially significant and unique within the Iowa River Valley. It lies in the southeast quarter of the southeast quarter of Section 33, T81N, R9W, east of Amana. (This is Site 13 IW 100 on the map, Appendix H.) The weir is constructed of large glacial rocks placed in a V-pattern across a sharp bend in the Iowa River. There is considerable controversy surrounding the site, since this type of structure has not been previously observed in this locality.

There are presently no plans for protection and/or salvage and interpretation of the fish weir or any of the above sites. None of the sites will be directly affected by recreation developments proposed in this plan. As funds permit, additional inspection of the known sites, particularly 13 IW 100, will be performed by a professional archeologist in order to determine potential recreation or interpretive resource values which could be part of the management plan for Coralville Lake and the adjoining recreation areas. If future development occurs near any of these sites, further investigations will also be undertaken.

C. Historic Resources

There are no known historic sites which are directly associated with federally owned land near or around Coralville Lake. The Amana villages in Iowa County and the Toolesboro Mound Group in Louisa County are the nearest sites to Coralville Lake listed in the National Register of Historic Places and in the Federal Register. A summary of noted historic events, markers, and sites in Iowa, Johnson, and Louisa counties is contained in a recent environmental assessment of Coralville Lake.9/

D. Ecosystem Relationships

The critical ecological aspects of project management and land use around Coralville Lake can be discussed in three general categories: botanical, aquatic, and terrestrial wildlife elements. Vector control programs are also described.

1. Botanical Resources: The terrestrial vegetation of the Coralville area was originally one of two general types: tallgrass prairie or a mixed deciduous forest community. Little, if any, of the present vegetation of the area remains unaltered by man's activities. Prairie areas have either been cultivated or, with the exclusion of fire, have reverted to forest. Similarly, cultivation, timber harvesting, recreation development and especially urban expansion and rural subdivision developments have removed or greatly modified the original forest communities.

Prairie areas can now be found only in isolated sites along drainageways, some road rights-of-way and in small corners which were unsuitable for cultivation or grazing in the past. Some of the dominant species of this vegetative type are Indian grass, little bluestem, big bluestem, prairie cordgrass, and several others.

Some disrupted areas which were once forest are now reverting back to native species. Old fields and pasturelands around Coralville Lake, such as in the vicinity of Sugar Bottom, are reverting to native species of more complex communities. Young trees are now present about 15 years after cessation of agricultural operations. Also, some areas have been planted to trees by the Corps of Engineers. In the upland sites, the climax association will probably be a form of oak-hickory, primarily

the bur oak-shagbark hickory association. The elm-ash association in the lowland sites will probably be dominated by ash, basswood and other subdominant species as the elms are gradually eliminated by Dutch elm disease.

The area between the conservation pool and the upper levels of the flood pool was largely floodplain forest and agricultural land prior to construction of Coralville Lake. There are a variety of gradients within the flood pool from precipices to gentle slopes. The area of steep slopes supports little to no vegetation below the 712 feet mean sea level elevation. In areas of low relief, the vegetation varies considerably from year to year in relation to the frequency and duration of flooding.

As may be expected, the areas at the lower elevations support more ephemeral, simplistic plant communities than those areas which are not frequently flooded. In the lowest zone (670 to 680 feet), the smartweed appears to be one of the most prevalent species. Slightly above the smartweed community and progressing upward over an elevation of 5 to 6 feet (680 to 685 feet elevation) several rather distinct communities are observed which have relatively narrow zones of integration. The lowest of these communities is predominately quillwort. Following this is a community with yellow nut grass as a major species with a concomitant decrease in the abundance of smartweed. Slightly higher, a zone of beggarticks of several species is present. Above this latter zone, communities with tree species are present with a subordinate vegetation of both annuals and perennials.

At higher elevations (685 to 695 feet mean sea level), perennial vegetation is becoming established. One site which was sampled had an overstory of cottonwood about 15 years old and from 25 to 35 feet tall. Tree species of the understory include silver maple, green ash, river birch and American elm. The silver maple are by far the most abundant of this group with densities of over 1,000 individuals per acre. Many of the maples have had the aerial portion of the plant killed, apparently by high water, but have resprouted from the root crown. It appears that the maples will become the dominant species in this community if they are able to gain sufficient height to photosynthesize during flood periods.

Floodwaters obviously destroy the aerial portions of plants which are inundated during the growing season. Many of the young stands of trees which are below the flood pool elevation have had the lower portions of their crowns killed. That portion of the trees which is killed may be 15 to 20 feet above ground level and corresponds to the 710 to 712 feet mean sea level elevation.

In summary, present water level management will continue to maintain relatively simplistic, unstable plant communities at the lower elevations. Communities at the higher elevations are forming a successional pattern which shows some increase in species diversity and productivity.10/

On the lands around Coralville Lake which are administered by the Corps of Engineers, there are 2,345 acres of forest land downstream from U.S. Highway 218. Of this area, 1,470 acres are considered to be fully stocked stands (75 to 100 percent crown cover), and 875 acres are sparce to moderately stocked. The forest land is estimated to be 7.265 million board feet. About 340 acres of this forest land are used primarily for recreation; 1,295 acres are managed primarily for wildlife habitat. The Corps lands upstream from U.S. 218 are leased to the Conservation Commission for the administration of Hawkeye Wildlife Area.

2. Aquatic Resources: The relationship between the existing aquatic ecosystem and project management is exceedingly complex. Three primary factors affecting this ecosystem are extreme water level fluctuations, high sedimentation and turbidity, and poor water quality.

Coralville Lake can be classified as a eutrophic body of water with high biological productivity.11/ Large amounts of organic and inorganic nutrients are brought into the impoundment by the Iowa River and the drainage area adjacent to the lake.12/ The shallowness of the lake's peripheral areas allows the photosynthetic zone to be in contact with nutrient-laden sediments and decomposing organic material in these areas. Readily available nutrients are responsible for periodic dense algal blooms in some shallow areas; these conditions have been partially responsible for at least one fish kill.13/ On the other hand, rapid flow-through conditions in the main body of the lake prevent the development of stabilized aquatic plant communities and open-water phytoplankton production.12/

The benthos is an important indicator of the general productiveness of a lake's fishery resources because benthic invertebrates are the basic food items of most small and many large fish. This is particularly true for the more specialized feeders such as the predatory game fish (in contrast to generalized feeders such as carp). During spring high water periods, dead trees and shrubs in the upper reaches of the lake are inundated and serve as substrates for the development of periphyton communities. Immediately after the onset of periphyton growth, benthic invertebrate colonization may occur, temporarily providing the lake with a large supply of these organisms. Sedimentation, water level fluctuations, and periodically low levels of dissolved oxygen have led to generally low benthic invertebrate production in the lake.

Large water level changes prevent the stabilization of rooted aquatic vegetation. These plants are necessary for attachment by benthic invertebrates and also for fish cover. Excessive turbidity limits growth of aquatic vegetation as well; the large number of rough fish in the lake also increases turbidity levels, thereby limiting the establishment of submerged and floating leaf aquatic plants. The lack of rooted aquatic vegetation limits habitat diversity and consequently the size of diversity of game fish populations.

During winter, heavy ice cover prevents aeration of surface waters. Lake management for flood control calls for a reduction in the size of the pool prior to spring runoff. This procedure reduces the volume of water available for dilution when spring runoff, heavily laden with nitrates, phosphates and organic matter, enters the lake. The result is a high BOD (Biological Oxygen Demand) which depletes the oxygen supply in the lake, annually killing many small fish and in at least one instance, killing up to 125 pounds of fish per acre.14/Game fish are generally much more susceptible to oxygen depletion than "rough" fish.

Other influences from extreme water level fluctuations include the desiccation of spawning areas and increased disease and parasitism during low water levels. The former is a key factor affecting fish species composition. Additionally, when water levels recede, small fish are forced out of their normal habitat into open water where they may fall victim to larger predators. During this period, the fish are crowded into a smaller volume of water and the resultant stress often leads to mortality.

The result of the above influences has been a highly productive aquatic ecosystem in terms of rough fish species (i.e., carp, carpsucker, and buffalo populations are large) while game fish such as channel catfish, crappie and bullhead are less dominant than rough fish. Game fish such as bluegill, northern pike, walleye and white bass have been maintained through intensive stocking efforts by the Iowa Conservation Commission.14/

The tailwaters of the lake have provided a significant sport fishery, largely due to the cooperative management efforts of the Iowa Conservation Commission and the Corps of Engineers. Conditions in the tailwaters are more predictable and easier to manage due to the buffering effects of the lake on extremes of flow and water quality.

The lake is now open to year-round commercial fishing. Gizzard shad adults were stocked during the spring of 1974 in hopes that this species would fill the void in the food chain left by the commercial removal of rough fish. The presence of this species should improve the growth and recruitment of game fish. However, it is anticipated that fluctuating water levels will continue to be primarily responsible for the simplified food chains and low reproductive success of game fish in the lake.

3. Terrestrial Wildlife Resources: Terrestrial wildlife habitat types around Coralville Lake include deciduous upland forest, floodplain forests, sloughs, swamps and mud flats in the lower areas between the conversation and flood pools. The mud flat areas are kept in the early stages of succession due to the fluctuating water levels. In areas of higher elevation, vegetation becomes more diversified as a result of the lower frequency of flooding; this more diverse vegetation provides better wildlife habitat.

The mud flats with their temporary ponds, sloughs and marshy areas provide good habitat for some species of amphibians, especially frogs, during summer months. Many turtle species utilize the fallen trees (primarily in the upper reaches of the flood pool) for sunning and resting spots. Where lakeside areas are vegetated, they provide good habitat for water snakes. Other snakes, such as the bullsnake and the prairie kingsnake, along with the lizards and box turtles, prefer the drier habitat of the upland woods and fields.

There are 274 species of birds with a geographical range which includes the project area. Waterfowl use the edges of the lake, temporary ponds and marshy areas during migration periods. Shorebirds, gulls and terns inhabit areas similar to those used by the waterfowl. Along the mud flats bordering large and small areas of water the common snipe and killdeer search the mud for insects, worms and other food.

The stand of dead trees at the lake's upper end provides good perching spots for osprey and excellent habitat for woodpeckers. Limited populations of raccoon and skunk may inhabit the flood pool areas.

The drier habitat of upland woods and fields is preferred by most reptile species of the area. Birds of prey, such as hawks and owls, are largely restricted to the drier upland sites where most of their prey (small mammals) are found. Quail and pheasant prefer the more open woodlands, forest clearings, and abandoned farmlands. Quail density is moderate with about 30 birds per square mile.15/ This area is on the northern edge of the geographical range for bobwhite quail. Pheasant densities are high, with approximately 180 birds per square mile.15/

There are a few wildlife species which are considered either rare or endangered and may be found within the project area. The peregrine falcon may migrate through in the spring and fall. The osprey and pigeon hawk are presently of "undetermined status." Bald and golden eagles may use the project area as a migration stop. Finally, the Indiana bat may be found nesting in hollow trees in the project area; this species is considered to be threatened nationally.

Game animals in the area include deer, eastern cottontail, jackrabbit, coyote, gray fox, red fox, raccoon, fox squirrel, grey squirrel and woodchuck.16/

The furbearers which inhabit this area are beaver, muskrat, raccoon, three species of weasel, mink, opossum, badger, striped skunk, spotted skunk, red fox, gray fox, woodchuck and coyote.16/ The riparian and floodplain forests are the most desirable habitats for beaver, muskrat and mink. Extensive beaver cutting or muskrat houses have not been observed above the dam, but some have been seen downstream.*

* Considerable beaver cuttings have been noted on Swisher Creek by County Road E, just upstream from Highway 218.

The available habitat for the other furbearers has probably increased on the federal lands around the lake. The abandoned farms around the lake have resulted in increased rabbit populations.

In general, the diversity and abundance of fauna are a direct result of the diversity and abundance of habitat types. The more simplistic plant communities existing within the flood pool primarily as a result of the fluctuating water levels of Coralville Lake have markedly reduced the diversity and abundance of terrestrial wildlife populations throughout that large area. On the other hand, on the federally owned land above the flood pool, many previously disrupted areas are now returning to native species and more complex communities. Here, terrestrial wildlife populations are becoming more stable. Any management policy which reduces habitat area also reduces wildlife populations to some extent. So long as recreation development is minimized and confined insofar as possible to compact sites in the project area above the flood pool, project management will have comparatively little effect on those area wildlife populations which require the drier upland sites to survive.

4. Insect and Vector Control: In a report prepared by the U.S. Public Health Service, it was concluded that the presence of Coralville Lake would not create a malarial or encephalitic hazard of any significance.17/ The Rock Island District biologist substantiated these findings during investigations in the summer of 1959. No outbreaks of these diseases have been reported since reservoir operation began.

Several practices are used to control possible vector problems. Water fluctuations are programmed to drain or pump water catch basins that are created within the project area. These catch basins can be managed for marsh habitat during periods of the year when mosquitoes are not breeding. Dead timber and floating debris are cleared in part to remove conditions favorable to mosquitoes and other noxious insects.

E. Environmental and Scenic Qualities

Land surrounding Coralville Lake is gently rolling with a few steep hills, ridges, and rocky outcrops in the lower reaches of the project area. There are sizeable areas of relatively flat farmland and river bottom land further upstream.

Scenic and aesthetic values are often tied closely with the distribution and management of forest resources. Johnson County has a higher percentage of forest land within the Iowa River "corridor" than any of the eight counties of the Iowa River portion of the Iowa River Subbasin. (This corridor is the strip of land and water delineated to include near- and far-view landscapes to the tops of ridges surrounding the stream and river valleys of the Iowa River.) Around Coralville Lake, a great acreage of forest land was cleared prior to inundation; the majority of lands now owned in fee title and under direct Corps management are abandoned agricultural fields. Nonetheless, upland hardwood forests are found along the upper sloping portions of the valleys, and the existence of these federally owned forest lands above the flood pool is responsible for preservation of part of the valuable scenic forest resource in the Iowa River Subbasin. The relative value of the forest resource is perhaps even higher in Johnson County because of the large urban populations in and near the county.9/ Emphasis will be continued on those management policies which encourage recreationists to use the forested areas around Coralville Lake in their natural state with a minimum of manmade developments.

Within the Iowa River Subbasin, the majority of land is devoted to agricultural use. Land which was previously used for grazing is increasingly being converted to use for crop production as worldwide demand for cereal grains and soybeans for human consumption rises. The increase in corn and soybean farming, however, has increased the rate of erosion. The Soil Conservation Service considers erosion to be a problem on 82 percent of the crop and pastureland within the Iowa River drainage area.18/ The present sediment load of the Iowa River is heavy, with about 1,200 acre-feet of sediment being deposited annually into Coralville Lake.18/ Increases in the amount of agricultural production leading to increases of siltation will naturally reduce the lake's effectiveness for flood control but more especially for recreation and wildlife uses related to the conservation pool. Equally important are the deleterious effects of high turbidity on aquatic ecosystems and the lake's aesthetic values.

The most noticeable visual feature of Coralville Lake is the area of barren, exposed shoreline which can be seen at any time, but especially during periods of maximum drawdown. At some points the mud flat area is much more visible than at others because the topography around the lake alters from steep,

sharply rising rocky outcrops to broad, gradually sloping, nearly flat areas. At recreation areas such as Sugar Bottom, the large mud flat area detracts appreciably from aesthetic enjoyment. At the summer conservation pool elevation (680 feet mean sea level), the lakeside areas are scenic.

In addition to the mud flats, a number of dead, bleached trees are highly visible within the flood pool. Within Hawkeye Wildlife Management area the stands of dead trees are beneficial to fishery and wildlife resources. However, below U.S. Highway 218, the isolated instances of dead trees which have never been removed from the flood pool are aesthetically objectionable to many recreationists. They can also pose a safety problem to boaters.

Surrounding hills, ridges, and draws above the flood pool are largely either floodplain forest or abandoned farmland, which is reverting to a mixed deciduous forest community. Lake Macbride State Park contrasts visually with Coralville Lake because water levels are sufficiently stable to have allowed good vegetative growth down to the water's edge.

Access roads within the project area are poorly marked or not marked at all. Where land is developed, as for some concessionaires in the project area, facilities and signs frequently appear in need of paint or repair. Solutions to these and other management problems will be discussed in Chapter X of the plan.

Examination of the water quality at lake sampling stations reveals several problem areas. During periods of high runoff, dissolved and suspended solids create excessive turbidity in the lake. In addition, serious deficiencies in dissolved oxygen concentrations occur annually below the lake's 5-foot depth, generally coinciding with heavy algae blooms. The low oxygen content apparently results from the microbial oxidation of organic debris from sources such as decomposing algae populations, sewage effluents, and material in surface runoff. Phosphate concentrations for the lake far exceed federal recommendations for Class A and B warm waters (classifications for primary contact recreation; and wildlife, fish, aquatic and semiaquatic life, and secondary contact recreation, respectively).19/ The primary pollution source for the lake is runoff

from both tilled and pasture land, domestic animal wastes, roadways, etc. Secondary sources include soil seepage from septic systems of lakeshore residents. Finally, pesticide studies on surface water and sediment samples[9/] show concentrations of DDT in excess of federal recommendations.[19/]

F. Recreation Uses at Coralville Lake

Table 6 shows the annual number of activity days (activity occasions) for the primary recreation activities provided at Coralville Lake. Data shown are for 1970, 1975, 1980 and 1985. Future visitation rates were projected using a unique MRI computer planning model, COMPATRAX, programmed to consider the changing population and recreation participation rates throughout a 24-state region.

During 1970, fishing, swimming, and picnicking constituted the primary recreation uses of the lake. Future projections indicate these three activities will continue to be the most important in terms of annual number of activity days. The total number of annual activity days is estimated to increase from about 2.4 million in 1970 to 6.9 million in 1985. Fishing, swimming, and picnicking combined will account for nearly four-fifths of the activity days by 1985.

TABLE 6

RECREATION PARTICIPATION AT CORALVILLE LAKE
(Thousands of Activity Days/Percent of Total)

Activity	1970		1975		1980		1985	
Picnicking	290	12.2	497	13.7	772	15.0	1,105	15.9
Boating	170	7.2	243	6.7	317	6.1	404	5.8
Camping	55	2.3	89	2.5	133	2.6	189	2.7
Fishing	941	39.7	1,357	37.4	1,811	35.1	2,310	33.3
Hiking	9	0.4	12	0.3	14	0.3	16	0.2
Hunting	144	6.1	178	4.9	213	4.1	249	3.6
Swimming	580	24.5	993	27.4	1,544	30.0	2,210	31.8
Sightseeing	64	2.7	78	2.2	92	1.8	106	1.5
Water Skiing	48	2.0	91	2.5	151	2.9	219	3.2
Other	68	2.9	89	2.5	110	2.1	131	1.9
Totals	2,369	100.0	3,627	100.1	5,157	100.0	6,939	99.9

Source: MRI's COMPATRAX Recreation Participation Allocation Model

Note: An activity day is equal to an activity occasion greater than one-half hour in duration for any particular activity.

VI. FACTORS INFLUENCING AND CONSTRAINING RESOURCE DEVELOPMENT AND MANAGEMENT

A. Population and Recreation Use Trends

Coralville Lake, having been developed approximately 17 years ago, now responds to many use patterns unforeseen at its inception. Existing building construction and circulation systems within the project area have been considered in the master plan, along with many outside pressures exerting influence over the area. The most dominant of these outside pressures includes two major areas of population, Iowa City 5 miles to the south and Cedar Rapids 10 miles to the north, with various smaller communities scattered throughout the surrounding area. The rapid and continued growth of these population centers has created a high demand for water-oriented recreation activities in the project area.

In a 10-county regional area around Coralville Lake, the population increased by 15.3 percent during the 1960 to 1970 decade.9/ Increases of 19 percent or more were evident in Scott, Linn, and Johnson counties. This growth can be attributed primarily to the increases in enrollment at the University of Iowa from 11,000 to approximately 20,500 during the same 10-year period. Recent population projections for Johnson County show that during the next 15 years the population may approximately double. Since much of this population will be among the college age group, appropriate consideration has been given in planning the development of recreation facilities at Coralville Lake.

B. Regional Recreation Resources

Coralville Lake is by far the most sizable water body in the east central Iowa region. (This 10-county region includes Benton, Linn, Jones, Iowa, Johnson, Cedar, Clinton, Scott, Muscatine, and Washington counties.) After Coralville Lake and Lake Macbride, the next largest lake is 305-acre Lake Darling in Washington County, nearly 50 miles to the southwest. Regional opportunities for activities requiring large water acreage (e.g., water skiing) are thus limited to Coralville Lake. The fact that most of the region's major public recreation areas are located on streams or rivers is an indication of the importance of water-based recreation in this area.

The most abundant recreation resources in east central Iowa are those classed as general outdoor recreation areas and natural environment areas in the Bureau of Outdoor Recreation Classification System. High-density recreation areas, historic and cultural sites, and reserved open spaces and undeveloped lands are represented occasionally. There are no unique natural areas or primitive areas. From these facts, it appears that there is a relative shortage of high value scenic resources, and opportunities for isolationist recreation are nonexistent. Future provisions for opportunities to sightsee, hike, walk, etc., should take into account the fact that recreationists in this region have ample areas for high density recreation activities but few opportunities to escape from other visitors and enjoy quiet and solitude.

As a result of the rapidly rising metropolitan populations in east central Iowa, there will be increases in the demand for activities such as golf, outdoor plays and concerts, and driving and walking for pleasure. Much of this demand will need to be met close to the population centers and will require greater commitment from municipal governments. Outlying recreation developments, such as Coralville Lake, will help meet regional needs by emphasizing scenic roadways and trails; other facilities and developments provided for in this master plan will improve the accessibility of public use areas, and provide additional facilities for picnicking, camping and sightseeing. The aesthetic appeal of recreation areas will become increasingly important as participation in "passive" activities rises relative to other pursuits.

C. Aesthetics

Fluctuating water levels from the 670-foot winter pool level to the 680-foot operating level and to the 712-foot flood pool level have a detrimental impact on the scenic quality of the shoreline and also inhibit game fish production.

D. Soils

The soils of the Coralville Lake area were generally developed either from glacial till or loess; the three major associations represented in those areas where recreational development is planned are Shelby-Lindley, Lamont-Chelsea, and

Fayette associations. The Shelby-Lindley association soils are dark colored, moderately well-drained loams found on strongly sloping to steep, well-dissected slopes (5 to 30 percent slopes). Lamont-Chelsea association soils were developed from eolian sand. They are light colored, well to excessively drained soils found on uplands and stream terraces (1 to 40 percent slopes). Light colored, well-drained silty loams found on gently to strong sloping sideslopes (1 to 24 percent slopes) are representative of the Fayette association, a soil class of loess origin.

Available data do not permit development of a detailed soils map for federal lands around Coralville Lake. A very small scale soils map of the project area was prepared for the recent environmental assessment.9/ For purposes of this master plan, Table 7 rates the three soil associations described above on their limitations for various land uses, including recreation development.

E. Transportation

A major problem area with regard to transportation networks concerns county roads which have been affected by the project. The rural Johnson County road system has received increased use from both new residents moving into rural areas and from increased recreation traffic flowing to Coralville and Macbride lakes. In addition to the effect of increased traffic, certain segments of the county road system are being damaged by flooding and wave action during high water levels at Coralville Lake. The additional traffic flow and flood damage to Johnson County roads have increased the county's operating and maintenance expenses substantially above the average cost for roads of this type. These problems received special attention in this document. Recommendations are made regarding the closing of certain roads. Road relocations are necessary in some cases to facilitate access to specific sites.

F. Law Enforcement

A primary problem hampering law enforcement at the Coralville Lake area is the 30 to 45 minute response time necessary for the sheriff's department to reach the lake. However, the Corps Rangers have authority to issue citations

TABLE 7

ENGINEERING INTERPRETATION OF MAJOR SOILS ASSOCIATIONS
NEAR CORALVILLE LAKE

Possible Limitations	Soil Association		
	Shelby-Lindley	Lamont-Chelsea	Fayette
Source Material:			
Topsoil	Fair to poor	Fair to poor	Good, upper 6 to 10 inches
Sand and Gravel	Not suitable	Good	Not suitable except locally
Features Affecting:			
Farm Ponds	Good sites common	Not suitable	Sites have several problems
Agricultural Drainage	Good sites common	Not suitable	Sites have several problems
Terraces and Diversions	High density subsoil, difficult to vegetate	Not favorable	Favorable
Degree of Limitation For:			
Residential Development	Moderate to very severe on steep slopes	Slight to moderate	Slight to severe on steep slopes
Agricultural Farm Crops	Moderate to severe on steep slopes	Moderate to severe	Slight to severe on steep slopes
Septic Tank Disposal Fields	Moderate to severe	Slight	Slight to severe on steep slopes
Recreational Uses (paths, play areas, campsites, etc.)	Slight to moderate	Slight to severe	Slight to severe on steep slopes

Sources: U.S. Department of Agriculture, Soil Conservation Service, "Inventory and Evaluation of Soil Resources of Johnson County, Iowa," 4 November 1974.
U.S. Department of Agriculture, Soil Conservation Service, Land Capability Classification, Agricultural Handbook No. 210, September 1961.

under Title 36 of the Code of Federal Regulations. The absence of telephone service at Sugar Bottom and Sandy Beach creates certain problems for persons who wish to register complaints from these areas. Placing police call boxes in these areas has been previously considered as a possible alternative. However, experience has shown that the number of false alarms received defeats the purpose of call boxes.

Some of the calls presently received by the sheriff's department from Coralville Lake users involve violations of Corps regulations, such as driving on the grass or in a restricted zone, rather than state laws. It appears that the only answer to the present law enforcement problems at Coralville Lake is additional staffing of rangers and enforcement people to allow surveillance of the lake and recreation areas. Appropriate recommendations have thus been made concerning staffing in this revised master plan.

G. Archeological, Historical, and Cultural Sites

At the present time, there are few important archeological, historical or other cultural sites in or near the Coralville project. Although a few have the distinction of being on the Federal Register none of these are located near existing or proposed recreation developments. Therefore, no special consideration is necessary to prevent deterioration of these areas.

H. Water and Sewerage Disposal

A detailed discussion of present water quality conditions in the lake is contained in a recent environmental assessment.[9/] The primary pollution source for the Iowa River and Coralville Lake is runoff from tilled fields and pastureland, roadways, etc. Secondary sources include domestic sewage, industrial and storm sewer discharges, and septic effluent from developments without central sewage system.

Septic tanks are the primary means of sewage disposal used in rural Johnson County. The use of septic tanks has created some problems with seepage of untreated sewage during periods of wet weather. The septic tank problem is particularly acute in northern Johnson County where the greatest concentration of exurban residents are located. The soils in these areas

are predominantly clay with slopes of greater than 15 percent in some locations. Soil and topography characteristics of this type are definitely not conducive to septic tank use.

The sewage disposal problem has become so severe that the county health board has restricted development of new rural homesites to a minimum lot size of 5 acres. A central sewage treatment facility has been proposed for existing residential developments located between Lake Macbride and Coralville Lake in northern Johnson County. A special sanitary sewage district will have to be formed, however, before this plan can be implemented.

A considerable oxygen deficiency occurs annually in the lake as dissolved oxygen is reduced below state standards to lethal limits for aquatic life.20/ Both dissolved and suspended solids have produced excessive turbidity levels during periods of high runoff. Phosphate concentrations in the Iowa River annually exceed the recommended levels for deterring algae growth. Both phosphates and nitrates stimulate nuisance growths of algae which usually occur annually and result in localized odor problems.

Fecal coliform data for the lake are very limited. Recorded values of 2,000 per 100 milliliters21/were probably the result of high, short-term surface runoff. State standards have set a maximum count for Class B waters* of 200 per 100 milliliters except when affected by high surface runoff. However, the 2,000 per 100 milliliters count would not comply with federal recommendations for Class B waters which call for a maximum of 200 per 100 milliliters and not to exceed 400 per 100 milliliters in more than 10 percent of monthly analyses.19/

Total coliform data on the Iowa River below Coralville Dam (water which enters the Iowa City impoundment for use as a raw water source, or Class C water) show maximum counts about 20 times greater than those in federal recommendations for Class C waters.19/ Waters entering Coralville Lake generally have a much higher coliform bacteria count than waters in or below the lake.

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* Classification for wildlife, fish, aquatic and semiaquatic life, and contact recreation. Coralville Lake is Class A and B downstream from Highway 218.

Recognizing the problem associated with sewage disposal and water quality, appropriate recommendations were made regarding recreation development at Coralville Lake (i.e., sewage lagoons rather than septic tanks were recommended in areas where flush toilets would be the major restroom facility).

I. Anticipated Facility Development

Corps directive ER 1120-2-403 suggests using Technical Report No. 2, "Estimating Initial Reservoir Recreation Use," October 1969, as a guide in estimating recreation visitation. Developed from a California study, this methodology uses the "similar project" concept to forecast visitation. That is, recreation use data from existing lakes of comparable size, operation and development characteristics are used to estimate visitation at the reservoir in question. Since the Corps technique was primarily developed to estimate initial use and because MRI has already conducted a considerable amount of recreation research in the area of demand, however, it was suggested that a unique MRI computer planning model be used to estimate visitation at the Coralville project. The COMPATRAX model was cited in a recent Corps of Engineers publication as a tool for use in urban and other regional planning studies.[22] Use of this model provides the Corps of Engineers with the following advantages:

* Participation rates developed from MRI's previous recreation studies are incorporated into the model. These rates have been obtained from approximately 50,000 personal interviews.

* The COMPATRAX model is a systems model; thus, visitation is forecasted at a single area considering all other recreation resources available.

* The COMPATRAX model provides forecasts for other than an initial year of operation--a 10-year period from 1975 to 1985, with four data base points, 1970, 1975, 1980, and 1985.

* The COMPATRAX model is fully programmed and operable for a 24-state region, and was utilized with a minimum of new input data for Coralville Lake.

* Outputs available from the MRI model provide estimates of activity days, visitor days, total number of visitors, visitor nights and a rank order listing of the major market areas influencing demand at Coralville Lake.

To test the validity of the COMPATRAX outputs, the 1975 forecast of visitor days from the model was compared to the Corps of Engineers 1974 estimate of use. Although a year's duration is between the two data points, both were in the 1-1/2 million visitor range. Therefore, it was felt that the COMPATRAX forecasts provide a reliable planning base for the Coralville master plan.

The following brief description summarizes the major components and underlying rationale for the COMPATRAX model (an expanded description is provided in Appendix G):

* Recreation demands are generated by the recreation participation desires of individuals, and are thus functions of numbers and characteristics of population concentrations.

* Their demands are satisfied at recreation destinations, having various resource characteristics.

* The portion of the recreation usage at an individual recreation destination complex (Coralville Lake) derived from each market concentration depends on the complex's distance from the market and the relative extent and quality of the complex's recreation resources compared with the extent and quality of resources at all other destination complexes that can compete with it.

* The total recreation usage at an individual recreation destination complex (Coralville Lake) is the sum of the usage generated by all the individual market concentrations that furnish a significant degree of demand where each market concentration's contribution to the total demand is based on distance and the competitive effects of all other accessible destination complexes.

Using this rationale, the COMPATRAX takes each population concentration (basically SMSA's) and groups the total number of persons into specific age classifications. These population origin areas are located in relation to each other and destination areas by geographic coordinates. Unique participation rates for 13 key recreation activities are then multiplied by the numbers of persons in each age category. These figures are then summed, and this aggregate participation estimate is further divided into four leisure time categories (i.e., few available hours, all day outings, overnight trips and vacations). Of course, each leisure time category has a different set of distance distribution coefficients. For example, all of the few available hours participation takes place within a short distance from home, whereas most of the vacation travel is distributed over long distances from the home residence. Total participation matrices are then developed through computer programs for each population area, by recreation activity, leisure time category and appropriate distance band. This participation is then allocated to the available supply of recreation resources.

On the supply side of the COMPATRAX model, recreation resources are classified by State Comprehensive Outdoor Recreation Planning (SCORP) regions except in the immediate area where a more sensitive approach must be utilized. In that case, single destination complexes (i.e., Coralville Lake) are summarized and located by geographic coordinates. Six different quality ratings facilitate a further classification of these recreation resources. Then, as the computer searches among available destination complexes, total participation is distributed among the available resources by recreation activity, leisure time category and distance band from the population complexes. The final estimate of recreation use (i.e., activity days, visitor days, total number of visitors or visitor nights) is, therefore, the result of summing all of the demand from the population areas and subtracting that portion of the demand that goes to a closer or more significant recreation complex.

Of course, the main purpose in estimating recreation demand is to determine the actual space or units necessary to be developed at Coralville Lake. The COMPATRAX projections of activity days are the basis for determining spatial units of need (acreage and facilities). Basically, the forecasted activity day estimate for 1970, 1975, 1980 and 1985 (see Table 6), was divided by the number of visitors that might be accommodated

by one standard unit of measure. These standards, especially adapted for the Coralville Lake Master Plan, are unique to each activity. The units are also in terms of the appropriate spatial measure and reflect the minimum necessary to serve visitors during peak periods.23/ This relationship is expressed in the equation:

$$\text{Standard Unit Required} = \frac{\text{Demand}}{\text{NP x TR x CD}}$$

where, Demand = Activity days (COMPATRAX output) 1970, 1975, 1980, and 1985; NP = Number of persons; TR = Turnover rate; and CD = Capacity days. This equation is adapted from a general planning approach suggested by Robert Douglas.24/ The components of the denominator in the above equation are described below.

Since a recreation project should be able to handle most normal summer Sunday crowds, the capacity days portion of the equation converts the total forecast of activity days to peak days of use. For example, a summer season usually extends from Memorial Day through Labor Day and includes about 14 weeks. Because of the cooler climate in the Coralville Lake area, however, it is expected that most recreation use is concentrated into a 10-week period. The 10 weeks contain 70 days of which 16 are capacity weekend days or holidays. By assuming that 3 weekdays of use equal the use on 1 weekend day or holiday, the weekday use is converted into peak day use. Thus, 54 weekdays (70 - 16)/3 are equivalent to 18 peak weekend days. Based on these assumptions, there are a total of approximately 34 capacity days (16 + 18) of use that will probably occur at Coralville Lake each year. Swimming is an exception because of its susceptibility of being curtailed by inclement weather. Thus, the capacity days for swimming is computed at only 60 percent of the capacity days estimate, or a total of only 20 days (0.6 x 34).

Participation is much more evenly distributed for hunting, fishing and boating activities. For these activities, the participant is usually more than a casual recreationist. In these cases, the total length of the recreation season is used to represent the capacity days and the needs are estimated as follows:

	Capacity Days
Hunting	
Small Game	130
Big Game-Gun	5
Big Game-Bow	50
Waterfowl	45
Fishing	50
Boating	
Launching Ramps	148
Parking Space	148

a/ The total length of the season rather than capacity days (symbol the same).

The remaining portion of the standard unit formula--number of persons per group, boat, etc., and turnover rate--was obtained from a recent recreation standards manual.25/ The space standards and other computed portions of the above equation are contained in Appendix I. Using the standard unit formula, the acreage and facility needs were computed for the Coralville Lake project, see Table 8. Acreage and facility needs are provided for the eight major water-oriented activities and for the years of 1970, 1975, 1980 and 1985.

Where possible, the acreage and facility needs were compared to the existing acreage and facilities at Coralville Lake. It appears that the major lack in available recreation facilities is for picnicking, camping, boating, and swimming facilities. Since the acreage in water and to some extent land is fixed, the hunting, water-skiing, and swimming acreage needs do not necessarily mean that additional acreage should be acquired. Instead, these needs should be interpreted as possible areas for intensive management during the next 10-year period. In general, these acreage and facility needs should be used as a guide in understanding the recreation use patterns that may be occurring at Coralville Lake.

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TABLE 8

RECREATION ACREAGE AND FACILITY NEEDS
AT CORALVILLE LAKE

Activity/Supply Units	Available Acreage and Facilities	1970	1975	1980	1985
Picnicking					
Number of units	109[a]	609	1,043	1,622	2,322
Boating					
Number of launching ramps (lanes)	11	12	17	22	28
Parking area (acres)	N/A[b]	8.6	12.3	16.1	20.5
Camping					
Number of units	320[a]	405	654	978	1,390
Fishing					
Water (acres)	4,900[c]	1,792	2,585	3,450	4,400
Hiking					
Number of trails (1 to 3 miles)	1	2	2	3	3
Hunting					
Land or water (acres)					
Small game	13,653	142	175	210	245
Big game					
Gun	13,653	23,040	28,480	34,080	39,840
Bow	13,653	576	712	852	996
Waterfowl	2,450 [d]	1,280	1,582	1,893	2,213
Swimming					
Land (acres)	N/A	9.6	16.4	25.5	36.5
Water (acres)	N/A	2.2	3.7	5.7	8.2
Linear feet of beach	N/A	1,450	2,482	3,860	5,525
Water skiing					
Water (acres)	2,450[d]	2,400	4,550	7,550	10,950

[a] See Table 4, page 28.
[b] Not available.
[c] Conservation pool acreage at El. 680.
[d] Half of the conservation pool acreage.
Source: Midwest Research Institute.

J. Cost-Sharing

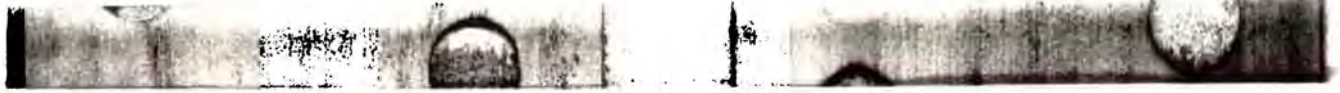
As explained previously, current Administration policy is that all new recreation development at projects like Coralville Lake will require at least 50 percent cost-sharing by a non-Federal public agency. The non-Federal sponsor is required to enter into a cost-sharing contract with the Corps prior to construction and must agree to assume operation and maintenance responsibilities for the completed recreation area. A sponsor for cost-sharing in new recreation development at Coralville Lake has not been identified.

As indicated on pages 28 and 29, the Corps leases land to several organizations and for a variety of recreation and scientific purposes. At present, there are nine long term leases involving a total of 15, 104 acres available for various forms of public use. The costs for development and management of these areas is borne solely by the lessee.

The Iowa Conservation Commission has expressed interest in leasing additional land in the Lake Macbride area (see pages 63 and 64). Otherwise, there has seen no interest expressed concerning leasing of additonal sites for development by a non-Federal public agency.

K. Environmental and Ecological Features

Environmental features of Coralville Lake and environmental impacts of continued project operation and maintenance are described in the project Environmental Impact Statement (EIS). The draft EIS was placed on file with CEQ on 16 May 1975. The final EIS is scheduled for submission to OCE in the 1st quarter FY 1977. When the revised Master Plan is approved and implemented, there should be a general beneficial impact on recreation and all basic project resources.



VII. COORDINATION WITH OTHER AGENCIES

The following list enumerates the agencies contacted during the course of the master planning study.

Agencies Contacted	Dates	
	Month	Year
U.S. Soil Conservation Service	November	1974
Iowa Conservation Commission (Macbride State Park)	November	1974
Iowa Conservation Commission (Hawkeye Wildlife Area)	December	1974
University of Iowa	November	1974
Iowa City Recreation and Parks Department	November	1974
City of Coralville Recreation and Parks Department	November	1974
Project Green Committee	November	1974
Johnson County Conservation Board	November	1974
State Liaison for History and Archaeology	November	1974
Johnson County Regional Planning Commission	November	1974
Johnson County Sheriff's Office	November	1974
Johnson County Highway Department	November	1974

From discussions with the various agency representatives, it appeared that the Iowa Conservation Commission has the most significant interest in the Coralville revised master plan. The regulation of the water levels at Coralville Lake vitally affects wildlife management at the Hawkeye Wildlife area. Since storage of flood waters can destroy planted seed crops, wildlife management must proceed with a great deal of caution. For example, in 1974, the Commission spent $1,500 in aerial seeding in preparation for the fall waterfowl migration. A late summer flood, just after germination, wiped out the entire seed crop. The wildlife management staff realizes that little can be done to change the project purpose and water level management at Coralville Lake. They do hope that at some future date, wildlife benefits will receive greater consideration.

The Iowa Conservation Commission is interested in leasing additional land acreage at Coralville Lake. The ICC

would like the Corps of Engineers to purchase additional land between the two embayments at Lake Macbride; the Commission would hope to lease this land from the Corps. They are also interested in leasing land to the south and west of Lake Macbride to gain access to Coralville Lake. This land is presently under lease to the University of Iowa for the Macbride Field Campus. In summary, the Commission's interest regarding Coralville Lake is to expand the Macbride facilities and gain access to Coralville Lake at a point near their presently developed state park. The Commission has no interest in managing other recreation areas on Coralville Lake.

A number of agencies expressed interest in law enforcement problems, collection of litter and the conflict between snowmobiles and other recreation users. However, few, if any, suggestions were made about the types of recreation facilities that might be developed or where they might be located. A major concern expressed by members of both local park agencies was the flooding of existing park areas below the dam.

VIII. PHYSICAL PLAN OF DEVELOPMENT

The development plan sets a framework for the orderly management of all lands in the Coralville Lake project area. In the planning process, future user needs were projected collaterally with the determination of land capacity to accomodate development. Project lands were then assigned a level of use to obtain the optimum balance between sustained use and resource preservation and enhancement. The user needs/resource capacity forecast from 1975 through 1990 are shown on Table 9.

A. Management Zones

Zoning classifications have been applied to all lands above the conservation pool, elevation 680 mean sea level. A more detailed zoning along the shoreline will be done in the future with the completion of Appendix F, Lakeshore Management Plan. Lakeshore zoning will be more detailed in nature than the more generalized land zoning classifications where there is an overlap in the zoning systems. The land zoning classifications, shown in Figure 10, are as follows:

Project Operations are those lands allocated for the operation of the project, i.e., the dam, spillway, administration areas, maintenance, etc. (60 acres)

Operations: Recreation/Intensive Use lands are those allocated for developments as public use areas for intensive recreational activities, including areas for concession and quasi-public development. (3,865 acres)

Operations: Recreation/Low Density Use areas are open spaces between intensive recreation developments or between intensive recreation development and other uses. Low density recreational uses such as hiking, trails, primitive camping and ecological workshops are acceptable in this zone. (554 acres)

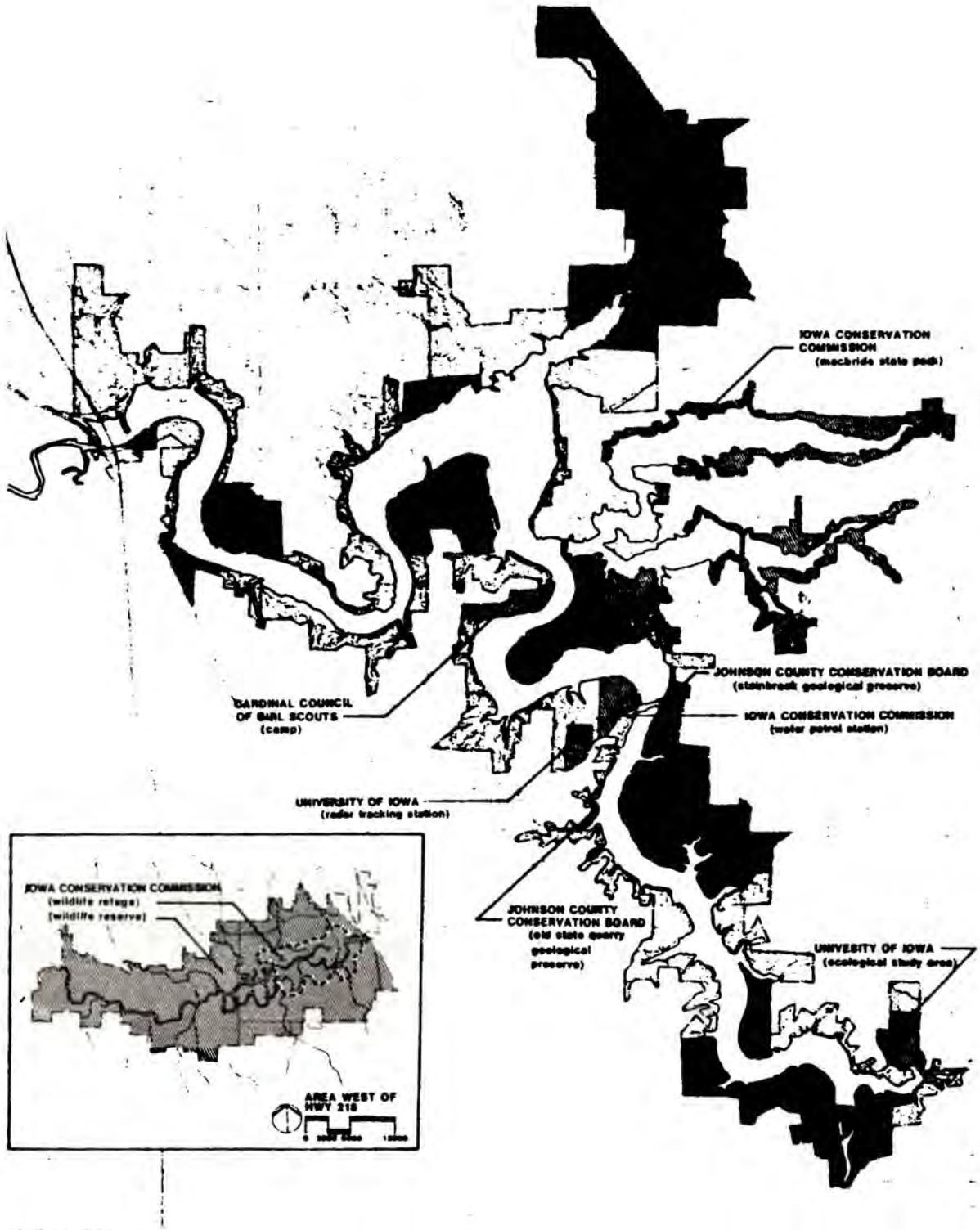
Operations: Reserve Forest lands are used for vegetation control to support certain management objectives. This land will not be used as a source of sustained timber harvest. Such lands will be continuously available for low density recreation activities. (2,901 acres)

Operations: Wildlife Mangement lands are allocated as habitat for fish and wildlife. All project lands above Highway 218 are zoned for this use. Except in the refuge portion of the Hawkeye Wildlife Area (See Insert in Figure 10) these lands are continuously available for low density recreational activities. (13,048 acres)

To insure proper utilization of water resources and minimize conflicting use, it is often desirable to establish water zoning. However, it is felt that land and shoreline zoning will adequately control water usage in most areas at this time. Certain restrictions will be placed near beaches and launching safety hazard limits public use potential. The lake at this time is mainly being used for four types of activities: boating for pleasure, water skiing, fishing and hunting. These activities do not seem to be in conflict now and do not require specific regulation although increasing recreation usage of the lake should be monitored and perhaps a more restrictive program will be needed at a later date. One major area has been set aside and designated for the specific use of sailing craft. This area lies in the northeast section of the reservoir and is bordered by Sandy Beach on the north and North Point camping area on the west and south. Sailing activities will have a high priority in this area and the zone will be appropriately marked as a "no wake" area for power boats whenever sailing activities are in progress.

B. Recreation Areas

All areas with reaction potential have been identified and designated for specific recreation uses based on a percentage of the total recreation need projected by the COMPATRAX



LEGEND

LAND ZONES

- reserve forest land
- recreation-low density use
- recreation-intensive use
- project operations

figure 10

MANAGEMENT ZONES

0 2000 4000 8000

TABLE 9

PROPOSED MAJOR RECREATION FACILITIES AT
CORALVILLE LAKE BY AREA

Date	Recreation Area	Picnicking (units)	Swimming (areas)	Hiking (miles)	Boating (launch lanes)	Camping (units)	Other
1975-1980	West Overlook	115	1	4	4*	105	
	Turkey Creek	90					
	Tailwater				4*		Fishing
	Linder Point					27	
	Squire Point	20					
	Mid River Park	40					
	Curtis Bridge	10			2*		Fishing
	Sandy Beach	90	1		2		
	Sugar Bottom		1	2	5*	439	Equestrian Center and Trails
1980-1985	ATV Staging						ATV Trails
	North Point	200	1	3	5	303	Equestrian Trails
1985-1990	West Point	70			2		
	South Point	50		1			Equestrian Trail
	Macbride	200	1	3	4	111	Equestrian Trail

* Includes upgrading of existing launching lanes.

model. This was assigned to each area by a ratio of gross acreage available at each site. For example, the total camping need has been allocated to those areas deemed most suitable for camping with the larger areas being assigned the highest percentage of the total indicated need. Day-use facilities have been assigned on this same percentage basis to all areas suitable for this type of use.

Conceptual site layouts were produced for each site and these were carefully "field checked" for feasibility. In the process of field adjustment, it was realized that all needs projected by the COMPATRAX model for day use and camping could not be accommodated on existing Corps-managed lands. Lands within the lake line currently subject to out grants have been included in the development plan to absorb some of this need (see Section X, Special Problems). Even with inclusion of these lands, the region's total projected need cannot be satisfied on Corps land. It is felt that increasing the intensity of use on the developed sites would result in substantial degradation of their natural character, and that remaining needs should be satisfied at other parks in Linn and Johnson counties.

The development plan includes two major day-use recreation complexes. The first occurs at the south end of the lake around the dam and is referred to as the Dam Site Recreation Complex. The second is at the north end of the lake and is referred to as Sandy Beach Recreation Complex. There are also four smaller dispersed recreation areas located between the two major complexes. Located in a nearly central position on the east side of the lake is Sugar Bottom recreation area which consists of major camping facilities and an equestrian center. Just to the north of Sugar Bottom is the Macbride Field recreation area which contains a mix of day-use and overnight camping. On the west side, and in a north central location, is North Point recreation area with overnight camping and extensive day-use facilities. South of Sugar Bottom is South Point recreation area, which has a variety of day-use activities in addition to connecting to the equestrian trail. As previously mentioned, the above complexes and areas are planned to be developed to respond to projected recreation needs through 1985.

Table 9 illustrates the number of facilities needed as well as a phasing plan in 5-year increments for the next 15-year period. The development plan provides for dispersed day uses at both ends of the lake, with major camping and overnight activities centrally located on both the east and west banks.

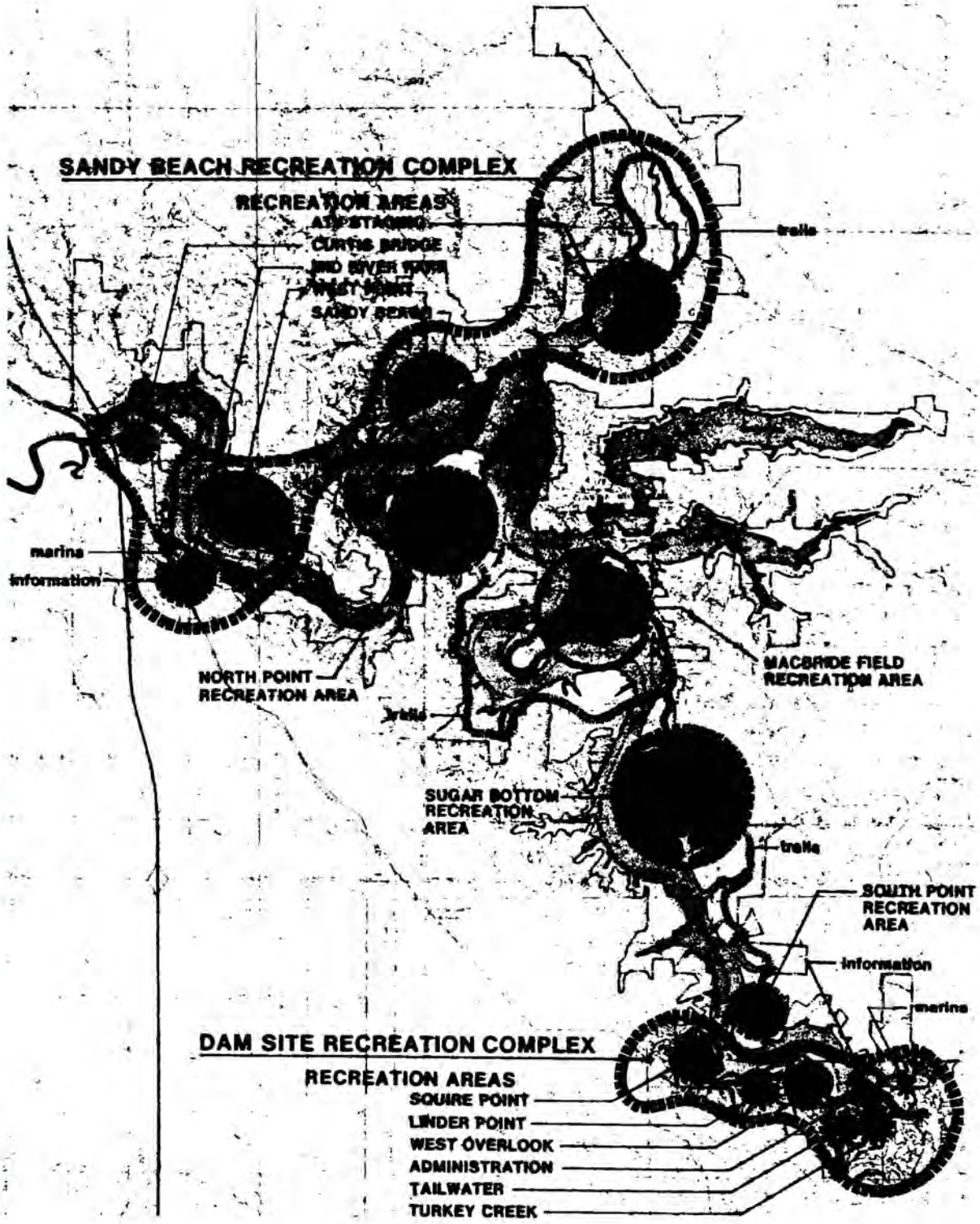


figure 11

RECREATION AREAS

0 2000 4000 8000

Having established the overall concept of the development plan and indicated areas for specific land uses based on human needs, resource capabilities, and recreation demand, certain considerations were undertaken to guide design decisions in preparing the recreation site plans. Since people are the reason for undertaking any development, the design must relate to those people. Attention to people's needs, site functions and natural ethics are the overriding considerations to be met in all recreation site designs. The discussion in the following paragraphs describes the proposed recreation area plans. Volume 2 of the development plan contains site structure diagrams and area plans for all proposed development on Coralville Lake.

1. Dam Site Recreation Complex comprises six development areas, each designed for specific types of uses. Upon completion of the road across the dam, the complex will have access from both the east off Prairie du Chien Road and from the west off Old Highway 218. It is also connected by way of a bicycle path to Iowa City constructed by Johnson County, City of Iowa City, and "Project Green." The proposed trail system will be coordinated with Iowa City officials and the park management group as they are initiating work on an extensive trail system throughout the lake area.

a. Administration recreation area is in existence and contains the administrative and maintenance buildings. A visitor information center will be added to this complex as well as a substantial amount of landscaping to create a pleasing front-door appearance for what should be a main entry to the lake.

b. Turkey Creek recreation area is directly to the south of the administration area. This site features a heavy, mature over-story canopy of native hardwood located on a high ridge and contains 90 individual picnic units. This site is located off Prairie du Chien Road and has good access for family-oriented picnic activities originating from the Iowa City area.

c. Tailwater recreation area is located just below the dam and is split in two by the Iowa River. East Tailwater provides 17 overnight camping spurs and a double launching ramp. This area is oriented toward family or small group fishing use with camping and picnicking available. West

Tailwater provides another double boat launching ramp with 12 overnight camping spurs. This area is also oriented toward the "fishing family" wanting close access to the recreation areas of Coralville Lake and the fishing potential of the Iowa River.

d. West Overlook recreation area will have a day-use and camping area which provides 48 tent camping units off the main access drive specifically for family-type tent camping activities. These are located on a high ridge with a commanding view of the surrounding areas and a vegetative canopy of mature oak and hickory. Also provided at the West Overlook area are 29 overnight camping spurs, a large multilane boat launching facility, a picnic area, and a well developed swimming beach. The swimming beach will have a capacity of 1,000 swimmers. The site will include a change house with showers, drinking water, and flush-type toilets. This area has a natural sand beach and sand bottom with a 5 percent slope extending into the lake. Buoyed safety lines will mark the 6-foot depth and will also be used to warn boaters. A raft will also be provided for swimming and diving activities. A picnic area has been sited adjacent to the beach and all permanent facilities have been sited above the 712 flood elevation. Located just to the west and isolated by a natural buffer of ravine and heavy woods is another cluster of camping units containing 28 camping spaces.

e. Linder Point recreation area is located on three ridges reaching out to the lake just west of the West Overlook area. Provided here will be eight rather isolated tent camping spaces for family - oriented groups. A parking area has been located just off this main access for dispersal of campers into the remote camping area. There will be 12 to 18 remote camping sites available along the lake shore between Linder Point and Squire Point to the northwest.

f. Squire Point recreation area will also have walk-in access beginning in a parking area for hike-in, picnicking and a connection to the remote camping area and trail system.

2. Sandy Beach Recreation Complex is located at the north end of the lake. Access to this complex is from Interstate 380 and Highway 218 to the north and west and Highway 1, Ely Road and local collectors on the east. The complex is composed of five development areas.

a. Mid River Park recreation area, to the east and directly off of Highway 218, is an existing area with minimal development. This area is proposed to be a family-oriented drive-in picnic area. The area is penetrated by one access road with a heavy screen and buffer separating the recreation site from the existing marina concession. The Mid River Park area is divided into two picnic areas, one to the south occurring on a low flat area for group activities, with a 30-car parking lot, group shelter and pit toilets. Located just to the north of this on a higher ridge overlooking the lake is another family-oriented picnic area with a drive-through loop and a visitor information center with an observation deck overlooking the lake. Also provided here are 25 picnic units and adequate parking to serve them. A large shelter is planned in this area to accommodate group picnicking as well as individual family units. The site will be cleared of brush near the shelter to provide a good view of the lake and the information/overview structure located at the edge of the lake along the limestone bluffs.

b. Curtis Bridge recreation area is another existing day-use area located 2 miles north of Mid River Park. This site will be set aside as a hunting and fishing access. Facilities included will be a multilane launching ramp with turn-around and trailer parking and an observation and fishing pier for the family that wishes to participate in fishing and hunting activities year-round. The site provides a launching area with access to both the wildlife reserve to the west and Coralville Lake to the east. This area will contain vault-type toilets, a small shelter with a heater for winter use, and picnic units. These facilities will be located above the 712 elevation except for the launching ramp and some of the picnic area which will be constructed in such a manner to withstand inundation. It should be noted that this area also can be seen from Interstate 380, a major north-south connector. Within the Interstate 380 area, heavy landscaping will be used to give visual continuity and act as an invitation into the lake area.

c. West Point recreation area, located across the lake from Mid River Park, is a newly proposed day-use site. Facilities will include 70 family picnic units, a boat launching facility, open game field areas and a small sunbathing beach area. This area has a commanding view of the adjacent shoreline and enjoys moderately rolling topography bisected by a deep ravine. The planned development will meet increasing day-use needs at the north end of the lake.

d. Sandy Beach recreation area is the major center in this recreation complex. This is an existing day-use area containing a very large expanse of light sand beach. Facilities here will include an extensive beach complex accommodating 1,000 plus swimmers and a day-use family picnic area containing 90 units--some having very close proximity to parking and others being rather remote and having walk-in potential. The shelter provided here for summer picnics will serve as a warmup hut in the winter. Also located here will be a major launching ramp providing access to all northerly areas of the lake.

e. ATV Staging recreation area is located at the northeasterly end of the Sandy Beach recreation complex, just off a local blacktop road. This area will serve as a gateway to 350 acres reserved for a full range of ATV activities from four-wheel drive and motorcross activities in the summer to snowmobiling rally activities in the winter. This area seems to be ideal for all types of wheeled recreation activities, and the somewhat secluded setting removed from other activities will provide safety and noise control. A paved staging area, heated shelter and pit toilets will be provided as well as a fenced-in area for competitive activities. Crude, unpaved and unleveled paths will radiate to the various sites within the area.

Between Dam Site Recreation Complex and Sandy Beach Recreation Complex are four smaller recreation areas.

3. Sugar Bottom recreation area is located just off of the blacktop road and southeast of Mehaffey Bridge. This is an established camping area and will be the first area to be reconstructed to provide a full range of overnight camping activities. This area contains 439 camping sites and is divided into two separate management units. The area consists of four ridges buffered by heavy wooded ravines. Using the clustering concept, all units will contain a parking spur, picnic table, fireplace, grill, tent pad and garbage can. Flush-type toilets, a waste disposal station and central shower building will also be provided. Two boat launching areas have been provided as well as an amphitheater for group activities. A group camping area designated for activities such as campventions has also been included, and adjacent to this area are two day-use lodge sites which will be available to the public. One will be reserved for group activities on a reservation basis. This entire camping area enjoys a view of a large expanse of lake corridor. A major

beach facility will be provided as well as numerous play areas with play apparatus for children of family users as well as a range of activities for all members of the family including the elderly.

Entry control stations will be provided at both the east and west entrances into the area with the east and west portions connected by a service drive only. Broad corridors of open natural vegetative buffer area will be provided for trail systems and field game activities. An equestrian staging area will link with the trail systems extending north across Mehaffey Bridge and south through the camping areas to South Point.

4. South Point recreation area, which forms the south terminus of the equestrian trail system, is designed in conjunction with Sugar Bottom. The site provides for equestrian needs as well as picnicking and other day-use activities. South Point is located just north and across the lake from West Overlook and enjoys a good view of the entire southern lake area.

5. Macbride Field recreation area, located just north of Mehaffey Bridge, is slated for construction in 1985. This is one of the more scenic areas on the lake and will provide boat launching access to both Lake Macbride and Coralville Lake. This area is located on a peninsula comprised of two high ridges running through the site to the lakeshore. There will be 115 camping units provided as well as a full range of day-use activities: hiking trails, picnic areas, swimming facilities, observation points and a handicapped children's retreat, already in existence at this time.

A small portion of the design for this recreation area utilizes state lands. Future development of this area will be dependent upon a costsharing agreement with the state. Cost estimates, therefore, include the facilities within the recreation area both inside and outside of government lands.

6. North Point recreation is located off Highway 218 and along a local collector road. This area is located on a large peninsula extending into the north arm of the lake, providing 303 camping units in a relatively flat and unencumbered area. This area is presently leased to the Coralville Docks Marina concession. Family camping units will include a table, fireplace, grill, gravel parking spur, tent pad, and garbage can. Flush toilet buildings, central shower stations

with toilets and several play areas with appropriate play equipment will be conveniently available to campers. Trails lead from the campground to the lakeshore and through the clustered camping areas to a major beach area. Extensive tree plantings of various types of hardwoods will be necessary to develop a wooded setting for the camping units. This planting should be implemented immediately even though the area is not scheduled for development until 1980. In this manner, a vegetative canopy can be established before the area is opened to public use. Directly adjacent to the camp sites is a large day-use recreation area. This area will provide, as mentioned above, a large beach complex as well as a multilane launching ramp for boating activities. A large open field will be provided for a multitude of recreation activities such as softball, baseball, and other group activities. Shelters and picnic units for both family enjoyment as well as group activities will also be provided. Some picnic areas are open and easily accessible by car while others are remote and quiet. The entire area enjoys a good overview of the existing lake area, with one of the larger areas of open water directly adjacent to this area.

Initial development of recreation areas proposed in this development plan should include the construction of all facilities as designed. Proximity of this project to large metropolitan centers and lack of a competitive lake of this size in the vicinity already creates heavy demands for use of these outdoor recreation areas. To avoid overuse and consequent deterioration of natural features, it is felt that recreation development should stay just ahead of the projected demand.

The estimated total cost of the facilities discussed in this report is $12,136,445. This amount does not include land which is already in government ownership, but does reflect the cost of construction of roads, buildings, facilities, utilities and related equipment. A detailed summary of the cost estimate on a unit basis is given in Appendix J.

Volume 2 of this report contains site structure diagrams and plans for all recreation areas proposed in the development plan.

IX. FACILITY LOAD AND OTHER DESIGN CRITERIA*

A. Siting of Facilities

Permanent facilities that could be damaged by inundation are to be located above flood pool elevation 712-foot mean sea level. Portable or flood-proof facilities may be located on lower grounds.

B. Water Systems

It has been determined that individual wells in the Coralville Lake area will produce 40-50 gallons per minute of high quality water. The pressure system for fully developed facilities will either be pneumatic or a gravity type system with facilities adequately designed to insure a minimum pressure of 15 psi to all flush-valve fixtures; one drinking fountain and tap will be provided for approximately every eight camping spaces. Hand pumps will be used in low capacity wells at outlying day-use areas.

C. Sanitary Waste Disposal

Two methods of sanitary waste removal will be employed within the recreation areas. Camping facilities and main buildings at the Dam Site Recreation Complex will be served by a centralized collection system discharging into a total evaporation sewage lagoon. The same type of system will also be provided at the Sugar Bottom camping area, Macbride Field area and North Point camping area. Septic tanks with tile fields at each toilet and shower building will be used in all outlying day-use areas and parts of the Macbride Field area which cannot be adequately sewered from a centralized collection system. The septic tank system was selected because of a lack of suitable lagoon sites for topographical reasons as well as an excessive amount of piping that would be required to reach remote treatment locations. Vault-type toilets will be used in all

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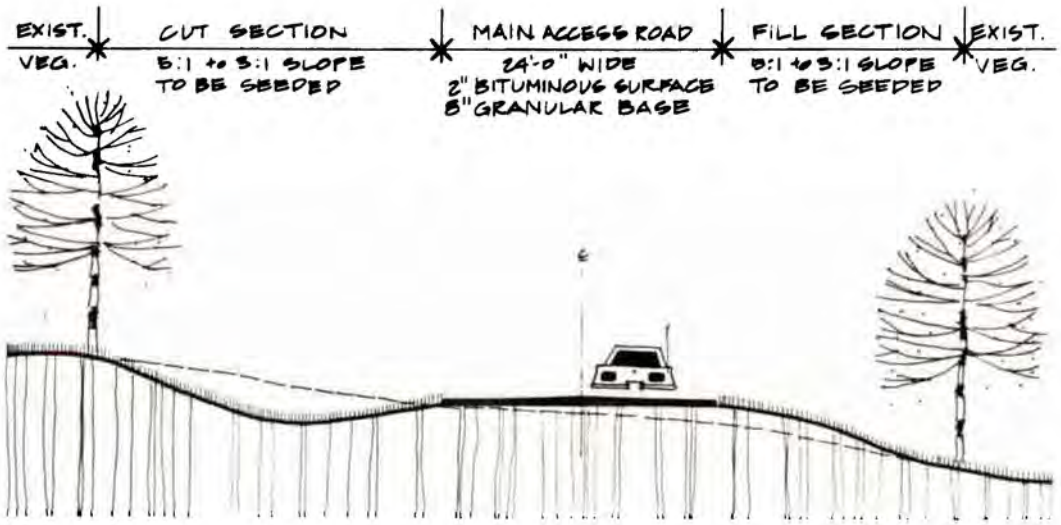
* This section is in compliance with EM-1110-2-400, Engineering and Design, Recreation Planning and Design Criteria, 1 September 1971.

satellite day-use areas and remote camping areas. Locations below flood pool will be provided with portable chemical toilets. Effluent from the lagoons will be either evaporated or infiltrated. The septic tank effluent will be distributed and disposed of in tile fields by infiltration. One waste water drain not connected to the sewer system will be provided for every four camp spaces.

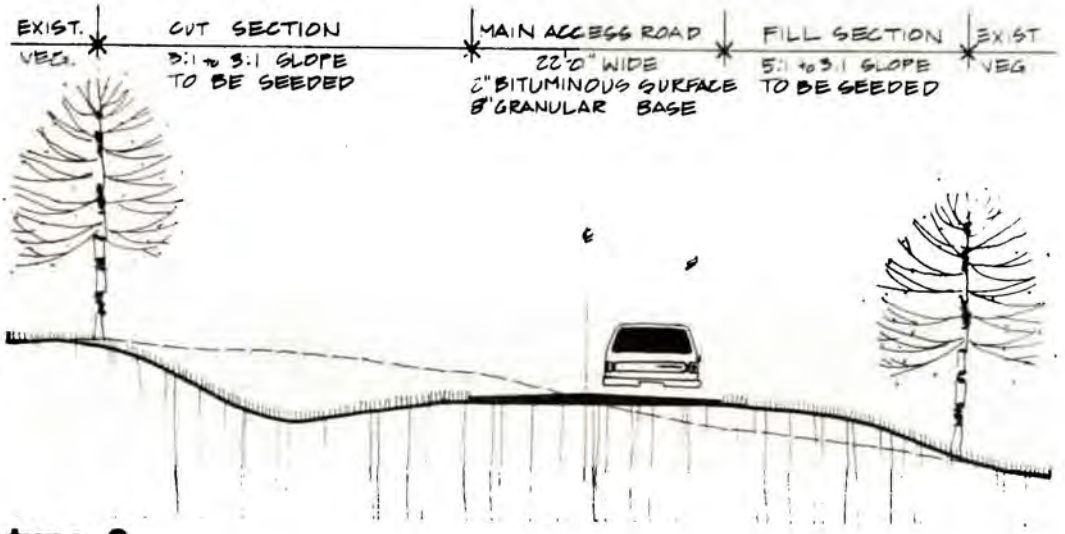
D. Circulation

The overall system of circulation roads within the project has been in existence for a number of years. This plan expands upon the existing system and uses it wherever feasible. All clusters are located off two-way major access drives with almost all individual camping sites located along one-way access roads. All two-way roads within day-use recreation areas will be at least 20 feet wide. All circulation as shown on the area plans has been checked in the field and is represented as accurately as possible on the area plans. Access roads and two-way circulation roads will have a natural or constructed drainage system and will have a minimum 20-foot-wide double bituminous surface on an 8-inch-thick granular base with 4-foot-wide turf shoulders. One-way circulation roads will, in general, have no constructed drainage system but will be subjected to natural drainage along or across the road. These roads will have a 12-foot-wide double bituminous surface on a 6-inch-thick granular base and 4-foot-wide turf shoulders. Maximum grade for all two-way access roads shall be 10 percent with 12 percent maximum grade on one-way accesses.

Traffic control to all camping areas will be provided by a centrally located control gate situated in the center section of a divided roadway with access to both outgoing as well as incoming traffic. (See Section Q, Signage, for additional information on traffic control.)



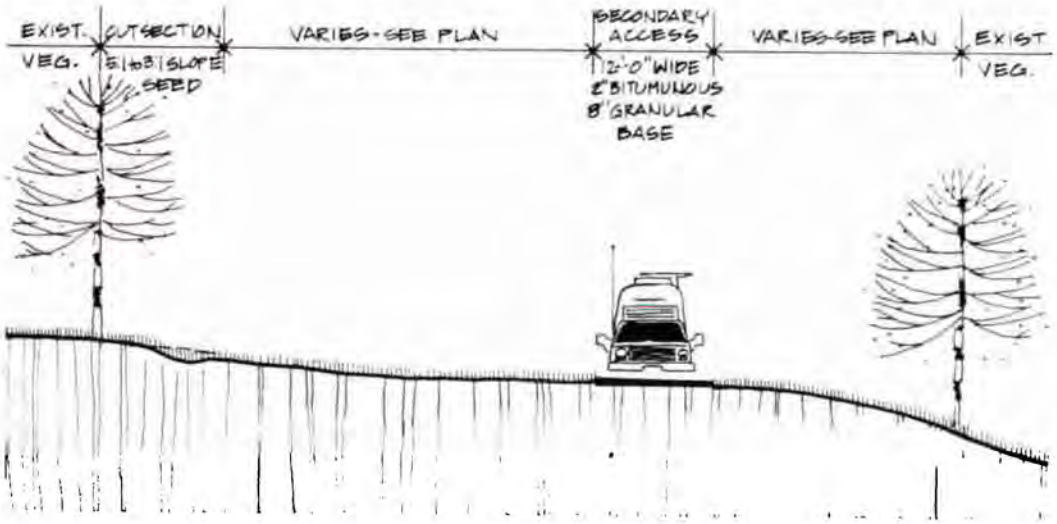
type 1
MAIN ACCESS ROAD



type 2
MAIN ACCESS ROAD

ROAD SECTIONS

SECONDARY ACCESS ROAD



ONE WAY ROAD

ROAD SECTIONS

E. Parking Facilities

Parking areas shall be of bituminous surface for permanent areas and grassed areas provided for overflow parking. Individual parking stalls will be marked by painted lines and each will be equipped with precast wheel stops as needed. Guard posts will be used at all spaces where slope is steep enough that gravity action could cause a free-rolling vehicle to endanger the visiting public and where the grade beyond the parking area is such that if the vehicle traveled off the parking area, its occupants would be in danger. Boat/trailer parking will be of the drive-through type. In general, drainage shall be interrupted before reaching parking areas and drainage structures in these areas will be kept to a minimum. In all areas, additional parking requirements will be satisfied by constructing new parking areas at adjacent locations rather than expanding upon planned units. Parking will be appropriately screened from view by berms and plantings.

PARKING SCREEN

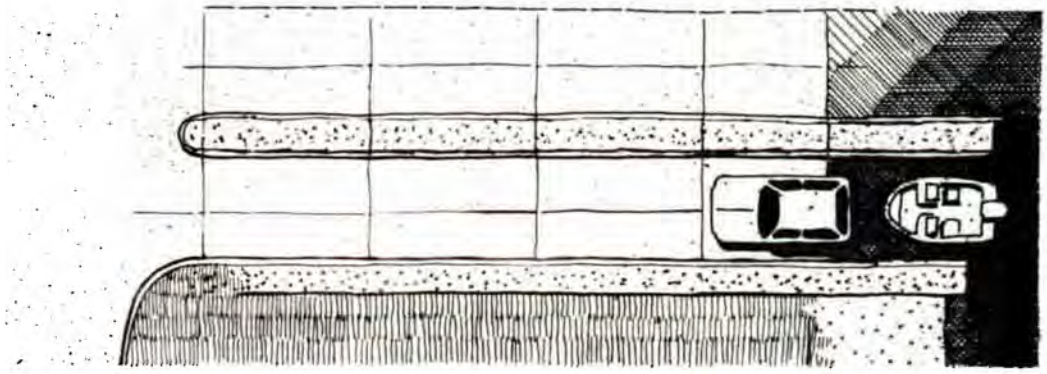
F. Boat Launch Ramps

The total number of launching ramps was established by the MRI COMPATRAX output. Individual ramps will have a 12 percent slope and be surfaced with a 12-foot-wide rough finished 6-inch-thick concrete slab with 6-inch curbs on each side. Single lane ramps shall be used in satellite areas unless otherwise indicated. Ramps in the main park areas will be multilane with each lane 12-foot wide and 4-foot from the next adjacent ramp. The 4-foot island between adjacent lanes will be surfaced with 4 inches of concrete for wave wash protection. A courtesy dock will be provided for each launching lane.

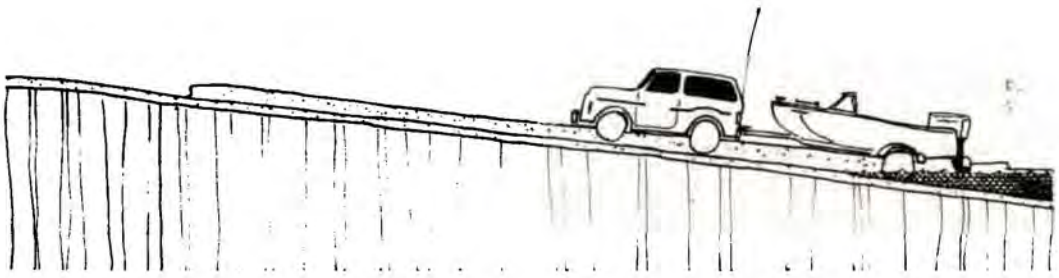
It is recommended that the major marina concessions continue in operation at the Coralville Lakes area (Marina 218, Coralville Docks and, Coral Marina). These facilities provide launching ramps as well as various marine needs such as gas, bait, and service. The most critical problem to overcome at the three existing marina areas is compatible site design. Existing areas lack a clearly defined circulation system as well as signage and landscape development. Marina operators will be encouraged to design appropriate facilities that are in keeping with the desired image of the Coralville Lake area.

G. Picnic Units

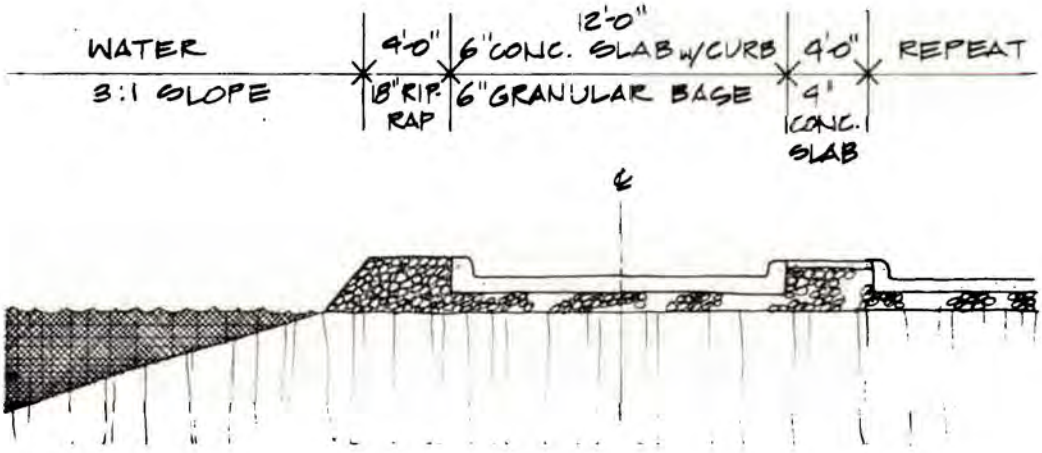
Picnic units will be located to provide a variety of individual outdoor picnicking needs. Typical units will consist of a 7-foot-long table with a steel frame, pedestal-type charcoal grill and one trash container for every four tables. These containers will be of the mesh basket type and will also be placed near paths and parking lots to permit convenient use. Picnic units are to be located on gentle grades in heavily wooded areas, near large trees in open areas or under shelters. Extra tables will be provided for families wanting to double up for large gatherings. The size and weight of the table will allow for some movement but shall discourage users from moving them great distances. Parking areas have been located for user



plan



elevation



section

BOAT RAMP

convenience and to provide an even distribution of use to all areas. In areas below the 712 elevation semipermanent tables of heavy construction will be used to insure that flood water will not affect them.

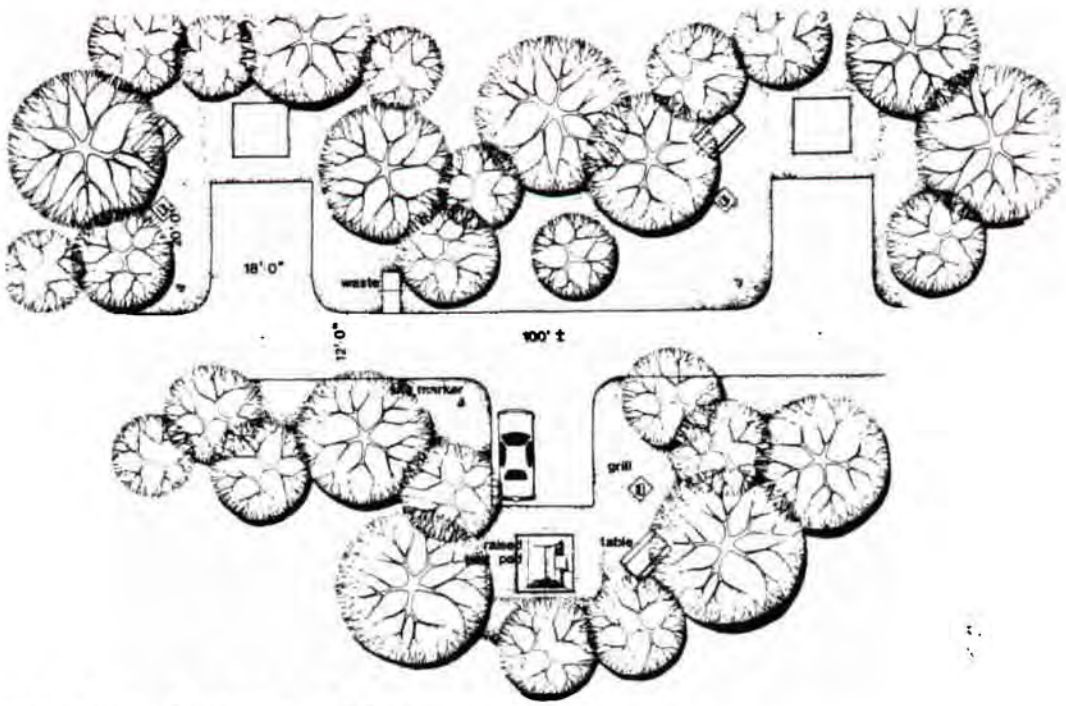
H. Camping Units

There will be two different types of camping experiences available at Coralville Lake, tent/trailer camping and remote camping. Remote camping will be on designated sites which are accessible by walking in from a central parking lot. Each remote site will have a fire pit, garbage can, a graded tent pad and will be close to a vault toilet facility.

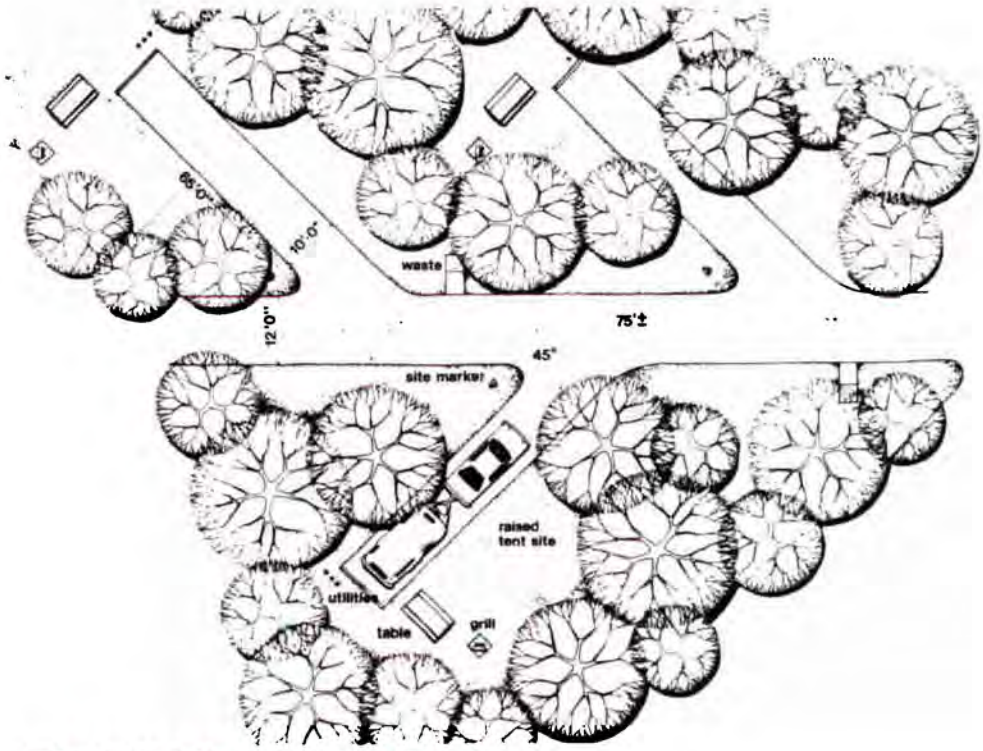
The basic tent/trailer camp unit will include a parking spur, table, fireplace, garbage can and a graded tent pad area. Tent camping will have a spur wide enough for two cars and a minimum spur depth of 20 feet, while the spur for trailer camping will be deep enough for a trailer and its tow vehicle to be completely off the road. Approximately one-third of these camping spaces will also have utility hookups. Individual units will be screened to give privacy and provide a natural setting for campers. Campgrounds will be built to provide users with a variety of activities and opportunities within close walking distance. Tent/trailer camping areas will be equipped to provide a safe play area for children. Camping clubs or other organized groups will find these facilities useful for weekend or extended visits.

I. Swimming Beaches

Major swimming beaches as shown on the Volume 2 area plans will provide a graded turf blanket area for sunbathing and a sand beach with sand bottom extending into the water. The 6-foot depth will be marked by a buoyed safety line to mark the deep water zone. Standard reservoir markers will delineate the swimming waters and indicate areas to be used for swimming only. An anchored diving raft will be provided at the Sandy Beach and West Overlook swimming areas. These swimming areas will have a change house that will include an exterior shower for rinsing. A mowed turf blanket area will provide an open area for sunbathers. Picnic tables or other facilities will not be developed within this area.



TENT CAMPING



TRAILER CAMPING

J. Building Types

One basic architectural theme has been chosen which represents a combination of aesthetics, ease of maintenance, security and function. Uniformity of the flat roof style and use of compatible natural materials will make the buildings blend with their surroundings. A flat roof style will require that all structures be designed to support a heavy snow load. A "Trocal" type roofing system with scuppers would insure water runoff and eliminate roof leaks sometimes associated with flat roofs in snow climates. Each building will be designed and constructed to meet requirements of ER-1110-2-102 which establishes criteria for facilities to accommodate the handicapped. Exterior treatment featuring rough sawn diagonal wood siding reflects the natural character of the area. In profile, the structures will be relatively low and give a horizontal appearance consistent with the open quality of the region. The interiors will be constructed to reduce vandalism, facilitate maintenance and promote cleanliness. Lighting will be both natural and fluorescent with interior colors kept light to promote optimum reflection. Variations in interior arrangement can be made to satisfy particular functions such as showers, toilets, laundry, storage, etc.

There are seven basic types of buildings planned for the recreation areas at Coralville Lake:

Day use lodge

Bathhouse

Washhouse

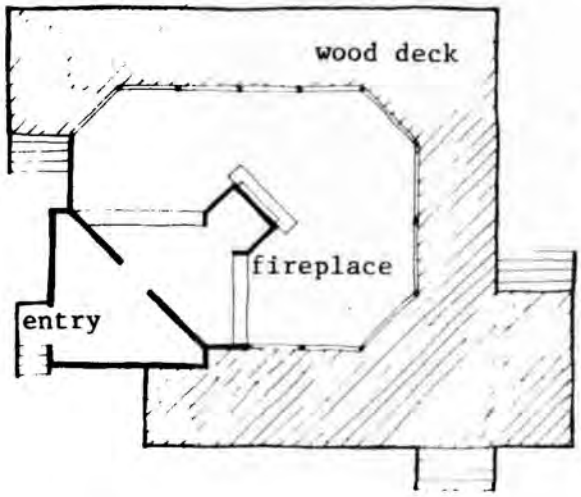
Waterborne toilet

Vault toilet

Shelter

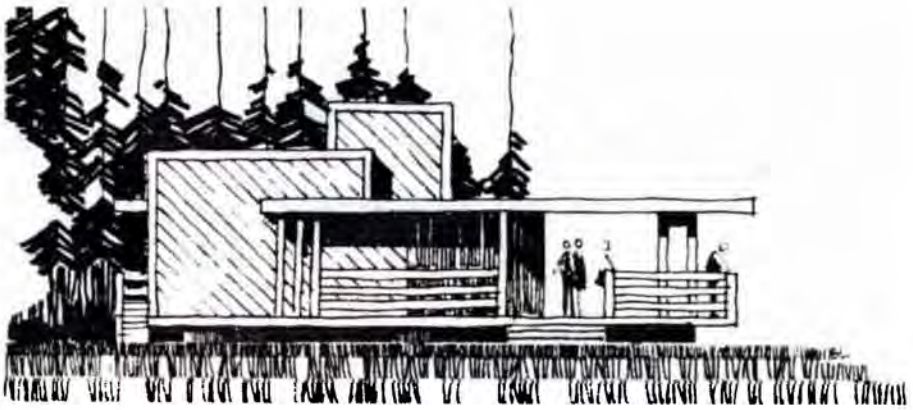
Control station

Day Use Lodges will be either undesignated or designated with reservations taken in advance for use by large groups or organizations. Undesignated lodges will be available on a first-come basis.



1200 sq. ft. (average)

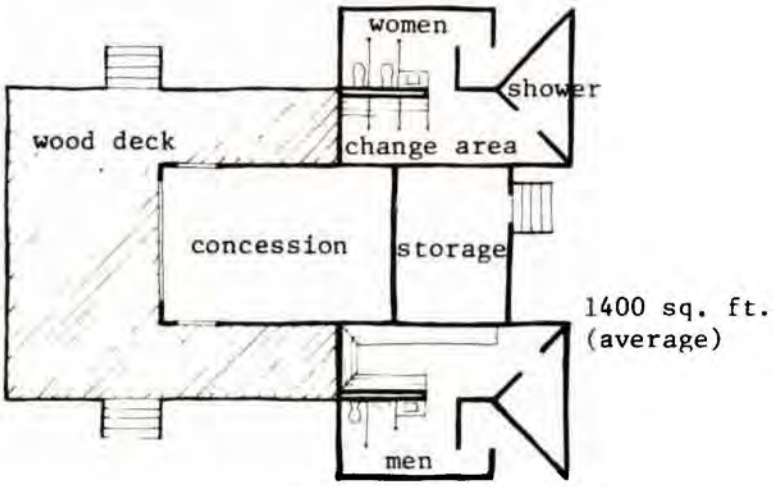
plan



elevation

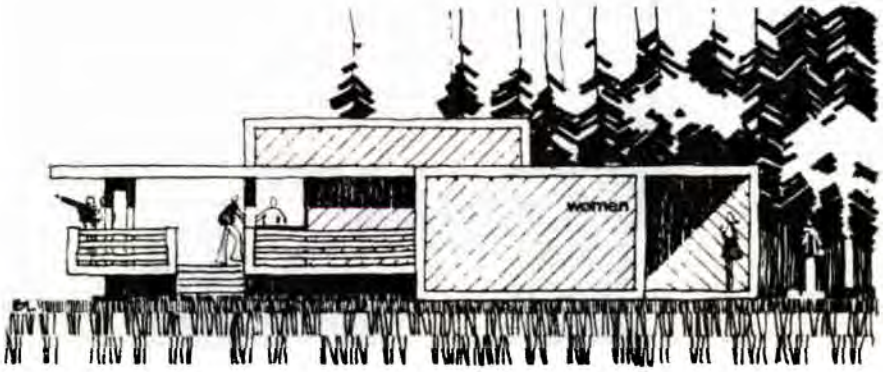
DAY USE LODGE

Bathhouses will be provided at the five major swimming areas. A privately operated concession will be part of the bathhouse.



1400 sq. ft.
(average)

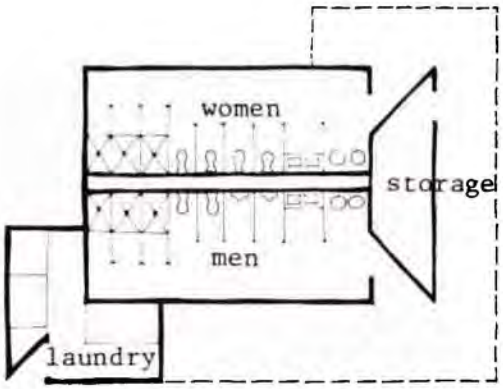
plan



elevation

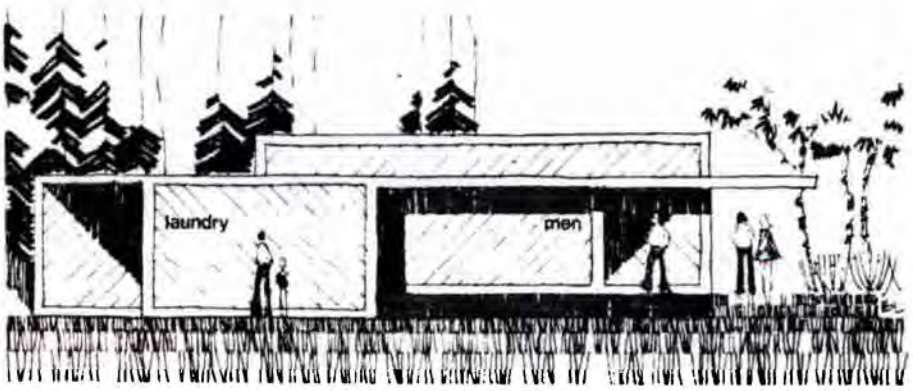
BATHHOUSE

Washhouse will serve from 25 to 50 camping units with the farthest unit no more than 600 feet away.



1250 sq. ft.
(average)

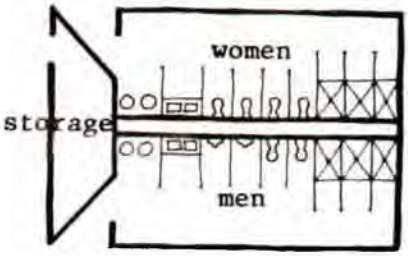
plan



elevation

WASHHOUSE

Waterborne Toilets will be provided for every 25 to 50 camping units in addition to the washhouse already mentioned.



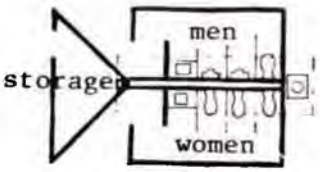
1000 sq. ft.
(average)

plan

elevation

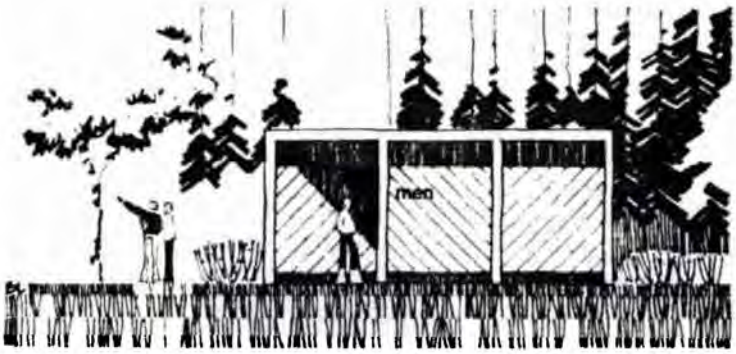
WATERBORNE TOILET

Vault Toilets will be used in all satellite day-use areas, remote camping areas and supplement other facilities in camping areas.



400 sq. ft.
(average)

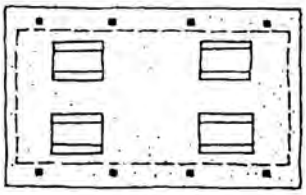
plan



elevation

VAULT TOILET

Shelters will be provided in picnic areas to give protection from the sun and inclement weather. Each shelter will be equipped with an appropriate number of picnic tables and benches. Some shelters will be so adapted so that side panels may be added in the winter to serve as warming huts and in the summer for wind protection.



150 sq. ft. min.
750 sq. ft. max.

plan

elevation

section

SHELTER

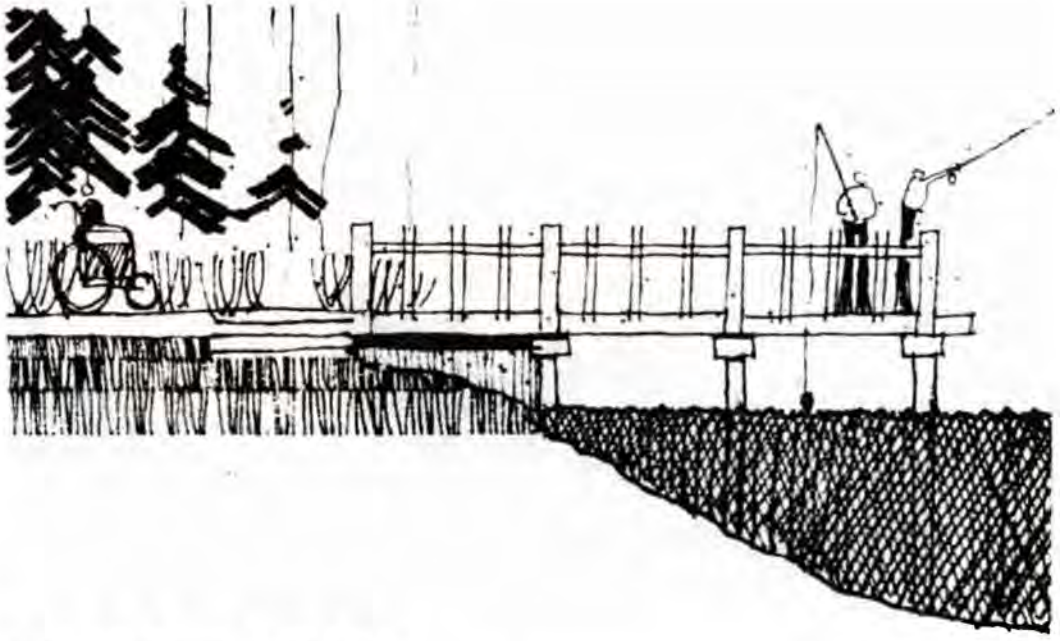
Control Stations will be located on the entry roads to all camping areas with the exception of the east entrance to the Dam Site Recreation Complex, which will be monitored out of the administration building. An attendant will be on hand to collect fees and assign campsites at each control station.

elevations

CONTROL STATION

Visitor information centers will be provided at semi-outdoor shelters, one at Mid-River Park area and another at the Administration area in the Dam Site Complex. Various displays showing both the project area and the history of the region should be utilized along with an information counter where visitors can receive assistance and additional information. Exterior decks and window areas will allow visitors a panoramic view of the lake area. During hours when the buildings might be closed, the outside deck area can still function as an overlook platform and allow visitors a view of the local scenery.

Overlook structures will be provided at West Point, Curtis Bridge, West Overlook and Sandy Beach areas. The overlook structure at Curtis Bridge will be combined with a fishing pier accessible to the handicapped.



CURTIS BRIDGE OVERLOOK/FISHING PIER

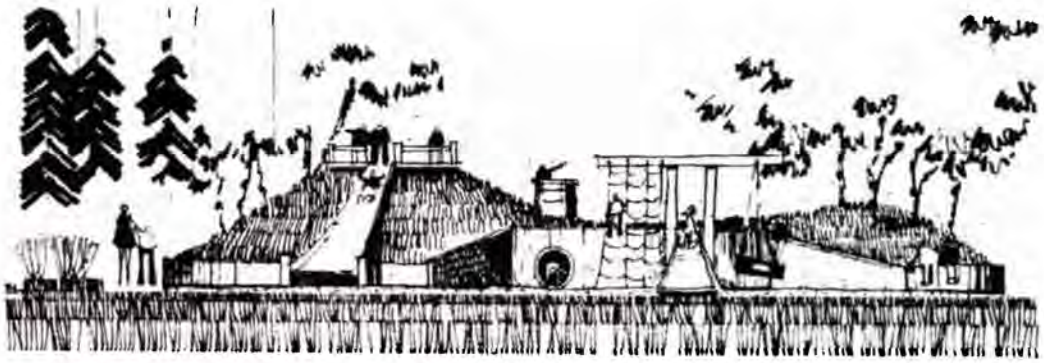
K. Maintenance

Operation and maintenance facilities for work crews and storage of equipment will be located at the administration area near the south end of the lake, Sugar Bottom and Sandy Beach. These facilities will be screened by either plantings and/or mounding.

L. Play Areas

Play areas are planned at each campground for use by children between the ages of 5 and 12 who are camping in the area. Each lot is designed to accommodate from 10-30 children.

Creative play equipment in character with the natural setting will be used. This type of play equipment can be easily purchased from several different manufacturers and then constructed on site by operation personnel. These play areas may occur in groups or may occur as individual items along the trail system. To minimize injuries, the ground area around all play areas will be sand or wood chips readily available from local sources.



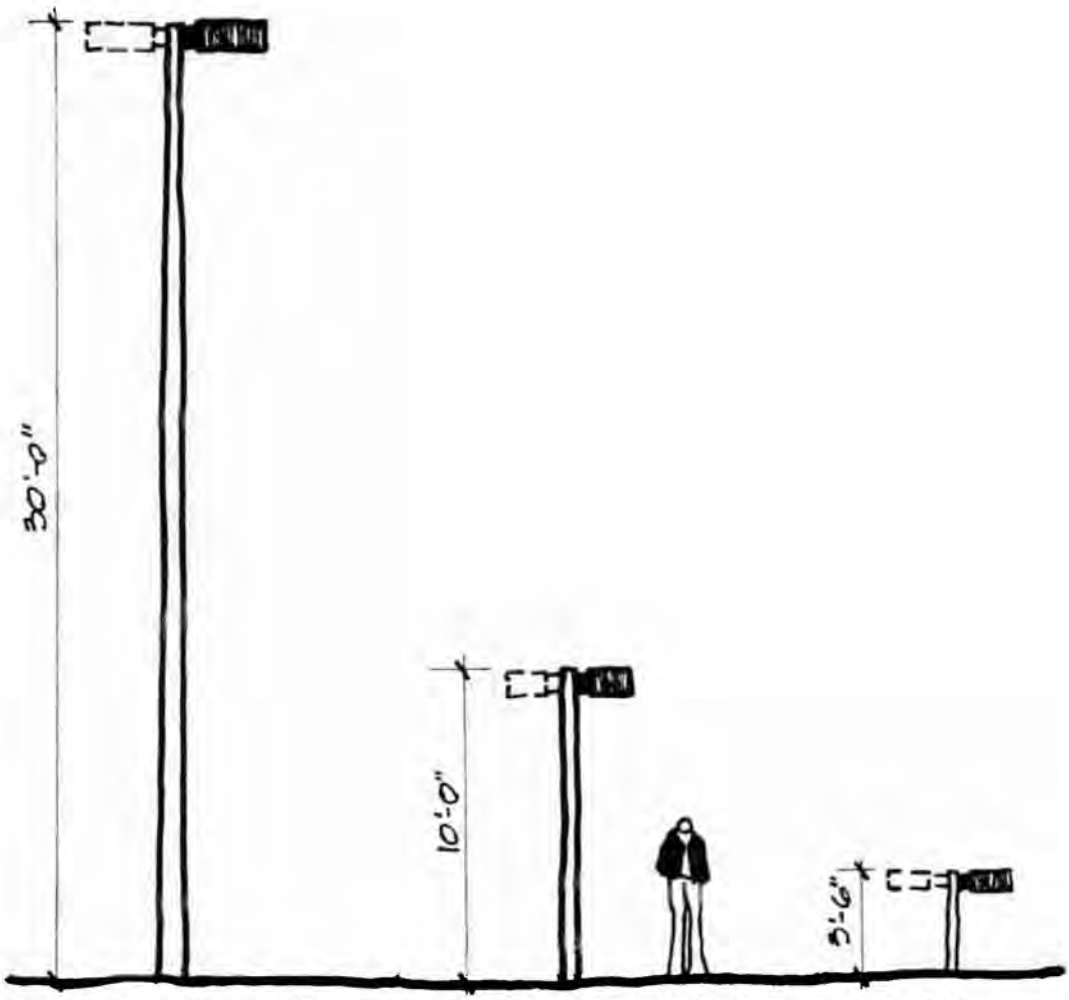
PLAY AREA

M. Bridges

Only two additional bridges are anticipated at this time. A vehicular bridge would be located at the West Point recreation area. It will have to span a large ravine and can be constructed largely with fill and large tubes inserted for drainage and back flow during flood conditions. The other proposed bridge will be for both hiking and equestrian use at South Point recreation area. It will provide access across an open ravine which is normally filled with water.

N. Lighting

Lighting around Coralville Lake will be needed to provide safety and security. Lighting will be necessary near all buildings that campers can be expected to use after dark, such as toilet and shower facilities and where major facilities, i.e., beaches, are located. Security lighting will also be needed at the administrative and operations maintenance areas and where pilferage could be a problem.



LIGHTING SYSTEM

A uniform lighting system will be used in all of the recreation areas. A 30-foot pole will be used along all lighted roads, parking and maintenance areas. All pedestrian spaces (for example, lighting around washhouses) will use a 10-foot pole. A 3-1/2 foot pole will be used along all lighted paths and trails.

Electric power will be provided for approximately one-third of all the camp units at the overnight camping areas. All lines within the recreation areas will be underground. All incoming lines between use areas will be generally underground insofar as practical and will be screened from view when used as overhead units.

The pole standards shall be of natural wood or wood stained in a natural color. These could be either an all wood or wood laminated with a metal center acting as a stiffener. It is important that a pole type similar to this be used to insure that the lighting is in character throughout Coralville Lake. Standards similar to those suggested are available commercially from a number of manufacturers, and are permanently finished so that no further maintenance is required. The fixture itself will be a black finish which would not require future maintenance except for normal bulb replacement. Bulbs should be mercury vapor of appropriate wattage, depending on area of use and lighting levels required. All wiring to lighting standards will be underground to avoid unsightly overhead lines.

O. Trails

There are a variety of trails proposed in the Coralville Lake area. Trails are provided for hiking and foot traffic, as well as for bicycles and equestrian activities. Short trails which are less than 2 miles long are provided in areas of high interest with convenient access and moderate grade. These trails are designed for use by families and child groups. Paving, benches and trash containers will be provided along with explanatory markers. More extensive trails requiring greater endurance are provided in conjunction with the equestrian trails to some of the remote camping areas. These should receive much less use than the short trails and are not provided with furniture or complete paving. A variety of trail experiences are available in the Coralville Lake area.

SHORELINE

FOREST

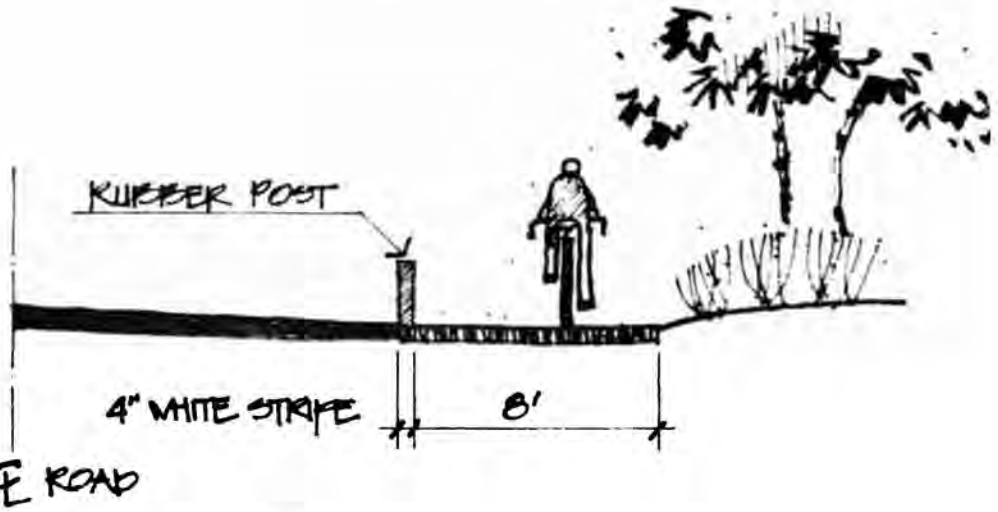
FOREST EDGE

MEADOW

TRAIL EXPERIENCES

All Terrain Vehicles (ATV's) will be accommodated within one specific area of operation and in this case the trails will be separated from all other recreation activities to insure complete separation of these uses and other activities. The prime objectives of these ATV trails are to provide a specific area for this growing sport in an attempt to satisfy a public need and to protect the environment from uncontrolled heavy use.

Bicycle trails are also planned as part of the overall trail system at Coralville Lake. Bicycling has become very popular in the Iowa City and Cedar Rapids areas. The City of Iowa City has provided a trail system from its urban limits out to the entrance to the Dam Site Recreation Complex. This trail should be expanded and extended into the recreation areas themselves. Extensive work is being done now by the operations/administration personnel at the reservoir and these plans should be coordinated with the efforts of these agencies. Where bike trails run parallel to a roadway they should be separated from the vehicle lane by a 4-inch solid white line with posts spaced 100 feet on center. All bike trails will be marked with the standard sign mounted 48 inches above the ground.



BICYCLE TRAIL

Equestrian trails are designated at three areas since active riding clubs and ranches exist all around the Coralville Lake area. The trails will provide a total of 6 miles and cover a variety of terrain and riding conditions. The equestrian center will be established at Sugar Bottom with trails from there to North Point and South Point.

EQUESTRIAN TRAIL

P. Plant Materials and Landscaping

There exists a need for extensive planting programs in certain camping areas and for enhancement of overlook areas seen by the general public. Planting shall be simple, functional and economical to maintain. Plant species will be those that are indigenous to the area, having proven to be hardy and tolerant of specific site conditions.

DECIDUOUS TREES

Ash, Green
Ash, White
Birch, Paper
Cherry, Black
Cottonwood
Honeylocust, Common
Maple, Red
Maple, Silver
Oak, Pin
Oak, Red
Willow, Black

CONIFEROUS TREES

Baldcypress, Common
Cedar, Eastern Red
Pine, Austrian
Pine, Red Norway
Pine, Scotch
Pine, White
Spruce, Norway

ORNAMENTAL TREES

Dogwood, Pagoda
Hawthorn, Washington
Maple, Amur
Plum, American
Red Bud
Russian Olive

PLANT MATERIALS

DECIDUOUS SHRUBS

Arrow-wood
Cherry, Manchu
Cotoneaster, Peking
Dogwood, Red Osier
Honeysuckle, BlueLeaf
Honeysuckle, Zabel
Nannyberry
Rose, Rugosa
Wayfaring Tree
Witch-hazel

CONIFEROUS SHRUBS

Arborvitae, American
Hemlock, Common
Juniper, Creeping
Juniper, Pfitzer
Juniper, Sargent
Pine, Mugo
Yew, Canada
Yew, Japanese

PRAIRIE GRASSES

Little Blue Stem
Big Blue Stem
Buffalo Grass
Canadian Wild Rice
Pale Purple Coneflower
Rattlesnake Master
Prairie Gentian
Prairie Switchgrass
Indian Grass

PLANT MATERIALS

Q. **Signage**

A sign system for Coralville Lake shall be used in recreation areas along roads, waterways and trails where the public might need guidance, direction, or information. The sign system shall be in conformance with the North Central Division Sign Handbook. There will be seven classes of signs:

Navigational aids at Coralville Lake will be of the approved Coast Guard* type for inland waterways in size, shape, and color. Channel hazards and restricted zones will be posted along the swimming beaches and harbors. Boaters will not be allowed within 100 feet of the dam structure or 300 feet of the control tower. During periods of high water, boating may have to be more severely restricted dependent on local conditions such as current, flow and debris.

Traffic control signs along all roads shall be consistent with the Uniform Manual on Traffic Control Devices.

The remaining five classes of signs shall be of a uniform style using the following materials. All lettering and directional arrows shall be routed and painted white. Federal recreation symbols will be used wherever possible. These symbols can be stenciled onto either plastic, metal or wood panels with their borders routed and painted white. Letters and symbols shall be displayed on a surface of rough sawn diagonal cut members stained dark brown. This shall be supported by rough sawn timber posts.

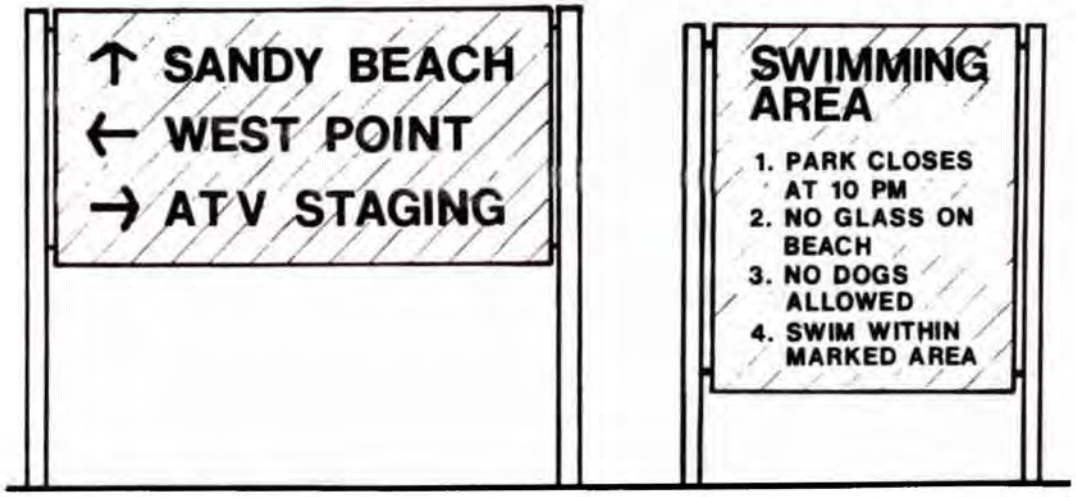
Directional signs are to be used off-site as guides to all recreation complexes and areas. Only routed letters and directional arrows will be used.

Project rules will be posted at those sites where more detailed information is needed for the public, i.e., beaches, overlooks, visitor information centers and camp sites.

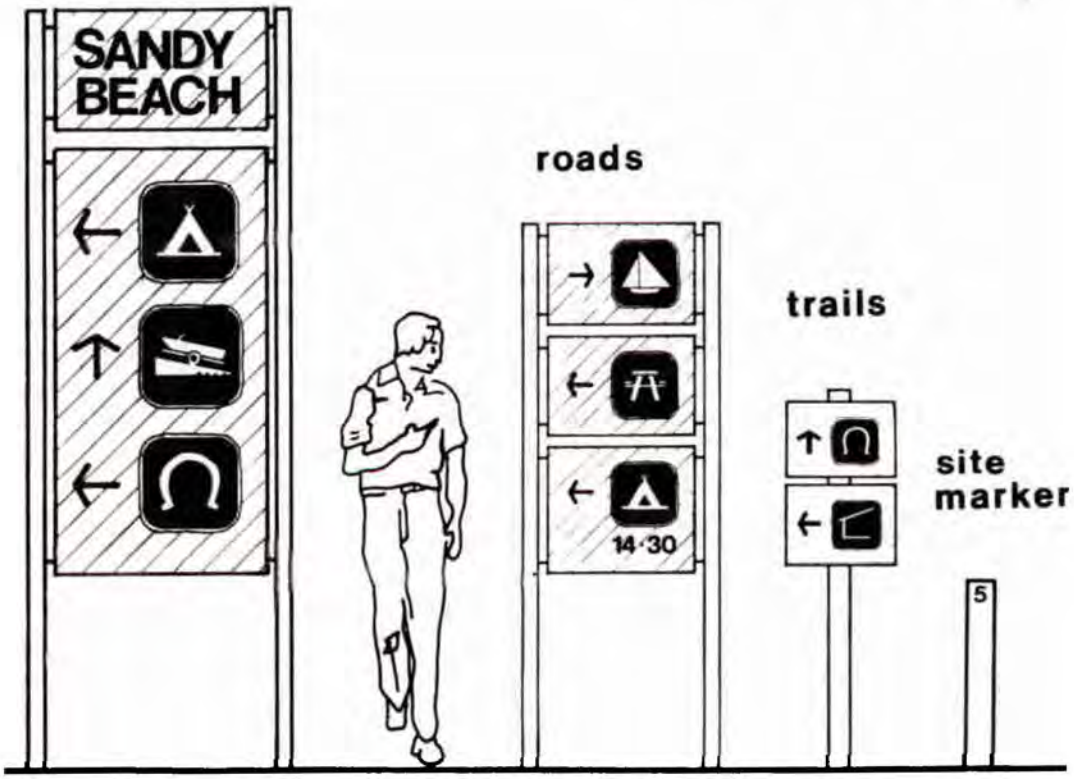
Entrance signs are to be located at the entry points to all complexes and areas. The top panel will contain the complex or area name with the lower panel displaying the activities by symbol within the area. No more than four symbols may be used on one sign.

* As approved by the Advisory Panel of State officials to the Merchant Marine Council, U.S. Coast Guard.

FEDERAL RECREATION SYMBOLS



DIRECTIONAL **PROJECT RULES**



ENTRANCE **INSTRUCTIONAL**

SIGN SYSTEM

Instructional signs are to be used as guides within each area. Symbols and arrows will be used with lettering used only where necessary. There are three subclasses of instructional signs: roads, trails, and site markers. The road and trail signs will be used as trail blazers and the site markers will be used to mark individual camp sites.

Interpretive signs and markers are a device which translates past or present events, management activities, or policy into useful public information. Due to the uniqueness of each site, each sign or marker will have to be designed separately. These shall be in conformance with Chapter 5 of the North Central Division Sign Handbook.

R. Waste Disposal System

A schedule of waste collection will be completed by the operations division and reservoir manager along with specific recommendations concerning dumping. An on-site location is now being used for disposal of solid waste; however, it will be closed and a more appropriate site will be found in an approved sanitary landfill nearby. If on-site dumping is desired, a detailed engineering study will be required.

Trailer sanitary dump stations are provided at each camping facility. These facilities will be of the double-entry type and include a water hydrant, disposal unit, lighting and paved surfacing.

S. Provisions For The Handicapped

To satisfy the recreation needs of the handicapped, special facilities for hiking and fishing are planned for development within the recreation area. The overview and fishing deck at Curtis Bridge will have handicap access and provide guard rails and wheelchair stops. Pole holders shall be provided to relieve the effort of holding the rod and reel for long periods of time.

Adjacent to the major parking lot at the West Overlook recreation area there will be a trail specifically designed for handicap use. Surfacing will be asphalt to facilitate wheelchair movement and to allow people on crutches or other support devices to circulate on their own if possible. Grades on the trails will not exceed 6 percent. Short sections of the trail will have wood plank bridges or crushed compacted stone to provide visual and textured interest. Signs, markers, animal/bird feeders, and other devices will be provided and placed at eye level from a seated position. Plaques describing features along the trail will be both printed and in braille. Plantings along the trail will emphasize sound, touch, and smell as well as visual interest. This trail will be open to the general public but will be geared toward use by the handicapped.

X. SPECIAL PROBLEMS

The purpose of this section of the plan is to enumerate the most significant problem areas affecting recreation development at Coralville Lake.

A. Urbanization and Community Docks

The presence of Coralville Lake and Lake Macbride State Park has caused a great deal of residential development throughout the area. Future housing developments will no doubt have several adverse impacts on recreation use at Coralville Lake. First, water table and surface water contamination from septic sewage systems will probably increase the incidence of fecal coliform bacteria in lake waters. Residential development will also affect the quantity and quality of wildlife habitat in lands adjoining the lake area.

Since one of the reasons that people locate and build a home next to the lake is to participate in water-oriented activities, most of the homeowners have boats. The Corps of Engineers, recognizing this special demand for facilities, has allowed homeowners to develop small docks in six community dock locations. These docks are privately owned and are used by the person building the dock.

A Lakeshore Management Plan will be prepared for Coralville Lake. The Lakeshore Management Plan will be identified as Appendix F to the Project Master Plan and will address the Community Boat Dock situation that now exists at Coralville Lake. It had previously been thought that the community boat docks could be eliminated; however, in accordance with the guidelines provided in ER 1130-2-406, we are developing a plan to reconcile this problem.

B. Water Level Fluctuations

Die-offs of fish will occur from time to time because of the high BOD and reduced dissolved oxygen which coincide with winter drawdowns. Severe water level changes will favor the survival of rough fish primarily because they have lower oxygen requirements than game fish.

C. Sedimentation

The lake will continue to very gradually become shallower due to sedimentation. As the lake becomes more shallow, water temperature will also increase. This, in turn, will probably induce more frequent, larger algal blooms and an increased undesirable taste in the water. In addition, winter drawdowns will have a negative impact on fish with increased die-offs because of high BOD and reduced dissolved oxygen levels. These influences favor rough fish which usually have lower oxygen requirements than game fish. Sedimentation will also reduce the area to boaters. From time to time this condition may become serious when the conservation pool fails to reach the summer elevation until well after the beginning of the recreation season. At some later date, perhaps during the preparation of the next updated recreation master plan, this problem may have to be specifically addressed.

D. Need for Additional Recreation Land

Coralville Lake receives heavy visitation, primarily because of its proximity to Iowa City and Cedar Rapids. Although a great deal can be done to upgrade the facilities at existing areas--and this has been proposed in the revised master plan--there are few areas on the lake where major new developments might occur. Therefore, development of those areas that have sufficient acreage and recreation resources is considered in this master plan.

There is not a tract of comparable size and resource characteristics to Sugar Bottom or West Overlook on the west side of Coralville Lake which is under Corps management. There is a site, however, that could support development of a large facility. This area is presently occupied by Coralville Docks, a private concession. The enterprise has recently changed management and the lease extended to 1997. The new lease has been expanded to include 39.6 acres, and camping facilities will be added to the expansion area. This action should reduce camping pressure to the west side of the lake and provide additional outdoor recreation activities to campers. This should also reduce congestion at other campgrounds on the project.

The Lake Macbride State Park has the highest visitation of all parks in the Iowa Park System. There is an obvious need for additional development and facilities in this general area. The Iowa Conservation Commission has requested that the Corps of Engineers acquire approximately 850 acres of land between the two embayments of Lake Macbride. They have proposed leasing this land from the Corps and intensively developing the area.

The University of Iowa Macbride Field Campus is just southwest of the state park and provides good access to Coralville Lake. Since the area has been well managed, the tract has perhaps the best scenic characteristics and potential for development on the lake. This parcel of land is near the heavily used Lake McBride State Park and should, therefore, be considered for development as a public use area. In addition to being already owned by the Corps, McBride Field Campus is in a key location and contains the necessary resources for a complex recreation development. Three alternatives are open to the Corps of Engineers and should be coordinated during the next 5 years with the University to assure full site utilization:

* Encourage the University of Iowa to develop the site for public use with the provision of renewing their lease in 1984.

* Earmark the site for future recreation development by a willing sponsor, presumably the Iowa Conservation Commission.

* Earmark the site for future cost-share recreation development by the Corps of Engineers and a willing sponsor.

Since the site has obvious potential, site plans have been suggested in Chapter VIII of this report and in Volume II of the master plan. The proposed design may be used under any three of the alternatives listed above.

E. Level of Resource Management

Some of the more important resource management problems that have been addressed in the design of new facilities are as follows:

* Standardization of Building and Facility Design: Development at Coralville Lake during the early years has been characterized by attacking immediate problems with the addition of various temporary facilities and buildings. This has resulted in a lack of standardization in design. For example, at least three different types of restroom facilities are present at the lake. All buildings and facility motif will be standardized in the future.

* Sign Program: The signage around Coralville Lake is confusing and inadequate. The thrust of the signage program presented in Section IX of this plan will be to place appropriate signs in proper locations and provide information that will enable the recreation user to understand the types of facilities available and the restrictions placed on use.

* Recreation Unit Design Concept: Existing recreation areas at Coralville Lake can be described as informal use areas. Roads have generally been the only management control to direct or disperse recreation use. Areas have not been clearly designated for camping, picnicking and other uses, and as a result conflicts among users have arisen. Lack of adequate control has resulted in swimming, camping, picnicking, boat launching and other activities occurring randomly. Areas and sites will be designated for specific types of uses. Only in this way can special facilities be developed for recreation users.

* Law Enforcement and Public Relations: Although the various agencies contacted showed little interest in the type of facilities and locations of additional recreation areas, there is interest in the Coralville project as a whole. A major area of concern is law enforcement. Staffing must be increased and safety and security of visitors must be a major thrust for the management staff. Future developments and plans will continue to be coordinated at the local level and a strong effort will be made to improve the public image of the Corps of Engineers in the area.

* Recreation Use Measurement: The COMPATRAX model results indicated that past use estimates are reasonable. However, statistics on use at specific areas and the activities people participate in were not generally available. The management staff at Coralville Lake will implement more sophisticated measurement of recreation use at Coralville in order to accommodate future planning needs.

XI. RESOURCE MANAGEMENT PLAN

A resource management plan will be prepared for Coralville Lake as Appendix A of the revised master development plan. This appendix is scheduled to be submitted to higher authority in the fourth quarter of FY 1977 The plan will follow the guidelines provided in ER 1130-2-400, Appendix A, and cover all aspects of project administration. The resource management plan will include a detailed analysis of all operational, administrative and organizational policies of the Coralville project. Operational concepts pertaining to primary and secondary project purposes and environmental considerations will be summarized. Policies on management of public use areas, user fee collection, law enforcement, encroachments and pest control will be identified. An inventory of present and projected Corps facilities, concessionaire activities and operations on leased land will be updated. Ongoing programs pertaining to ranger activities and staff training will be examined and, where appropriate, revised. All aspects of visitor use including safety, recreation area maintenance and available educational and interpretive programs or opportunities at the lake will be critically reevaluated.

Although a detailed analysis of staffing and equipment at the lake is required by regulation in the resource management plan, this present version of the revised master plan provides general recommendations with regard to additional staffing at Coralville Lake. The basis for these recommendations is an analysis of staffing of both permanent and temporary employees at 36 reservoirs in five different Corps districts. The present staffing at Coralville Lake is listed below:

* Permanent Personnel

No.	Job Title	Job Grade
1	Park Manager	GS-11
1	Park Manager	GS-9
1	Project Clerk	GS-3
2	Park Technicians	GS-7
1	Eng. Equip. Opr.	WG-10
1	Maintenance Man	WG-8
1	Motor Vehicle Opr.	WG-7
2	Tractor Operators	WG-6

* Temporary Staff

One Year Appointments:

1 Park Technician	GS-5
1 Laborer	WG-3
1 Laborer (Student)	WW-3

Summer (Recreation Season):

3 Park Technicians	GS-5
4 Laborers	WG-1
2 Summer Aids	-

An additional three full time employees and twelve part-time employees during the summer months would significantly improve recreation resource management and operations at Coralville Lake. The three full time employees and eight of the part-time employees would be in the ranger class. Of these, four would be in the field at all times during the recreation season to provided visitor security and to disseminate information.

The resource management appendix will coordinate the many disparate aspects of lake management into a single coherent plan including staffing. During the preparation of this appendix, every effort will be made to improve the public's understanding of and experiences with the operation and administration of the Coralville Lake project.

XII. FOREST MANAGEMENT PLAN

A Forest Management Plan will be developed for federal lands around Coralville Lake east of U.S. Highway 218; this plan will be Appendix B of the revised recreation master plan. This appendix is scheduled to be submitted to higher authority in the fourth quarter of FY 1977. Lands west of U.S. Highway 218 are licensed to the Iowa Conservation Commission for wildlife management purposes. Management of forests on that portion of the federal lands will be facilitated through periodic coordination between the Corps of Engineers and the Iowa Conservation Commission.

A preliminary inventory of forest resources on Corps-owned lands below U.S. Highway 218 has been completed. Approximately 340 acres have recreational management and aesthetics as the primary objective; 1,295 acres are managed principally for wildlife habitat. Commercial timber production will not be an objective of the plan.

A. Recreation and Aesthetics

From time to time, tree regeneration is necessary to replace dead or diseased trees, to provide additional screening or shade, or to add to the general aesthetic appeal of a site. Either through natural regeneration or planting, tree species which are adapted to the site and are wind-firm species will be favored. In high use areas, selection will favor those species which are the most tolerant of soil compaction. Generally, tree selection will favor native deciduous tree species. Coniferous species will usually be used for screening purposes, since they maintain year-round foliage.

Silviculture practices in heavy-use recreation areas will be limited to the removal of dead, dying, or hazardous trees. If a commercial market is available, it will be utilized. However, if removal is not commercially economical, it will still be accomplished and the trees used for wood supply in designating camping areas. No harvesting as such will be done in these sites.

B. Wildlife Management and Dispersed Recreation

Uneven age management and species diversity will be used to improve wildlife values of the land. To achieve uneven age management, the group selection method of harvest will be used. Small areas of not more than 0.5 acres will be cut randomly throughout this area in order to optimize wildlife habitat (but not to favor any one wildlife species).

Tree regeneration will favor those species which are mast or nut producers (such as walnut, pecan, wild cherry, or various species in the white oak group). Silviculture methods will be limited to reducing competition by thinning and leaving those species which are deemed the most desirable species for wildlife habitat. Any trees posing a direct safety hazard to the public will be removed, however.

Tree harvest will be periodic and confined to small areas as described above. Planning for timber disposal will be included and will be incidental to planned land use. Where practicable, forest products generated through clearing, flood damage, or salvage operation and not required for Corps use will be sold. A disposal plan must be developed which indicates the location, extent, volume and justification for such sale.

XIII. FIRE PROTECTION PLAN

The fire protection plan, Appendix C to the revised project master plan, is scheduled to be submitted to higher authority in the fourth quarter of FY 1977. It will include provisions and guidelines for grass and forest fire presuppression and suppression activities and protection of recreation, maintenance and other facilities on all project lands. The plan will also provide for training of personnel, the procedures to follow in case of fire and recommendations of the necessary equipment and tools to be readily available for prompt suppression activities. Since several agencies may be involved in the protection of project lands, it is necessary to fully coordinate all agencies having an interest in the plan.

XIV. FISH AND WILDLIFE PLAN*

In compliance with Public Law 85-624, ER 1120-2-400, and ER 1130-2-400, a Fish and Wildlife Management Plan will be developed as Appendix D to the revised recreation master plan. The primary purpose of this plan will be to evaluate fish and wildlife habitat on land and water owned and managed by the Corps of Engineers at the Coralville Lake project and to prescribe practices for maintaining or improving habitat on these areas. The following discussion is a summary of the plan's principal components and management alternatives that should be considered.

The project area presently supports populations of whitetailed deer, some predatory and small game species and a variety of nongame mammals and birds. Management of nongame species for nonconsumptive uses such as sightseeing and photography will receive equal attention with management of game species for hunting and trapping.

The limiting factors for wildlife populations in the project areas are: (1) the severe water level fluctuations which flood large land areas (a problem which is particularly detrimental during the spring nesting season), (2) the disturbed soils of the area, (3) the limited acreage of project land available for intensive wildlife enhancement along the shores of the eastern half of the lake, and (4) the heavy public recreational use in some areas.

Approximately 13,048 acres of the 24,118 acres owned in fee title by the Corps are leased to the Iowa Conservation Commission and comprise Hawkeye Wildlife Management area. The primary effort of the Commission has been the intensive development of this area for waterfowl refuge (about 2,000 acres), fish and waterfowl habitat throughout the area and upland game population for public hunting.

During the spring and fall migration periods, many species of waterfowl common to the Mississippi Flyway use Coralville Lake as a resting point. Carefully controlled lake water levels would improve habitat for these waterfowl.

* Scheduled for submission to higher authority in the 4th quarter of FY 1977.

The fish and wildlife plan will provide for improving or maintaining those native plants which establish nesting cover, escape cover, winter cover, and good quality food for wildlife. Project managers may utilize several different management practices to improve or develop habitat based on soil type, topography, elevation, size of area and/or land use. Lands intensively developed for recreation will receive plantings of tree and shrub species beneficial to wildlife. Other areas may be managed to either promote natural succession from annual weeds to biennial and perennial vegetation, or to prolong the annual weed production seral stage. Where an interspersion of vegetation to produce food, nesting sites and cover is desired, agricultural practices and/or controlled burning can be used. One-third of the land thus suited to intensive management (e.g., mowing, disking, planting food plots) might be treated each year. Food plots would, of course, vary according to field size and habitat requirements of the area. Plant species which might be used include buckwheat, milo, brown top millet, soybeans, cowpeas, sorghum cane, domestic grasses, ladino clover and Korean lespedeza. Lands below the 5-year flood pool (elevation 696) could be managed to favor annual weed production and prevent large, thick, single-type vegetation blocks which have little wildlife food or edge value.

Nesting boxes will be added to upland woodlots to provide shelters for cavity-using wildlife such as squirrels and wood ducks. Project personnel should try to identify and save older trees which have a potential as den trees (primarily black oaks in upland areas and sycamore and red maple in lowlands).

Minor lake level manipulation should be utilized during the summer and fall to improve shorebird and waterfowl habitat and permit aerial seeding of plant species which will survive inundation.

Public hunting should continue to be permitted on that part of Hawkeye Wildlife Management area not posted as a refuge. The entire boundary will be subject to federal and state hunting laws as well as special departmental regulations.

The Division of Fisheries in the Iowa Conservation Commission is responsible for fishery management in Coralville Lake. Water level fluctuation, particularly during the spring spawning period, is the major factor limiting fish populations in the lake. During flood control operations, either fish nests

are stranded on exposed mud flats or water reaches such a depth over the nests that the fish abandon them. Closer coordination between pool levels and hatching times needs to be maintained insofar as possible.

Standing and lodged flooded timber provides the main fish habitat and cover. Without the flooded timber the fishing success would probably markedly decrease, owing to the lake's present lack of aquatic vegetation. By establishing more aquatic and semiaquatic plant beds in the lake, more of the cover needed by small fishes could be provided. Since dry years and resulting low lake levels have adverse effects on aquatic vegetation, it is recommended that lake level manipulation be carefully coordinated during low-flow years in order to enhance the overall lake fisheries. Also, the use and placement of artificial fish cover in the form of brush piles, stake beds, etc., to add cover and concentrate fish for improved angling success should be considered.

When sedimentation is heavy, spawning beds are covered and fish eggs are suffocated. Under current operational procedures, sedimentation will eventually eliminate all habitat below the 670-foot pool level. As the capacity of the conservation pool is reduced, operational procedures should be periodically reviewed and altered to maintain adequate water volume for fish habitat.

The high BOD load associated with the agricultural runoff from the watershed has caused oxygen depletions in the lake and has resulted in winter fish kills in the past; the largest kills occurred in 1965, 1966, 1969, and 1972.

Further consideration should be given to zoning the lake to prevent water skiers and boaters from disturbing important fish spawning areas. Limits on important game fish species to preserve an adequate supply of brood fish will be discussed in the Management Plan. Finally, supplemental stocking of certain species should continue to be a necessary reservoir fish management technique; the recommended stocking schedules for selected species should continue to be explored and altered as to Coralville Lake fisheries habitat changes.

XV. PROJECT SAFETY PLAN

The safety plan, Appendix E of the revised project master plan, will be completed during the fourth quarter of FY 1977. This plan will include consideration for overall public safety at public use areas, as well as guidelines for safety and protection of Corps employees and property. Since snowmobiling, ice fishing, swimming and boating are important recreation activities at Coralville Lake, special attention will be given to the safety needs for these activities.

The safety plan will include discussion of safety features for construction, maintenance, public use areas, visitor protection, equipment operation, and office management. Once hazardous situations have been identified, the Safety Plan will indicate the precautionary actions to be taken to prevent, reduce or control such hazards. Development of Appendix E of the revised master plan will be fully coordinated with the District Safety Office in the initial preparation and will be periodically reviewed during subsequent safety surveys and inspections.

XVI. LAKESHORE MANAGEMENT PLAN

The Lakeshore Management Plan, Appendix F of the revised project master plan, is scheduled to be submitted to higher authority in the fourth quarter of FY 1977. This plan will provide policy and guidance in protecting desirable environmental characteristics and restoring shorelines where degradation has occurred through private exclusive use of the lake. The plan will include an area allocation map, related rules and regulations; a time-phase definitive plan for managing the lakeshore; a description of the criteria used in granting permits for private facilities or developments; and other information.

The allocation map will depict limited development, public recreation, protected lakeshore, and prohibited access areas. Full public participation will be encouraged in the plan formulation.

XVII. CONCLUSIONS

The revised Coralville Lake Master Plan presents a conceptual basis for design and construction of additional recreation facilities. Particular attention has been paid to the capability of project resources to withstand further development. The design concepts presented balance the human factors against the overall resource constraints to ensure that both will be carefully treated and that the ecological balance will be maintained over the life of the Coralville project.

As future recreation development is implemented according to this plan, Coralville Lake will continue to provide high quality water and land oriented recreation.

Current policy requires cost-sharing by a non-Federal public agency for expansion of existing recreation areas or for development of new recreation areas at Coralville Lake. A sponsor for cost-sharing in recreation development at Coralville Lake has not been identified. Because of this, development proposed in this Master Plan may not be accomplished within the time frames indicated. However, the Master Plan identifies the capabilities of project resources to accomodate recreation needs and provides a framework for possible future cost-share development.

Pending identification of a non-Federal cost-share sponsor or a policy change allowing new recreation development by other means, the following management principles shall be applied at Coralville Lake:

1. Existing facilities will be operated and maintained, as in the past, to provide the highest quality recreation experience to visitors that available funding and personnel spaces will permit.

2. Rigid control of facility loading will be instituted in the interest of public health and safety and to prevent overuse of basic resources.

3. Continuing efforts will be made to obtain a non-Federal cost-share sponsor for needed recreation facility development.

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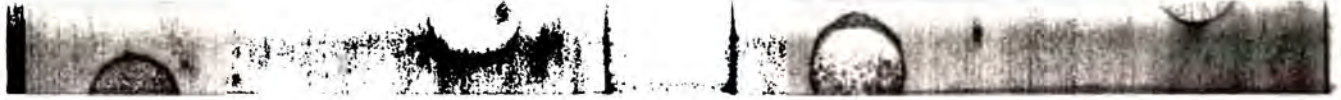


APPENDIX G

DESCRIPTION OF MRI's COMPATRAX RECREATION DEMAND ALLOCATION MODEL

COMPATRAX is a computer-based model that has evolved into a powerful tool for providing forecasts of recreational demand. In its present version, or with additional refinement, COMPATRAX provides a unique means for expeditious and comprehensive solutions to many problems involving leisure/recreation/tourism markets.

Presently, COMPATRAX contains over 200 metropolitan and nonmetropolitan demand sources and over 200 recreation destination regions. All multicounty SCORP regions within a 24-state area are incorporated in a machine-readable supply file. Additional geographical coverage and recreational activities can readily be incorporated.

COMPATRAX prepares recreation destination region demand forecasts for individual recreational activities, in activity-days, as well as visitation analysis in terms of visitor-days, visitor-nights, visitors, and visitor expenditures. In addition, COMPATRAX prepares a market summary indicating, in rank order, the most important visitor sources for each destination region.

I. Previous Applications

The COMPATRAX model was developed to enable recreation economists at MRI to make estimates of recreational usage (present and projected) at recreational regions (multicounty areas) in Appalachia. It has since been used in similar studies in Missouri, Arkansas, Oklahoma, and Iowa. In New York, the model was used to evaluate the economic impact of a proposed highway project that would have connected a recreation region with major urban centers in the southern part of the state. The model was also used (with some modifications) to project short-term marina concession needs at three Corps of Engineers lakes in Arkansas and southwestern Missouri and to evaluate the impact of the proposed Ozark National Recreation area. Although the model was not initially designed to incorporate travel resistance (quality of highways, toll roads, etc.), it has been modified in a study for the Highway Research Board to include this factor.

II. Abstract

The MRI COMPATRAX Demand Allocation Model is a computerbased systems model designed to provide estimates of current and future usage at individual recreational destination complexes. The model's underlying rationale is as follows:

* Recreational demands are generated by the recreational participation desires of individuals, and are thus functions of numbers and characteristics of population groups.

* Their demands are satisfied as recreational destinations, having various resource characteristics.

* The portion of the recreational usage at any individual recreation destination complex derived from each market concentration depends on the complex's distance from the market and relative extent and quality of the complex's recreational resources, compared with the extent and quality of resources at all other destination complexes that can compete with it.

* The total recreational usage at any individual recreational destination complex is the sum of the usage generated by all of the individual market concentrations that furnish a significant degree of demand, where each market concentration's contribution to total demand is based on distance and the competitive effects of all other accessible destination complexes.

The COMPATRAX model permits the inclusion of large numbers of destination complexes and market concentrations in the determination of usage at any individual destination complex. In the model, demand functions and distance-participation functions are empirically determined by the results of extensive observation and measurement of observed behavior.

In a recent version of COMPATRAX prepared for the Ozarks Regional Commission, MRI included all of the population concentrations in the 24 states between the Appalachian and Rocky Mountains as potential sources of demand for Ozark destination complexes. This group of 24 states is termed the "primary market area."

MRI also included in the supply inventory all of the destination complexes in these same 24 states that offer the same basic recreational facilities as the Ozark complexes. This group of destination complexes is termed the "primary resource area." The primary resource area excludes destination complexes in the 24 states that provide fundamentally different types of recreational resources, such as major cities, desert areas, and Gulf of Mexico and Great Lakes coastal areas. It also includes a few complexes outside of the primary market area that compete with complexes in the primary resource area for snow skiing. Thus, the primary resource area is not precisely equivalent to the primary market area, although both incorporate the same general portion of the U.S.

The basic COMPATRAX model consists of six major sections: A preprocessor, a demand allocator program, an activity analysis, a visitation analysis, an expenditure analysis, and a market report. Inputs, internal tables, and computations that form these major sections are explained in a section below.

III. Technical Description

A. Preprocessor

The function of the preprocessor is to structure the basic demand file. The first portion of the preprocessor reads input data regarding the primary market area. Specific input data include the state codes and names for each of the standard metropolitan and statistical areas (SMSA) in the primary market area, together with 1970-1975-1980 total population estimates for these SMSA's and the latitude and longitude of their centroids.

Non-SMSA population data for each state are also included. These data were derived from estimates prepared by the National Planning Association.

Because the NPA population forecasts by SMSA did not go beyond 1980, included as the next step of the preprocessor is a simple computation to extrapolate population to 1985. This is accomplished on constant-rate-of-growth basis.

In a similar adjustment computation, the next step in the model consists of allocating the non-SMSA populations to the SMSA populations, on the basis of relative size.

Next, there is an internal table (AGED) consisting of an age distribution of total population in each of the two census regions in which primary market states are located. Data in this table are employed to develop age breakdowns in each of the market area SMSA's. Although the procedure utilized to apportion the population of each market area SMSA into appropriate age categories is something less than fully rigorous, it seems to be sufficient. Nevertheless, it would be simple to incorporate more precise age-group population forecasts if reliable data were to become available from some external source.

Another internal table (PR) contains per capita participation rates for the year 1970 in the 13 key recreational activities. Separate rates are contained for the two census regions involved, and for five different age groups. These participation rates were derived directly out of MRI's recent nationwide leisure/recreation survey.

Immediately following the participation rate table is another internal table (YIX) containing indices reflecting growth in demand for each of the 13 key recreational activities for 1975, 1980 and 1985. The 1970-1975 growth rates were incorporated directly from the forecasts developed in the national MRI leisure/recreation study. The 1980 and 1985 forecasts were prepared by MRI by first extrapolating the 1970-1975 growth rate and then making judgment-based downward adjustments to reflect approaching levels of saturation in some of the activities for which the 1970-1975 growth rate is exceptionally high.

B. Demand Allocator

The demand allocator allocates all of the demand generated within the primary market area among all of the complexes in the primary resource area. The initial section of the demand allocator reads input data describing the recreational supply file. Basically, each recreational destination complex, or supply element, consists of an individual multi-county outdoor recreation region, as defined in the State Comprehensive Outdoor Recreation Plans (SCORP's) for all of the states in the primary resource area. The identification and

numbering of each recreational complex, as well as detailed data concerning individual recreational resources within these complexes, were developed through a review of SCORP's as kept on file in the Bureau of Outdoor Recreation. Each destination complex is indexed in terms of a standard numerical state code and the numerical code assigned by each state to each region, as well as the latitude of the centroid of the region.*

The supply file also contains both the numerical and the judgmental elements of the relative attractiveness rating for each destination complex for land-based activity, water-based activities, viewing, fishing, hunting and snow skiing. The relative attractiveness of a complex for water-based activities is measured by the total acreage of recreational water available, determined from the SCORP data. We decided to limit this measurement at a level of 100,000 acres, beyond which point we concluded that additional acreage would not exercise a proportionate drawing power on adjacent markets. As a practical matter, there were only a few complexes in the entire supply inventory containing more than 100,000 acres of water. In a similar way, relative regional attractiveness for land-based activities is measured by the aggregate acreage of public recreational lands available.

Attractiveness indices for the other activities were based on the judgmental "A-B-C-D-E" rating scales carrying numerical values of 0, 0.5, 1.0, 2.0, and 4.0, respectively. For most of the supply inventory, a procedure of rating "by exception" is normally followed. Every complex is given a "C" rating unless there is positive evidence to the contrary, indicating either that a complex is relatively deficient in certain resources or that a complex may contain one or more nationally known major tourist attractions. In some cases, it may also be desirable to superimpose judgmental ratings on land or water acreage measurements to reflect a quality and attractiveness level known to be considerably above or below average value.

* The National Atlas of the USA, U.S. Department of the Interior, Geological Survey, Washington, D.C.

For some analyses, it may be desirable to subdivide an individual complex for more detailed study. As a practical matter, COMPATRAX works reasonably well down to a single-county level. Subdivision requires the generation of new centroid latitude and longitude coordinates and determination of the acreages of recreational land and water available within each subcomplex. Resource measures based on acreage obviously pose no problems in the determination of revised attractiveness measures for the subdivided complexes. In the case of the judgmental ratings, the practice has been to develop subcomplex ratings such that the sum of the numerical rating values for each activity is equal to the numerical value of the rating given the total complex, in most cases a value of 1.0.

Following the supply file is an internal table (TBMNFC) containing destination factors. Eight destination factors are incorporated, one for each of the four occurrence categories in each of the two census regions involved. The purpose of these destination factors is to remove from further consideration that portion of the primary market area's total demand that will be unavailable to the primary resource area because of its measured preference for major cities, desert areas, the Great Lakes, and the Gulf Coast as weekend trip and vacation destinations. These destination factors were developed out of the vacation and weekend travel sections of the 1970 MRI leisure/recreation study. Because we are removing these demands as potentially unavailable to the primary resource area, we have deleted the corresponding resources so as to avoid a doubling of the demand diversion effect that would otherwise be present. The destination factors for "few available hours" and "all day outings" do not reflect this demand leakage, since all of this demand must necessarily be served within an extremely short distance of the market location. For this reason, all the potential demands generated in the "few available hours" and "all day outings" occurrence categories are considered as potentially available.

This approach poses no theoretical problems to the analysis of demands for any recreational complex, except for those that are immediately adjacent to the excluded types of destination area. To date, we have had no requirement to study any such destination areas; conceptually, however, we are certain that these other classes of demand could be handled in the model through use of modified destination coefficients and resource measures.

Another internal table (TBDDMX) is a representation of the distance/distribution matrix. In this matrix, the percent of total recreation activities occurring in each of the four occurrence categories is allocated among six concentric distance bands. Data used in the distance distribution matrix were derived initially in the Appalachian Highlands Recreation study from data contained in the 1965 BOR report.

An internal table of occurrence coefficients (TBOCCF) shows the percentage of annual activity days taking place in each of the four occurrence categories for each of the 13 key recreational activities. As in the prior internal table, the data in the occurrence coefficient table were developed by MRI out of the 1965 BOR study.

There is an internal table (TBDBDF) indicating the specific mileages associated with the six concentric distance bands. This is followed by another internal table used to reflect average differences between airline miles and actual highway miles associated with travel to each of these six distance bands.

C. Activity Analysis

The activity analysis provides estimates of present and future usage at each destination complex separately for the 13 key recreation activities, measured in activity-days. This activity analysis is the initial output of the allocator process and serves as the basis for all subsequent output.

D. Visitation Analysis

The visitation analysis converts activity-day demand measures into measures of visitor-days, visitor nights, and visitors. The first internal table in the visitation analysis consists of a series of activity replication factors (ACTRFC) employed to convert total activity-days into measures of visitor-days. The activity replication factors were developed through a study of experience reported at a number of reservoirs by the Corps of Engineers concerning the extent of multiple-activity participation during the course of any one visitor-day.

Visitors participating in the activities of driving for pleasure and camping almost invariably participate in other recreation activities, so a replication factor of 0 is assigned

to these activities. By contrast, individuals who participate in snow skiing, fishing, and hunting, very seldom participate in any other kinds of activities except, possibly, driving for pleasure and camping; for this reason a replication factor of unity is employed for these activities. The replication factor for all of the other activities is estimated at 1.85, through analysis of Corps of Engineer data. Application of these replication factors to the projected total activity-days overcomes the problem of double counting in which a single activity-day is often erroneously equated to a visitor-day.

The next internal table (VDVNVR) contains a conversion matrix used to translate visitor-days into total visitors and then to visitor-nights. These factors were developed through an analysis of average length of stay data, some of which were developed in the 1970 MRI national study, some of which were obtained from other published sources.

E. Expenditure Analysis

The expenditure analysis provides estimates of visitor expenditures in each complex. The initial internal table (EXCO) in the expenditure report program contains a series of average daily expenditures for food, lodging, and other expenses, for general summer activities, hunting, fishing, and snow skiing, for each of the four occurrence categories. Basic inputs to this table of expenditure coefficients were developed from a number of sources, including the American Automobile Association, the U.S. Department of the Interior, and the report "Skier Markets in Northeast North America." All of these data were inflated to 1969 levels in the Appalachian Highlands Recreation Study, and inflated again to 1972 price levels for the Ozarks study. Expenditure coefficients for food and lodging in the overnight trips and vacation occurrence categories are average values, reflecting the several price levels associated with commercial accommodations, camping, and staying with friends and relatives. Any disaggregation of expenditures to show, for example, total expenditures of campers, will require an external calculation.

F. Market Analysis

The market analysis provides summaries, for each complex, of the numerical values and percentages of that complex's total market provided from each market concentration in the primary market area. Depending on user preferences, the

market analysis may be accumulated on any one of the usage measurements: visitor-days, visitor-nights, and visitors.

An internal table (TVISIT) is used in the market analysis to convert from activity-days, which are the usage measure on intermediate file ALLOUT, to whichever variable is to be reported in the market summary. A single card is read by the program to cause the program to choose visitors, visitor-nights, or visitor-days. The factors in this matrix are derived from quantities used in the visitation analysis (ACTRFC and VDVNVR). A computer flowchart showing the COMPATRAX process is located on the next page.

IV. Use of COMPATRAX for the Coralville Lake Visitation Forecast

In applying the COMPATRAX model to the Coralville Lake project, four steps were completed prior to ordering the computer run. These include:

* Reviewing the recreation acreage (both land and water) for all projects in Iowa SCORP Region Number 2.

* Inventorying the recreation acreage under the Corps of Engineers jurisdiction at Coralville Lake. All leased land was excluded from the COMPATRAX analysis, and the summer conservation pool (El. 680--4,900 surface acres) was assumed to be the water acreage during the main recreation season.

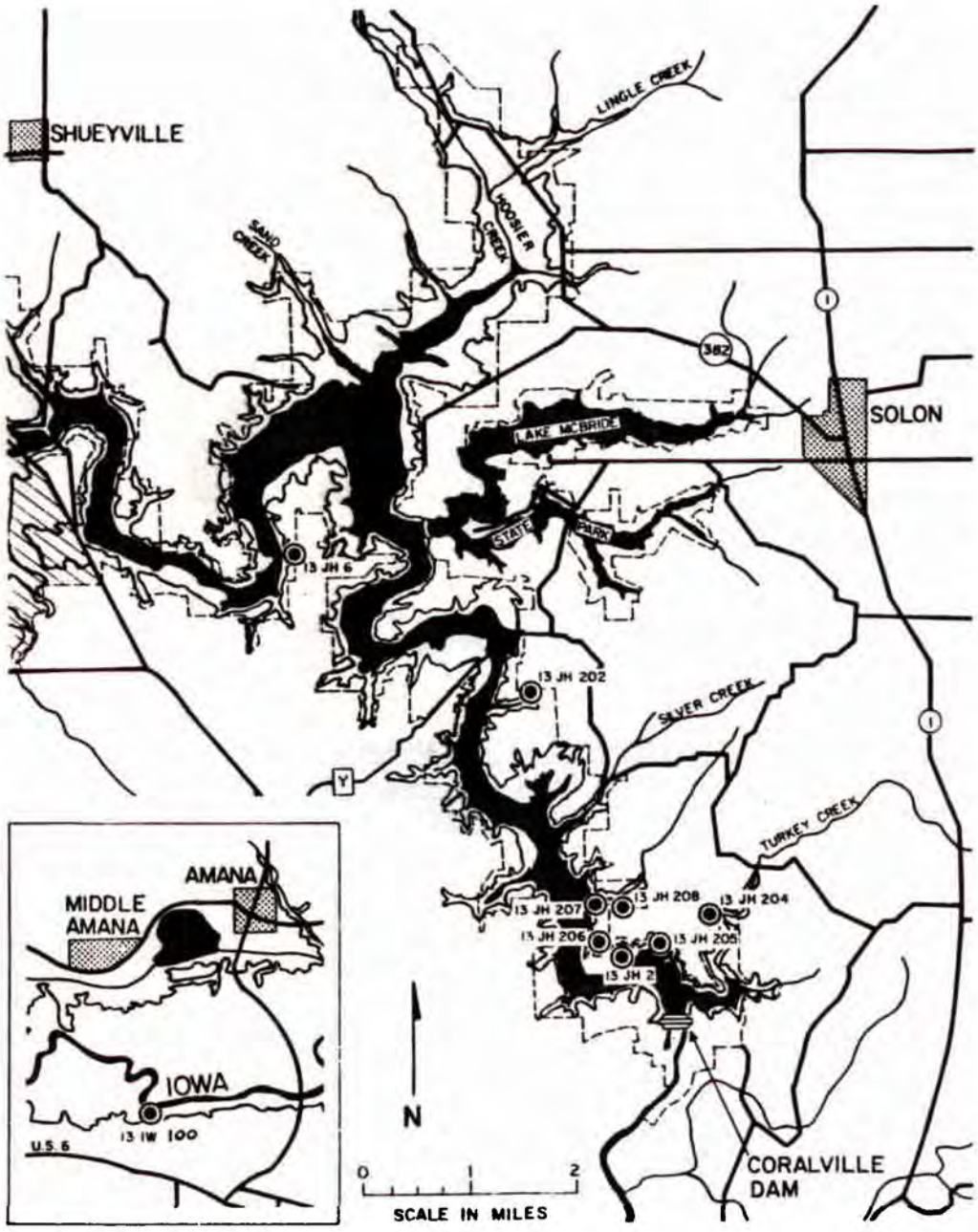
* The recreation resources at Coralville Lake were given a quality rating for the Relative Attraction Index. All six quality factors were given an average rating (C = 1.0).

* The geographic coordinates for the approximate center of the Coralville Lake project were established (90 degrees, 32.3 minutes longitude and 41 degrees and 47.5 minutes latitude).

The results of the Coralville Lake COMPATRAX computer run are contained in the body of the master plan.

APPENDIX H

SUMMARY OF KNOWN ARCHEOLOGICAL SITES
ON OR NEAR FEDERALLY OWNED LANDS
AT CORALVILLE LAKE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HOOSIER CREEK
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SOLON
LAKE MCBRIDE
STATE PARK
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13 JH 202
SILVER CREEK
TURKEY CREEK
13 JH 207
13 JH 208
13 JH 204
13 JH 206
13 JH 205
13 JH 2
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MIDDLE AMANA
IOWA
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SCALE IN MILES

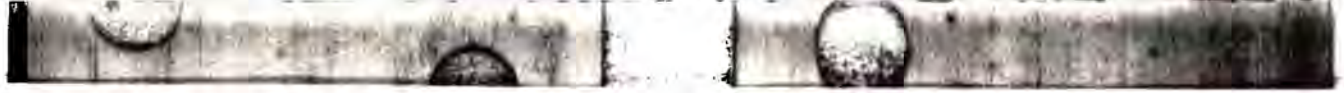

TABLE H-1

SUMMARY OF KNOWN ARCHEOLOGICAL SITES ON OR NEAR FEDERALLY OWNED LANDS AT CORALVILLE LAKE

Number	Location	Elevation (ft msl)	Type	Association	Mounds (no., type)	Materials: Lithic	Materials: Ceramic	Potential Developmental Impact	Comment and Recommendation
13 JH 2	Bluff and terrace, S 1/2 of the SE 1/4, Section 16; and SW 1/4 of the SW 1/4, Section 15, T80N, R6W	690-720	Camp and mound group; "Crosback Site"	Archaic, early/middle/late woodland, Oneota	7 conical	Points, tools		Camp inundated, mounds apparently destroyed by cultivation	Excavated 1956; reinspection
13 JH 6	Bluff top, SE 1/4 of the SE 1/4, Section 25, T81N, R7W	790-800	Mound group	Generalized woodland	7 conical			Potted	Reinspection
13 JH 202	Bluff above small stream, SE 1/4 of the NW 1/4 of of Section 4, T80W, R6W	750	Rock shelter "Woodpecker Cave"	Early/middle/late woodland		Points, tools	Madison, Minott, Havanna-like Black Sand	Excavated	Reinspection
13 JH 204	Bluff overlooking Turkey Creek, SW 1/4 of the NW 1/4 Section 14, T80N, R6W	750	Rock shelter	Unknown				Test excavation needed	Reinspection
13 JH 205	Terrace, SW 1/4 of the SW 1/4, Section 15, T80N, R6W	670-680	Camp	Late woodland, Oneota		Points, tools	Shell-tempered shard	Test excavation needed	Reinspection
13 JH 206	Knoll, SE 1/4 of the NE 1/4, Section 16, T80N, R6W	750	Camp	Unknown, woodland		Points, flakes		Possible intermittent inundation	Reinspection
13 JH 207	Terrace, SE 1/4 of the NE 1/4 of Section 16, T80N, R6W	700-710	Shell midden	Unknown				Inundated	Reinspection
13 JH 208	Ridge top, SE 1/4 of the NE 1/4, Section 16, T80N, R6W	760-770	Camp	Unknown		Scraper		Unknown	Reinspection
13 IW 100	Floodplain, SW 1/4 of the SE 1/4 of the SE 1/4, Section 33, T81N, R9W, east of Amana	700	Stone weir	Unknown				Intermittent inundation, vandalism	Reinspection and preservation

Source: Midwest Research Institute.

APPENDIX I

RECREATION SPACE STANDARDS USED TO PROJECT ACREAGE AND FACILITY NEEDS AT CORALVILLE LAKE

USE OF SPACE STANDARDS TO DETERMINE NEEDS

Using the recreation standards provided in the pages that follow, the recreation acreage and facilities required at Coralville Lake were computed. As an example, the camping units required at the lake by 1980 will be around a thousand. This estimate is computed as follows:

$$\text{Number of Units Required} = \frac{\text{AD/Yr (Camping)}}{\text{NP x TR x CD}} \quad \text{where,}$$

AD/Yr - Activity Days/Year (1980 - COMPATRAX output) See Table 6, page 48.

NP = Number of Persons in the Group

TR = Turnover Rate

CD = Capacity Days/Year--or,

$$\text{Number of Camping Units Required (1980)} = \frac{133{,}000}{136} = 978 \text{ units}$$

TABLE I-1

RECREATION SPACE STANDARDS FOR
CORALVILLE LAKE, IOWA

Picnicking[a/]

standard unit*- number of family picnic units
3.5 persons per family picnic unit
daily turnover rate of 4[b/]
number of capacity days per season 34
NP x TR x CD = 476

Camping

standard unit - number of family camping units
4 persons per family camping unit
daily turnover rate of 1
number of capacity days per season 34
NP x TR x CD = 136

Hiking (Natural or Interpretive Areas)

standard unit - number of trails (1 to 3 miles)
2 persons per group
daily turnover rate of 100
number of capacity days per season 34
NP x TR x CD = 6,800

Swimming

standard unit - acres of land
1 person per beach unit (144 sq ft)
daily turnover rate of 10
number of capacity days per season 20
NP x TR x CD = 200

standard unit - acres of water
1 person per beach unit (49 sq ft)
daily turnover rate of 10
number of capacity days per season 20
NP x TR x CD = 200

TABLE I-1 (continued)

standard unit - linear feet of beach
0.5 of linear beach per beach unit

Water Skiing

standard unit - acres of water
0.1 acre per water skiier (10 acres per skiier)
daily turnover rate of 10
number of capacity days per season 20
NP x TR x CD = 20

Hunting (Waterfowl)

standard unit - acres of water
0.2 person per acre (5 acres per hunter)
daily turnover rate of 2
average length of season 45 days
NP x TR x CD = 18

Average Breakdown of Hunting Activity in the Midwest[c/]

Activity	Percent
Small Game	64
Big Game	
Gun	16
Bow	4
Waterfowl	16
Total	100

Fishing

standard unit - acres of water
3.5 persons per acre
daily turnover rate of 3
average length of season 50 days
NP x TR x CD = 350

TABLE I-1 (continued)

Sightseeing

Space standards not appropriate--acres to be developed based on available resources.

Hunting (Small Game)

standard unit - acres of land
1.0 person per acre
daily turnover rate of 5
average length of season 130 days (varying with the wildlife species)
NP x TR x CD = 650

Hunting (Big Game--Gun)

standard unit - acres of land
0.1 person per acre (10 acres per hunter)
daily turnover rate of 2
average length of season (gun) 5 days
NP x TR x CD = 1

Hunting (Big Game--Bow)

standard unit - acres of land
0.1 person per acre (10 acres per hunter)
daily turnover rate of 2
average length of season (bow) 50 days
NP x TR x CD = 10

Boating (Launching Ramps)

standard unit--number of launching ramps
2.5 persons per boat
daily turnover rate of 40
average length of fishing and summer recreational season 148 days
NP x TR x CD = 14,800

TABLE I-1 (concluded)

Boating (Parking Areas)

standard unit - acres of land
1 parking unit (1,633 sq ft)
2.5 persons per boat
daily turnover rate of 2
average length of fishing and summer recreational season 148 days
NP x TR x CD = 740

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a/ The COMPATRAX model does not include participation in picnicking. Demand for this activity is estimated at 50 percent of swimming activity-days. Analysis of MRI's 1970 L/R data base revealed that such a relationship exists between swimming and picnicking.

b/ All turnover rates were adapted from National Standards to meet the unique Iowa resources and climatic conditions.

c/ MRI's Opportunities in the Leisure Industry study (1972). These percentages were applied to the COMPATRAX activity-days estimate for hunting.

* Standard Unit - The basic unit of supply to provide the facilities for the pursuit of a particular recreation activity.

APPENDIX J

COST ESTIMATE BREAKDOWN

CORALVILLE LAKE

The estimated total cost [a/] of the proposed facilities discussed in this report reflects the cost of constructing roads, buildings, facilities, utilities and related equipment.

Summary	Cost
Total Recreational Facilities	$13,855,708
Engineering & Design	1,108,450
Supervision & Administration	831,338
Total Basic Development	Total - $15,795,496

Development Period	Cost
1975-1980	$ 7,435,334
1980-1985	2,894,167
1985-1990	3,535,757
	Total - $13,855,708

Annual Operation and Maintenance	Cost [b/]
1975	$ 800,000
1980	1,100,000
1985	1,500,000
	Total - $ 3,400,000

a/ This estimate is based on prevailing costs in the area as of June 1976. This estimate should be periodically updated to allow for inflationary trends.

b/ The cost figure is based on COMPATRAX projections and the average operation and maintenance cost per recreation visit.

DAM SITE RECREATION COMPLEX

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
1-way	11,200	LF	$ 13	$145,600	Bituminous Surface
2-way	5,000	LF	$ 21	$105,000	Bituminous Surface
Parking Areas	31,700	SY	$ 9	$285,300	Gravel
Boat Launches:					
East Tailwater	2	each	$11,000	$ 22,000	Concrete
West Tailwater	2	each	$11,000	$ 22,000	
West Overlook	4	each	$11,000	$ 44,000	
Camp Units:					
Trailer					
Spur	84	each	$ 375	$ 31,500	Gravel
Grill	84	each	$ 150	$ 12,600	
Table	84	each	$ 200	$ 16,800	
Trash	42	each	$ 75	$ 3,150	
Tent					
Spur	56	each	$ 275	$ 15,400	Gravel
Tent Pad	56	each	$ 100	$ 5,600	
Grill	56	each	$ 150	$ 8,400	
Table	56	each	$ 200	$ 11,200	
Trash	28	each	$ 75	$ 2,100	
Picnic Area:					
Table	225	each	$ 200	$ 45,000	
Grill	115	each	$ 150	$ 11,250	
Trash	6	each	$ 75	$ 450	
Trails:	4	mile	$ 3,300	$ 13,200	
Play Areas:	2	each	$ 2,500	$ 5,000	
Beach Area:	140,000	SF	$ 1	$140,000	

Dam Site Recreation Complex
Page 2

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Structures:					
Bathhouse	1	each	$100,000	$100,000	
Washhouse	1	each	$ 50,000	$ 50,000	
Shelter	9	each	$ 12,000	$108,000	
Control Station	1	each	$ 12,000	$ 12,000	
Waterborne	1	each	$ 20,000	$ 20,000	
Vault	20	each	$ 10,000	$200,000	
Utilities:					
Sanitary Sewer Pipe	3,000	LF	$ 10	$ 30,000	
Man Hole	8	each	$ 800	$ 6,400	
Sanitary Dump Station	1	each	$ 10,000	$ 10,000	
Lagoon	1	job	$ 50,000	$ 50,000	Remodel
Water Service:					
Well	1	each	$ 10,000	$ 10,000	
Pipe	15,000	LF	$ 7	$105,000	
Drinking Fountain	19	each	$ 550	$ 10,450	
Electrical Service:		LS		$ 84,000	
Landscape/Signage:		LS		$175,000	
		SUBTOTAL		$1,916,400	
Contingencies at 15 percent				287,460	
Total Recreational Facilities				2,203,860	
Engineering & Design				176,308	
Supervision & Administration				132,231	
		TOTAL		$2,512,399	

SUGAR BOTTOM AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Secondary Access					
1-way	28,600	LF	$ 13	$371,800	Bituminous Surface
2-way	37,700	LF	$ 21	$791,700	Bituminous Surface
Parking Areas	37,045	SY	$ 9	$333,405	Gravel
Boat Launches:	5	each	$ 11,000	$ 55,000	Concrete
Camp Units:					
Tailer					
Spur	439	each	$ 375	$164,625	Gravel
Grill	439	each	$ 150	$ 65,850	
Table	439	each	$ 200	$ 87,800	
Trash	220	each	$ 75	$ 16,500	
Picnic Areas:					
Table	20	each	$ 200	$ 4,000	
Grill	10	each	$ 150	$ 1,500	
Trash	5	each	$ 75	$ 375	
Trails:	2	mile	$ 3,300	$ 6,600	Grub/Clear
Play Areas:	4	each	$ 2,500	$ 10,000	
Beach Area:	140,000	SF	$ 1	$140,000	
Structures:					
Day Use Lodge	2	each	$ 75,000	$150,000	
Bathhouse	1	each	$100,000	$100,000	
Washhouse	4	each	$ 50,000	$200,000	
Shelter	3	each	$ 12,000	$ 36,000	
Control Station	1	each	$ 12,000	$ 12,000	
Waterborne	11	each	$ 20,000	$220,000	
Vault	20	each	$ 10,000	$200,000	

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Utilities:					
Pipe	11,300	LF	$ 10	$113,000	
Man Hole	9	each	$ 800	$ 7,200	
Sanitary Dump Station	2	each	$ 10,000	$ 20,000	
Lagoon	3	each	$100,000	$300,000	
Water Well	2	each	$ 10,000	$ 20,000	
Pipe	19,600	LF	$ 7	$ 67,200	
Drinking Fountain	23	each	$ 550	$ 12,650	
Electrical Service:		LS		$145,000	
Landscape/Signage:		LS		$180,000	
		SUBTOTAL		$3,832,205	
Contingencies at 15 percent				$ 574,830	
Total Recreational Facilities				4,407,035	
Engineering & Design				352,562	
Supervision & Administration				264,422	
		TOTAL		$5,024,019	

SANDY BEACH AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Secondary Access					
1-way	2,000	LF	$ 13	$ 26,000	Bituminous Surface
2-way	2,600	LF	$ 21	$ 54,600	Bituminous Surface
Parking Area	12,900	SY	$ 9	$116,100	Gravel
Boat Launch:	2	each	$ 11,000	$ 22,000	Concrete
Picnic Areas:					
Table	90	each	$ 200	$ 1,800	
Grill	45	each	$ 150	$ 6,750	
Trash	23	each	$ 75	$ 1,725	
Play Area:	1	each	$ 2,500	$ 2,500	
Beach Area:	270,000	SF	$ 1	$270,000	
Structures:					
Bathhouse	1	each	$100,000	$100,000	
Shelter	4	each	$ 12,000	$ 48,000	
Vault	3	each	$ 10,000	$ 30,000	
Utilities:					
Water					
Well	1	each	$ 10,000	$ 10,000	
Pipe	1,700	LF	$ 7	$ 11,900	
Drinking Fountain	4	each	$ 550	$ 2,200	
Electrical Service:		LS		$ 10,000	
Landscape/Signage:		LS		$ 35,000	
		SUBTOTAL		$748,575	
Contingencies at 15 percent				112,286	
Total Recreation Facilities				860,861	
Engineering & Design				68,868	
Supervision & Administration				51,651	
		TOTAL		$981,380	

NORTH POINT AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Main Access					
2-way	7,800	LF	$ 24	$187,200	Bituminous Surface
Secondary Access					
1-way	11,600	LF	$ 13	$150,800	Bituminous Surface
2-way	4,150	LF	$ 21	$ 87,150	Bituminous Surface
Parking Area	28,500	SY	$ 9	$256,500	Gravel
Boat Launches:	5	each	$11,000	$ 55,000	Concrete
Camp Units:					
Trailer					
Spur	303	each	$ 375	$113,625	Gravel
Grill	303	each	$ 150	$ 45,450	
Table	303	each	$ 200	$ 60,600	
Trash	152	each	$ 75	$ 11,400	
Picnic Area:					
Table	200	each	$ 200	$ 40,000	
Grill	100	each	$ 150	$ 15,000	
Trash	50	each	$ 75	$ 3,750	
Trails:	3	mile	$ 3,300	$ 9,900	Grub/Clear
Play Areas:	3	each	$ 2,500	$ 7,500	
Beach Area:	200,000	SF	$ 1	$200,000	

North Point Area
Page 2

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Structures:					
Bathhouse	1	each	$100,000	$100,000	
Washhouse	2	each	$ 50,000	$100,000	
Shelter	7	each	$ 12,000	$ 84,000	
Control Station	1	each	$ 12,000	$ 12,000	
Maintenance	1	each	$ 30,000	$ 30,000	
Waterborne	6	each	$ 20,000	$120,000	
Vault	6	each	$ 10,000	$ 60,000	
Utilities:					
Sanitary Sewer Pipe	6,100	LF	$ 10	$ 61,000	
Man Hole	13	each	$ 800	$ 10,400	
Sanitary Dump Station	1	each	$ 10,000	$ 10,000	
Lagoon	1	each	$100,000	$100,000	
Water Service:					
Well	2	each	$ 10,000	$ 20,000	
Pipe	26,560	LF	$ 7	$185,920	
Drinking Fountain	20	each	$ 550	$ 11,000	
Electrical:		LS		$150,000	
Landscape/Signage:		LS		$230,000	
		SUBTOTAL		$2,528,195	
Contingencies at 15 percent				379,229	
Total Recreational Facilities				2,907,424	
Engineering & Design				232,593	
Supervision & Administration				174,445	
		TOTAL		$3,314,462	

MACBRIDE FIELD AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Main Access					
1-way	700	LF	$ 15	$ 10,500	Bituminous Surface
2-way	9,900	LF	$ 24	$237,600	Bituminous Surface
Secondary Access					
1-way	5,100	LF	$ 13	$ 66,300	Bituminous Surface
2-way	600	LF	$ 21	$ 12,600	Bituminous Surface
Parking Areas	19,000	SY	$ 9	$171,000	Gravel
Boat Launch:	4	each	$11,000	$ 44,000	Concrete
Camp Units:					
Trailer					
Spur	111	each	$ 375	$ 41,625	Gravel
Grill	111	each	$ 150	$ 16,650	
Table	111	each	$ 200	$ 22,200	
Trash	56	each	$ 75	$ 4,200	
Picnic Areas:					
Table	200	each	$ 200	$ 40,000	
Grill	100	each	$ 150	$ 15,000	
Trash	50	each	$ 75	$ 3,750	
Trails:	3	mile	$ 3,300	$ 9,900	Clear/Grub
Play Areas:	2	each	$ 2,500	$ 5,000	
Beach Area:	90,000	SF	$ 1	$ 90,000	

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Structures:					
Bathhouse	1	each	$100,000	$100,000	
Washhouse	1	each	$ 50,000	$ 50,000	
Maintenance	1	each	$ 30,000	$ 30,000	
Shelter	10	each	$ 12,000	$120,000	
Control Station	1	each	$ 12,000	$ 12,000	
Waterborne	2	each	$ 20,000	$ 40,000	
Vault	9	each	$ 10,000	$ 90,000	
Utilities:					
Sanitary Sewer Pipe	4,300	LF	$ 10	$ 43,000	
Man Hole	11	each	$ 800	$ 8,800	
Sanitary Dump Station	1	each	$ 10,000	$ 10,000	
Lagoon	1	each	$100,000	$100,000	
Water Service:					
Well	1	each	$ 10,000	$ 10,000	
Pipe	15,000	LF	$ 7	$105,000	
Drinking Fountain	20	each	$ 550	$ 11,000	
Electrical:		LS		$ 75,000	
Landscape/Signage:		LS		$ 80,000	
		SUBTOTAL		$1,675,125	
Contingencies at 15 percent				251,268	
Total Recreational Facilities				1,926,393	
Engineering & Design				154,111	
Supervision & Administration				115,583	
		TOTAL		$2,196,087	

MID RIVER PARK AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Secondary Access					
1-way	500	LF	$ 13	$ 6,500	Bituminous Surface
2-way	700	LF	$ 21	$ 14,700	Bituminous Surface
Parking Areas	2,789	SY	$ 9	$ 25,100	Gravel
Picnic Areas:					
Table	40	each	$ 200	$ 8,000	
Gril	20	each	$ 150	$ 3,000	
Trash	10	each	$ 75	$ 750	
Play Sculpture:	1	each	$ 500	$ 500	
Structures:					
Shelter	2	each	$12,000	$ 24,000	
Vault	2	each	$10,000	$ 20,000	
Utilities:					
Water					
Well	1	each	$10,000	$ 10,000	
Pipe	1,000	LF	$ 7	$ 7,000	
Drinking Fountain	3	each	$ 550	$ 1,650	
Landscape/Signage:		LS		$ 6,100	
		SUBTOTAL		$127,300	
Contingencies at 15 percent				19,095	
Total Recreational Facilities				146,395	
Engineering & Design				11,711	
Supervision & Administration				8,783	
		TOTAL		$166,889	

CURTIS BRIDGE AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Secondary Access 2-way	700	LF	$ 21	$ 14,700	Bituminous Surface
Parking	3,000	SY	$ 9	$ 27,000	Gravel
Boat Launch:	2	each	$11,000	$ 22,000	Concrete
Structures:					
Shelter	1	each	$12,000	$ 12,000	
Vault	1	each	$10,000	$ 10,000	
Utilities:					
Water					
Well	1	each	$10,000	$ 10,000	
Pipe	375	LF	$ 7	$ 2,625	
Drinking Fountain	2	each	$ 550	$ 1,100	
Landscape/Signage:		LS		$ 10,000	
		SUBTOTAL		$109,425	
Contingencies at 15 percent				16,413	
Total Recreational Facilities				125,838	
Engineering & Design				10,067	
Supervision & Administration				7,550	
		TOTAL		$143,455	

WEST POINT AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Secondary Access					
1-way	2,630	LF	$ 13	$ 34,190	Bituminous Surface
2-way	6,000	LF	$ 21	$126,000	Bituminous Surface
Parking Area	15,900	SY	$ 9	$143,100	Gravel
Boat Launches:	2	each	$11,000	$ 22,000	Concrete
Picnic Areas:					
Table	70	each	$ 200	$ 14,000	
Grill	35	each	$ 150	$ 5,250	
Trash	18	each	$ 75	$ 1,350	
Play Area:	1	each	$ 2,500	$ 2,500	
Structures:					
Shelter	8	each	$12,000	$ 96,000	
Vault	7	each	$10,000	$ 70,000	
Utilities:					
Water					
Well	1	each	$10,000	$ 10,000	
Pipe	6,000	LF	$ 7	$ 42,000	
Drinking Fountain	10	each	$ 550	$ 5,500	
Landscape/Signage:		LS		$ 28,500	
		SUBTOTAL		$600,390	
Contingencies at 15 percent				90,058	
Total Recreational Facilities				690,448	
Engineering & Design				55,235	
Supervision & Administration				41,426	
		TOTAL		$787,109	

SOUTH POINT AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Secondary Access					
1-way	500	LF	$ 13	$ 6,500	Bituminous Surface
2-way	3,000	LF	$ 21	$ 63,000	Bituminous Surface
Parking Area	3,695	SY	$ 9	$ 33,255	Gravel
Picnic Areas:					
Table	50	each	$ 200	$ 10,000	
Grill	25	each	$ 150	$ 3,750	
Trash	13	each	$ 75	$ 975	
Trails:	1	mile	$ 3,300	$ 3,300	Clear/Grub
Play Sculpture:	1	each	$ 500	$ 500	
Structures:					
Shelter	4	each	$12,000	$ 48,000	
Vault	4	each	$10,000	$ 40,000	
Utilities:					
Water					
Well	1	each	$10,000	$ 10,000	
Pipe	2,350	LF	$ 7	$ 16,450	
Drinking Fountain	4	each	$ 550	$ 2,200	
Landscape/Signage:		LS		$ 12,000	
		SUBTOTAL		$249,930	
Contingencies at 15 percent				37,489	
Total Recreational Facilities				287,419	
Engineering & Design				22,993	
Supervision & Administration				17,245	
		TOTAL		$327,657	

ATV STAGING AREA

Item	Quantity	Unit	Unit Cost	Sub Total	Remarks
Road System:					
Secondary Access					
1-way	800	LF	$ 13	$ 10,400	Bituminous Surface
2-way	2,600	LF	$ 21	$ 54,600	Bituminous Surface
Parking Area	1,950	SY	$ 9	$ 17,550	Gravel
Fence:	7,350	LF	$ 15	$110,250	
ATV Trails:	5	mile	$ 3,300	$ 16,500	
Structures:					
Shelter	1	each	$12,000	$ 12,000	
Control Station	1	each	$12,000	$ 12,000	
Utilities:					
Water					
Well	1	each	$10,000	$ 10,000	
Pipe	650	LF	$ 7	$ 4,550	
Drinking Fountain	1	each	$ 550	$ 550	
Landscape/Signage:		LS		$ 12,500	
		SUBTOTAL		$260,900	
Contingencies at 15 percent				39,135	
Total Recreational Facilities				300,035	
Engineering & Design				24,002	
Supervision & Administration				18,002	
		TOTAL		$342,039	