*REPORT OF THE COMPTROLLER GENERAL OF THE UNITED STATES*

# Environmental And Economic Issues Of The Corps Of Engineers' Red River Lake Project In Kentucky

## Department of the Army

This report questions the reasonableness of the Corps' estimates of project benefits to be obtained from the recreation, flood control, and water supply purposes. The questionable estimates, if not sustained, could affect the benefit values supporting the project's economic feasibility. GAO recommends that the Corps resolve these matters and recalculate all project benefits under current conditions.

In addition, the report presents the many questions that have been raised relating to the environmental issues associated with the project. Because of a pending court case, the Corps is restrained from construction until the issues can be heard and resolved.

RED-76-10

AUG. 15, 1975

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-181819

The Honorable Carl D. Perkins
House of Representatives

Dear Mr. Perkins:

This is the report on our review of the environmental and economic issues surrounding the Corps of Engineers' planned Red River Lake project in Kentucky. Comments were obtained from the Secretary of the Army and have been considered in our report. We also obtained comments from the Council on Environmental Quality.

We want to invite your attention to the fact that this report contains recommendations to the Secretary of the Army which are set forth on page 37. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions he has taken on our recommendations to the House and Senate Committees on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of report. We will contact your office to arrange for copies of the report to be sent to the Secretary and the four committees so that the requirements of section 236 can be set in motion.

Sincerely yours,

Comptroller General
of the United States

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OF THE UNITED STATES

ENVIRONMENTAL AND ECONOMIC ISSUES OF THE CORPS OF ENGINEERS' RED RIVER LAKE PROJECT IN KENTUCKY
Department of the Army

D I G E S T

In 1962, the Red River Lake project--flood control and recreation--was estimated to cost approximately $8 million. In 1968, water supply was added to the purposes of the Kentucky project.

In 1975, the project's total cost was estimated at approximately $34 million and its ratio of benefits to costs was 1.8 to 1. The Corps stated the project would substantially reduce flood damages along the Red River and the Kentucky River and would contribute to reducing flood flows along the Ohio River. (See pp. 2 and 29.)

In this report, GAO questioned the reasonableness of the benefit estimates by the Corps of Engineers because:

--Recreation benefits from the new, man-made lake may be considerably overstated. (See pp. 20 to 28.)

--Flood control benefits are overstated. (See pp. 26 to 33.)

--Water supply benefits were included without an adequate assessment of the need and without reaffirming payment assurances. (See pp. 33 to 36.)

The questionable benefit estimates, if not sustained, could have a large impact on the values supporting the economic feasibility of the project. The Corps should resolve these matters and recalculate all benefits under current conditions before proceeding with the project.

The Army disagrees. The Army contends that its estimates of recreational benefits is reasonable; that flood control benefits, if recomputed, would not be changed appreciably; and that the water supply is a valid purpose

because of need for future supplies in the area. (See app. I.)

In addition, GAO found that many questions have been raised relating to environmental issues associated with the project.

The Council on Environmental Quality, environmentalists, and others ask whether:

--The unique character of the scenic Gorge area and the project's impact on natural systems, including plant and fish life, have been assessed adequately. (See pp. 8 to 14.)

--There are alternatives to the project which could result in less adverse impact on the environment. (See pp. 14 and 15.)

--The sociological impacts of the project have been assessed adequately. (See p. 16.)

--Important archeological sites remain to be identified and tested and what protection there would be for sites now known. (See pp. 16 and 17.)

--The geological impacts of the project have been assessed adequately. (See pp. 17 and 18.)

Critics of the project disagree with the Corps' assessment of the amount of environmental damage that would result from the lake. (See p. 6.)

In August 1974, a coalition of environmental groups and three individuals filed suit against the Corps and sought to enjoin construction of the dam. The following May, the court ruled in favor of the plaintiffs; now the Corps is restrained from construction until the issues can be heard and resolved in court. (See p. 4.)

In computing estimated annual benefits and costs for the project, the Corps used an interest rate of 3-1/8 percent. This rate complies with applicable law. (See pp. 40 and 41.)

Although the project had been supported by past State administrations, the current Governor of Kentucky has stated that he is studying the matter and has not taken any position. (See pp. 4 and 5.)

# CHAPTER 1

## INTRODUCTION

We have reviewed the environmental and economic issues of the Army Corps of Engineers' planned construction of the Red River Lake project on the Red River in Kentucky. The project would be located about 110 air miles east-southeast of Louisville, Kentucky.

The Red River Lake project was authorized as a part of the flood control plan for the Kentucky River basin, adopted by the Flood Control Act of 1962, Public Law 87-874, approved on October 23, 1962. This plan was authorized generally in accordance with the Corps' recommendations in House Document Number 423, 87th Congress. The plan included four flood control lakes in the Kentucky River basin, with three recommended for construction by the Corps. One of the lakes, designated as Red River Lake, was to be located at mile 47.5 on the Red River at an estimated construction cost of $8,020,000 and at estimated annual maintenance and operation costs of $40,000.

Preconstruction planning and design funds for the Red River project were first appropriated in fiscal year 1964, and initial construction funds for land acquisition were appropriated in fiscal year 1967.

In August 1967, before the start of land acquisition, the first formal opposition to the project was voiced at the Corps' real estate hearing in Stanton, Kentucky. Various groups contended that if the dam were constructed at the authorized site, irreparable harm would be done to the unique natural environment of the Red River Gorge area.

In 1968, the Congress directed the Corps to study alternative downstream sites. In early 1969, due to concern over the Red River Gorge environment, Kentucky Governor Louis B. Nunn requested relocating the damsite about 5 miles below the authorized site at mile 42.3 on the Red River to preserve the unique upper Red River Gorge. The Corps adopted the new site, and the Congress has appropriated some construction funds for the project at this site.

The project's critics stated that the downstream site would be much less destructive to scenic and wilderness values than the former site but that they were still

concerned about the downstream site because they felt the proposed lake would cause damage to the Gorge's environment.

The following diagram of the Red River Lake shows the dam's location, the flood control pool level, and the upper and lower Gorge area.

Detailed planning on the project at the downstream site began in February 1970. In fiscal year 1972 the Congress appropriated $300,000 in construction funds for the project. Its total cost, as reported in February 1975, was $34.1 million, and its benefit-cost ratio was 1.8 to 1. Although some land was acquired for the previous damsite at a cost of $152,900, no additional land has been acquired since its relocation.

The proposed dam would be an earthfill and rockfill embankment with a crest width of 30 feet at an elevation of 786 feet above mean sea level. It would have a maximum height of 141 feet and would be 1,800 feet long. The lake elevation is to be regulated to achieve the project purposes of flood control, water supply, and recreation. The lake would be maintained at elevation 703 feet for water supply. At this elevation the lake would inundate 1,546 acres and have a length of 15 miles. During flood periods, storage from elevation 703 to 759 feet would be available for flood waters. At the maximum flood pool level of 759 feet the lake would inundate 3,177 acres and would be about 19 miles in length.

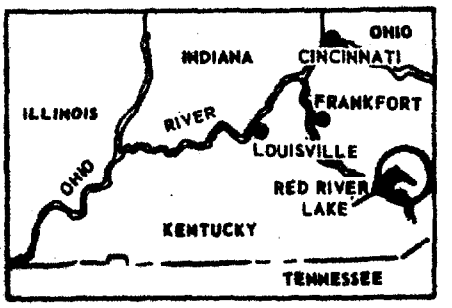
## ENVIRONMENTAL ISSUES

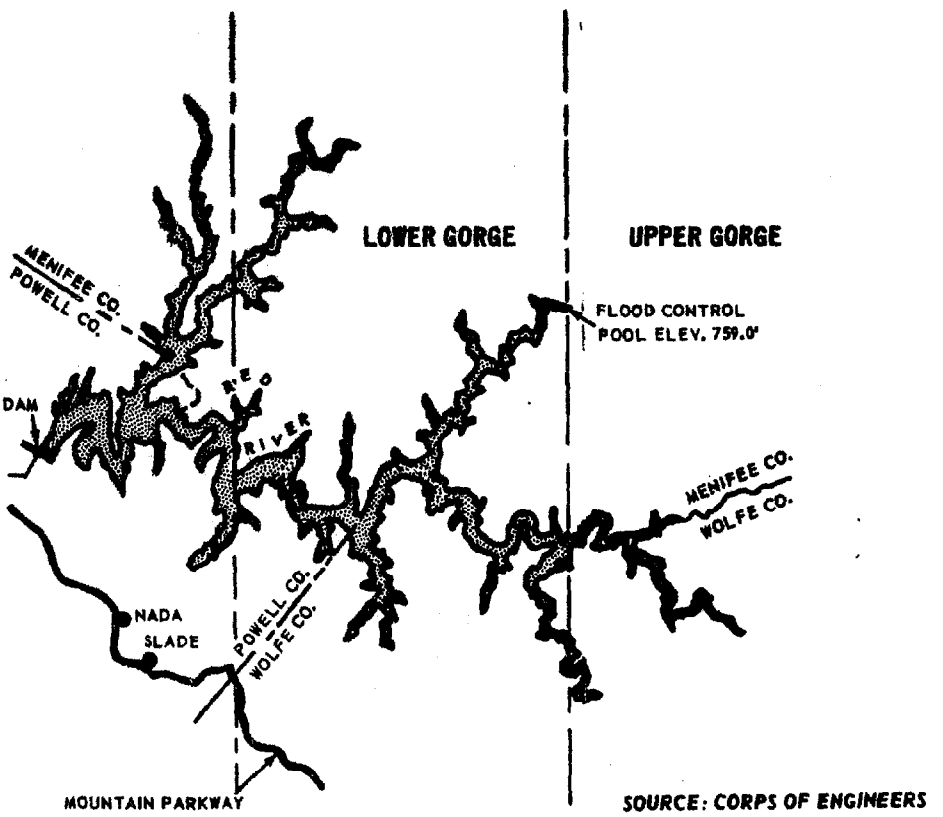
Critics contend the Corps has not objectively evaluated its decision to continue with the project following the enactment of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). They have expressed concern about the adequacy of the Corps' final environmental impact statement.

## PROJECT BENEFITS AND COSTS

Environmental groups, economists, and others have criticized the project's benefit-cost ratio, claiming the economic benefits are overstated and costs are understated. They contend that (1) the project will substitute low value recreation experiences for higher value unusual experiences associated with the environment and (2) the losses associated with destroying part of the natural environment in the Red River Gorge and with modifying much

# PROPOSED RED RIVER LAKE




*SOURCE: CORPS OF ENGINEERS*

of the remainder of that environment are treated as "intangible" and thereby not entered in the economic analysis.

Federal water resource construction agencies develop and report to the Congress benefit and cost analyses to show the economic feasibility of proposed projects. The Congress seldom authorizes water resource projects unless the benefit-cost ratios exceed unity (estimated benefits exceed economic cost).

The Red River Lake project was initially authorized to provide flood control and recreation benefits. At Kentucky's request, water supply was added as a project purpose in 1968. From the initial estimates in 1958 to the 1973 estimates, the Corps' calculations show the project's annual benefits have increased from about $491,000 to $2,469,000 and annual costs have increased from about $336,000 to $1,436,000. The initial estimate showed flood control benefits amounting to 85.7 percent of the total project benefits, while recreation benefits amounted to 14.3 percent. In the Corps' 1973 estimate of the project's benefits, flood control benefits accounted for 46.8 percent and recreation benefits accounted for 42.4 percent, consisting of 40.9 percent general recreation and 1.5 percent fish and wildlife.

PROJECT STATUS

In August 1974 a coalition of environmental groups and three individuals filed suit in Federal court against the Corps [Save Our Red River, et al. v. Corps of Engineers, et al., U.S.D.C., E.D. Ky., Civil No. 74-320L(B)]. The suit charged the Corps with violating the National Environmental Policy Act of 1969 and other Federal statutes and regulations and sought to enjoin the Corps from further action on the project pending a hearing and judgment on its merits.

The Corps' first step toward construction would be taking options on land at the site for later acquisition. The Corps is restrained from this activity due to a court order in favor of the plaintiffs resulting from a hearing in the Federal District Court in Louisville, Kentucky, on May 7, 1975. The oral order temporarily restrains the Corps from taking further construction actions until the issues raised by the plaintiffs can be heard and resolved in court. A hearing date has been set for September 3, 1975.

As of July 17, 1975, the current Governor of Kentucky, Julian Carroll, had not taken a position on the

project. He has stated publicly that he is studying the project.

Public Works Appropriation Acts for fiscal years 1964 through 1975 show that funds of $3,911,000 have been appropriated for the project, including $805,000 for planning and $3,106,000 for construction. About $1.7 million has been spent on the project through February 1975, with most of the money used for engineering and design and for supervision and administration. About $152,900 was spent for land acquired at the former damsite. The Corps' budget submission included a request for $1 million for fiscal year 1976 and $527,000 for the 1976 transition quarter. The requested funds are required for acquiring land and initiating construction of the dam's outlet works.

## SCOPE OF REVIEW

We made our review at the Corps' District Office in Louisville, Kentucky, which had done the environmental and benefit-cost studies for the project. We also talked with officials of the

- --Corps of Engineers, Washington, D.C., and the Ohio River Division, Cincinnati, Ohio;
- --Council on Environmental Quality, Washington, D.C.;
- --U.S. Forest Service, Department of Agriculture, Winchester, Kentucky, and Stanton, Kentucky;
- --Kentucky's State Department of Natural Resources and Environmental Protection, Division of Water Resources, and the Parks Department, all located in Frankfort, Kentucky;
- --Red River Legal Defense Fund, Inc., Lexington, Kentucky;
- --Cincinnati Chapter of the Sierra Club; and
- --Kentucky's State Water Resources Authority, Frankfort, Kentucky.

Further, we interviewed various academic and technical authorities concerning their views on the project.

## CHAPTER 2

## ENVIRONMENTAL ISSUES

The Corps of Engineers as well as other Federal agencies, environmental organizations, and individuals have stated that the Red River Lake project would adversely affect the environment. They do not agree, however, on the nature and extent of the adverse effects or on the measures that should be taken to reduce the adverse impact.

Adverse environmental impacts identified in the Corps' environmental impact statement include (1) elimination of 15 miles of free-flowing stream, (2) loss of plant life, (3) loss of river fish, (4) loss of archeological sites, and (5) displacement of 55 family units.

However, the Council on Environmental Quality and members of the scientific community have questioned whether

- --the Gorge area's unique nature and the project's impact on natural systems, including unique plant and fish life, have been adequately assessed;
- --there are alternatives which would result in less adverse impact on the environment;
- --the sociological impacts of the project have been adequately assessed;
- --important archeological sites remain to be identified and what mitigation there would be for known sites; and
- --the geological impacts of the project have been adequately assessed.

### CORPS STUDIES OF ENVIRONMENTAL IMPACTS

In planning water resource projects, the Corps is required to comply with the National Environmental Policy Act of 1969. The purposes of the act, among other things, are to

- --declare a national policy which will encourage productive and enjoyable harmony between man and his environment,
- --promote efforts which will prevent or eliminate damage to the environment and biosphere and will stimulate man's health and welfare, and

--enrich the understanding of the ecological systems and natural resources important to the Nation.

The act established the Council on Environmental Quality. The Council is responsible for providing policy advice and guidance on Federal activities affecting the environment, for assisting in the coordination of these activities, and for reviewing the act's implementation by Federal agencies.

In preparing the environmental impact statements required by section 102 of the act, Federal agencies are to consider

--the environmental impact of the proposed action,

--any adverse environmental effects which cannot be avoided should the proposal be implemented,

--alternatives to the proposed action,

--the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

--any irreversible and irretrievable commitments of resources involved in the proposed action should it be implemented.

Pursuant to the act's requirements, the Corps issued a draft environmental impact statement on July 18, 1973, and a final environmental impact statement on July 3, 1974.

In accordance with its review responsibilities, the Council commented on the final statement in a letter to the Secretary of the Army, dated August 12, 1974. The Council said that the statement left questions unanswered and recommended that the Corps refrain from taking administrative action on the project until the project's environmental impacts and alternatives had been more adequately addressed.

On August 19, 1974, a coalition of environmental groups and three individuals filed suit in Federal court against the Corps. The suit cited the Corps' failure to observe the procedural and substantive requirements of the National Environmental Policy Act and other statutes and regulations relating to water resource projects.

In response to the questions raised by the Council and the litigants, the Corps provided supplementary

information in December 1974 intended to amplify and clarify certain environmental conditions and impacts of the project. In a January 24, 1975, letter, the Council stated that this response still did not adequately treat certain project issues and again requested that the Corps provide the necessary information before taking action on the project. The Corps provided additional information to the Council on April 28, 1975.

In a May 5, 1975, letter to the Secretary of the Army, the Council Chairman stated that the Corps had not as yet responded adequately to the issues raised by the Council. The Council recommended that the Corps not proceed with the project as described in the final environmental impact statement.

Environmental issues raised by the Council and others are herein discussed.

## NATURAL SYSTEMS

Although the Corps' treatment of the proposed project's impact on the environment is extensive, questions raised by the Council and others as to identifying and adequately assessing the important natural communities and other life forms have not been resolved. Also, the Corps and the Council have agreed neither on the value of the unique diversity of life subject to damage in the project area nor on the uniqueness of the Gorge itself.

### Uniqueness of the Gorge

The Corps, the Council, and certain members of the scientific community differ in opinion concerning the project's impact on the uniqueness of the Gorge. The scientists contend the Gorge area is unique because of the wide variety of life forms found within such a small area. The Council has stated that the scenic beauty of both the upper and lower Gorge makes the entire Gorge area unique. In its December 1974 supplemental response, the Corps reported that the project will somewhat alter biological resources; however, the project will not result in destroying or severely modifying the total Gorge complex.

A Professor Emeritus of Biology from Georgetown College, Kentucky, commented on the adequacy of the Corps' assessment of the project's impact on the uniqueness of the Gorge. In a letter to the Council on Environmental Quality, the professor discussed the Gorge's unique features and explained how the project would severely modify them. Direct

excerpts from these comments follow. (The page numbers cited in the excerpts refer to pages within the Corps' supplemental response.)

> "Data from other studies concerning the effect of inundation on certain trees are included. On page 43, the second paragraph should be emphasized: 'Many of the tree species found in the mixed mesophytic forest have never been studied in response to flood stress because they are typically upland species which are not found near bodies of standing water. It must be assumed that such species as cucumber magnolia (Magnolia acuminata), umbrella magnolia (M. tripetala), basswood, Canadian hemlock, buckeye (Aesculus octandra), and red oaks (Quercus spp.) are not particularly tolerant of frequent inundation. These species which are present in the Red River Gorge are not normally found in habitats where inundation occurs. The mixed mesophytic forest 'develops on moist and well-drained sites.' (Braun, 1950).' The occurrance of such mesophytic species on the lower slopes and even to the edge of the flowing Red River is one of the many unique features of the Gorge.
>
> "As is pointed out in the succeeding paragraphs of the Response, the community structure would change as flood-intolerant species of trees and shrubs are replaced by flood-tolerant species, and the herbaceous plants of the rich mesic forest would be killed. The present herbaceous flora of the Gorge is predominantly mesic and not alluvial, and with periodic inundation would be replaced by species more weedy and less diverse. To quote from the first paragraph on page 45: '* * * the habitat will be altered and so may competitive species introduced that specialized herbs above the 720 foot contour line will disappear.'
>
> "Quoting from the fourth paragraph at the top of page 46: 'Within a century a forest of flood-tolerant trees, box elder, alder, willow, sycamore, green elm, American elm, will evolve on the lake margin * * *' Such communities are common; the communities which they would replace are uncommon. Therefore the concluding statement on page 47 that development of the

project 'will not result in destruction or severe modification of the total Gorge complex' is untrue. The destruction of a segment severely modifies the complex."

A University of Kentucky zoologist also commented on the Corps' conclusion concerning the uniqueness of the Gorge. In a letter to the Council, the zoologist discussed the Gorge's unique features and stated that the value of the Gorge as a scientific laboratory would be seriously and irreparably damaged by the project. Pertinent excerpts from that letter are quoted below.

"* * * concerning scientific use of the Gorge, the Corps states that 'the proposed project will not substantially reduce the potential for use as an outdoor laboratory.' This is of course a matter of opinion. My opinion, based on nearly 40 years familiarity with the Gorge, 30 years of teaching college courses in field biology, and the authorship of 7 books and over 200 articles on the subject of field biology, almost all in Kentucky, is that the Corps is simply wrong in their judgment on this item. There are hundreds of wooded valleys in eastern Kentucky that are reasonably good outdoor laboratories, but I know of none that equal the Red River Gorge in diversity of plant and animal species. The establishment of a dam and subsequent impoundment in the Gorge will eliminate or at best seriously reduce the population of many of the very species that create the uniqueness of the Gorge. If the lake is established, I firmly believe that the value of the Gorge as a scientific laboratory will be seriously and irreparably damaged, and its potential will be reduced to or below that of innumerable Kentucky hollows."

The Council has stated that the Corps' conclusions regarding the project's likely impact on that portion of the Gorge of most national importance appear to be misleading and unsupported by data in the Corps' assessment. The Council's letter of January 24, 1975, included the following comments:

"The conclusions drawn by the Response regarding the project's likely impact on that portion of the Gorge of most national importance appear to be misleading and unsupported by data in the Response.

"The Response states, for example, that 'although the development of the project will cause certain alterations to the biological resources of the lower Gorge, it will not result in the destruction or severe modification of the total Gorge complex.' (Response, p. 47)

"This statement follows a quote taken out of context from the report by Winstead and Nicely (1973) [consultants for the National Park Service] that seems to imply that it is the upper Gorge which is most significant but that it does not meet National Landmark criteria. In fact, however, Winstead and Nicely concluded that 'although this section (upper Gorge) offers much scenic beauty with its high cliff walls, it does not compare with the scenic quality of the entire area known simply as the Red River Gorge. The upper Gorge takes on its greatest significance only when considered within the context of the entire Red River Gorge.' (author's emphasis) These and several other similar statements by Winstead and Nicely emphasize the value of the Gorge 'as a whole' and including particularly the lower Gorge. The significance of the lower Gorge is, in fact, being evaluated as a potential National Landmark by the National Park Service. Consequently, a recent letter to the Council by the Acting Director of the Park Service concluded: 'We recommend that the Corps of Engineers delay the implementation of the project so as not to preclude the National Park Service from completing the onsite evaluation.' (Letter from Acting Director Russel E. Dickinson to Chairman Russell W. Peterson, January 21, 1975.)"

A National Park Service official informed us that the onsite evaluations have been completed and their report, which recommended landmark status, was submitted to the U.S. Forest Service for comment on May 8, 1975. Designating landmark status would encourage Gorge landowners to protect and use the area in accordance with its natural integrity.

Fish and wildlife

To determine the type of fish and wildlife in the Red River Lake area, the Corps contracted with the University of Kentucky zoologist to list the area's vertebrates. The

list prepared by the zoologist included the following numbers of species which exist in the proposed lake area: 59 fish, 31 amphibians, 30 reptiles, 105 resident birds, and 36 mammals. The list showed that although the species distribution did not lie wholly within the proposed project area, the species were important in their diversity and quantity.

Three vertebrate species were reported in the final environmental impact statement as rare and endangered species in Kentucky. They were the four-toed salamander (Hemidactylium scutatum), the eastern ribbon snake (Thamnophis sauritus), and the corn snake (Elaphe guttata). In addition, an association of darters (small fish) was reported as notable because of the variety of species at the same site.

The Corps' assessment recognized that the darter assembly would be eliminated by the proposed lake and that the corn snake would be eliminated. No measures for mitigating these impacts were discussed in the impact statements because the Corps' fish and wildlife study determined that individual species were known to exist outside the project area. The supplemental response discussed the presence of one crayfish species (Cambarus) presently known to exist only in the North Fork of the Red River. No comments in the impact statement were directed to the project's direct effect on this species.

In commenting on the Corps' supplemental response, the zoologist stated that:

--The corn snakes' colony in the area to be flooded is one of the two known colonies in Kentucky.

--The unique assembly of darters in the Red River is the only known site of such an assembly.

Plant life

The final environmental impact statement and supplemental response include extensive listings of plant life in the project area. The final environmental impact statement lists 555 species of plant life found in the Red River Gorge. It briefly discusses a rare association of beech and sycamore trees and identifies some rare and endangered species of plant life. The supplemental response also lists 48 species of rare and uncommon plant life which the proposed lake will directly affect.

The supplemental response also discussed the problem of acquiring complete and accurate data on plant life threatened by the project. The Corps reported that 156 species had been added to a 1968 inventory of species and that, in one day's field work, 3 new species had been added. The Corps also reported that no definite or official listing of rare and endangered plant species existed for Kentucky and that those qualified individuals who were most experienced with the project area must be relied on to identify species.

Among other comments on the Corps' supplemental response, the biologist from Georgetown College stated that the Corps' listing and assessment of the rare and uncommon plant life species to be directly affected by the proposed lake and by periodic flood inundation did not include six rare or uncommon species which are known to exist only at elevations below 759 feet (flood pool level). We found that, while the six species were not included in that portion of the Corps' supplemental response which lists and discusses rare and uncommon plant species directly threatened by the project, five of the six species were listed and briefly discussed in a four-page appendix of the supplemental response. This listing does not, however, show these species as being affected by the proposed lake or by the periodic flooding.

A University of Kentucky associate professor of botany stated that the Corps' assessment ignored an additional project area plant species, Habernia (Plantanthera), mentioned in a list of endangered species prepared at the Smithsonian Institute. We found that this species was not mentioned in either the final environmental impact statement or the supplemental response.

In its January 24, 1975, letter, the Council reiterated its position that the Corps needed to better analyze the project's ecological impacts. The Council stated that the project would apparently eliminate a unique cluster of natural communities of high scientific, educational, aesthetic, and recreational value and requested a more accurate and detailed description of the location and composition of affected communities.

The Corps provided additional discussion of the project's impact on natural communities on April 28, 1975; however the Council stated that this discussion still did not provide the information it had requested. The Council noted that the beech-sycamore community was the only one described and located on a map in the Corps' response. They contend that other affected communities could be described and mapped along with major archeological sites and other natural and

cultural features to provide a more integrated picture of the anticipated environmental impacts for agency and public review.

## ALTERNATIVE PROJECTS

Although the dam's location was moved downstream to reduce the possibility of adverse ecological change in the upper Gorge area, there is still concern over the potential adverse effects associated with this site. The Council on Environmental Quality contends that because of the proposed dam's potentially severe impact, the environmental impact statement should give more consideration to all alternatives--structural, nonstructural, and combinations thereof.

### Structural alternatives

In the final environmental impact statement the Corps reported that various structural alternatives for flood control had been examined, including other damsites on the Kentucky River, its 3 forks, and 15 tributary systems. The Corps reported that none of these was found acceptable because they were either economically or technically unfeasible. The Corps' study of other damsites on the Kentucky River was made from 1958 to 1962 and was primarily concerned with determining reservoir potential in the Kentucky River basin. This study formed the basis for selecting the upstream site originally authorized in 1962.

In reformulating the project at the downstream site, the Corps reported that it analyzed 10 alternative plans for both higher and lower dams and larger and smaller reservoirs. The Corps reported that alternative pool elevations from 683 to 769 feet mean sea level were selected and evaluated for impact. The Corps selected an alternative which provided a flood control pool elevation of 759 feet and a water supply pool elevation of 703 feet because it kept the water supply pool below 710 feet of elevation and would eliminate permanently inundating the upper Gorge. The Corps stated that this plan optimized economic, operational, and environmental goals.

The Corps reported that a site near the town of Rosslyn on the Red River's channel, about 5 miles below the present damsite, was proposed at one time but that preliminary studies indicated that dislocating the families involved, as well as relocating the Mountain Parkway and other roads, made this site economically unfeasible. Although the Corps had made an aerial reconnaisance of the area, it had not

collected data on the actual number of families for dislocation at the Rosslyn site nor had it collected data for a detailed analysis of the proposal's economic or environmental impact.

The Corps also cited two local protection plans for Clay City in the final environmental impact statement as possible alternatives to the proposed Red River Lake project. One plan was a levee estimated at about $3.8 million. The other was a combination of channel diversion and levee estimated at about $2.7 million. The Corps found these alternatives to have a benefit-cost ratio of 0.37 to 1 and 0.66 to 1, respectively. The Corps did not collect data on the environmental impact of these alternatives because of their unfavorable benefit-cost ratios.

The Corps did not evaluate the two local protection plans as possible alternatives to the project but rather evaluated them in combination with a smaller sized dam. The Corps' evaluations were performed in response to a specific congressional request that consideration be given to local protection possibilities for Clay City and other communities, which might tend to reduce the amount of storage required in the project for flood control.

Nonstructural measures

The Corps cited the following nonstructural alternatives investigated in its assessment of the Red River Lake project.

--Flood plain zoning
--Evacuation
--Flood forecasting
--Flood insurance
--Acquiring flood-prone lands
--Flood proofing
--No action

The Corps concluded that although the damage prevention measures, if effectively implemented, would reduce the potential for increased future damages, these alternatives were not acceptable because flood damage to existing developments would not be eliminated or because other project purposes, such as recreation and water supply, would not be satisfied.

We were advised by Corps officials that, although they considered each of the nonstructural measures in their investigation of alternatives, they gave priority to detailed analytical study of structural alternatives.

SOCIOLOGY

One environmentalist expressed concern over the adequacy of the Corps' assessment of the impacts associated with the family displacements caused by the project.

A University of Kentucky sociologist described the type of information lacking in the Corps' assessment which should have been an integral part of the family dislocation assessment process. Those topics which the sociologist felt should have been studied and described in the Corps' assessment were:

--The number of children and elderly people dependent on the families to be dislocated.

--The kinship existing among those to be dislocated.

--Special difficulties encountered by dislocated elderly persons.

--The quality of replacement property for farming versus the property acquired by the Corps.

The Corps' supplemental response presented added details concerning some of the topics raised by the sociologist. However, the Corps did not investigate special difficulties encountered by elderly persons to be dislocated or the kinship existing among those to be dislocated.

ARCHEOLOGICAL SITES

In the final environmental impact statement, the Corps reported that no historically important sites had been identified in the land to be inundated by the Red River Lake. In its supplementary data the Corps reported that five major sites had been identified, four of which would be completely inundated by the lake.

The Council on Environmental Quality, in commenting on the supplementary data, noted the increase in the number of archeological sites that had been identified in the Corps' investigation. The Council expressed the opinion that other important sites may still remain undiscovered. The Council concluded that a more detailed inventory and a better analysis of all the sites was needed.

The State archeologist, commenting on the Corps' supplementary response, stated that all potentially important sites in the flood pool area have not been adequately

tested to determine their uniqueness and potential. In addition, the archeologist expressed concern as to how the impact on archeological sites would be mitigated.

In response to these comments, the Corps developed a preliminary archeological resources mitigation plan in April 1975. This plan provides a general outline of the detailed salvage measures the Corps anticipates will be necessary to preserve important archeological sites. The plan includes such features as designating priorities for test and excavation which will be conducted at sites in the pool area, work to be performed, and estimating work-time required at the designated sites. While the Corps has not developed firm cost estimates of the measures discussed in the mitigation plan, preliminary analysis indicates costs will be about $566,000.

Corps officials stated this work was part of their normal process and would have been accomplished before any construction at any important sites affected by the project.

GEOLOGY

Several persons have expressed concern about the lack of geological data in the project's environmental impact statement. Two geologists we interviewed described their concerns about geological matters that were not addressed in the final environmental impact statement. The primary concerns were:

--The number of oil and gas wells in the project area and the estimated cost of plugging them.

--The lack of data on the bedrock formations to support the dam.

--The potential for reservoir leakage due to the fractured and jointed rock condition known to exist extensively in the project area.

--The lack of identification of uranium and mineral resources in the project area.

Our review showed that the Corps had considered the geological concerns expressed about the project. We found that after the final impact statement was issued, the Corps had a commercial research firm study the oil and gas wells in the project area. The study showed that 34 oil wells and

8 gas wells were in the project area. The Corps estimated the cost of capping each well to be about $1,000.

The Corps advised us that there were no known appreciable adverse geological impacts attributable to the project. The Corps believes it has much more precise geological data regarding this project than exists elsewhere. Further, the Corps stated that the State geologist had been consulted and that data on uranium deposits was obtained from the Kentucky Department of Commerce in March 1973.

## AGENCY COMMENTS

The Army told us that they believe the Red River Final Environmental Impact Statement adequately addresses the environmental issues. They also said that the various environmentally oriented questions raised by the project's opponents have been responsibly considered and the environmental consequences objectively weighed in reaching their final conclusion that the project's continuance is warranted.

The Council on Environmental Quality has told us that the Corps' present assessment of environmental impacts does not justify proceeding with the project, and that additional economic and environmental analysis is needed.

Regarding the Corps' consideration of alternative projects, the Council stated that "the EIS should have given more consideration to both non-structural and structural alternatives." The Council also reiterated their comments of January 24, 1975, to the Secretary of the Army that

> "the final EIS analyzes each non-structural alternative in isolation, failing to recognize that a combination of such measures is likely to constitute a far more effective and meaningful alternative."

## CONCLUSION

Federal agencies, other groups, and individuals are concerned about the environmental damages that could result from constructing the Red River Lake project.

Many questions raised on the environmental issues are subject to determination by the court in connection with the pending court case. Therefore, we are not expressing an opinion on these matters in line with our policy of not commenting on matters under litigation.

## CHAPTER 3

## PROJECT BENEFITS

The Corps' 1973 estimate of annual benefits for the Red River Lake project totaled $2,469,000. Our review questioned the reasonableness of the Corps' computation of certain benefits. We found that:

--Recreation benefits were developed for the project without adequately assessing the impact of existing recreation use in the project area and in the surrounding market area.

--Flood control benefits included, without sufficient justification, an amount resulting from applying an economic increase adjustment to total urban benefits.

--The effects of the Flood Disaster Protection Act of 1973 on restricting development in the flood plains was not considered in computing the flood control benefit.

--Water supply benefits are included in the economic justification for the project without adequately assessing the need for water from the project or reaffirming demand and payment for the water supply from current State officials.

Although we could not fully quantify them, these questionable benefits, if not sustainable, could have a substantial impact on the benefit values that should be claimed for the project. We believe the Corps should resolve these matters and recalculate all project benefits under current conditions.

### PROJECT BENEFITS AND COSTS

Federal water resource construction agencies develop and report to the Congress benefit-cost ratios showing the economic feasibility of proposed projects. These ratios are used by the Congress (and by the Corps) in its decisionmaking process to evaluate a project's economic feasibility. The Congress seldom authorizes a water resource project unless the benefit-cost ratio exceeds unity.

In making its economic feasibility analysis for Red River, the Corps followed Senate Document 97 which contains the governing criteria for formulating and evaluating plans for water resources projects. Although Senate Document 97 has been superseded by the new principles and standards issued by the

Water Resources Council on October 25, 1973, the Corps continues to apply Senate Document 97, as permitted by Council procedures, to certain projects already authorized, including Red River.

The benefit-cost ratio for the Red River Lake project, as formulated by the Corps, was 1.7 to 1.0 based on a July 1973 price base. The Corps estimated that annual benefits would be about $2.5 million and annual project costs would be about $1.4 million. The flood control and recreation benefits together account for about 88 percent of the total project benefits.

The following shows the benefit values covered by our review.

Corps' 1973 Estimate of Annual Benefits and Costs

| Annual benefits | Amount | Percent of total |
|---|---|---|
| Flood control | $1,155,000 | 46.8 |
| General recreation | 1,010,000 | 40.9 |
| Fish and wildlife | 38,000 | 1.5 |
| Water supply | 144,000 | 5.8 |
| Redevelopment (note a) | 122,000 | 5.0 |
| Total annual benefits (note b) | $2,469,000 | 100.0 |
| Total annual costs | $1,436,000 | |
| Benefit-cost ratio | 1.7 to 1.0 | |

a/Corps procedures allow redevelopment benefits to be included in project justification only in special circumstances and require that the benefit-cost ratio also be shown without including such benefits. Excluding these benefits would reduce the Corps' benefit-cost ratio to 1.6 to 1. In its comments, the Army pointed out that such benefits are now permitted in all cases under the new principles and standards issued in October 1973.

b/Higher benefits and costs, reflecting price level increases, were shown in the Corps' budget submission for fiscal year 1976.

## RECREATION BENEFITS

The Corps estimated annual general recreation benefits for the project to be $1,010,000. These benefits were

developed without adequately assessing either the impact on the expected project attendance of the area's current level of recreation activities without the project or the inherent physical limitations of the area's capacity for recreation activities. Although the Corps stated that competing lake projects were considered in estimating recreation benefits for the proposed lake, the extent and type of consideration which they received was not clear. Fully assessing these factors might show that the estimated project recreation benefits should be substantially reduced.

Criteria for estimating benefits

Recreation benefit evaluation standards are set forth in Supplement No. 1 to Senate Document 97 which the Corps adopted for use in July 1964. In evaluating recreation benefits, the Supplement states:

> "The basis for attributing recreation effects to a project is similar to that for other project purposes. Differences in expectations, both with and without the project and with and without recreation as a project purpose provide the primary basis for estimating net project effects on recreation."

As indicated in Supplement No. 1, project attendance estimates should be net; i.e., project attendance estimates should contain an adjustment for current recreational activities lost or reduced by the project's construction.

The Corps has developed a methodology to be used for predicting recreation use at proposed reservoirs. Such procedures require that the Corps planner evaluate various factors in determining recreational potential at proposed projects.

The Corps determines recreation benefits for water resource projects by estimating annual attendance during the life of the project and assigning a dollar value for each visit. Projected attendance is based on actual experience at similar projects and on the current and projected population residing within the project's market area.

Method used to estimate general recreation benefits

The Corps estimated initial annual attendance 1/ (in third year of operation) to be 554,000 and projected annual attendance to increase to 1,054,000 over the project's life.

The average annual benefits of $1,010,000 were determined by using a value of $1.25 per visit recognizing incremental annual growth in attendance and discounting future growth benefits at 3-1/8 percent a year.

The Corps' methodology for predicting recreation attendance is described in Technical Report No. 2, "Estimating Initial Reservoir Recreation Use." The methodology utilizes the "most similar project" concept which relates recreation-use information from existing reservoirs to the reservoir under study. Technical Report No. 2 includes recreation data on many existing Corps reservoirs.

In developing initial annual attendance at the Red River project, the Corps selected two projects from Technical Report No. 2 which were determined to be most comparable to the Red River project in accessibility, uniqueness, diversity of recreational activity, distance from population centers, and available support facilities.

By analyzing the attendance data reported for these two projects, the Corps developed a "per capita use curve" for Red River Lake. This curve shows the relationship between per capita use and distance from the lake.

The Red River market area was then evaluated. The Corps planner determined that the project would attract visitors from 56 counties, some of which were over 100 miles from the project. The applicable per capita use rate was applied to the population of each county on the basis of the county's distance from Red River. Initial attendance for the project was computed by adding expected attendance from each county and then increasing the total for campers and for visitors expected from outside the market area.

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1/The Corps determines visitors in terms of recreation days which are standard units of use consisting of an individual's visit to a recreation development or area for recreation purposes during any reasonable portion, or all, of a 24-hour period.

Technical Report No. 2 lists several factors that the planner should consider which might require modifying the per capita use curve or adjusting the final attendance estimate. These factors are (1) the existing recreation use of the area, (2) the physical capacity of the area, and (3) the affect of competing water-oriented recreation opportunities in the vicinity.

Existing recreation use of the area

An important consideration stipulated in the Corps procedure is the estimation of existing recreation use at prospective reservoir areas under preproject conditions. Corps guidelines require that this amount of recreation use must be subtracted from the initial use estimate prepared for the project. We found that the Corps had not made such an adjustment because it was felt that the proposed project would have only a nominal effect on existing recreational opportunities and use.

The proposed Red River Lake project is located entirely within an area of the Daniel Boone National Forest designated as the Red River Gorge Unit. The Gorge unit is under the management of the U.S. Forest Service. The Forest Service has 13 developed recreation sites, such as scenic overlooks, camping grounds, and picnic facilities within the area. The Corps' project will provide more of the same type of recreation sites which will also be managed by the Forest Service. The Forest Service estimated that there were 1,022,000 visits to the 13 developed sites during 1974, but the exact number of people making these visits was not determined. Further, the Forest Service expects visits to the Gorge unit to increase even without the proposed lake.

The Army said that the proposed Red River Lake project's effect on existing visitation would be negligible and within the tolerance of the Corps' visitation projections. The Army also said that the existing recreation sites would not be affected by Red River Lake project waters and that the waters and structures of the project would not be visible from the existing recreation sites. We were told that, for these reasons, the project would not have more than a nominal effect on the existing recreational opportunities.

Senate Document 97, as supplemented, defines the primary basis for attributing a project's recreation benefits as the differences in expectations both with and without the project and with and without recreation as a project purpose.

We believe the Corps has overstated its estimate of project recreation benefits because many of the recreational

opportunities supporting the estimate of benefits are now provided within the area.

The Forest Service said that the more important current (without the project) recreation activities in the Gorge area are: camping, viewing outstanding scenery, hiking and walking, picnicking, motoring, hunting small game, and canoeing. Other activities in the area are swimming, horseback riding, hunting big game, attending talks and programs, and fishing. These are generally the same as the activities to be provided by the proposed project. For example, the Corps estimated that camping would account for 16 percent of the recreational visitation claimed for the project. Although there is a need for additional camping facilities in the area, we believe these can be provided without the lake and should not be attributed to the proposed project.

Rowboating, paddleboating, and sailing would be new activities provided by the lake; however, the Forest Service has stated that powerboating will not be allowed.

Our review of Corps records supporting the benefit computations and discussions with Corps officials did not indicate that the computations were adjusted for the many and wide-ranging recreational opportunities now existing in the area. It seems reasonable to us that the Corps should have documented support of its judgment that the proposed project would have only a nominal effect on existing recreational opportunities and use.

Physical capacity of the area for recreation

Estimating the physical carrying capacity of a proposed project area to support recreation is one of the important considerations provided in the Corps' methodology for estimating a project's visitation. Corps methodology and Supplement No. 1 to Senate Document 97 both recognize there will be a certain level of use beyond which there would be damage to the existing natural resources. Further, in some situations, inherent physical limitations on carrying capacity will set an upper limit for visitors which is less than estimated future demand.

Our discussions with Forest Service officials indicated that 1974 recreation use of the Red River Gorge area was extensive and that visits to some sites were at the saturation point. Further, these Forest Service officials expect the number of visitors to the Gorge area to increase even without the project because the area is now well known.

In its final environmental statement for managing the Red River Gorge Unit, the Forest Service stated that (1) the projected demand for use of the Gorge area exceeds its ability to withstand the impact without damage, (2) this demand necessitates limiting visitor numbers, and (3) on high-use days portions of the Gorge must be temporarily closed to relieve traffic congestion. According to the Corps' environmental impact statement, damage has already occurred in the form of soil compaction (bare soil areas) and accelerated erosion.

The Army has told us that the full increment of projected visitation would not be in the Gorge but would be dispersed throughout a broader area. They concluded that with appropriate management, the lands of the Daniel Boone National Forest, in combination with project lands, were sufficient to accommodate the projected visitation without unduly stressing the ecosystem. They also noted that the Corps' plan encouraged use outside of the Gorge proper.

It seems to us, however, that if the projected visitation assigned to the project includes expected visits to areas outside of the project, then the question arises as to whether it is reasonable to attribute all the recreational benefits to Red River Lake.

We believe that the inherent physical limitation on the project area's carrying capacity should be assessed and taken into consideration in determining the recreation use estimate for the project. We also believe that only those visits which can be attributed to the lake should be included in the recreation benefits claimed for the project.

Other Corps projects

In addition to the existing recreation already provided within the Red River Gorge area, a number of other existing or planned Corps projects, which include recreational opportunities, are located in the proposed project's vicinity. For instance, Cave Run Lake is a newly completed Corps project which, like the proposed project, is located in the Daniel Boone National Forest about 18 miles from the proposed lake. Cave Run Lake has a seasonal pool surface area of 8,270 acres versus 1,546 acres for the proposed Red River Lake. Existing recreation activities at Cave Run include camping, boating, water skiing, swimming, and fishing. Picnic areas and walking trails are planned. These activities are similar to those proposed for the Red River Lake project.

Corps officials stated that several vicinity lake projects were considered in estimating benefits for the proposed

project; however, the extent and type of consideration they received is not clear.

The lakes which the Corps said they considered include Cave Run Lake, Buckhorn Lake, Carr Fork Lake, Herrington Lake (not a Corps project), and Falmouth Lake which is in the early planning stages. Other project lakes in the vicinity of the proposed project apparently were not considered. These included Grayson Lake, Yatesville Lake, and Paintsville Lake, all of which will provide recreation activities similar to the proposed project. For instance, Grayson Lake, which had over 570,000 visitors during 1973, provides camping, swimming, picnicking, and fishing activities. The other two lakes are under construction. Corps projects located in the vicinity of the proposed Red River project are shown on page 27.

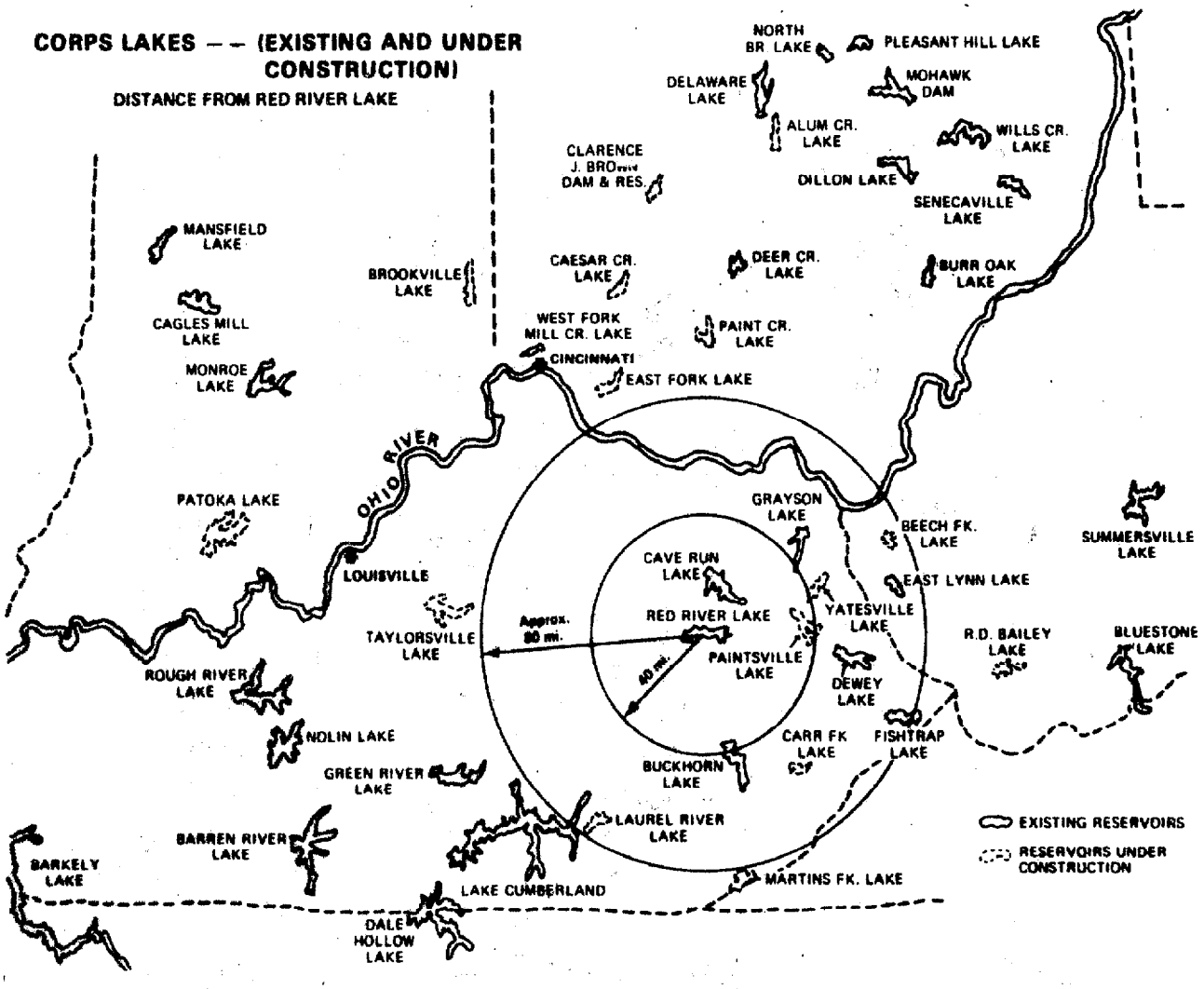
Many other Corps projects are located near the major urban centers which the Corps included in the market area for the Red River Lake project. Of the 56 counties which the Corps included in the market area, more visitors are expected from Hamilton County, Ohio (Cincinnati area), and Jefferson County, Kentucky (Louisville area), than from any of the other counties. These two counties account for over 25 percent of the projected visitors. The diagram on page 28 shows the Corps lake projects within commuting distance between these two urban centers.

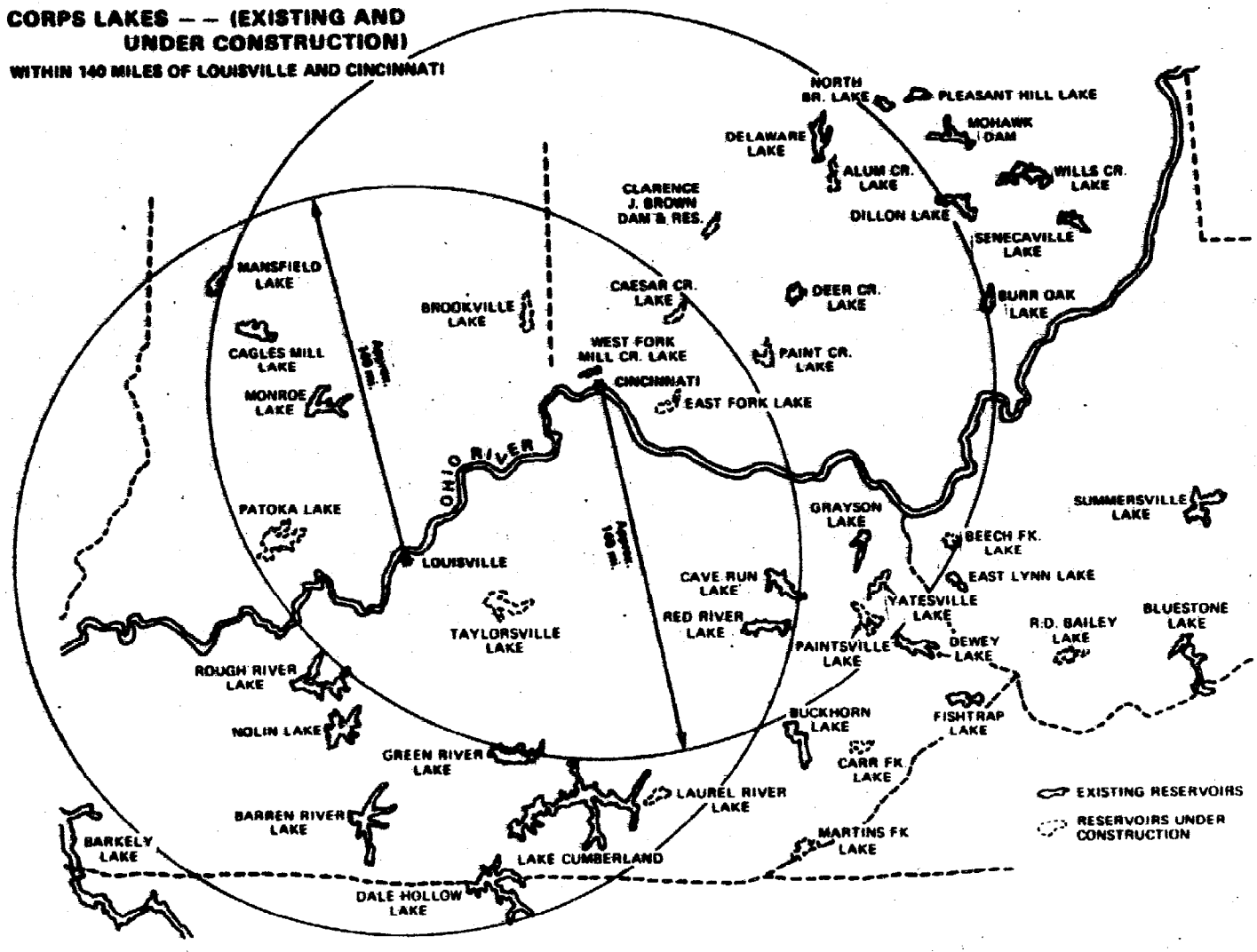
The Army said experience has shown that introducing a new project in the proximity of an existing one has had little or no effect on visitation at the existing project. In addition it pointed out that the Kentucky State Outdoor Recreation Plan shows a great need for various types of recreational facilities. Our review of the State plan showed that the greatest need for water-based recreation, other than fishing, was for water skiing and powerboating--neither of which will be provided by the proposed Red River Lake.

We believe that competition from all the lake projects in the market area of the proposed project should be considered in determining the project's recreation benefits and that the Corps should clearly demonstrate how these lakes would or would not affect visitation at Red River Lake. The effect of competing lakes could be shown by adjusting the per capita use curve for Red River Lake.

## FLOOD CONTROL BENEFITS

Flood control benefits are defined as reducing, in all forms, damage from inundation of property and increasing net returns from higher property use made possible by lowering the flood hazard. Such benefits are estimated by determining the project's capability to reduce flood stages throughout





the range of possible floods and computing the damages to existing and future development that would be prevented by the reduced flood stages.

The Corps estimated that the flood control benefits attributable to the Red River Lake project would be $1,155,000 annually. These benefits were derived from damage survey and hydrology data developed in the early and mid-1960s. Since then various adjustments have been made to reflect (1) price level increases, (2) the change in the dam location, and (3) the inclusion of an economic increase adjustment factor (generally referred to as affluence) in computing these benefits.

Our review showed that two factors have a considerable impact on the amount of benefits which should be claimed.

--The effects of the Flood Disaster Protection Act of 1973 on restricting development in the flood plain was not considered in the flood control benefit calculation.

--Flood control benefits included, without sufficient justification, an amount resulting from applying an economic increase adjustment to total urban benefits.

The Corps determined that the project will provide flood protection on the downstream portions of the Red River, the Kentucky River, and the Ohio River. Our analysis of Corps data shows that $436,000, or 37.7 percent, of the annual benefits for flood control are attributed to future development in the flood plain which would be affected by the 1973 act. In addition, $329,700, or 28.6 percent, of the flood control benefits are identified as the adjustment for the affluence factor.

Annual Flood Control Benefits

| Basin | Existing development (note a) | Future development | Economic increase adjustment | Total |
|---|---|---|---|---|
| | (thousands) | | | |
| Red River | $199.5 | $161.8 | $ 56.5 | $ 417.8 |
| Kentucky River | 88.6 | 74.0 | 62.7 | 225.3 |
| Ohio River | 100.8 | 200.2 | 210.5 | 511.5 |
| Total | $388.9 | $436.0 | $329.7 | $1,154.6 |
| Percent of total | 33.7 | 37.7 | 28.6 | 100.0 |

a/Existing development includes development existing in 1971. It does not include development occurring since then. However, the figures are adjusted for price level changes.

Further, 88 percent of the $329,700 economic increase adjustment relates to future development while 12 percent relates to existing development.

Affluence factor benefits

In the late 1960s the Corps added a new step to its procedure for determining flood control benefits for reservoir projects. This procedure involved using a factor to adjust a project's flood control benefits for the increases in real per capita output expected to occur from an expanding economy during the project's life.

In 1971, with completion of the general design memorandum, the procedure was applied to the Red River Lake project. In computing the project's flood control benefits, the Corps applied the factor to the total value of residential, commercial, and industrial property subject to flooding. Applying this factor resulted in a 40-percent increase in the project's flood control benefits.

In 1973, the Office of Management and Budget notified the Corps that revised regulations and guidelines were required for projecting real and personal property economic growth rates on its water resource projects. The Corps was advised that without such guidelines there was no uniform basis for approving projects whose calculated benefits were partially or totally dependent on the affluence factor. The Chief, Office of Civil Functions, Office of the Secretary of the Army, instructed the Corps to comply with the Office of Management and Budget directive and recommended a study to establish "empirically tested techniques for making real and personal property value projections."

A Corps task force evaluated the appropriateness of applying an affluence factor to various types of investments. The Chief of the task force told us that the results of a thorough analysis did not justify applying such a factor to commercial and industrial property. Consequently, a new regulation was drafted which limited applying the factor to the value of personal property in residential buildings.

The draft Corps regulation established a specific methodology for applying the affluence factor adjustment. Before this no formal guidance of this type existed. Under this methodology the adjustment factor is applied only to the content value of residential property. In computing benefits for the Red River Lake project, the Corps applied the factor to the total value of residential, commercial, and industrial property subject to flooding. We estimated that the project's flood control benefits included about $260,700 derived from applying the factor to commercial and industrial property.

In view of the large amount of benefits attributed to this factor, we believe it would be appropriate to recompute the benefits. If the Corps cannot support the appropriateness of applying the affluence factor to industrial and commercial structures and their contents, then values for such a factor should not be included in the flood control benefits.

Flood Disaster Protection Act of 1973

In 1968 the Congress passed the National Flood Insurance Act (42 U.S.C. 4001) establishing the National Flood Insurance Program to give property owners the opportunity to buy insurance for protection against flood losses at federally subsidized rates. However, for property owners to be eligible for such insurance, the local communities must adopt and enforce land use and control measures.

During the ensuing years it became clear that the voluntary nature of the National Flood Insurance Program was a serious problem and that, without mandating provisions to bring about sound flood plain management, no real accomplishment towards reducing flood losses could be made. The Congress therefore passed the Flood Disaster Protection Act of 1973 (Public Law 93-234) which expands the 1968 Flood Insurance Program by creating incentives for flood-prone communities to enter the program and thereby making insurance available to their citizens.

Specifically, the Flood Disaster Protection Act requires that for Federal agencies to approve financial assistance for acquiring or constructing property in flood hazard areas after July 1, 1975, localities with special flood hazards must participate in the National Flood Insurance Program. As a result, local communities were, in effect, under strong pressure to adopt at least interim land use and control measures by July 1, 1975, in order to qualify for the program.

The Corps acknowledged the effect of the 1973 law by issuing a regulation on August 15, 1974, which required that benefit computations be based on the assumption that flood damageable property would not be built in flood plains after July 1975.

Estimates of future growth in the areas to be protected by Red River dam were developed from data and studies available when the general design memorandum 1/ was prepared in

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1/A general design memorandum is prepared to update and summarize project plans and design, cost estimates, and feasibility studies during postauthorization planning.

1971. Since then the Corps has not adjusted its estimates of future growth in the flood plain or the associated flood control benefits for Red River Lake to reflect the national policy declared in the Flood Disaster Protection Act and the assumptions required in its new regulation.

The Council on Environmental Quality, in a letter to the Secretary of the Army, noted that the economic analysis in the final environmental impact statement assigns a substantial portion of the flood prevention benefits for protecting property not now existing in the flood plain. The Council says this is contrary to the Congress' intent as expressed in the Flood Disaster Protection Act of 1973 and the President's intent as expressed in Executive Order 11296 to reduce unwise development in flood plains.

The Corps had stated that a brief review of project benefits indicated that eliminating all future urban flood control benefits would not seriously affect the economic justification since the benefit-cost ratio would still be above unity. However, we believe restricting future development could result in appreciably reducing the benefits claimed for the project.

The Army recognizes that new procedures for estimating flood control benefits have been developed and that implementing these procedures would affect the Corps' computations. However, they have stated that the current estimate reasonably approximates the value of the flood control function of the project and that the order of magnitude of the benefits, if recomputed, would not be altered enough to affect ultimate project decisions.

To support their position that the new guidelines would not noticeably alter the magnitude of the benefits, the Army provided us with an estimate showing that, if every potential for future increases in damages were excluded from consideration, the ratio of 1.7 would be reduced to 1.22 with redevelopment benefits and 1.13 without redevelopment benefits.

The Army explained that the Flood Disaster Protection Act will control, but not prevent, developments in the flood plains. New developments can be constructed if buildings are floodproofed or placed on fills. However, providing flood protection will result in project benefits due to the reduction in construction costs, since a project will reduce flood crests so that the depths of fill or the building elevations can be reduced. The Army also noted that the act does not prevent using the flood plain for agricultural purposes, and agricultural damages can be expected to increase.

Regarding the affluence factor, the Army referred to the Corps' consideration for developing new procedures to estimate the effects of increased productivity and higher living standards on flood damage costs.

Finally, the Army told us that applying the new Corps flood control benefit evaluation guidelines to projects for which construction funds have been appropriated is not required.

Nevertheless, current Corps procedures limit using the affluence factor in estimating future flood damages to the contents of residences. We believe that until a Corps study can demonstrate the appropriateness of applying the affluence factor to industrial and commercial property, values for such a factor should not be included in the flood control benefits.

Current Corps regulations also require that benefit computations be based on the assumption that flood damageable property will not be built in flood plains after July 1975. This assumption recognizes the pressure which the Flood Disaster Protection Act exerts on local communities to adopt land use and control measures in the flood plain.

The dollar amount of flood control benefits attributed to future development in the downstream areas to be protected by Red River Lake is considerable--about 63 percent, based on development existing in 1971. The Council on Environmental Quality noted that a large portion of the flood control benefits are for protecting property not now existing in the flood plain.

While it may be reasonable, as the Army suggests, that some future flood control benefits may be justified under the new guidelines, only a restudy can accurately assess the impact of the guidelines on flood control benefits.

## WATER SUPPLY BENEFITS

The Corps has included estimated benefits of $144,000 annually for future water supply in the project's economic justification. Although the Corps obtained assurances from the former State administration concerning demand and payment for the water supply, the present State administration has not reaffirmed such assurances. In addition, Kentucky's Division of Water Resources currently estimates that except for drought conditions projected to occur about once every 100 years, existing and other potential water supply sources are adequate for future needs.

Considering (1) the current estimates of the adequacy of existing water supply sources and (2) the State's lack of

reaffirmation of demand and payment assurances, we believe that including water supply benefits in the project's economic justification is questionable.

The Water Supply Act of 1958, as amended (43 U.S.C. 390b), and Corps implementing regulations recognize the need for Federal, State, and local cooperation in developing water supplies with public works projects as a means of meeting current and future domestic water needs. The law requires that State or local interests agree to pay for the costs allocated to such developments. This enables the Federal Government to recover from the users that portion of the construction costs and operation and maintenance costs applicable to the water supply function.

The Corps estimates the investment costs for the water supply function of the Red River project to be about $2.3 million. If the water supply function were eliminated there would be a minimal reduction in project costs since most costs would be reallocated to other project purposes. However, project alternatives which do not provide water supply might meet the remaining project purposes at lower cost.

Water supply needs

In the environmental impact statement, the Corps reported that the Kentucky Water Resources Authority had determined the need for dependable water supply flows and that 12 municipalities had been identified as potential users with a projected aggregate maximum demand of about 177 million gallons of water a day by the year 2000.

The projected water supply needs reported by the Corps in the final environmental impact statement were based primarily on a study prepared by a private research organization for the State Division of Water Resources. We were told that before completing the final environmental impact statement, the Corps had compared the private study projections with those made by the Federal Water Quality Administration (now part of the Environmental Protection Agency) and with similar projections made by the Lexington Water Company of Lexington, Kentucky. We found no supporting documentation of the Corps' comparative analysis.

The State's views of future water needs

Officials of the State Division of Water Resources, the agency responsible for determining the State's water needs, informed us that the study used by the Corps for depicting future water demand for the Lexington-Blue Grass area had no official standing with the State and represented only one

individual's views and assumptions. Division officials said that, of the potential users contacted during the period from October 1972 to July 1973, only two small communities representing only a small percentage of the 177 million gallons a day maximum demand had indicated a willingness to execute a contract for water payment. We were also told that the city of Lexington, estimated to have a requirement for 60 percent of the total, had positively declined to participate in obtaining water from this source.

State officials told us on December 4, 1974, and again on May 14, 1975, that this project is not essential as a water source since there are numerous existing and other potential sources which can satisfy the area's future water needs. A current technical report prepared by the Division of Water Resources addressing the Lexington area's future water needs indicated support for their assessment. The report showed that under current conditions and area development, existing water sources are adequate for future needs, except during periods of extreme drought projected to occur about once every 100 years.

Corps officials have advised that notwithstanding the current State study, they are convinced there will be a need for additional water supplies and that it is only a matter of time until this need becomes evident.

Assurances received

The Water Resources Authority of Kentucky, the State body having authority to coordinate the use of State water resources, and the former Governor had requested that water storage be included in the project. In September 1966 and again in April 1971, in connection with the former and current project site, the Water Resources Authority provided demand and payment assurances for the requested water storage. The Kentucky attorney general subsequently determined, however, that the assurance provided for the current site did not legally bind the State to make payments for the water storage.

In a May 1974 letter of intent to the Corps, the former Governor affirmed that demand would be made for using such storage during a time period which would permit paying the allocated costs within the life of the project. In his letter the Governor cautioned that the assurance given should not be construed as legally obligating the State to make any appropriation of funds for repaying the Federal investment. The Corps considered the former Governor's letter as adequate assurance concerning demand and payment for the water under the law and Corps regulations.

Before proceeding with project construction, District policy requires that water supply assurances made by former State administration officials be reaffirmed by current administration officials. In January 1975 the new administration took office requiring that the former Governor's 1974 letter be reaffirmed. As of July 17, 1975, the reaffirmation had not been obtained.

In view of (1) current State estimates of the adequacy of existing water supply sources and (2) the District policy which requires that assurances made by former State officials be reaffirmed by current officials, we believe the Corps should determine the need for future water supply from the project and obtain assurances from current State officials that the State will require and pay for the water supply.

The Army told us that studies made by the Corps and others indicate that Kentucky's water supply demands will exceed currently available supply during drought periods. The Army also said that although there is a need for future water supply in the area, the project is not essential to meeting that need. The Army expressed its belief that since a water supply contract would not be required for a number of years, the former Governor's letter of May 20, 1974, provides the assurances required by the law.

## AGENCY COMMENTS

In commenting on the project benefits discussed in this report, the Army disagreed with our proposal that reexamining the benefit determinations and computations was required. The Army felt that the estimate of the recreational visitation was reasonable; that the flood control benefits, if recomputed, would not change appreciably; and that future water supply was a valid project purpose because there is a need for water in the area. We have discussed the Army's views and our assessment of their comments in the respective sections of this chapter.

## CONCLUSIONS

Federal water resource construction agencies develop and report benefit-cost analyses to the Congress to show the economic feasibility of proposed projects. Such analyses are an important part of the congressional and agency decisionmaking process and have become of increasing interest and concern to Members of the Congress and to various groups of citizens.

It seems to us, therefore, that benefit-cost analyses should realistically represent the expected conditions with and without the project and be fully documented and supported.

Although we could not fully quantify them, the benefit values questioned in our review, if not sustainable, could have a large impact on the benefits that should be claimed for the project.

Although the Army's contention about the impact of benefit recomputations may prove to be warranted, we believe that adequate reanalyses should be made to provide sufficient, documented support for concluding that the benefit values are reasonable and that benefit recomputations would not materially affect the project's economic feasibility.

## RECOMMENDATIONS

Accordingly, we recommend that, before proceeding with the project, the Secretary of the Army require the Corps of Engineers to resolve the questions on project benefits raised in our review by determining the

--existing recreation usage in the immediate project area and its impact on the recreation benefits that should be claimed for the project and adjust the benefits accordingly,

--the probable impact on the expected project attendance of the inherent limitation on the area's carrying capacity and the competing influence of other lakes providing similar recreational opportunities and adjust the benefits accordingly,

--the amount of flood control benefits attributable to the affluence factor which should not be considered in claiming project benefits,

--the amount of flood damage reduction benefits which should not be claimed because of the effects of the Flood Disaster Protection Act of 1973, and

--the need for future water supply from the project as well as obtaining assurances from current State officials that the State will require and pay for the water supply.

# CHAPTER 4

# INTEREST RATE USED IN THE PROJECT'S ECONOMIC EVALUATION

Construction costs for a project are mostly incurred before the project is put into operation. Benefits, on the other hand, are realized over the operating life of the project. Therefore, an interest (or discount) rate is used either to discount future project benefits to present value and to amortize benefits and costs over the project's expected economic life or to convert benefits and costs to a common time basis. The interest rate used has an important impact on a project's benefit-cost ratio, because as the interest rate increases, the present value of future benefits decreases and the project's economic costs increase.

## RATE SELECTION

The criteria in Senate Document 97 were used to select the interest rate for the Red River Lake project. The Document provided:

> "The interest rate to be used in plan formulation and evaluation for discounting future benefits and computing costs, or otherwise converting benefits and costs to a common time basis shall be based upon the average rate of interest payable by the Treasury on interest bearing marketable securities of the United States outstanding at the end of the fiscal year preceding such computation which, upon original issue, had terms to maturity of 15 years or more * * *."

Annually, the Secretary of the Treasury advises the Secretary of the Army as to what interest rate is applicable for use in new project formulations and evaluations during the coming fiscal year. 1/

As can be seen from the following schedule of prescribed rates from 1967 to 1975, there has been a steady increase in rates since 1967.

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1/As of December 24, 1968, by amendment to Senate Document 97, the discount rate formula was changed to provide for the use of "the average yield" rather than the average rate of interest.

| Fiscal year | Rate |
|---|---|
| 1967 | 3-1/8% |
| 1968 | 3-1/4 |
| 1969 | a/3-1/4 |
| 1970 | 4-7/8 |
| 1971 | 5-1/8 |
| 1972 | 5-3/8 |
| 1973 | 5-1/2 |
| 1974 | 5-5/8 |
| 1975 | 5-7/8 |

a/3-1/4 percent in effect to December 24, 1968; 4-5/8 percent in effect for the remainder of fiscal year 1969.

## CORPS' POLICY ON USE OF RATES

In a letter dated January 9, 1975, the Chief of the Office of Civil Functions, Secretary of the Army, told us that Corps policy provides that the interest rate in effect at the time the Congress first appropriates funds for project construction shall be used in all future economic studies for the project. Appropriations for construction include funds for land acquisition. This rate, once set, is maintained irrespective of changes in project status or any time lapse between the Congress' construction appropriation and the initiation of actual construction.

The Army stated the rationale for this policy is that when the Congress considers appropriating initial construction funds for a particular project, its decisions are based on project justification data and economic conditions in effect at the time the Corps request is made. The Corps considers a favorable interpretation of these factors by the Congress as a formal declaration of intent to complete the project. At this point in the process, the interest rate is frozen and is used thereafter for economic studies and project justification.

The 3-1/8-percent interest rate being used for evaluating the Red River project is the prescribed rate in effect for 1967 as established under Senate Document 97 criteria. Corps officials stated that the adoption and continued use of this rate is in accordance with Corps policy and has been repeatedly accepted by the Congress.

## CHANGES IN PROJECT FUNDING STATUS

A University of Kentucky economist has suggested that if the project with a dam located at the current site is

viewed as a separate and distinct project from that originally authorized, then a more recent interest rate should be used.

Although the project was authorized in 1962, the Congress did not make an appropriation for construction until fiscal year 1967. At that time funds were appropriated for construction at the original site located at mile 47.5 on the Red River. The Corps used none of these initial funds for actual construction, although some funds were used to purchase about 440 acres of needed land at the site.

Public opposition which began in 1967 influenced the Corps to consider moving the proposed damsite downstream. The Corps subsequently determined that a new location at mile 42.3 would be less destructive to the Gorge. In 1969 when the Corps requested funds for construction at the original site, the Congress chose not to appropriate funds for that purpose, but instead appropriated $500,000 for fiscal year 1970 for additional study of the new site. In the fiscal year 1972 appropriations, the Congress once again restated the project's funding status by designating $300,000 for constructing the Red River Lake project at the new site.

## IMPACT OF INTEREST RATE CHANGES

The value of the interest rate is extremely important in evaluating a project's economic justification. As indicated previously, the benefit to cost ratio is a key indicator of whether a project is cost effective. Because of the long period (100 years) used in computing benefit-cost ratios, the computations are highly sensitive to changes in the interest rate as shown below for the Red River project.

| Interest rate | Benefit to cost ratio |
|---|---|
| 3-1/8% | 1.7 to 1 |
| 4-1/8 | 1.29 to 1 |
| 5-1/8 | 1.04 to 1 |
| 6-1/8 | 0.83 to 1 |
| 7 | 0.68 to 1 |

The ratios shown above reflect only those changes resulting from use of varying interest rates. No adjustments were made for the benefit values we questioned in chapter 3.

## CONCLUSIONS

In view of the Corps' continuous practice over the years of freezing interest rates at the rate in effect when

the initial construction appropriation is justified, and with the Congress' apparent knowledge of the practice, it is reasonable to assume that had the Congress been dissatisfied with the practice, it would have been addressed when the Congress enacted the Water Resources Development Act of 1974 (Public Law 93-251, Mar. 7, 1974) which prescribes the formula for establishing the interest rate to be used in formulating and evaluating plans for water resource projects. Rather, in section 80(c) of the act, the Congress directed that a presidential study be made of the principles and standards for planning and evaluating water and related resources projects including the interest rate formula to be used in evaluating and discounting future benefits for such projects.

Although the construction site for the dam was relocated, necessitating redesign of the structure, it cannot be said that the project, as modified, was so totally unrelated to that for which construction funds had originally been appropriated in 1967 and 1968 as to require it to be considered an entirely new project.

Therefore, in view of what we have previously stated concerning the Corps' policy of freezing interest rates to that used in support of the budget submission upon which appropriations for initial construction were based, we cannot say that the interest rate figure used for preparing the economic analysis for the Red River Lake project was not in compliance with the requirements of applicable legislation.

APPENDIX I

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

Mr. Henry Eschwege
Director, Resources and
Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

29 JUL 1975

Dear Mr. Eschwege:

On behalf of the Secretary of Defense, this is in response to the Draft GAO report entitled "Environmental and Economic Issues of Constructing the Red River Lake Project in Kentucky" (OSD Case #4098).

The report indicates the GAO expresses no opinion concerning project-related environmental matters because they are at issue in pending litigation. Nevertheless, the draft report details at some length the various environmentally-oriented questions which those opposed to the project have raised. We, of course, believe that the Final Environmental Impact Statement adequately addresses the issues, and that all of these questions have been responsibly considered and the environmental consequences objectively weighed in reaching our final conclusion that to proceed with the project is merited.

I am pleased to note that the GAO has concluded that the Corps of Engineers has complied with applicable legislation and regulations in determination of the appropriate interest rate for the project.

The only substantive recommendation in the draft report is that the Corps be required to reexamine the benefit computations in certain areas. I do not agree with the conclusions drawn in the report which led to the GAO recommendation. I believe, particularly, that the estimate of recreational visitation is reasonable. I recognize that the procedures used for estimating flood control benefits do predate the most recent developments in policies which impact on such computations. Nonetheless, the resulting estimate reasonably approximates the value of the flood control function of the project; the order of magnitude of the benefits, if recomputed, would not be so significantly altered as to affect ultimate project decisions. There is a need for future water supply in the area. Therefore, although the project is not essential to meeting that need, the water supply benefits are valid because they are equated with the least costly alternative means of doing so. More detailed comments, specifically related to the pertinent parts of the draft report, are furnished in the inclosure.

Sincerely,

Victor V. Veysey
Assistant Secretary of the Army
(Civil Works)

1 Incl
As stated

DETAILED COMMENTS ON GAO DRAFT REPORT
RED RIVER LAKE, KENTUCKY

PROJECT BENEFITS AND COSTS, PAGE 28, TABLE

Note a should be expanded to indicate that new regulations, recognizing evolving policies and procedures, provide for inclusion of redevelopment benefits in benefit-to-cost ratio computations.

RECREATION BENEFITS AND COSTS, PAGE 28, PARAGRAPH 1

There is the implication that the Corps did not properly account for the "without project" visitation in the Gorge. It is important to note that not a single one of the developed sites is affected by the waters of the Red River Lake project. These data reaffirm the Corps conclusion that the Red River project's effect on existing visitation would be negligible and within the tolerance of the visitation projections. It is equally important to note that, in addition to the developed sites not being affected by Red River Lake project waters, neither the waters nor the structures of Red River Lake would be visible from the developed sites. Therefore, it is improper to conclude that the Red River Lake project would have more than a nominal effect on the existing recreation opportunities. The Corps, based on data presented by GAO, concludes that reaffirmation of Corps visitation (with and without project conditions) estimates is effected and that the procedures are in accord with Senate Document 97 and ER 1120-2-405 (Technical Report No. 2 - Estimating Initial Reservoir Recreation Use).

The full increment of projected visitation will not be in the Gorge but will be dispersed throughout a broader area. The lands of the Daniel Boone National Forest in combination with project lands are concluded to be sufficient to accommodate the projected visitation without unduly stressing the ecosystem with appropriate management. GAO presents no data to the contrary. It should be noted that the Corps plan encourages use outside of the Gorge proper.

OTHER CORPS PROJECTS, PAGE 33, PARAGRAPH 1

The Corps experience indicates that the introduction of a new project proximal to an existing one has little or no effect on visitation at the existing project. The unmet demand for recreation is so great that facilities cannot be constructed in quantities to satisfy demand. This is borne out by the Kentucky State Outdoor Recreation Plan. Also, competing projects are taken into account in the comparative project analysis used by the Corps.

APPENDIX I

OTHER CORPS PROJECTS, PAGE 35, PARAGRAPH 1

The populations of both Hamilton County, Ohio and Jefferson County, Kentucky are greater than any other counties in the market area. Both these counties are linked to the proposed project by a fine transportation network (Interstate system and Mountain Parkway).

FUTURE FLOOD CONTROL BENEFITS, PAGES 38 THROUGH 42

This section suggests that the estimate of future flood control benefits should be revised to eliminate some of the flood control benefits computed for future developments and the projected increases in flood damages which can occur if increased productivity provides better living and working conditions. There have been many procedures developed over the years to determine where new developments will take place and the value of those developments in constant dollars. The estimates of future flood damages developed over five years ago for the flood plains below the proposed Red River project used procedures which were acceptable at that time and were used in many other studies. A study using current criteria and considering the effects of the Flood Disaster Protection Act enacted in December 1973 would result in some changes in the estimates of future damages but it is not felt that the magnitude of these changes would have as much effect on future flood damages as is indicated by GAO. The Flood Disaster Protection Act will control but not prevent developments in the flood plains. New developments can be constructed if buildings are flood proofed or placed on fills. Providing flood protection will result in project benefits due to the reduction in construction costs where a project will reduce flood crests so that the depths of fill or the elevations of buildings can be reduced. The Disaster Act does not prevent use of the flood plain for agricultural purposes and agricultural damages can be expected to increase as productivity increases, normalized prices rise, and land is used more intensively. At the present time consideration is being given to developing new procedures for estimating the effects of increased productivity and higher standards of living on flood damages. At the time the formulation studies were made for Red River, it was determined that these flood damages were related to personal income. When income increases, citizens have more money to spend on housing and for the goods sold by commercial establishments and produced by industries. A recent study of the changes in damages to residential developments indicated there was a relationship between the flood damages to the contents of buildings and per capita income but not to the value of homes. A draft Engineer Regulation has been prepared which limits the use of the affluence factor in estimating future flood damages to the contents of residences. An Engineer Regulation has not been prepared which would provide guidance on estimating the increase in future flood damages to commercial and industrial properties. These damages are expected to increase but the research and detailed studies needed to develop specific procedures and indices which would have general application have not been developed. If a new study were made to determine the future flood damages

in the flood plains below the authorized Red River project, consideration would need to be given to developing new criteria where it appears that realistic estimates cannot be obtained with existing procedures. The overall benefits from flood control projects have often been underestimated because it is very difficult to develop generalized procedures which will project land use and development through the 100-year life of flood control projects.

EC 1105-2-39 does not require application of the new Corps flood control benefit evaluation guidelines (ER 1105-2-351) to projects for which construction funds have been appropriated. Moreover, application of the regulation could not affect project justification. The benefit-to-cost ratio would still exceed unity even if every potential for future increases in damages was excluded from consideration. The ratio (page 28) of 1.7 would be reduced to 1.22 under present (flooding) conditions with redevelopment benefits, and 1.13 under present (flooding) conditions without redevelopment benefits. This is based on adjustment for current price levels and flood plain development since 1971. The amounts shown for existing development on page 38 of the GAO report adjust for price levels but not for development since 1971.

WATER SUPPLY BENEFITS, PAGES 43 THROUGH 47

This section indicates that the water supply benefits are questionable because the state has determined that water from this source is not essential for future development and payment assurances have not been obtained from current state officials. The Lexington urban area has grown very rapidly during the last decade and all projections indicate that growth will continue. Studies made by the Corps and others indicate that the state's water supply demands will exceed the supply which can be obtained from the currently available sources during future droughts. The state's water supply can be obtained from a number of alternative sources. The water supply benefits used for the Red River project are based on the cost of an alternative project and the cost to the state for purchasing this water supply storage needed to meet future needs will be less than the cost of developing an alternative project. If the proposed water supply storage is included in the project, it is considered that the storage can be sold and the cost allocated to water supply repaid during the project life as required by the Water Supply Act. The Corps accepted a Letter of Assurance for the state water supply from the Governor who is also the Chairman of the Kentucky Water Authority.

It is felt that this letter dated 20 May 1974 provides the assurances required by the Water Supply Act of 1958, as amended for the inclusion of water supply storage in a multipurpose project. Since a water supply contract will not be required for a number of years, there is no legal requirement to obtain another Letter of Assurance at this time.

GAO note: Page number references in this appendix may not correspond to pages of this report.