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Tennessee Valley Authority's use of recreational benefits in resource allocation for multiple-purpose water resource projects

William Henry Hedley

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I am submitting herewith a thesis written by William Henry Hedley entitled "Tennessee Valley Authority's use of recreational benefits in resource allocation for multiple-purpose water resource projects." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Environmental Engineering.

Floyd C. Larson, Major Professor

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Kenneth Krick, Donald Overton

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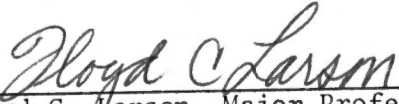
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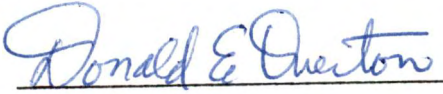
I am submitting herewith a thesis written by William H. Hedley entitled "Tennessee Valley Authority's Use of Recreational Benefits in Resource Allocation for Multiple-Purpose Water Resource Projects." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Water Resources Development.




Floyd C. Larson, Major Professor

We have read this thesis and
recommend its acceptance:





Accepted for the Council:



Vice Chancellor
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TENNESSEE VALLEY AUTHORITY'S USE OF RECREATIONAL BENEFITS
IN RESOURCE ALLOCATION FOR MULTIPLE-PURPOSE
WATER RESOURCE PROJECTS

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

William H. Hedley

December 1977

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Finally, my humble thanks to God from whom all blessings flow for my family whose love and care is my source of strength.

Phillipians 2:3 Do nothing from selfishness or empty conceit, but with humility of mind let each of you regard one another as more important than himself.

ABSTRACT

This research studied how the Tennessee Valley Authority (TVA) has used recreational benefits in resource allocation for multiple-purpose water resource projects.

Procedures used in answering this question were: (1) a literature review consisting of (a) pertinent information involving methods for the estimation of recreational benefits, (b) tracing of the Federal Government's steps in the legitimization of recreational benefits as a major project purpose, and (c) independent research; (2) a presentation of key facts found in the benefit-cost studies made by TVA and other Federal agencies which have used recreational benefits; (3) analysis of TVA's and other Federal agencies' use of set guidelines; (4) a comparison of demand and value measurements calculated by TVA and other Federal agencies.

Results of the study indicated that TVA has used their own methods in determining the demand and value measurements for recreational benefits. A comparison of demand and value measurements could not be made between TVA and other Federal agencies reservoir projects because no criteria of this kind could be obtained.

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CHAPTER I

INTRODUCTION

Streams, lakes, rivers, and oceans have always played an important role in people's attempts to find relaxation from the pressures of everyday living. Since water-oriented recreation is an important source of leisure activity, water bodies are increasingly valued for their recreational potential.

The attractiveness of water is demonstrated by statistics concerning water-oriented outdoor recreation. In a 1965 publication of "Outdoor Recreation Trends," it was estimated that Americans participated in swimming on almost a billion occasions (1).^{*} Swimming is expected to be the most popular outdoor activity by 1980. "Boating Statistics—1969," indicates that between 1970 and 1980, participation in water skiing is expected to increase by 121 percent. In 1969, over eight-and-a-half million recreational boats were owned in this country (2).

As the statistics indicate, recent years have brought a rapid increase in participation in water based outdoor activities. The trend can be witnessed at many reservoirs originally built for other purposes, i.e., people lying on a beach, walking in the woods near the shoreline, or skimming the water surface in a boat. Every indication is that the

^{*}Numbers in parentheses refer to references listed in the Bibliography.

increase in visitation to reservoir recreational sites is only beginning.

Several reasons may be suggested as contributing to the increase in visitation at reservoir recreational sites. Increased incomes have allowed people to spend more money on boats, motors, camping equipment, fishing gear and license, trapping, and hunting. Fewer working hours have allowed more time for outings to the water areas. Other factors increasing visitation are modernized high-speed transportation systems which make visiting different sites possible and expanding urbanization which reinforces the attraction of a country outing. These are just a few of the reasons why there has been greater emphasis placed on recreational issues in planning and the managing of water resources.

The growth of recreational use of government built water projects and the growing pressure for provision of recreational facilities and, in some cases, for providing reservoirs for the sole purpose of recreation compelled Congress to recognize the importance of the benefits and costs of recreation in the consideration of new projects. Senate Document 97 (3) first labeled outdoor recreation as a separable purpose of government projects in 1962. This document requires that the benefits and the costs of recreation opportunities be measured and accounted for in the justification of public resources projects.

As indicated, this recognition of recreation as a major project purpose has been relatively recent. For example, the Tennessee Valley Authority (TVA) was established in 1933 to serve only three major project purposes: (1) flood control, (2) navigation, and (3) hydroelectric

power. Recreation was just something that occurred because of the other three purposes.

The use of recreational benefits has been difficult because of:
(1) difficulty in assessing both tangible and intangible recreational benefits, (2) the calculation of demand and value measurements, (3) determining methods for estimating recreational benefits, and (4) which method(s) to use.

Since TVA was one of the leaders in water resource development in this country, it should follow that it would be among the leaders in using recreational benefits for water resource projects.

It is the intent of this investigation to evaluate how TVA used recreational benefits in resource allocation for multiple-purpose water resource projects.

CHAPTER II

METHODOLOGY

In answering the question how TVA attempted to include the use of recreational benefits in resource allocation for multiple-purpose water resource projects, the following procedures were used: (1) a literature review of (a) pertinent information involving methods for the estimation of recreational benefits, (b) the Federal Government's steps in the legitimization of recreational benefits as a major project purpose, and (c) independent research was made; (2) a presentation of key facts found in benefit-cost studies made by TVA and other Federal agencies which have used recreational benefits was done; (3) analysis of TVA with other Federal agencies use of Federal guidelines was shown; and (4) a comparison of demand and value measurements calculated by TVA and other Federal agencies was investigated.

CHAPTER III

LITERATURE REVIEW

This review involved a discussion of a variety of documents, reports, studies, and books dealing with the difficulty of incorporating recreational benefits into a benefit-cost analysis.

These sources of information have been classified into the following categories: (1) methods used to estimate the economic value of recreation, (2) the role of the Federal Government in the legitimization of recreational benefits as a major project purpose, and (3) independent research results.

Due to the technical nature of some of the terms, a glossary was compiled and is shown in Appendix A.

Methods Used to Estimate the Economic Value of Recreation

"When recreation and other related uses of water are recognized to have an economic good and from the status of by-product to that of a joint product comparable with other projects purposes, the search for evaluation techniques to aid in the allocation process intensifies and becomes increasingly important" (4).

The search for techniques to determine the economic value of recreation can be traced back to the Prewitt Report published in 1949 (5). The report noted "that there were two approaches that had been tried in an attempt to determine the economic value of recreation; (1) the Imputation Approach, (2) the Expenditure Approach."

In 1962, Lionel Lerner (6) classified the methods that had been proposed up to that time as the:

1. Expenditure Method
2. Gross National Product Method
3. Consumer's Surplus Method, including the Trice-Wood Method, the concentric Travel Zone Method, and the Travel Cost-Saving Method.
4. Cost Method
5. Market Value Method
6. Monopoly Revenue Method

In 1967, Hubert Hinote (4) classified the proposed methods for evaluating recreational benefits into five conceptual approaches:

1. Recreation Expenditures
2. National Income or Gross National Product
3. Cost of the recreational facilities
4. Market value
5. Consumer's surplus and/or demand curve analysis

A 1977 report from the University of Illinois (7) recommended that when a project creates additional recreational opportunities, the appropriate concept for estimating the contribution of that increase in output to national economic development is the willingness of users to pay.

The report suggested two general methods that are presently available for developing models to estimate the user benefits from recreation:

1. Travel Cost Method
2. Survey Method

The Role of the Federal Government in
Legitimization of Recreational Benefits
as a Major Project Purpose

In the past, recreation was regarded to have no major economic value and as a result no techniques were needed to evaluate recreation. As demands for recreational facilities and uses of Federal reservoirs for recreation increased, the Federal Government took certain steps in the recognition of recreational benefits as a major purpose for water resources projects. They are as follows:

1. U. S. Laws, Statutes at Large, LVIII, 887.

First formal recognition of recreation as a purpose came in the Flood Control Act of 1944. This act authorized the Corps of Engineers to construct and maintain recreational facilities at the reservoirs it built. The act's provision that facilities were to be open to the public without charge appears to have established the precedent for the resistance to user charges.

2. U. S. President's Water Resources Policy Commission. Report of the Commission. Washington: U. S. Government Printing Office, 1952.

This report recommended that recreation be treated as an integral project purpose.

3. U. S. Executive Office of the President. Budget Bureau Circular A-47. Washington: U. S. Government Printing Office, 1952.

Directed that recreation be treated apart from other project purposes, which means that it was to be treated as a byproduct of the project.

4. U. S. Congress. Senate. A Bill to Make the Evaluation of Recreational Benefits Resulting from the Construction of any Flood Control, Navigation or Reclamation Project an Integral Part of Project Planning, and for Other Purposes; and a Bill to Make the Evaluation of Recreational Benefits and Wildlife Development Resulting from the Construction of any Flood Control, Navigation or Reclamation Project an Integral Part of Project Planning, and for Other Purposes. 85th Congress, 1st Session, Senate Bill No. 1164 and Senate Bill No. 1221, 1957.

The primary difference between these two bills was that S. 1221 included Wildlife development. These bills were based on the consumption and welfare of the Nation. They were an attempt to make recreation benefits an integral part of project planning.

5. U. S. Congress. Senate. Evaluation of Recreational Benefits from Reservoirs. Hearings Before a Subcommittee of the Committee on Public Works. 85th Congress, 1st Session, March 12, 13, and 14, 1957.

It appeared as though the rationality behind the decision to utilize the per capita day as a method for the economic analysis of recreation benefits was developed in these hearings. Section 3(b) of S. 1164 states:

The evaluation of the recreational benefits, as provided in this section, shall be made upon the assumption that the annual value of such benefits is the product of
(1) the estimated average number of persons which may

reasonably be expected on any day to enjoy the recreational benefits of the project area, (2) 365, and (3) \$1.

Thus, bills S. 1164 and S. 1221 and subsequent hearings were the first real attempts to make evaluation benefits an integral part of the project planning and to assign a monetary value to these benefits. Budget Bureau opposition led to the defeat of these bills.

6. U. S. Inter-Agency Committee on Water Resources. Subcommittee on Evaluation Standards. Proposed Practices for Economic Analysis of River Basin Projects. Commonly called the "Green Book." Washington: U. S. Government Printing Office. Revised May 1958.

In accordance with Circular A-47 (recreation to be treated apart from other project purposes), allocation of project costs to recreation was limited to separable or incremental costs; that was, the difference between the cost of the multi-purpose project and the cost of the project with recreation omitted. Benefits are to be calculated by comparing expected recreational activity in the area with and without the project.

7. U. S. Department of the Army. Corps of Engineers. "Recreation as a Purpose in Civil Works Projects." Engineering Manual 1120-2-115. Washington. August 24, 1959.

The Corps directed, under the authority of the Fish and Wildlife Coordination Act of 1958, that recreational benefits be incorporated into economic analysis whenever recreation was designed as a project purpose. Effectively, under this directive, recreation could justify only 15 percent of a project. However, a general policy recognizing recreation was absent although specific project authorization did recognize recreation.

8. U. S. Congress. Senate. Policies, Standards, and Procedures in the Formulation, Evaluation and Review of Plans for Use and Development of Water and Related Land Resources. 87th Congress, 2d Session. Senate Document No. 97. Washington: U. S. Government Printing Office, 1962.

This Document states:

Full consideration shall be given to the opportunity and need for outdoor recreational . . . enhancement in comprehensive planning for water and related land use and development, and project formulation and evaluation . . .
(page 6)

The requirements are that:

. . . Benefits and costs shall be expressed in comparable quantitative economic terms to the fullest extent possible.

2. Comprehensive plans shall be formulated initially to include all units and purposes which satisfy these criteria in quantitative economic terms;

- (a) Tangible benefits exceed project economic costs.
- (b) Each separable unit or purpose provides benefits at least equal to its costs.
- (c) The scope of development is such as to provide the maximum net benefits.
- (d) There is no more economical means, evaluated on a comparable basis, of accomplishing the same purpose which would be precluded from development if the plan were undertaken. (pages 7-8)

In order to include recreation, the document states:

Recreation benefits: The value as a result of the project of net increases in the quantity and quality of boating, swimming, camping, picnicking, winter sports, hiking, horseback riding, sightseeing, and similar outdoor activities. (Fishing, hunting, and appreciation and preservation of fish and wildlife are included under par. V-E-10.) In the general absence of market prices, values for specific recreational activities may be derived or estimated on the basis of a simulated market giving weight to all pertinent considerations, including charges that recreationists should be willing to pay and to any actual charges being paid by users for comparable opportunities at other installations or on the basis of justifiable alternative costs
(page 10)

Thus, this document provides for full consideration of recreation as a purpose in project formulation and evaluation. Recreation, then, was to be treated as a joint product with other project purposes.

9. U. S. Congress. Senate. Evaluation Standards for Primary Outdoor Recreation Benefits. 87th Congress, 2d Session. Senate Document No. 97, Supplement No. 1. Washington: U. S. Government Printing Office, June 4, 1964.

Supplement No. 1 states that:

The purpose of this supplement is to provide standards, pending further research, for the evaluation of recreation benefits from the use of recreation resources provided by water and related land development projects. Investigations and planning for recreation purposes, including appraisal of recreational values, should be of comparable scope and intensity to studies of other project purposes. (page 1)

Part of the scope of the Supplement No. 1 states:

The standards prescribed in this supplement are intended primarily for the evaluation of recreation benefits associated directly with the use by outdoor recreationists of services made available by the project . . . (page 2)

It then defines the terms used; among the terms defined was the recreation day which is to be used as the standard unit of measurement for demand. It states that:

A recreation day, as defined herein, will be used as the standard unit of measurement for the determination of primary outdoor recreation benefits. Estimates of the pattern of total annual recreation days of use over the economic life of the project will be developed. This generally will require estimates of use during both the initial development period and at optimum carrying capacity. (page 3)

This supplement defines a recreation day as:

A standard unit of use consisting of a visit by one individual to a recreation development or area for recreation purposes during any reasonable portion or all of a 24-hour period. (page 3)

Supplement No. 1 contains a "Schedule of Monetary Unit Values for Tangible Benefits." It states that:

A single unit value will be assigned per recreation day regardless of whether the user engages in one activity or several. The unit value, however, may reflect both the quality of activity and the degree to which opportunities to engage in a number of activities are provided. (page 4)

Supplement No. 1 goes on to list a range of values for two types of outdoor recreation day—general and specialized. The "General Project Recreation Activities" are categorized into the following:

. . . most warm water fishing, swimming, picnicking, hiking, sightseeing, most small game hunting, nature studies (except nature photography), tent and trailers camping, marine pier and party boat fishing, water skiing, scuba diving, motor boating, sailing, and canoeing in placid waters. (page 3)

The "Specialized Project Recreation Activities" are categorized into the following:

. . . cold water fishing for resident and migratory species, upland bird and waterfowl hunting, specialized nature photography, big game hunting, wilderness pack trips, white water boating and canoeing, and long-range cruisers in areas of outstanding scenic environment. (page 3)

<u>Type of Outdoor Recreation Day</u>	<u>Range of Unit Day Values</u>
<u>General</u>	\$0.50-\$1.50
(A recreation day involving primarily those activities attractive to the majority of outdoor recreationists and which generally require the development and maintenance of convenient access and adequate facilities . . .)	
<u>Specialized</u>	\$2.00-\$6.00
(A recreation day involving those activities for which opportunities, in general, are limited, intensity of use is low, and often may involve a large personal expense by the users . . .) (page 4)	

Supplement No. 1 states:

. . . The unit values per recreation day set forth herein are intended to measure the amount that the users should be willing to pay, if such payment were required, to avail themselves of the project recreation resources. (page 5)

This supplement provides standards for the evaluation of recreation benefits. A schedule of monetary unit values for tangible benefits is given.

10. Federal Water Project Recreation Act, Public Law 89-72, 79 Stat. 213, July 9, 1965.

This act states the policy that:

(a) full consideration shall be given to recreation and fish and wildlife enhancement as purposes of Federal water projects; (b) planning with respect to recreational aspects of a project shall be coordinated with existing and planned recreation developments; and (c) project construction.

Agencies shall encourage non-Federal public bodies to assume responsibility for management of project areas and facilities, except at those projects which are appropriate for Federal administration because of other Federal programs.

For projects authorized where there is non-Federal interest, the recreation and fish and wildlife benefits shall be limited to the number of visitor-days and the value per visitor-day which would take place on the basis of the provision of minimum facilities for public health and safety, and excluding any additional land which may be acquired expressly to provide for subsequent recreation or fish and wildlife enhancement development.

11. The National Archives of the United States, "Establishment of Principles and Standards for Planners." Federal Register, Monday, September 10, 1974.

The principles provide the broad policy framework for planning activities and include the conceptual basis for planning.

The standards provide for uniformity and consistency in comparing, measuring, and judging beneficial and adverse effects of alternative plans.

In Standards for Planning Water and Related Land Resource, section I-B stated:

1. Comprehensive planning. These standards apply to Federal participation in comprehensive framework studies and assessments and regional or river basin planning of water and land resources . . . (page 22)

2. Federal and federally assisted programs and projects. These standards apply to the planning and evaluation of the effects of the following water and land programs, projects, and activities carried out directly by the Federal Government and by State or other entities with Federal financial or technical assistance;

- (a) Corps of Engineers civil functions;
- (b) Bureau of Reclamation projects;
- (c) Federally constructed watershed and water and land programs;
- (d) National parks and recreation areas;
- (e) Wild, scenic, recreational rivers and wilderness areas;
- (f) Wetland and estuary projects and coastal zones;
- (g) Federal waterfowl refuges;
- (h) Tennessee Valley Authority. (page 23)

In section F. Beneficial effects on National Economic Development, subsection (e) Recreation stated:

. . . the increase in recreation provided by a plan, since it represents a direct consumption good, may be measured or valued on the basis of simulated willingness to pay. In computing the projected recreation demand, however, the analysis should take explicit account of competition from recreation opportunities within the area of influence of the proposed plan.

There are in existence a number of methods, or approaches, to approximating demand and what people are willing to pay for outdoor recreation. A generalized

methodology encompassing the travel-distance approach is set forth below.

(1) An analytical approach relating to travel cost to distance.

(2) Other approaches. A variety of other approaches may be taken toward the evaluation of recreation goods and services . . . no one method is completely satisfactory to the exclusion of all others. The applicable rule to follow, taking cognizance of the unique circumstances of a particular setting, including the availability of actual market data and experience, is to use that procedure which appears to provide the best measure or expression of willingness to pay by the actual consumer of the recreation good or service provided by the plan. (Emphasis provided)

In the interim, while recreation evaluation methodology is being further developed, the following schedule of monetary unit values may be used in the preparation of plans.

<u>Type of Outdoor Recreation Day</u>	<u>Range of Unit Day Values</u>
<u>General</u>	\$0.75-\$2.25
<u>Specialized</u>	\$3.00-\$9.00

(pages 50-52)

Independent Research

Hinote presented a current state-of-the-art for benefit-cost analysis for water resource projects (8). Chapter VI contained an annotated bibliography dealing with recreation. The chapter was broken down into sections which consisted of A—Definition of Outdoor Recreation, B—Forecasting Demand, C—Benefit Measurement and/or Cost Determination, D—Evaluation Techniques, E—Decision Criteria, F—Major Governmental Background.

In 1974, Jack L. Knetsch gave a critical analysis of the method to be used by Federal agencies in Supplement No. 1 to Senate Document 97 (9).

Knetsch stated:

The criterion for evaluating the benefits to users of recreation afforded by alternative developments of natural resources is in principle given by the willingness of users to pay for the alternative opportunities and is measured by the area under the appropriate demand curve. It is this measure that should be compared with the costs of providing facilities.

. . . A path commonly followed is that prescribed for United States agencies for many years (U. S. Congress, 1964). This criterion essentially takes recreational benefit to be the total number of recreation days estimated to occur at a site multiplied by a unit day value The value chosen within this range is usually dependent on the amount of development at the site.

Although the method is correct in that it attempts to associate the value of recreational benefits with a value purporting to be what consumers of the commodity would be willing to pay for the opportunity to participate, it is in fact a very poor operational definition of this criterion. (pages 65-66)

In 1974, Charles B. Garrison published a report which attempted to estimate the local economic impact of recreation activities at Norris Lake (10). The results showed:

. . . the contribution of recreation expenditures to the economy has been relatively unimportant. This is the case despite the popularity of Norris Lake, which has an annual visitation in excess of two million persons. . . . The net result of the income and employment changes occurring in the area was continued outmigration and a small population decrease from 1960 to 1970. (page 18)

The book, The 1965 Survey of Outdoor Recreation (11) was undertaken by the Bureau of Outdoor Recreation "as an integral part of the development of the nationwide outdoor recreation planning program" (page i).

"The Survey was designed to provide data which would be helpful in identifying present and future outdoor recreation needs. . . . the Bureau of Outdoor Recreation contracted with the Bureau of the Census

to conduct a nationwide survey of participation and preferences for outdoor recreation activities" (page i).

For example, the publication consisted of trends in participation, preferences, travel, outdoor recreational activities on a seasonal basis.

CHAPTER IV

COMPARISONS OF DEMAND AND VALUE MEASUREMENTS

It was the intent of this investigation to evaluate how TVA used recreational benefits in resource allocation for multiple-purpose water resource projects. One way to accomplish this was (A) a comparison of demand and value measurements of TVA and other Federal agencies reservoir projects with the literature review and (B) a comparison of methods used by TVA and other Federal agencies in estimating demand and value measurements for recreational benefits.

Comparisons

A. Prior to 1962 there was no recognition of recreational benefits as a joint project purpose. Senate Document 97 officially changed this by recognizing recreation as a major project purpose. However, by 1962 TVA had completed most of its multiple-purpose water resource projects, i.e., dams. In studying TVA's water resource projects after 1962, only four of the five multiple-purpose projects had recreational benefits incorporated into their benefit-cost studies. Appendix B contains a list of these five projects along with a project construction schedule and a map showing the location of these projects.

The Melton Hill dam did not have recreational benefits incorporated into its benefit-cost study. However, it mentioned recreational benefits as unevaluated and thus would be an example of how recreational benefits were treated prior to their justification as a major project purpose.

For Melton Hill dam, the project planning report (12) stated:

. . . The reservoir, because of its excellent quality, and suitable shoreline topography, would create ideal conditions for recreational use and development.
(page 32)

In Project Planning Report No. 50-100 for the Tellico Project on the Little Tennessee River (13), the report had recreation included under the heading of General Economic Development. The report stated:

Recreation . . . includes only those activities and facilities usually thought of in connection with vacations at fresh-water lakes. These leisure-time aspects include permanent homes, summer cottages and camps, restaurants, concession stands, boat docks, swimming, etc. Fishing, hunting, and associated services are also included in the concept of recreation.

. . . Consideration was given to the many advantages previously mentioned in estimating that the average visitor-day use of the Tellico reservoir within 5 to 7 years after completion would be in the order of 1.75 million per year. This number of visits would result in considerable benefit to the area from expenditures made for facilities and equipment associated with recreational use of the reservoir. (pages 37-38)

General economic developments were estimated at \$15 million and a benefit-cost ratio of 1.5 to 1.0.

The 1965 project planning report for Tellico (14) stated:

. . . Recreation use of the Tellico project should increase at a rapid rate, eventually exceeding the average use of main stream reservoirs. TVA estimates that such use would reach 1,750,000 visitors annually within five to seven years after completion of the project and would begin to level off at 2,500,000 visitors within twelve to fifteen years. To accommodate this growth, it is estimated that private investment in shoreline development would total some \$5 million within 10 years or less after completion of the project.
(pages 7-8)

In a 1972 environmental impact statement for the Tellico project (15), the report stated recreational benefits as:

In evaluating the proposed Tellico project, TVA lists annual net recreational visits of \$1,440,000. The estimation for general recreation can be derived by utilizing a valuation figure of \$1.00 per day visit which is at the midpoint of the allowable range. An estimated annual 856 day visits per acre of lake can be derived from the total number of recreational day visits to TVA reservoirs in a year and the total acres of projected lake at full pool capacity. Application of this visitation rate to the planned full pool capacity of the proposed Tellico impoundment at \$1.00 per day visit yields annual benefits of approximately \$1,400,000. (page 49)

In Project Planning Report No. 54.4 for the Tims Ford Project on the Elks River (16), the report stated recreational benefits as:

. . . water-oriented activities would reach about 2 million visitor-days annually within a period of 10 years after completion of the project. On the basis of the experience of other TVA reservoirs, such intensive use would result in an investment in recreational facilities which would amount to approximately \$25,000 per mile of shoreline at the end of 25 years. (page 20)

In Project Planning Report No. 54-100 for the Tims Ford Project (17), the report stated recreational benefits as:

TVA experience with reservoirs of similar size and characteristics indicates that about 1,850,000 visitors a year can be expected to use the lake within 10 years after the project is completed Using the minimum value of \$0.50, the annual net benefit from 1,850,000 visitor-days would be \$925,000. After allowing for a portion of the operation and maintenance costs of the reservoir, which is common to all purposes, and capitalizing the remainder at 3-1/9 percent for the service life of the project, the resulting justifiable investment would be about 27,000,000. (page 33)

In Feasibility Report No. 0-6438 for the Bear Creek Watershed (18), the report stated recreational benefits as:

The minimum value of \$0.50 per person-day is being used to be conservative although it is considered extremely

low For this feasibility report annual dollar benefits for water-based recreation are taken equal to one-half of the estimated person-day use. (page 4)

Benefits from recreation water provided in the 3 multiple use reservoirs are estimated to total \$132,000 annually. (page 6)

In Project Planning Report No. 59-100 for Bear Creek (19), the report stated recreational benefits as:

. . . The annual days for all of the projects have estimated to be 378,000 excluding those visitors primarily interested in fishing and hunting.

Figures varying from \$0.50 to \$2.50 have been used as a measure of the net income creditable to a project as a result of one visitor-day.

For the Bear Creek area the annual benefit of \$0.50 per visitor-day. This would result in a capitalized benefit of \$5,762,000 when capitalized at 3-1/8 percent with a service life of 100 years. (page 26)

In a 1972 environmental impact statement for the Bear Creek Project (20), the report stated recreational benefits as:

The \$200,000 estimated annual value for recreation consists of the reservoir being used for swimming, boating, and skiing, and shoreline would be used for picnicking. (page 34)

In Project Planning Report No. 65-100-1 for the Duck River Project (21), the report stated recreational benefits as:

Based on past experience at similar projects, the recreational usage of the two reservoirs comprising the Duck River Project, excluding hunting and fishing, is estimated to be 1,065,000, 1,450,000, and 1,470,000 in 1980, 2000, and 2020 respectively. Since the project demand for reservoir-oriented activities is considerably larger than this usages, it is evident that the recreation potential of the Duck River Project will be fully utilized but can supply only part of the expected demand. Using \$1 per recreation-day as the applicable value for day-use areas when certain minimum facilities are added and converting these values to present worth, the average annual benefit would be an estimated \$1,275,000. (page 38)

The planning report also stated:

The reservoir recreation demand for the project was estimated by using the Bureau of Outdoor Recreation 1965 Participation Rates for the East-South-Central Census Region for 11 Selected Activities. These activities include those reservoir oriented or reservoir-related uses which are expected to be major determinants of the demand for reservoir recreation in the project market area. Of all the social and economic factors considered by the Bureau of Outdoor Recreation, per capita income was found to be the most significant determinant of participation rates. The demand estimates are adjusted for the difference in per capita income between the project market area and the east south-central census region. The local market area includes all those counties within a 1-hour drive of the project, but the primary local market is confined to the 13 counties within or immediately adjacent to the Duck River Basin.

The net recreation demand from the primary local market area is estimated at 64 percent of the total recreation demand for the Duck River Project in 1980 and 70 percent in both 2000 and 2020. A larger regional market area, located between 1 and 3 hours' driving time from the project, was also utilized in the study. Although some use is expected to originate beyond a 3-hour drive, it was not determined in this study. The projected populations, 12 years and older, for these market areas are:

Year	Primary Local Area (13 counties)	Regional & Remaining Local Area
1980	284,000	2,272,000
2000	366,000	3,090,000
2020	464,000	4,059,000

(page 39)

Table 11 summarized pertinent recreation demand and supply estimates for the eleven selected recreation activities. The gross potential demand from the primary local market area is adjusted for the expected supply of recreation opportunities without the Duck River Project. This has been done in two steps: (1) deducting the nonreservoir and nonpark-oriented demand and (2) deducting that portion of demand which

is expected to occur at alternative reservoirs and parks existing or presently under construction.

In a 1972 environmental impact statement for the Duck River Project (22), the report stated recreational benefits as:

The Duck River Project would provide opportunities for a variety of water-based recreation activities to complement the area's existing natural and man-made recreation attraction. Based on past experience at similar projects, the potential recreational use of the two reservoirs, excluding hunting and fishing, is estimated to be 1,065,000 recreation days 1980; 1,450,000 in 2000; and 1,470,000 in 2020. The demand for recreation in the project area was estimated from participation rates established by the Bureau of Outdoor Recreation for the east south-central census area. Even though there are already opportunities for recreation in the project area, these estimates showed that the recreation potential for the Duck River project would be fully utilized but could supply only part of the expected demand. Using \$1 per recreation day as the applicable value for day-use areas when certain minimum facilities are added and converting those values to present worth, TVA estimated the average annual benefit to be \$1,200,000. (page 37)

In Project Planning Report No. 65-100 for the Columbia Dam (23), the report stated recreational benefits as:

After a 5-year development period the project is expected to receive an average of 900,000 annual recreation visits, exclusive of those for hunting and fishing. Using \$1 per recreation-day as the applicable value for day-use areas when certain minimum facilities are provided, the annual benefit would be \$900,000. This benefit would accrue only if adequate public, commercial, and private facilities and services enterprises of a good quality are provided at the proper time. (page 35) (Emphasis provided)

After searching different Federal agencies, three agencies were found that had done project planning reports in which the benefit-cost analysis had used recreational benefits. The three agencies were: (1) the United States Corps of Army Engineers, (2) United States Soil Conservation Service, and (3) United States Bureau of Reclamation.

The Corps of Army Engineers provided three water resource projects which had used recreational benefits in the benefit-cost analysis.

The projects were: (1) Laurel River Project, (2) Martins Fork Reservoir, and (3) the Big South Fork.

In the Letter from the Secretary of the Army for the Laurel River Project (24), paragraph 106 stated recreational benefits as:

The report contends that the project would contribute substantially to the local economic and social advancement. It estimates that, with the provision of basic facilities, non-fishing, non-hunting recreation use would average about 150,000 visitors-days annually A monetary figure representing average annual non-fishing, non-hunting recreation benefits is computed by the Park Service by multiplying the estimated average annual attendance by \$1.60, a derived market value for a day reservoir recreation, for a total of \$240,000.
(page 54)

In the Letter from the Secretary of the Army for the Martins Fork Reservoir (25), paragraph 98 stated recreational benefits as:

. . . A unit value of one dollar per man-day was selected as the benefit for recreation usage, regardless of the type of activity involved. Application of this unit value to initial and ultimate visitation estimates, as developed in the earlier sections on recreation, gives average annual benefits over a 100-year project life of \$83,000 with allowance for discount factors. (page 45)

In Supplement to Review Report for the Big South Fork Project (26), paragraph 51 stated recreational benefits as:

. . . Using a unit value of \$1.25 per visitor day for general recreation and \$1.00 for reservoir fishing as furnished by the Bureau of Outdoor Recreation and the Bureau of Sports Fisheries and Wildlife, respectively, average annual benefits attributable to recreation amounts to \$1,471,000 (100 years and 4-7/8 percent interest).
(page 21)

The \$1,471,000 consists of the \$1,385,900 for the 100 year project life for general recreation, with allowances for discount factors, and \$85,200 for fishing activities.

The Soil Conservation Service provided two water resource projects which had used recreational benefits in the benefit-cost analysis. The projects were: (1) Marion County Recreation Park and (2) Meigs County Recreation Park.

In Water-Based Recreation Measure Plan from the Southeast Tennessee RC&D Project for Marion County Park (27), the report stated recreational benefits as:

The average annual benefits used in justification of the RC&D measure are estimated to be \$67,900. The direct primary recreation benefits are \$55,425 (36,950 annual recreational visits having an estimated value of \$1.50 each). The value of local secondary benefits that will accrue to the surrounding area due to project installation amounts to \$5,550. The economic impact of project installation is considered pertinent; and redevelopment benefits of \$5,925 were evaluated and used in measure justification. These benefits will accrue primarily to underemployed and unemployed people in this area. Even though the provisions set forth for operation and maintenance will provide continuing benefits throughout project life, only the impact on the local economy for the first 25 years was used.

The average annual benefits are estimated to be \$67,900; and the average annual cost to install, operate, and maintain the facilities is estimated to be \$34,038, which yields a benefit-cost ratio of 2.0 to 1.0. (page 20)

In Water-Based Recreation Measure Plan from the Southeast Tennessee RC&D Project for Meigs County Park (28), the report stated recreational benefits as:

The average annual benefits used in justification of the measure are estimated to be \$84,400. The direct primary recreational benefits are \$60,000. The value of local

secondary benefits which will accrue to the surrounding area due to measure installation amounts to \$6,000. The economic impact of measure installation is considered pertinent and redevelopment benefits of \$18,400 were evaluated and used in the measure justification. These benefits will accrue primarily to underemployed and unemployed people in this area. Provisions set forth for operation, maintenance, and replacement, will provide continuing benefits throughout the project life but only the impact on the local economy for the first 25 years was considered.

The average annual benefits are estimated to be \$84,400 and the average annual cost to install, operate, and maintain the facilities are estimated to be \$54,290, which yields a benefit-cost ratio of 1.6 to 1.0. (page 23)

Project Planning reports from the Bureau of Reclamation were requested but the information had not arrived in time to be included.

Appendix C contains Tables 2 through 18 which are the benefit-cost analyses for 10 projects studied.

B. This part of the comparison section shows methods used by TVA and other Federal agencies in estimating demand and value measurements for recreational benefits.

Recreation day was to be the standard unit for the estimation of demand measurement. However, neither Senate Document 97 nor Supplement No. 1 stated how the recreation day was to be measured. Since no one technique was set forth, the agencies could use the technique in which they had the data and the expertise.

TVA utilized several techniques for estimating project related outdoor recreation benefits: (1) visits per shoreline mile, (2) distance zone-participation rate, and (3) land use plans (29).

Visits per shoreline mile involved estimating the number of visits per shoreline mile on a similar existing project. The estimated visits per shoreline mile was

then applied to the miles of shoreline of the proposed reservoir to obtain an estimate of average annual recreation visitation. This initial estimate was subject to modification based on judgments regarding how the new project was expected to differ from the existing project(s) from the standpoint of topography, drawdown, location with respect to population centers, and other pertinent factors. A dollar value per visit within the guidelines of Supplement No. 1 to Senate Document No. 97 was applied to the final estimated average annual visits to arrive at an estimated average annual recreation benefit. (page 1)

The Tellico dam project used visits per shoreline mile method to determine average annual recreation benefits.

Distance zone-participation rate was employed in estimating recreation visitation and the associated benefits utilized Bureau of Outdoor Recreation 1965 participation rates for the east-south-central census region for eleven selected activities to determine the "demand" for reservoir recreation. the participation rates were applied to the current and projected populations of some very general distance zones to determine gross potential participation. The existing and projected alternative recreation supply in terms of activity occasions without the project was removed from the gross potential participation estimate to determine estimated average annual recreation visitation to the project. A dollar value within Supplement No. 1 to Senate Document No. 97 guidelines was applied to the estimated average annual visitation to yield estimated average annual recreation benefits. (page 1)

The Duck River project used distance zone-participation rate method to determine average annual recreation benefits.

Land use plans used to estimate recreation benefits involves relating past and future participation as evidenced by demand studies included in the various state comprehensive outdoor recreation plans and other sources to a reservoir recreation land use plan. The visitation estimate obtained is a function of facilities which are determined by the "market" and land suitability and capability. Benefits are derived for each type of facility by assigning a value per visit which is an estimate of willingness to pay. Under this method, benefits are also derived from land enhancement as well as an estimate of enhanced employment provided by the various facilities. (page 2)

The Tims Ford and Bear Creek projects used land use plans to determine average annual recreation benefits.

The Corps of Army Engineers took a different approach as compared to TVA.

From a letter entitled "Derivation of Alternative Costs for Recreation in Survey Scope Investigations" (30), it stated:

1. In assigning a benefit value for a recreation day the Bureau of Outdoor Recreation employs unit values from Supplement No. 1 to Senate Document 97. However, in project formulation we cannot use these benefits because they are based on assumed values and are not additive with the values of other project purposes. To provide a meaningful measurement of recreation in a multiple-purpose analysis we should derive an alternative cost representing the least costly single-purpose alternative source of benefits of the same kind, quality, and magnitude as those provided by the multiple-purpose project being studied. The test of efficiency lies in determining the cheapest alternative.

3. . . . the planner should select that curve that most closely reflects the pattern of visitation expected at the reservoir under study. These five curves provide a practical range of typical growth characteristics of recreation visitation at Corps of Engineers Reservoirs. In selecting the most appropriate curve, factors such as proximity to population centers, scenic qualities of the reservoir site, ease of access, recreation visitations at existing reservoirs and state parks in the region should be considered. Judgment must be used in making the selection, but it should be founded in a sound knowledge of the patterns of outdoor recreation visitation. (page 1)

Supplement No. 1 listed a range of values for two types of outdoor recreation. However, Supplement No. 1 does not state how to determine which value to use except by stating that "day values will be established by the consensus judgment of qualified technicians" (page 5). This also allows the agencies to use their own judgment.

TVA divided the unit day values into low end and high end values. For example, the low end values would consist of open-underdeveloped land, boat-launching areas, a parking lot, a campsite, a picnic table and thus would be assigned a range of unit day values of lower magnitude while the high end values would consist of commercial facilities and state parks and thus would be assigned a high range value. These values were to be assigned on the degree of projected development which was to take place.

CHAPTER V

RESULTS AND DISCUSSION

Results

The comparison of demand and value measurements of TVA and other Federal agencies reservoir projects with the literature review showed how both TVA and the other Federal agencies complied with Senate Document 97 and Supplement No. 1 in estimating demand and value measurements for the water resource projects.

In comparing TVA with other Federal agencies on measurement of demand, it was found that TVA and the Corps of Army Engineers differed in methods used to estimate demand. This was legal because Supplement No. 1 defines only a recreation day as the standard unit for measurement of demand and not methods for determining a recreation day. Information was not available from the Soil Conservation Service or the Bureau of Reclamation to compare with the other agencies.

A detailed comparison of TVA with other Federal agencies on measurement of value could not be done because of lack of information. Since Supplement No. 1 did not state how to determine which value to use, TVA was allowed to determine what the low end and high end values should be. However, this determination was done by a consensus judgment of qualified technicians.

Discussion

In studying how TVA attempted to include the use of recreational benefit in resource allocation for multiple-purpose water resource projects, the set guidelines provided no criteria for arriving at the benefit-cost figures.

The comparison of demand and value measurements calculated by TVA and other Federal agencies in an attempt to show how TVA's estimation of recreational benefits compared with other Federal agencies proved to be of little value here because the information found in TVA's project planning reports, the Corps of Engineers' letters to the Secretary of the Army, and the Soil Conservation Service's recreation measure plans did not indicate how the demand or value measurements were calculated nor the criteria used to estimate demand or value measurements. Summary information was available on the methods used to determine demand measurements by TVA and the Corps of Army Engineers. Also, limited information on how TVA divided value measurements in low and high end values was available.

One of the procedures used in this study was a comparison of demand and value measurements calculated by TVA and other Federal agencies.

Due to lack of funds, time and personal contacts, the information critical to this comparison was unobtainable by the writer.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this investigation was to evaluate how TVA attempted to include the use of recreational benefits in resource allocation for multiple-purpose water resource projects.

The comparison of demand and value measurements of TVA and other Federal agencies reservoir projects with the literature review showed that each conformed to the Federal guidelines. The benefit-cost studies in Appendix C showed that each agency used different methodologies to conform with the regulations.

The few demand and value measurements calculated by TVA and other Federal agencies showed different methods for estimating each measurement. It appeared that there was no consensus estimating demand and value measurements.

The information derived from the study does not compare TVA's projections with actual figures after completion. Since the TVA projects studied were either under construction or recently completed, there was no way to prove which methods provided the most accurate projections of recreational benefits.

In summary, TVA used their own methods to determine the demand and value measurements for recreational benefits. The Federal standards allowed TVA to do this. However, due to the unattainability of criteria used for determining demand and value measurements for TVA and other Federal agencies reservoir projects, a comparison of demand and value

measurements could not be made. This comparison was to have been the key factor in evaluating how TVA included the use of recreational benefits in water resource projects. Without this comparison, the study did not accomplish that objective.

On the basis of the information found in this study, it is recommended that:

1. Some standardized method(s) be developed for determining the value of water based recreational benefits.
2. Methodologies be developed to determine the most accurate standard criteria for demand and value measurements.
3. Procedures be established to determine which estimated recreational benefits are most accurate. For example, five and ten year intervals could be used to check the validity of recreational benefit projections.
4. Criteria used in determining demand and value measurements should be verified by further field study at the reservoirs.
5. Standardized criteria and procedures for analyzing data be formulated in order to single-out pertinent information for more accurate recreational benefit projections.

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APPENDICES

APPENDIX A

GLOSSARY

Benefit-cost analysis—a means by which the benefits and costs of public investments can be systematically described and related.

Consumer's surplus method—the difference between what people pay for a good or service and what they would be willing to pay rather than do without it.

Cost method—a cost allocation procedure which assumes that the value of the recreation product is equal to some ratio of its cost.

Demand measurement—the projected number of persons that are projected to use a particular facility.

Expenditure approach—a measure of the economic value of recreation by determining how much is spent for it by the recreationist.

Gross national product method—a method to determine how much expenditure would be made for recreational goods and services on and off the area, and the income that this expenditure would induce in the economy.

Intangible benefits—those benefits which, although recognized as having real value in satisfying human needs or desires, are not fully measureable in monetary terms, or are incapable of such expression in formal analysis.

Market value method—a method to determine the average value of a recreation day at private recreation areas, i.e., it attempts to use fees charged at private areas as a measure of benefits.

Recreational benefits—increases or gains, net of associated or induced costs, in the value of goods and services which result from conditions with the project, as compared with conditions without the project.

Survey method—responses of participants to questions as a means for estimating their willingness to pay.

Tangible benefits—those benefits that can be expressed in monetary terms derived from actual or simulated market prices for the products or services.

Travel cost method—a method used to estimate willingness to pay from the actual behavior of participants.

Value measurement—the monetary value assigned to use of a facility for certain activities.

APPENDIX B

TABLE 1
TVA'S PROJECT CONSTRUCTION SCHEDULE

Project	Start	Completion
Melton Hill Dam	9/60	5/63
Tellico Dam	3/67	1/77 ¹
Tims Ford Dam	3/66	12/70
Bear Creek Watershed	5/67	3/69 ²
Duck River Project:		
Columbia Dam &	8/73	1/80
Normandy Dam	6/72	1/76

¹Cour order stopped completion.

²Channel improvements not complete.

Source: Compiled the TVA Handbook's section on Dams and Reservoirs, pp. 43-56, May 1977.

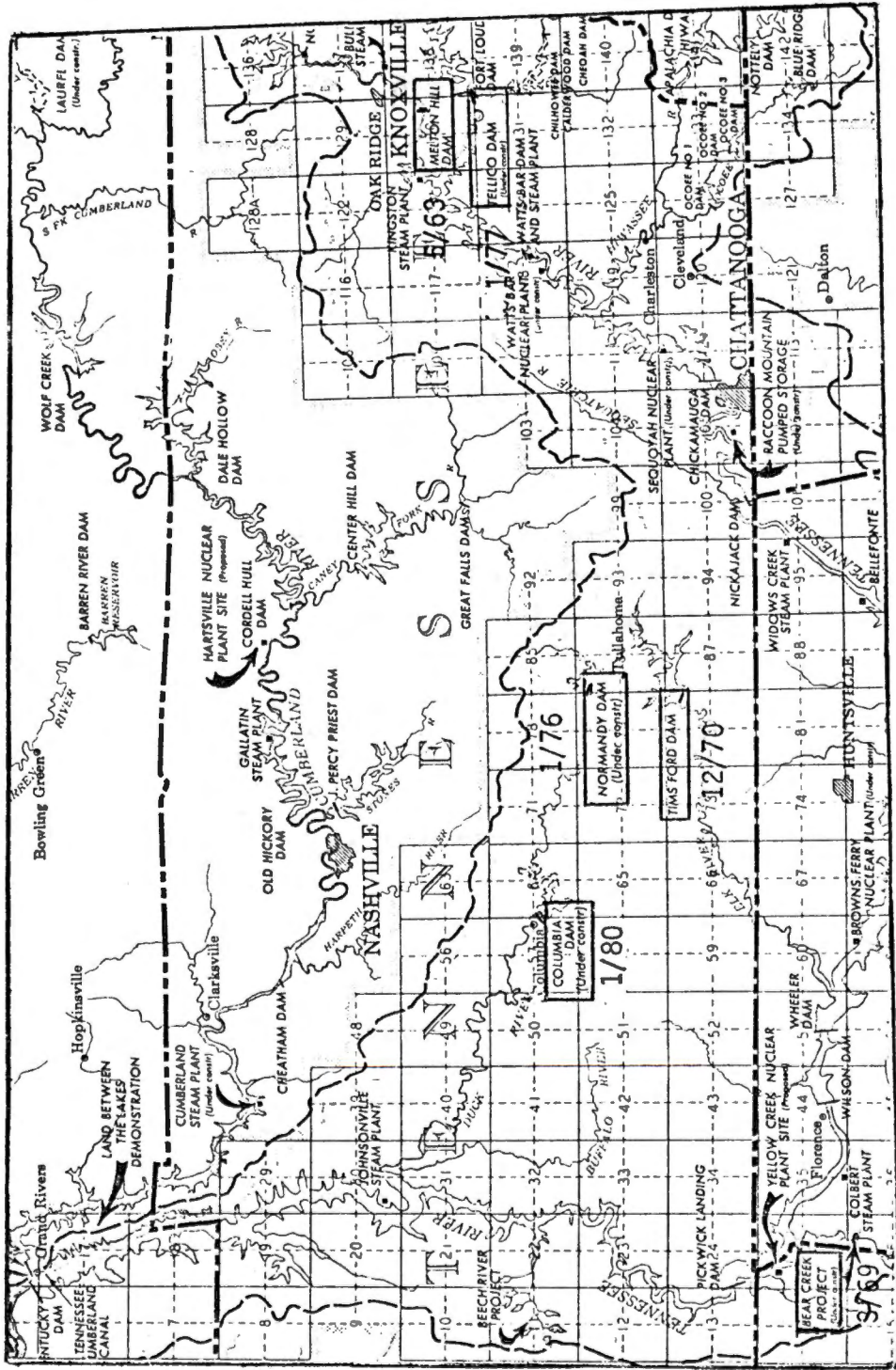


Figure 1. Projects indicated by enclosed areas and dates indicated scheduled project completion.

Source: TVA-USGS Topographic Maps, Tennessee Valley Watershed.

APPENDIX C

APPENDIX C

Tables 2 through 18 contain benefit-cost studies from TVA, Corps of Army Engineers, and the Soil Conservation Service. The TVA's benefit-cost studies were constructed from project planning reports and environmental statements. The Corps of Army Engineers' benefit-cost studies were taken from Letter from The Secretary of the Army. The Soil Conservation Service's benefit-cost studies were taken from Southeast Tennessee RC&D Project, a Water Based Recreation Measure Plan's.

TABLE 2
BENEFIT-COST STUDY FOR THE MELTON HILL PROJECT, SEPTEMBER 1957

<u>Annual Costs</u>	
Interest	\$ 460,000
Amortization	629,000
Operation and Maintenance	<u>150,000</u>
Total Annual Costs	\$ 1,239,000
<u>Annual Benefits</u>	
Power:	
Peaking capability:	
80,000- \$8 per kw-yr	\$ 640,000
Average annual energy:	
167,000,000 kwh- 2.5 mills	
per kwh	<u>418,000</u>
Estimated total annual power benefits	\$ 1,058,000
Navigation:	
Barge transportation	<u>729,000</u>
Total Annual Benefits	\$ 1,787,000
Benefit-Cost Ratio	1.2:1.0

Source: Compiled from TVA report No. 36-100-1, September 1957.

TABLE 3
BENEFIT-COST STUDY FOR THE TELLICO PROJECT, OCTOBER 1963

Net Cost of the Project	\$ 30,500,000
 <u>Benefits</u>	
Navigation	\$ 11,800,000
Flood Control	10,700,000
Power	<u>8,400,000</u>
Subtotal	30,900,000
General Economic Development	<u>15,000,000</u>
Total Benefits	\$ 45,900,000
Benefit-Cost Ratio	1.5:1.0

Source: Compiled from TVA report No. 50-100, October 1963.

TABLE 4

BENEFIT-COST STUDY FOR THE TELLICO PROJECT, FEBRUARY 1972

Annual Costs

Interest and Amortization	\$ 2,450,000
Operation and Maintenance, including replacement	<u>205,000</u>
Total Annual Costs	\$ 2,250,000

Annual Benefits

Flood Control	\$ 505,000
Navigation	400,000
Power	290,000
Recreation	1,440,000
Water Supply	70,000
Fish and Wildlife	220,000
Shoreline Development	710,000
Redevelopment	<u>15,000</u>
Total Direct Annual Benefits	\$ 3,760,000
Benefit-Cost Ratio for Direct Benefits	1.7:1.0
Secondary Annual Benefits	
Enhanced Employment	<u>\$ 3,650,000</u>
Total Annual Benefits	\$ 7,410,000
Benefit-Cost Ratio, including Secondary Benefits	3.0:1.0

Source: Compiled from TVA's Environmental Statement, Tellico Project, Volume No. 1, February 10, 1972.

TABLE 5
BENEFIT-COST STUDY FOR THE TIMS FORD PROJECT, JUNE 1964

	<u>Cost</u>
Estimated Construction Cost	\$ 30,300,000
Allowance for Interest during Construction	<u>1,000,000</u>
Project Cost (for economic appraisal)	\$ 31,300,000
Estimated Capital Benefits:	
Flood Control (system)	\$ 5,900,000
Flood Relief (agriculture)	2,200,000
Power	<u>8,100,000</u>
Subtotal	16,200,000
Portion of Cost Justified by the benefits	52%
Other Estimated Capital Benefits:	
Land Enhancement	2,900,000
Recreation	18,150,000
Water Supply	2,000,000
Water Quality Control	150,000
Commercial fishing	<u>1,500,000</u>
Subtotal	<u>\$ 24,700,000</u>
Total Estimated Capital Benefits	\$ 40,900,000
Net Benefits	9,600,000
Benefit-Cost Ratio	1.3:1.0

Source: Compiled from TVA Report No. 54.4, June 1964.

TABLE 6
BENEFIT-COST STUDY FOR THE TIMS FORD PROJECT, OCTOBER 1965

Estimated Construction Cost	\$ 39,000,000
Allowance for Interest during Construction	<u>1,700,000</u>
Project Cost (for economic appraisal only)	\$ 40,000,000
 Estimated Capital Benefits:	
Flood Control	\$ 7,800,000
Power	6,600,000
Shoreline Development	7,800,000
Recreation	27,000,000
Water Supply and Water Quality Control	2,050,000
Commercial Fishing	800,000
Fish and Waterfowl	<u>5,050,000</u>
Total Estimated Capital Benefits	\$ 57,100,000
Net Benefits	\$ 16,400,000
Benefit-Cost Ratio	1.4:1.0

Source: Compiled from TVA Report No. 54-100, October 1965.

TABLE 7

BENEFIT-COST STUDY FOR THE BEAR CREEK WATERSHED, APRIL 1964

Average Annual Charges

Interest on Land	\$ 51,000
Depreciation and Interest (excluding land)	394,000
Operation and Maintenance	<u>52,000</u>
Total Annual Costs	\$ 497,000

Average Annual Benefits

Agricultural	\$ 368,000
Road and Bridges	10,000
System Flood Control	130,000
Recreation	132,000
Shoreland Development	19,000
Redevelopment	43,000
Secondary	<u>88,000</u>
Total Annual Benefits	\$ 790,000
Benefit-Cost Ratio	1.6:1.0
Net Annual Benefits	\$ 293,000

Source: Compiled from TVA Report No. 0-6438, April 1964.

TABLE 8

BENEFIT-COST STUDY FOR THE BEAR CREEK WATERSHED, SEPTEMBER 1964

<u>Estimated Cost of Construction</u>	
Dams and Reservoirs	\$ 14,986,000
Channel Improvements	<u>3,014,000</u>
Subtotal	18,000,000
Allowance for interest during construction	<u>700,000</u>
Total Estimated Cost	\$ 18,700,000
<u>Estimated Capital Benefits</u>	
Flood Control	\$ 13,087,000
Recreation	5,762,000
Fish and Wildlife	2,546,000
Redevelopment	2,900,000
Water Supply	500,000
Water Quality Control	95,000
Shoreline Development	<u>2,325,000</u>
Subtotal	27,206,000
Capitalized Operation and Maintenance Allowances	<u>-1,600,000</u>
Net Capitalized Benefits	\$ 25,606,000
Benefit-Cost Ratio	1.4:1.0

Source: Compiled from TVA Report No. 59-100, September 1964.

TABLE 9

BENEFIT-COST STUDY FOR THE BEAR CREEK WATERSHED, DECEMBER 1972

<u>Annual Costs</u>	
Interest and Amortization	\$ 810,000
Operation and Maintenance	<u>55,000</u>
Total Annual Costs	\$ 865,000
<u>Annual Benefits</u>	
Flood Control	\$ 400,000
Recreation	200,000
Fish and Wildlife	108,000
Shoreline Development	156,000
Water Supply	72,000
Redevelopment	<u>124,000</u>
Total Annual Benefits	\$ 1,060,000
Benefit-Cost Ratio	1.2:1.0

Source: Compiled from TVA's Environmental Statement, Bear Creek Project, (Final), December 29, 1972.

TABLE 10
BENEFIT-COST STUDY FOR THE DUCK RIVER PROJECT, SEPTEMBER 1968

<u>Annual Costs</u>	
Interest and Amortization	\$ 3,685,000
Operation and Maintenance, including replacement	365,000
Total Annual Costs	\$ 4,050,000
<u>Annual Benefits</u>	
Flood Control:	
System	\$ 180,000
Local	185,000
Water Supply	810,000
Water Quality Control	365,000
Recreation	1,275,000
Shoreline Development	320,000
Fish and Wildlife	200,000
Transportation Savings	50,000
Redevelopment	80,000
Expansion	1,445,000
Total Annual Benefits	\$ 4,960,000
Benefit-Cost Ratio	1.2:1.0

Source: Compiled from TVA Report No. 65-100-1, September 1968.

TABLE 11

PROJECTED RECREATION DEMAND FOR THE DUCK RIVER REGION

	Visitation	
	1980	2000
<u>Primary Local Market Area</u>		
Gross recreation demand	5,331,000	7,540,000
Supply without project	2,924,000	3,170,000
Net recreation demand, Duck River Project	<u>2,407,000</u>	<u>4,370,000</u>
<u>Regional and Remaining Local Market Areas</u>		
Gross recreation demand	146,426,000	203,460,000
Recreation demand, Duck River Project	1,340,000	1,840,000
Residual recreation demand	<u>146,086,000</u>	<u>201,620,000</u>
Total Recreation Demand, Duck River Project	3,747,000	6,210,000
Estimated Visitation, Duck River Project	<u>1,065,000</u>	<u>1,450,000</u>
Unsatisfied Demand	-2,682,000	-4,760,000
		<u>1,470,000</u>
		-6,930,000

Source: Taken from TVA's Final Environmental Statement for the Duck River Project, April 28, 1972.

TABLE 12

BENEFIT-COST STUDY FOR THE DUCK RIVER PROJECT, APRIL 1972

Annual Costs

Interest and Amortization	\$ 3,485,000
Operation and Maintenance including replacements . . .	355,000
Other Public Investments	<u>75,000</u>
Total Annual Costs	\$ 3,915,000

Annual Benefits

Flood Control:	
System	\$ 155,000
Local	199,000
Water Supply	777,000
Water Quality Control	295,000
Recreation	1,200,000
Shoreline Development	370,000
Fish and Wildlife	190,000
Transformation Savings	50,000
Redevelopment	85,000
Enhanced Employment	<u>\$ 1,970,000</u>
Total Annual Benefits	\$ 5,275,000
Benefit-Cost Ratio	1.3:1.0

Source: Compiled from TVA's Environmental Statement, Duck River Project, April 1972.

TABLE 13
BENEFIT-COST STUDY FOR THE COLUMBIA PROJECT, AUGUST 1972

Annual Costs

Interest—3-1/4 percent	\$ 1,710,000
Depreciation	54,000
Operation and Maintenance	<u>203,000</u>
Total Annual Costs	\$ 1,967,000

Annual Benefits

Flood Control:	
System	\$ 85,000
Local	121,000
Water Supply	306,000
Water Quality Control	172,000
Recreation	900,000
Shoreline Development	210,000
Fish and Wildlife	200,000
Redevelopment	<u>159,000</u>
Total Annual Benefits	\$ 2,153,000
Benefit-Cost Ratio	1.1:1.0

Source: Compiled from TVA Report No. 65-100, August 1967.

TABLE 14

BENEFIT-COST STUDY FOR THE LAUREL RIVER PROJECT, MAY 1960

<u>Annual Costs</u>		
Corps of Engineers:		
Interest on gross investment-----	574,900	574,900
Adjustment for net loss in productivity of reservoir lands (purchased)-----	---	3,900
Subtotal, interest-----	574,900	578,800
Amortization of net investment-----	235,900	235,500
Maintenance and operation-----	125,000	125,000
Allowance for major replacements-----	19,800	19,800
Total annual charges, Corps of Engineers	955,600	959,100
U. S. Forest Service:		
Interest on investment-----	4,600	4,600
Adjustment for net loss in productivity of reservoir lands (transferred)-----	---	1,100
Subtotal, interest-----	4,600	5,700
Amortization of investment-----	1,900	1,900
Total annual charges, U. S. Forest Service-----	6,500	7,600
Total Federal annual costs-----	(1) 962,100	(1) 966,700
<u>Annual Benefits</u>		
At-site power-----	\$ 661,600	\$ 1,391,000
Downstream power-----	202,400	202,400
Credit from filling period-----	300	300
Subtotal, gross power benefits-----	864,300	1,593,700
Marketing cost-----	(-) 15,000	
Net power benefits-----	649,300	
Recreational benefits-----	264,600	264,600
Total, project benefits-----	1,113,900	1,658,300
<u>Annual Charges</u>		
Economic costs:		
Corps of Engineers-----	959,100	959,100
U. S. Forest Service-----	7,600	7,600
Subtotal, Federal annual costs-----	966,700	966,700
Non-Federal annual costs-----	(1) 30,700	(2) 441,800
Total economic annual costs-----	997,400	1,408,500

TABLE 14 (continued)

<u>Economic Ratio</u>		
Annual benefits/economic costs-----	1.1:1	1.3:1

(1) Payments in lieu of state and local taxes.

(2) Taxes foregone.

Source: Letter from the Secretary of the Army, May 20, 1960.

TABLE 15

MARTINS FORK RESERVOIR PROJECT SUMMARY OF ESTIMATED
RECREATIONAL USAGE AND BENEFITS, JUNE 1965

Item	Initial development	Ultimate increment	Total
<u>Visitations</u>			
General recreation -----	33,400	60,000	93,400
Fish and wildlife recreation:			
Reservoir fishermen -----	10,900	-	10,900
Tailwater fishermen -----	700	-	700
Total-----	45,000	60,000	105,000
<u>Annual benefits</u>			
General-----	\$33,400	(1) \$38,800	\$72,200
Fish and wildlife-----	11,600	-	11,600
Total-----	45,000	(1) 38,800	83,800

(1) Annual equivalent of present worth of future recreation
increment (3-1/8%, 100 years)

Source: Letter from the Secretary of the Army, June 2, 1965.

TABLE 16
 MARTINS FORK RESERVOIR PROJECT ECONOMIC ANALYSIS,
 MULTIPLE-PURPOSE DEVELOPMENT, JUNE 1965

Item	Amount
<u>Annual benefits:</u>	
Flood control-----	\$ 157,800
Water quality-----	114,000
Recreation-----	83,800
Subtotal, primary benefits-----	355,600
Redevelopment-----	34,200
Total, project benefits-----	389,800
<u>Annual charges:</u>	
Total economic annual costs-----	214,600
<u>Economic ratio:</u>	
Annual (primary) benefits/economic costs-----	1.7:1
Annual (project) benefits/economic costs-----	1.8:1

Source: Letter from the Secretary of the Army, June 2, 1965.

TABLE 17

BIG SOUTH FORK PROJECT ECONOMIC ANALYSIS, NOVEMBER 1969

Item	Amount
<u>Annual benefits:</u>	
<u>User</u>	
Power-----	\$ 9,942,600
General recreation-----	1,385,900
Fishing-----	85,200
Subtotal, user-----	<u>11,413,700</u>
<u>Expansion</u>	
Redevelopment:	
Construction-----	1,392,100
Operation and maintenance-----	91,600
Subtotal, redevelopment-----	<u>1,483,700</u>
Development:	
General recreation-----	3,820,000
Fishing-----	274,000
Subtotal, development-----	<u>4,094,000</u>
Subtotal, expansion-----	<u>5,577,700</u>
Total project benefits-----	16,991,100
<u>Annual charges:</u>	
Total economic annual charges-----	13,010,100
Total economic annual charges with associated development costs-----	13,583,800
<u>Economic ratio:</u>	
Annual (user and redevelopment) benefits/economic costs	1.00:1
Annual (total project) benefits/economic charges with development costs-----	1.25:1

Source: Corps of Army Engineers, Supplement to review report, November 7, 1969.

TABLE 18

ANNUAL COST, MARION COUNTY RECREATION PARK RC&D MEASURE, SEPTEMBER 1975

(Dollars) ¹			
Evaluation Unit	Amortization of Installation Cost ²	Operation and Maintenance Cost	Total
45-acre Recreation Facilities Development	19,668	12,500	32,168
Administration	1,870	-----	1,870
GRAND TOTAL	21,538	12,500	34,038

¹Price base - 1975.

²50 years @ 5-7/8 percent interest (0.06234).

Source: Soil Conservation Service, Southeast Tennessee RC&D Project, September 1975.

TABLE 19

COMPARISON OF BENEFITS AND COSTS, MARION COUNTY RECREATION PARK RC&D MEASURE, SEPTEMBER 1975

Evaluation	(Dollars)				Avg. Annual Cost ²	Benefit-Cost Ratio
	AVERAGE ANNUAL BENEFITS ¹			Total		
	Recreation	Secondary	Redevelopment			
45-acre Recreation Facilities Development	55,425	5,550	6,925	67,900	32,168	2.1:1.0
Admini-stration	XXX	XXX	XXX	XXX	1,870	XXX
GRAND TOTAL	55,425	5,550	6,925	67,900	34,038	2.0:1.0

¹Price base - 1975.

²From Table 3.

Source: Soil Conservation Services, Southeast Tennessee RC&D Project, September 1975.

TABLE 20
ANNUAL COST, MEIGS COUNTY PARK RC&D MEASURE, FEBRUARY 1976

(Dollars) ¹			
Evaluation Unit	Amortization of Installation Cost ²	Operation and Maintenance Cost	Total
250-acre Recreation Facilities Development	30,550	20,000	50,550
Administration	3,740	xxxxxx	3,740
GRAND TOTAL	34,290	20,000	54,290

¹Price base - 1975.

²50 years @ 5-7/8 percent interest (0.06234).

Source: Soil Conservation Service, Southeast Tennessee RC&D Project, February 1976.

TABLE 21

COMPARISON OF BENEFITS AND COSTS, MEIGS COUNTY PARK RC&D MEASURE, FEBRUARY 1976

Evaluation	AVERAGE ANNUAL BENEFITS (Dollars) ¹			Total	Avg. Annual Cost ²	Benefit Cost Ratio
	Recreation	Secondary	Redevelopment			
250-acre Recreation Facilities Development	60,000	6,000	18,400	84,400	50,550	1.7:1.0
Admini- stration	XXX	XXX	XXX	XXX	3,740	XXX
GRAND TOTAL	60,000	6,000	18,400	84,400	54,290	1.6:1.0

¹Price base - 1975.

²From Table 3.

Source: Soil Conservation Service, Southeast Tennessee RC&D Project, February 1975.

VITA

William Henry Hedley was born in Knoxville, Tennessee, on August 6, 1953. He attended elementary and junior high school at Anderson School. He graduated from Young High School in Knoxville in May of 1971. In June of 1971, he entered the University of Tennessee, Knoxville, and received a Bachelor of Arts degree in geography in June 1975. In March of 1976, he entered the Water Resources Development Program in conjunction with the Water Resource Research Center at the University of Tennessee, Knoxville, and began work on a Master's degree. He assisted with a research project from September 1976 to December 1976, however, not in conjunction with his thesis. He received the degree of Master of Science in Water Resources Development in December 1977.