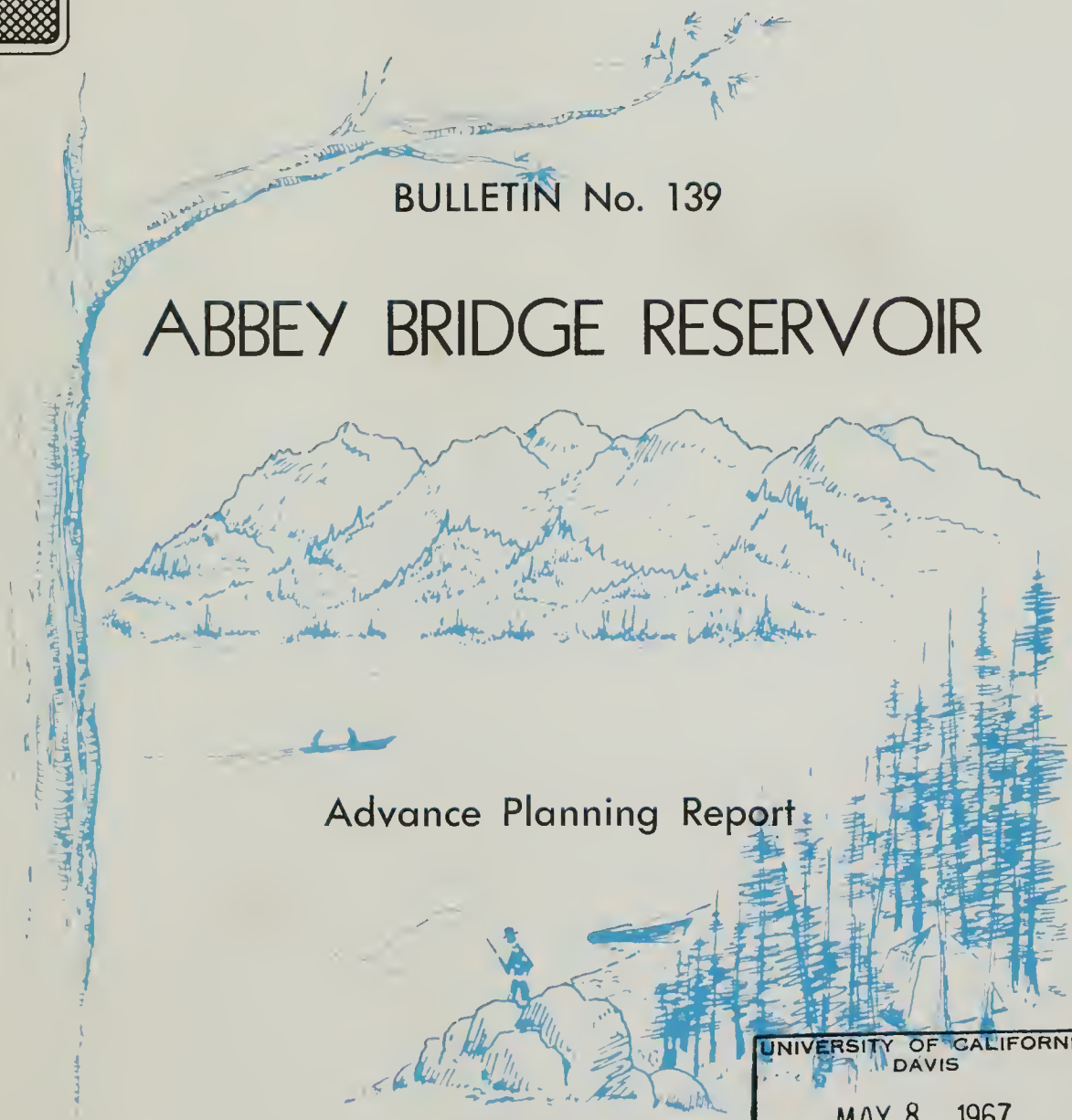
State of California

THE RESOURCES AGENCY

Department of Water Resources

BULLETIN No. 139

ABBEY BRIDGE RESERVOIR



Advance Planning Report

DECEMBER 1966

HUGO FISHER
Administrator
The Resources Agency

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources

CONCEPTION OF

ABBEY BRIDGE RESERVOIR

State of California

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FOREWORD

This bulletin presents the results of advance planning studies of Abbey Bridge Dam and reservoir made during the period 1964-66. Recommendations on project purposes, amount of reservoir storage capacity, other project features, and time of construction are included.

A related report, Bulletin No. 117-4, "Abbey Bridge Reservoir - Water Resources Recreation Report", presents recommendations on land acquisition for recreation purposes and plans for onshore recreation development.

Abbey Bridge Dam and reservoir were authorized by the Legislature by amendment of Water Code Section 11260 in 1957 (California Statutes of 1957, Chapter 2359, page 4088). A dam and reservoir in the vicinity of Red Clover Valley in Plumas County were included in the State Water Facilities authorized for construction with funds made available under the California Water Resources Development Bond Act (California Statutes of 1959, Chapter 1762, page 4235), approved by the voters November 8, 1960.

This is the fourth of five reservoirs of the State Water Project in the Upper Feather River Basin. These reservoirs are being constructed in approximately two-year intervals, mainly for recreation and fish and wildlife enhancement purposes.

William E. Warne, Director
Department of Water Resources
The Resources Agency
State of California
December 15, 1966

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State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

EDMUND G. BROWN, Governor
HUGO FISHER, Administrator, The Resources Agency
WILLIAM E. WARNE, Director, Department of Water Resources
ALFRED R. GOLZE', Chief Engineer, Department of Water Resources

John R. Teerink . . . Assistant Chief Engineer, Area Management

Sacramento District

Carl A. Werner . . . . . District Director
M. Guy Fairchild . . . . . Chief, Planning Section

----------0----------

Planning studies and preparation of this bulletin
were conducted under the direction of

Walter L. Terry . . . . . Senior Engineer, Water Resources
and
Warren J. Cole . . . . . Senior Engineer, Water Resources

by

Richard W. Kretsinger . . . Associate Engineer, Water Resources
Norman L. Meade . . . . . Associate Engineer, Water Resources

assisted by

Gerald Stevens . . . . . Associate Engineer, Water Resources
Mel Warner . . . . . Associate Economist
Haruo Najima . . . . . Associate Economist
Jack H. Lawrence . . . . . Senior Land and Water Use Analyst

Fish and Game studies were conducted
by

William M. Kier . . . . . Fishery Biologist III
John B. Robinson . . . . . Fishery Biologist III
Department of Fish and Game

Recreation studies were conducted
by

Paul R. Meier . . . . . Recreation Planner III
Robert H. Hagy . . . . . Recreation Planner II
Department of Parks and Recreation

CALIFORNIA WATER COMMISSION

RALPH M. BRODY, Chairman, Fresno

WILLIAM H. JENNINGS, Vice Chairman, La Mesa

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MARION R. WALKER, Ventura

----------O----------

WILLIAM M. CARAH
Executive Secretary

WILLIAM L. BERRY, SR.
Engineer

ABSTRACT

Project purposes of Abbey Bridge reservoir are recreation and fisheries enhancement. Other potential purposes are not justified under existing economic conditions. / Maximum net benefits would be realized with a reservoir of 45,000 acre-foot storage capacity. Estimated annual recreation use in the year 2020 is 341,000 visitor-days. / Principal project features will be a 98-foot high earthfill dam, outlet works providing water temperature control for downstream fishery preservation and enhancement, onshore recreation facilities, a surfaced access road from nearby Lake Davis, and roads around the reservoir perimeter. Initial onshore recreation facilities, including 125 camp units and 35 picnic units, are scheduled for completion concurrently with the dam and reservoir. / The principal attraction of Abbey Bridge reservoir is expected to be trout fishing. Early construction will help meet an increasing demand for new trout waters. / The project plan is engineeringly feasible and economically justified on the basis of primary benefits to recreationists. The project would have statewide recreational appeal and would accelerate the economic growth of the area.

CHAPTER 1. INTRODUCTION

The planning of projects to supply needs of areas of origin is an important policy guiding the development of the waters of California. This policy was established by the Legislature during the "thirties" when the Central Valley Project was authorized, and has since governed all state planning of water resources development.

In furtherance of this policy, the Legislature included five reservoirs within Plumas County in the Upper Feather River Basin as authorized features of the State Water Project. One of these is Abbey Bridge reservoir.

Previous Studies

Abbey Bridge reservoir was first proposed as an upstream unit of the Feather River Project in reports of the Division of Water Resources in 1955 (Table 1, Item 1 and 2). It was described as one of three reservoirs that would greatly enhance the recreation potential of the Upper Indian Creek Basin, a subunit of the Feather River Basin.

In February 1957, the Department submitted Bulletin No. 59 (Table 1, Item 4) to the Legislature. This report described the Indian Creek Recreation Project consisting of Abbey Bridge, Antelope Valley, and Dixie Refuge reservoirs; the Frenchman Project; and the Grizzly Valley Project. Preliminary engineering feasibility and economic justification of these projects were presented. Following the publication of Bulletin No. 59, the Legislature authorized these five reservoirs as units of the Feather River Project.

TABLE 1

BIBLIOGRAPHY OF ABBEY BRIDGE DAM AND RESERVOIR

Item	Document	Project Purpose[1]	Capacity of reservoir (acre-feet)
1	"Program for Financing and Constructing the Feather River Project as the Initial Unit of the California Water Plan", dated February 1955.	R, F&WE	8,400
2	"Report on Upper Feather River Service Area", dated April 1955.	R, F&WE, I	*
3	Application No. 16954 to appropriate water from Red Clover Creek, filed with the State Water Rights Board, March 20, 1956.	R	8,400
4	Bulletin No. 59, "Investigation of Upper Feather River Basin Development - Interim Report on Engineering, Economic, and Financial Feasibility of Initial Units", dated February 1957.	R, F&WE	11,100
5	Authorization by Legislature, Amendment to Section 11260 of the Water Code by California Statutes of 1957, Chapter 2359, page 4088. (Refers to Item 1)	*	8,400
6	Executive Order No. P.1, by Director of Water Resources, signed October 14, 1958. (Refers to Items 1 and 4)	*	*
7	Section 12934 of the Water Code (Part of California Water Resources Development Bond Act), added by California Statutes of 1959, Chapter 1762, page 4235.	*	*
8	Bulletin No. 59-2, "Investigation of Upper Feather River Basin Development", dated October 1960.	R, F&WE	11,100
9	Bulletin No. 132 Series, "The California State Water Project in 196_", dated April 1963; June 1964; and June 1965.	R, F&WE	11,100
10	Bulletin No. 117-4, "Abbey Bridge Reservoir - Water Resources Recreation Report".	R, F&WE	45,000

1/Abbreviations: R - Recreation; F&WE - Fish and Wildlife Enhancement; I - Irrigation (Indian Valley)

*Not specified

A list of documents concerning Abbey Bridge Dam and reservoir is presented in Table 1.

Objective of Advance Planning Studies

The general objective of advance planning studies is to develop a final plan for the commencement of design, right-of-way acquisition, and construction, which is in general conformance with the plan upon which project authorization is based.

For Abbey Bridge reservoir, the specific objectives were as follows:

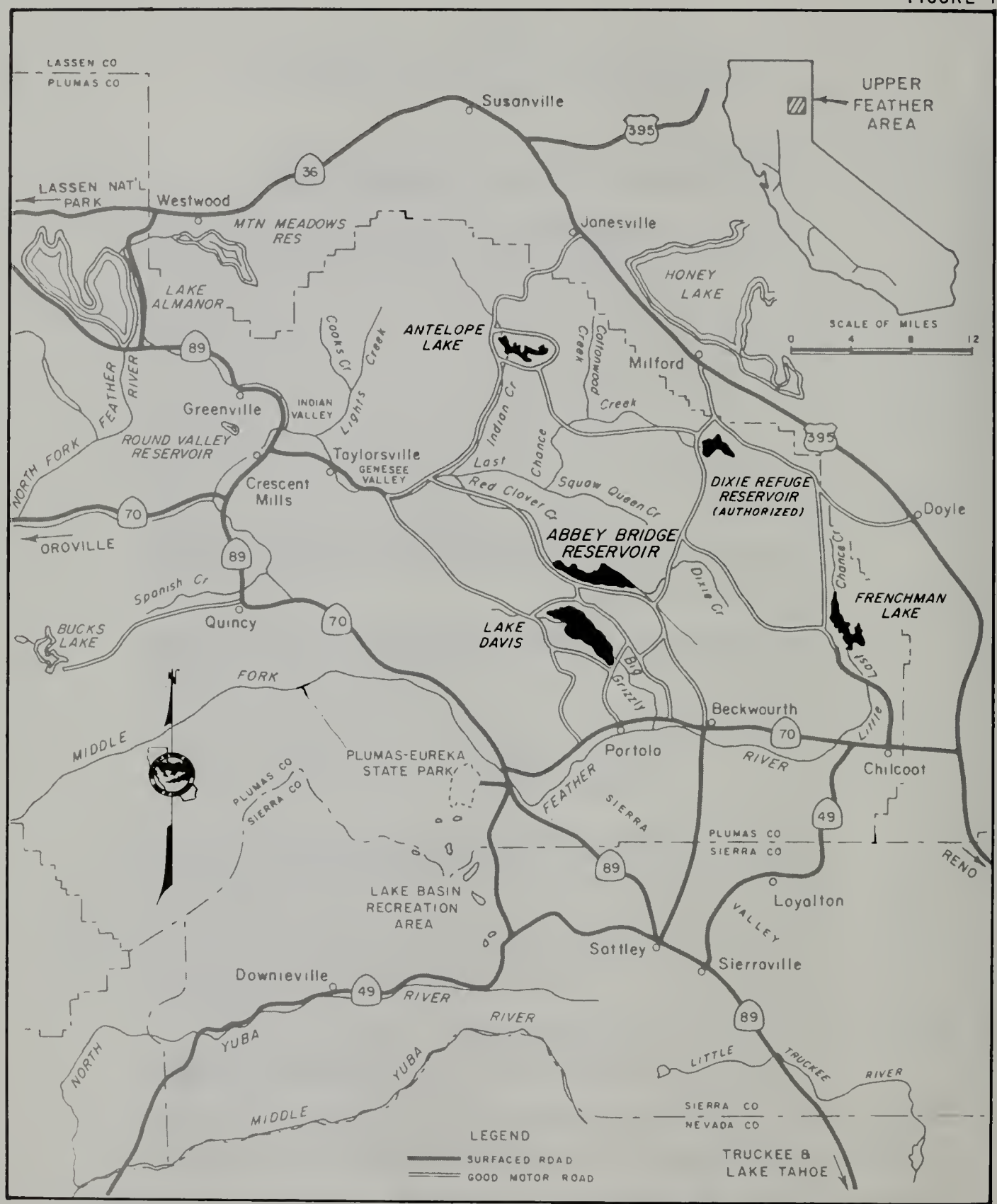
1. Refinement of the project plan, including a determination of storage capacity and size and location of project features.
2. Development of revised estimates of project costs and benefits.
3. Recommendation for timing of construction.

Scope of Study

Advance planning for Abbey Bridge Dam and reservoir began with a review of previous studies that led to its authorization. All possible project purposes were considered. Engineering and economic data for various reservoir sizes were developed to determine the most feasible size.

The work included a study of hydrology; sizing of reservoir, spillway, and outlet works; evaluation of project benefits; development of operational criteria; and compilation of information on construction designs and specifications for the dam, roads, and recreation facilities.

FIGURE 1



VICINITY MAP

Project Area

The area of investigation is in the Upper Feather River Basin in northern Plumas County within the Plumas National Forest. It includes the drainage basin of Red Clover Creek above the damsite and extends downstream along Red Clover and Indian Creeks to Indian Valley. These areas are shown on Figure 1.

The Upper Feather River Basin is a vacation area for many people from all sections of California and western Nevada. Plumas National Forest had more than 1.5 million visitor-days of recreation use during 1965.

Surveys have shown that most of the recreationists visiting the lakes and streams in the Upper Feather River Basin live in the metropolitan areas of California. Abbey Bridge reservoir is expected to be an outstanding recreation facility, attracting visitors from afar to this popular vacation area.

Past and Present Development

Plumas County was franchised by the Legislature in 1854. Gold was the original lure that attracted immigrants into the area. Numerous camps, built by miners engaged in mining gold by placer or hydraulic methods, sprang up alongside streams. For many years the mining industry held an important place in the economy of the region. Because of changing economic conditions and the fixed price of gold, mining activity declined to where it is no longer a significant factor in the economy.

With the decline of mining, livestock and forest products have become the dominant industries. The raising of beef cattle was developed to a high level prior to World War I. Grasses grow abundantly during the spring, and streams are easily diverted onto flat valley floors to irrigate hay lands and summer pastures. Most of this irrigation development was accomplished by individuals or small groups.

Manufacture of forest products is presently the major industry of Plumas County. Approximately three-fourths of the county is covered with forests, much of which is used for commercial purposes.

The timbered mountains, scenic valleys, and streams and lakes have attracted increasing numbers of vacationists in recent years. An adequate system of highways serves the area and provides access for visitors. Recreation and the development of summer homes contribute an appreciable portion of the income to Plumas County. They offer the major opportunity for further expansion of the local economy.

Topography

Abbey Bridge reservoir will inundate Red Clover Valley and extend upstream into the larger Clover Valley. The topography of this region is generally less precipitous than that of the lower reaches of the Upper Basin. The upper reaches are characterized by alluvial valleys surrounded by heavily forested hills and mountains.

Elevations in and adjacent to Red Clover Valley vary from 5,400 feet above sea level at the damsite to 8,300 feet at Dixie Mountain. Several tributaries contribute to the flows of Red Clover Creek, the most important of which are Crocker and Dixie Creeks. Red Clover Creek below the damsite flows through 11 miles of steep and narrow canyon to its confluence with Last Chance Creek and thence into Indian Creek at the head of long and picturesque Genesee Valley. From lower Genesee Valley, Indian Creek traverses a forested canyon for several miles. At Taylorsville, the stream enters the broad flat Indian Valley at an elevation of 3,500 feet. After flowing for eight miles through Indian Valley, Indian Creek passes through a narrow canyon for a distance of six miles to its confluence with the East Branch of North Fork Feather River.

Red Clover Valley is a narrow meadow valley about three miles long, with gentle to moderate slopes. It forms the lower and westernmost arm of the large shallow Clover Valley. Scattered stands of evergreens and aspens are found on the lower hillsides and become denser at the higher elevations. The elevation of the valley floor at the constriction where Red Clover Valley joins Clover Valley is approximately 40 feet higher than that at the damsite. In Clover Valley, vegetation consists of meadow grasses, shrubs, and a few isolated trees.

Climate

The western slope of the northern Sierra Nevada is a region of large climatic differences. Within the area of investigation, where air movement is substantially affected by topography, marked differences in temperature and precipitation occur within short distances. Most of the precipitation above the damsite occurs as snowfall and is retained until the spring and summer snowmelt runoff period. In general, the winters are moderately severe, but the summers are warm and conducive to out-of-door living.

Land Use and Population

The Red Clover Creek Basin is uninhabited. Most of the mountain and hill land is presently owned and managed by the U. S. Forest Service for timber production, wildlife, grazing, recreation, and watershed management.

Almost all of the land in Clover Valley is privately owned and is used principally for grazing of livestock during the summer months. Red Clover Valley is also used for grazing, but to a lesser extent.

Further downstream in Genesee and Indian Valleys, the predominant use of land is for the production of beef cattle on improved range pasture. In accordance with the availability of natural runoff, meadow lands are irrigated by wild flooding for the production of hay for winter feeding.

Three small unincorporated communities are located in Indian Valley. They are Taylorsville, Greenville, and Crescent Mills. Their total present population is approximately 1,600.

The largest community in the vicinity of Red Clover Valley is Portola, with a population of about 2,000. It is the only incorporated municipality in Plumas County and is located about 11 miles to the south on the Middle Fork Feather River and California State Highway Route 70.

Nearby Recreation Facilities

Of the five authorized reservoirs of the State Water Project in Plumas County, Frenchman Lake, with a storage capacity of 55,400 acre-feet, was the first to be constructed. The dam was completed in October 1961, and the initial recreation facilities were completed during 1964.

Construction of Antelope Dam and Lake, located about 15 miles north of Red Clover Valley, was completed in December 1963. It has a storage capacity of 22,500 acre-feet and is used entirely for recreation and fish and wildlife enhancement purposes. Initial recreation facilities were constructed during 1965.

Construction of Grizzly Valley Dam on Big Grizzly Creek was initiated in the fall of 1964. When completed late in 1966, it will store 83,000 acre-feet of water in Lake Davis to be used primarily for recreation. Lake Davis will

be about five miles south of Abbey Bridge reservoir. These two reservoir sites are presently connected by a graded dirt road which ascends over Bagley Pass at an elevation of 6,200 feet.

Other nearby reservoirs, at which recreation facilities are provided, are Lake Almanor and Round Valley reservoir. The location of these and other reservoirs in relation to Abbey Bridge reservoir is shown on Figure 1.

CHAPTER 2. PROJECT PLANNING

This chapter presents a discussion of the various items considered in formulating plans for Abbey Bridge reservoir. Data concerning water supply and recreation potential are presented. Criteria and assumptions used to size the reservoir are described.

Project purposes justified by these studies are recreation and fish and wildlife enhancement. Some incidental flood control benefits will accrue.

Water Supply

The water supply available for storage and regulation by Abbey Bridge reservoir is the inflow less evaporation and releases required to satisfy existing downstream water rights.

Inflow

Water supply information presented in Bulletin No. 59 was revised as a part of the advance planning studies.

The Department has operated a gaging station on Red Clover Creek about 1.5 miles above the damsite since January 1963. The drainage area above the damsite is approximately 96 square miles.

A gaging station, "Red Clover Creek near Genesee", was operated by the Department from September 1954 to

October 1, 1965. It was just upstream from Genesee Valley and about nine miles below the damsite.

Streamflows for Red Clover Creek at Abbey Bridge damsite were estimated by correlation with the recorded streamflow of Red Clover Creek near Genesee. These estimates were further extended by correlation with the recorded streamflow of the U. S. Geological Survey gaging station, "North Yuba River below Goodyear's Bar".

Measurements and estimates of flow show that about 95 percent of the annual runoff of Red Clover Creek at the damsite occurs in the period November through May. Flows during summer and early fall range from zero to about ten cfs (cubic feet per second).

The estimated monthly runoff of Red Clover Creek at Abbey Bridge damsite for the 53-year period 1910-11 through 1962-63 is shown in Table 2.

Water Rights

The waters of Indian Creek and its tributaries are distributed to users in the Indian Creek Watermaster Service Area in accordance with a court decree. The planned releases for fishery enhancement downstream from Abbey Bridge Dam will be greater than the reservoir inflow during the irrigation season. Therefore, prior rights for irrigation water will not be impaired by the project.

TABLE 2

ESTIMATED RUNOFF
RED CLOVER CREEK AT ABBEY BRIDGE DAMSITE
(In acre-feet)

Season	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1910-11	170	310	5,440	6,010	6,010	16,240	39,630	13,700	2,960	590	190	150	91,400
1911-12	140	170	1,030	1,110	1,430	2,860	4,910	5,160	710	90	50	70	17,730
1912-13	90	230	990	970	1,790	2,980	10,110	5,740	410	90	50	50	23,500
1913-14	120	220	4,720	11,740	8,330	19,160	31,990	14,610	1,310	270	120	110	92,700
1914-15	180	200	1,500	1,490	5,490	9,250	20,600	13,230	1,180	190	100	90	53,500
1915-16	170	240	3,940	4,080	11,550	28,930	5,810	14,790	1,910	380	150	150	72,100
1916-17	190	220	3,130	1,390	4,490	7,130	19,970	9,000	1,440	230	110	100	47,400
1917-18	70	80	880	590	1,440	4,330	9,280	2,690	180	40	30	50	19,660
1918-19	150	180	1,170	980	3,890	5,580	16,820	7,280	280	70	50	50	36,500
1919-20	80	90	1,050	780	940	3,470	7,350	4,150	270	640	40	40	18,900
1920-21	170	940	5,820	6,200	6,290	16,990	19,830	8,840	1,070	220	130	100	66,600
1921-22	190	260	2,940	2,880	4,960	10,200	22,320	20,390	2,990	430	190	150	67,900
1922-23	160	220	3,960	2,590	2,660	5,680	13,270	7,190	590	180	110	100	36,700
1923-24	60	60	430	370	1,060	930	2,270	510	30	10	10	20	5,760
1924-25	100	160	1,450	1,260	7,270	5,600	11,880	4,440	260	10	50	60	32,540
1925-26	70	90	850	630	2,600	3,700	8,900	1,590	90	30	20	30	18.600
1926-27	130	870	4,210	3,790	14,780	15,540	23,940	10,610	1,300	220	110	100	75,600
1927-28	110	350	1,640	1,580	2,310	23,140	14,530	5,410	180	60	40	50	49,400
1928-29	60	90	820	510	830	2,190	3,590	2,330	180	40	30	30	10,700
1929-30	60	70	4,600	1,380	2,890	5,970	10,580	2,960	240	60	40	50	28,900
1930-31	40	60	330	380	520	1,730	2,280	590	410	10	10	20	6,380
1931-32	110	140	2,900	2,190	3,530	1,090	16,380	9,950	1,000	160	80	70	37,600
1932-33	70	80	630	490	670	2,780	6,240	2,860	450	60	30	40	14,400
1933-34	50	50	820	810	1,340	3,770	3,610	640	460	20	10	20	11,600
1934-35	70	190	1,440	1,590	2,830	4,790	22,450	7,930	700	100	60	50	42,200
1935-36	80	100	780	3,670	6,240	8,380	15,570	17,060	440	80	50	50	52,500
1936-37	50	60	510	390	1,600	3,820	8,320	14,940	290	60	30	30	30,100
1937-38	100	30	5,860	1,690	4,740	25,540	21,550	40,690	930	190	90	90	101,500
1938-39	60	80	530	390	470	2,340	4,380	2,420	50	20	20	30	10,790

(over)

TABLE 2 (cont.)

ESTIMATED RUNOFF
RED CLOVER CREEK AT ABBEY BRIDGE DAMSITE (Continued)
(In acre-feet)

Season	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1939-40	60	70	700	4,250	8,400	17,920	16,070	15,110	270	60	40	50	63,000
1940-41	90	210	5,310	3,900	7,730	10,880	12,510	26,550	560	130	70	60	68,000
1941-42	110	190	8,270	7,790	9,480	7,950	20,790	24,970	1,130	220	110	90	81,100
1942-43	100	380	5,310	7,250	5,520	16,730	19,920	16,440	420	100	70	60	72,300
1943-44	60	70	580	580	1,100	2,860	4,340	9,790	210	50	30	30	19,700
1944-45	70	210	2,350	1,240	5,780	4,080	8,820	14,760	340	70	40	40	37,800
1945-46	100	230	6,280	2,890	1,980	5,490	12,030	16,380	350	70	50	50	45,900
1946-47	50	220	1,070	490	1,870	4,510	5,200	4,060	110	30	20	20	17,650
1947-48	100	120	650	2,450	1,080	2,240	11,730	14,720	530	90	50	40	33,800
1948-49	40	80	570	320	490	2,290	7,180	8,130	130	30	20	20	19,300
1949-50	50	80	570	2,030	3,920	6,270	13,460	15,620	430	80	50	40	42,600
1950-51	200	220	20,760	6,680	9,820	11,530	18,550	20,130	370	100	70	70	88,500
1951-52	150	260	6,070	2,910	8,660	9,300	29,770	47,230	1,740	470	130	110	106,800
1952-53	1,190	150	2,270	8,120	3,490	6,100	14,610	17,560	980	250	100	80	54,900
1953-54	80	140	950	1,220	2,600	7,460	10,750	8,950	150	40	30	30	32,400
1954-55	130	180	1,180	1,030	1,050	4,600	5,060	4,400	370	100	50	50	18,200
1955-56	90	130	23,050	12,440	4,030	16,990	25,110	12,880	1,050	150	90	90	96,100
1956-57	170	220	1,380	1,350	11,310	9,880	6,390	5,610	640	110	60	80	37,200
1957-58	160	210	1,860	1,720	17,930	9,260	27,230	14,390	960	200	100	80	74,100
1958-59	100	180	1,020	2,950	3,380	8,980	4,400	2,000	280	80	60	70	23,500
1959-60	90	100	610	760	5,550	10,490	4,830	1,530	190	60	40	50	24,300
1960-61	80	140	970	800	1,690	2,540	1,930	1,320	290	60	50	50	9,920
1961-62	90	90	620	520	2,420	4,180	24,290	4,430	380	80	50	50	37,200
1962-63	1,690	320	1,220	6,000	18,900	4,410	20,600	5,800	1,600	370	100	140	61,200
53-Year Average	150	190	2,980	2,670	4,740	8,130	13,660	10,650	680	140	70	60	44,120

The Pacific Gas and Electric Company claims prior rights to the waters of the North Fork and main stem of the Feather River based on riparian rights, rights affirmed by adjudication, rights based upon appropriations initiated prior to the Water Commission Act of 1913, and rights granted by permits and licenses issued by the State Water Rights Board.

On March 20, 1956, the State filed Application No. 16954 proposing the appropriation of 8,400 acre-feet per annum from Red Clover Creek. Water sought under this application would be stored in Abbey Bridge reservoir and used for recreation at the reservoir and for streamflow maintenance of Red Clover Creek below the reservoir down to Indian Valley.

Evaporation

A study was made of evaporation from Abbey Bridge reservoir and consumptive use of native vegetation in the reservoir area. The annual water depletion was computed to be 40.15 inches from water surface evaporation less 19.66 inches of preproject evapotranspiration losses, which will be eliminated, for a net depletion of 20.49 inches. The monthly unit values of net depletions, used for reservoir operation studies, are shown in Appendix A, page 63.

Need for the Project

Projections of potential demand for recreation at the Abbey Bridge Project were used for sizing the reservoir, as will be described later in this chapter. Distribution of population and probable future water development projects were considered in the determination of future potential demand.

Special attention was given to the potential demand in 1970. This is the earliest year possible for initial public use of Abbey Bridge reservoir, allowing a reasonable period of time for design and construction. The reservoir will be needed by 1970 to meet the projected demand for trout fishing.

Potential demand estimates were made in terms of the number of trout-angler days which could be attracted to the project. Although other types of recreation use will occur, there are valid reasons for basing the demand estimates solely on fishing use.

1. The Abbey Bridge reservoir site has excellent potential for development of a trout fishery. Trout angling is expected to be the primary attraction to recreationists.

2. An unsatisfied demand for trout fishing can be met only by additional trout waters, unless the expensive program for planting of catchable trout is expanded in existing waters. Lakes and streams

which are naturally productive of trout offer little potential for increased fish production through presently known management techniques.

3. Fishing is a major inducement to participation in water-associated outdoor recreation. Many families and groups look forward to testing their angling skills during their leisure time. They will pass by an attractive lake to proceed to another that offers a better chance of filling their creel. They will participate in other activities, such as camping and swimming, but fishing is their prime objective and their major consideration in choosing a location.

Potential Demand for Trout Fishing

Trout are the most popular fish sought by California anglers. Surveys indicate that almost half of all licensed anglers fish for trout each year. Data collected in 1955 by the Department of Fish and Game showed that California trout fishermen spent more than $100,000,000 on their sport. A new survey would undoubtedly show substantially greater expenditures, in view of population growth and the rise in general price levels since 1955.

The Department of Fish and Game has made a comprehensive study of California's fish and wildlife resources and projected the impact of human activities on these resources to

1980. The results were published during 1965 in the report, "California Fish and Wildlife Plan". The following information regarding trout fishing in California is quoted from this report (page 69).

> "Estimated use in 1963 was 6,805,000 angler-days, a little over 50 percent of it supported by stocked 'catchables'. Another 150,000 to 200,000 days were spent fishing for trout at commercial catch-out ponds."
>
> "Use in 1980 is expected to increase to between 11,261,000 and 12,305,000 angler-days, exclusive of use at catch-out ponds."

The five reservoirs of the State Water Project in the Upper Feather River Basin can play an important part in meeting this increased demand for trout fishing. Frenchman Lake is noted for its high rate of fish growth, and with normal fingerling planting is expected to support 60 angler-days per acre in 1980 while maintaining a reasonable success rate. The fishing use supported by Abbey Bridge reservoir is expected to be of similar magnitude. The present average for trout is 19 angler-days per acre in all the streams and lakes of California.

The 1980 statewide demand of 11.26 to 12.31 million angler-days, quoted above, was used to project trout angling use within Plumas County for future years. The lower figure is based solely upon population growth, while the higher figure takes into consideration the trend in sales of fishing licenses in recent years. For this discussion, the terms

"minimum demand" and "maximum demand" are used. It was assumed that the ratio between these two figures would remain constant.

Data from the California Fish and Wildlife Plan show that trout angling at all the streams, lakes, and reservoirs in Plumas County amounted to 314,000 angler-days in 1963. Of this total, 70,000 angler-days were supported by planting catchable trout. Angler use at Frenchman Lake was about 62,000 angler-days that year but increased rapidly in 1964 and 1965 as anglers learned about its good fishery. From these data, it is concluded that, with the exception of the state reservoirs, the waters of Plumas County can support about 180,000 trout angler-days with natural trout populations and plantings of fingerlings.

By 1970, the potential demand for trout fishing in Plumas County is estimated to be 400,000 to 430,000 angler-days. The trout angling use which can reasonably be supported by Frenchman and Antelope Lakes and Lake Davis is estimated to be 140,000 angler-days. Further deduction of the use supported by other waters leaves an unsatisfied demand for trout angling in Plumas County of 80,000 to 110,000 angler-days by 1970.

The foregoing estimate of potential demand may be low, since the state reservoirs will probably be especially attractive to trout anglers by 1970. Many anglers will be aware of the relatively high fish productivity at these reservoirs from which the average success rate is expected to be

considerably higher than the statewide average. This in turn could attract additional angling use.

The present success rate of all California trout anglers is approximately 0.5 pound per angler-day. This is equivalent to about two average size "catchables". This catch rate is apparently acceptable, since trout angling in recent years has increased at a rate slightly higher than that of the population. It is questionable, however, that trout angling will continue at such a per capita rate if the average catch declines below this figure.

Figure 2 shows graphically the projected potential demand for trout angling in Plumas County from 1963 to 2020. It also shows the estimated total angling use which could be supported by the four other reservoirs of the State Water Project and by other waters. The difference between these figures is considered to represent the potential demand for trout angling at Abbey Bridge reservoir.

The assumptions used for these estimates are:

1. Dixie Refuge reservoir would be constructed in the early 1970's to the capacity proposed in Bulletin No. 59.

2. Each of the five reservoirs would be planted at the normal rate of 300 fingerling trout per acre per year.

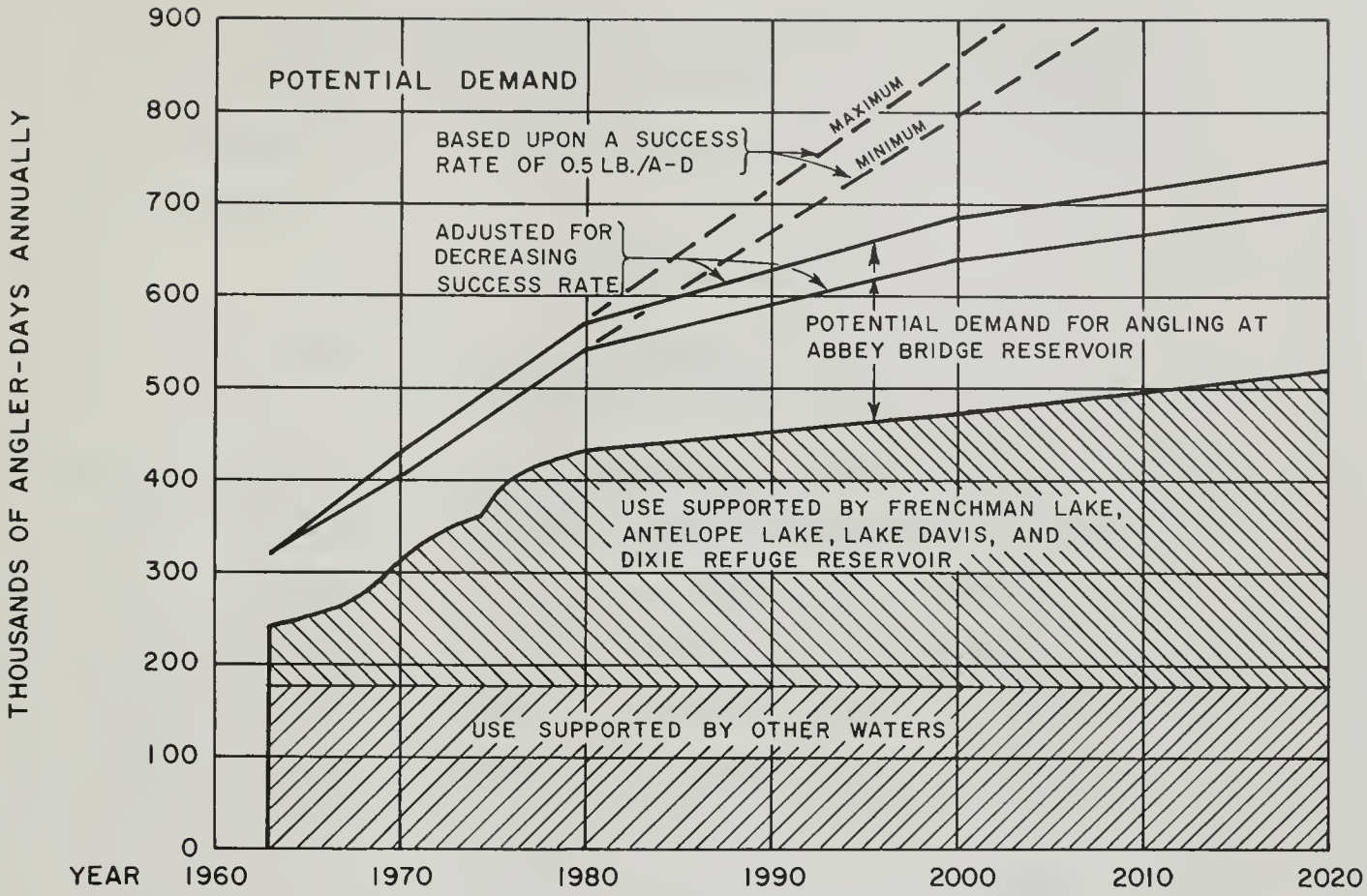


Figure 2. PROJECTED TROUT ANGLING IN PLUMAS COUNTY

3. With a rapidly increasing demand, the average catch rate satisfactory to anglers at the five reservoirs would decline from 1.2 pounds per angler-day in 1970 to 0.5 pound by 1980 and to 0.33 pound by 2020. Therefore, a gradually increasing number of anglers will share the stabilized fish poundage at these reservoirs.

4. As the average catch rate declines below 0.5 pound per angler-day, the potential demand for trout fishing at the state reservoirs would decrease proportionately.

Recreation Use Without the Project

Without Abbey Bridge reservoir, Red Clover Valley and Red Clover Creek could not accommodate this potential demand for trout fishing. A major increase in other recreation activities would not occur without the reservoir.

A relatively small number of local fishermen are currently attracted to the creek. The reach of Red Clover Creek between the proposed reservoir area and its confluence with Indian Creek could support more intensive angling use than it now receives. An unpaved road follows along its course. Future angling use of the creek without a project was projected on the assumption that future demands will increase and adequate angling access will continue. It is estimated that Red Clover Creek presently supports 2,000 angler-days per year. Without Abbey Bridge reservoir, it is estimated that angling use would increase to 5,400 angler-days per year by 2020.

Some waterfowl and deer inhabit Red Clover Valley. It is estimated that an increase in hunting use from 1,500 hunter-days in 1965 to 2,700 hunter-days in 2020 could be supported.

Without the project, the use of the area by recreationists such as campers and picnickers would be negligible. The estimated recreation use without Abbey Bridge reservoir is presented in Table 3.

TABLE 3

ESTIMATED RECREATION USE WITHOUT THE PROJECT
(In Visitor-Days)

Year	Downstream fishing	Reservoir area		Total
		Fishing	Hunting	
1965	1,700	300	1,500	3,500
1970	2,000	300	1,700	4,000
1980	2,500	300	2,000	4,800
1990	3,100	400	2,100	5,600
2000	3,700	500	2,300	6,500
2010	4,300	600	2,400	7,300
2020	4,800	600	2,700	8,100

Potential for Downstream Fishery Enhancement in Red Clover Creek

The self-propagating trout fishery presently existing downstream from the damsite to the confluence with Indian Creek can be somewhat enhanced if sustained flows of water of suitable temperature are provided by Abbey Bridge reservoir. The Department of Fish and Game has recommended flows of ten cfs from July to September, five cfs from October to June,

and a water temperature just below the dam of 55°F from June to September. These summer releases will increase the trout-carrying capacity of the stream and thereby increase angling use downstream from 2,000 angler-days in 1970 to an estimated 7,000 angler-days by 2020.

Evaluation of Alternative Reservoir Sizes

Major purposes of the advance planning studies were recommendations for a construction date and the amount of reservoir storage capacity. On the basis of the demand for trout angling -- an important part of outdoor recreation -- it has been shown that Abbey Bridge reservoir will be needed by 1970.

Evaluation of the potential for fishery enhancement of a reservoir at the Abbey Bridge site showed that water surface area and distribution of water depths would have considerable effect on recreation use. Because the topography of Clover Valley is flat, the area of the reservoir would increase rapidly with an increase of normal pool elevation and a resulting extension of the reservoir from Red Clover Valley into Clover Valley.

The usual restraints for sizing recreation reservoirs, such as topography and the pattern of tree cover, are not present at the site of Abbey Bridge reservoir. The restraint used was based upon estimates of potential recreation use in combination with the maximization of net benefits (maximum excess of benefits over total economic costs).

Reservoir Sizing Studies

Alternative reservoir capacities ranging from 11,100 acre-feet, as proposed in Bulletin No. 59, to 99,000 acre-feet were considered. Corresponding normal pool elevations ranged from 5,420 feet to 5,470 feet. The damsite and water supply were both determined to be adequate for construction and operation of reservoirs in this range of capacities. A reservoir of each alternative size was assumed to be constructed and operated for recreation and fish and wildlife enhancement. Other potential project purposes were eliminated for reasons presented later. Detailed data on use, benefits, and costs were developed.

The following assumptions were made in projecting recreation use for alternative reservoir sizes:

1. Fish growth of the fingerling plantings would increase linearly with effective water surface area. (Effective area is the average surface area of the reservoir during the recreation season.) Angler use also would increase linearly up to the maximum potential demand, shown in Figure 2. Table 4 shows the unit values used.

2. Above the minimum potential demand, the gain in angler-use per additional acre would gradually decrease to zero at the maximum potential demand.

TABLE 4

UNIT VALUES FOR FISHING

Year	Fish productivity (lb./acre)	÷	Average catch (lb./angler-day)	=	Angler use (angler-days/acre)
1970	50		1.20		42
1972	100		1.00		100
1980	30		0.50		60
1990	30		0.44		67.5
2000	30		0.40		75
2010	30		0.36		82.5
2020	30		0.33		90

3. Nonangling or general recreation use would be directly related to fishing use, as shown in Table 5.

TABLE 5

GENERAL RECREATION USE FACTORS

Year	General recreation use (percent of total use)	Total recreation use (percent of fishing use)
1970	25	133
1972	15	118
1980	30	143
1990	35	154
2000	40	167
2010	45	182
2020	50	200

The relationship of total recreation use to reservoir area, as computed by these assumptions, is shown in Figure 3 for each of the foregoing years.

The relationship of equivalent average annual costs and benefits with reservoir size is shown graphically in Figure 4. The breakdown of total costs into their major components is also shown. The composition of costs and the method of computing benefits are described in Chapter 3.

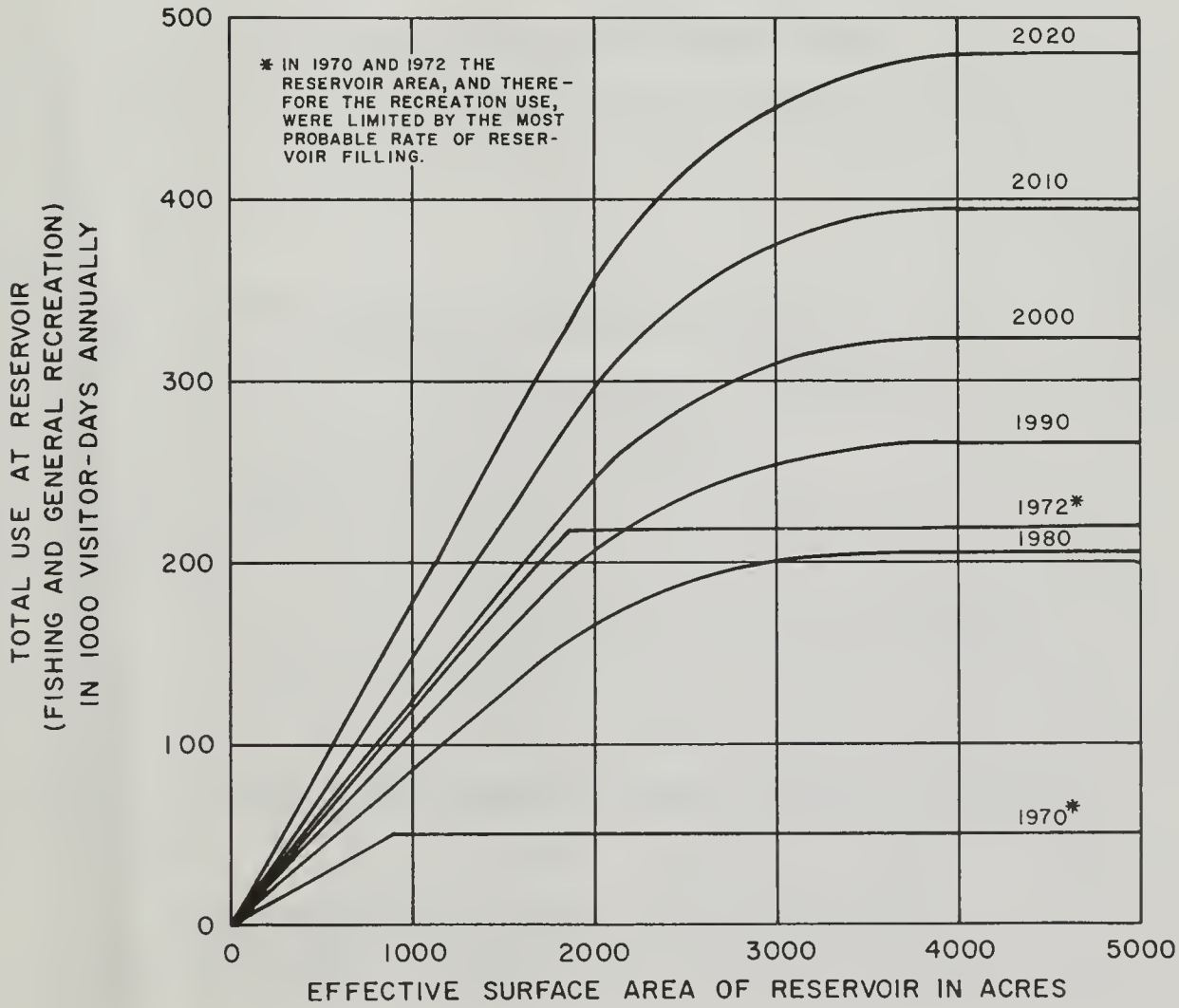


Figure 3. RECREATION USE VS. RESERVOIR SIZE

Selection of Reservoir Size

Figure 4 shows that maximum net benefits will be achieved with a reservoir of 1,850 effective surface acres. Construction of a reservoir size larger than this would provide greater benefits but would result in a smaller excess of benefits over costs. The gross storage capacity of a reservoir with 1,850 effective surface acres is 45,000 acre-feet.

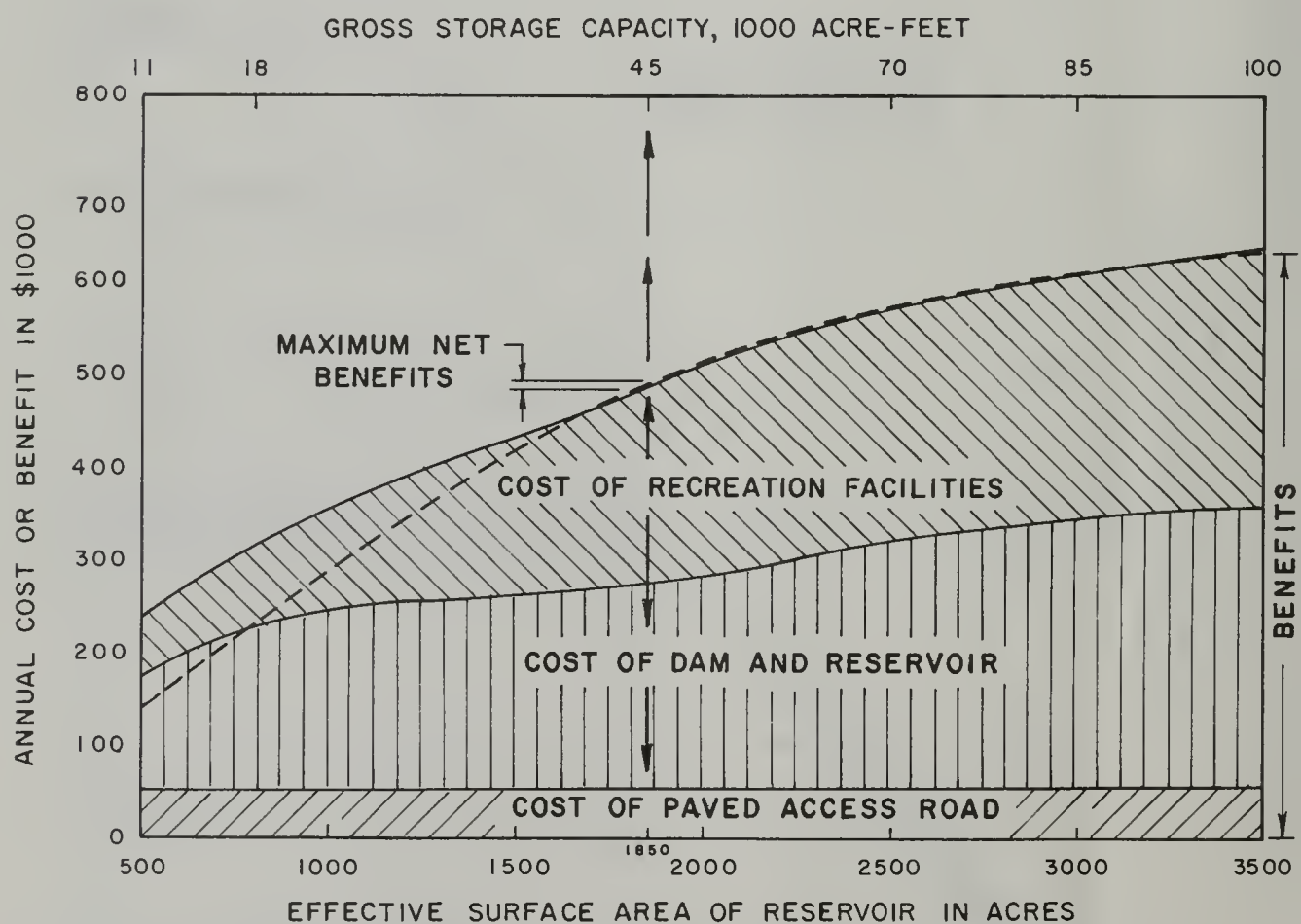


Figure 4. BENEFITS AND COSTS VS. RESERVOIR SIZE

Department of Fish and Game studies indicate that a reservoir of 45,000 acre-feet capacity would provide a good balance between shallow areas for fish production and deep areas for coldwater summer habitat and should consequently provide an excellent fishery. Some grazing lands in Clover Valley will be inundated, but most of the valley pasturelands will remain available for grazing.

Based upon the foregoing considerations, a reservoir with gross storage capacity of 45,000 acre-feet was selected for development. Based on runoff estimates and downstream water rights, the average time to fill this reservoir will be three years. This filling period will not be detrimental to trout production in light of the experience at Frenchman Lake.

Other Possible Project Purposes

The reasons for elimination of other project purposes are discussed here.

Flood Control

Within recent years, high flows in Indian Creek have caused damages in Genesee and Indian Valleys. Pasturelands have been eroded, diversion structures have been damaged, and State Highway 89 has been temporarily closed. Antelope Lake, even without specific operation for flood control, has caused some reduction in the peak flows of Indian Creek. Abbey Bridge reservoir will provide some small further

reduction of peak flows. An indication of the amount of reduction in peak flows for three reservoir stages is presented in the following tabulation.

Flood, Average recurrence interval	Peak inflow	Reserve storage at beginning of flood	Peak outflow over spillway
100 years	13,910 cfs	None	10,060 cfs
		5,000 acre-feet	9,850 cfs
		10,000 acre-feet	9,040 cfs

The normal drawdown during December would approximate 5,000 acre-feet. With operation of the reservoir to provide the 10,000 acre-feet reservation for flood control, spring runoff would fail to fill the reservoir at least one year out of seven.

From these estimates, it is doubtful that the small reduction in flood flows resulting from specific operation for flood control would justify the possible detriments to recreation and fish and wildlife resulting from lower water surface levels. A thorough evaluation of present flood damages and potential flood control benefits which will accrue to the project is not warranted for this report. Therefore, flood control is not included as a project purpose and any benefits are considered to be incidental.

Irrigation

There has been no expression of interest by the ranchers of Indian Valley and Genesee Valley in contracting for an irrigation water supply from Abbey Bridge reservoir. For this reason, irrigation was not evaluated in formulating the project. Releases from the reservoir will be made as required to maintain the present water rights for irrigation.

Domestic

Residents of Indian Valley have not expressed an interest in contracting for a domestic water supply. Present supplies are apparently sufficient to satisfy future requirements.

CHAPTER 3. RECOMMENDED PROJECT

In this chapter the features, operation, and accomplishments of the recommended project are described. Estimated costs and benefits are presented to show economic justification. Some additional economic considerations are discussed.

Project Development Features

Dam

Abbey Bridge Dam (Plate 1) will be a homogeneous earthfill embankment with a chimney drain and rock slope protection. It will have a height of 98 feet above streambed and a crest length of about 1,150 feet at an elevation of 5,468 feet above sea level. It will contain about 500,000 cubic yards of fill. The spillway will be located at the left abutment. At a maximum water surface elevation of 5,467 feet, the discharge capacity of the spillway will be 37,000 cfs and the surcharge storage will be about 50,000 acre-feet. The spillway will have a concrete crest with a length of 165 feet and will discharge into a stream channel tributary to Red Clover Creek.

Outlet Works

A dual outlet works will provide a means of controlling water temperatures for downstream fishery preservation

and enhancement.

The primary outlet works (Plate 1) will consist of a low-level intake structure, a concrete conduit beneath the dam, a control structure, and a stilling basin.

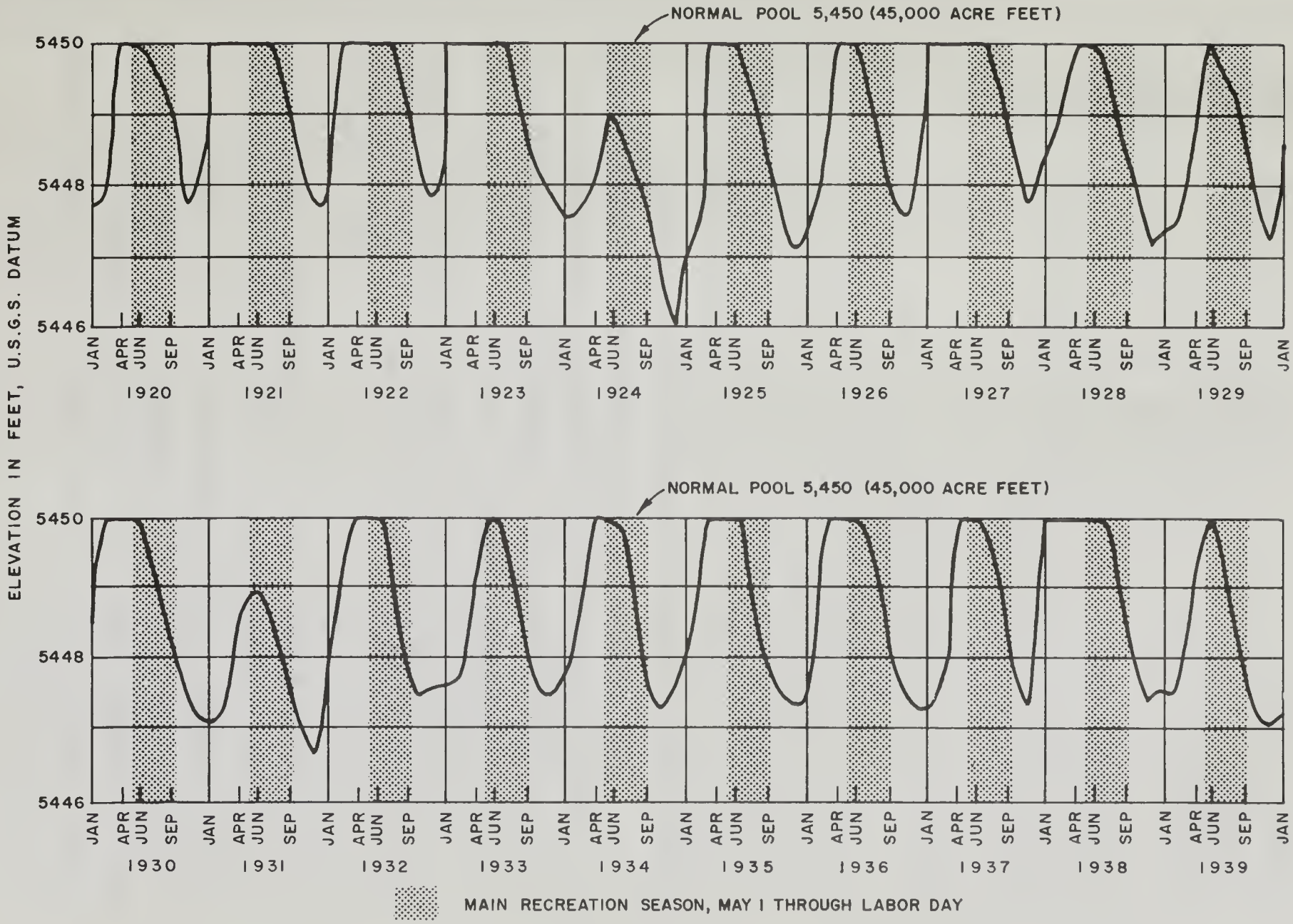
The secondary outlet works will consist of a gated concrete pipe discharging into the spillway channel, which will draw warmer water from an elevation just below the minimum planned operating level of the reservoir. The pipe will be designed for ten cfs, the recommended fishery release.

Reservoir and its Operation

At a spillway crest elevation of 5,450 feet above sea level, the reservoir will have a gross storage capacity of about 45,000 acre-feet. The lake will have a water surface area of 1,925 acres and a shoreline of about 21 miles.

The reservoir will be operated to minimize drawdown during the recreation season, consistent with water releases to satisfy downstream water rights in Genesee and Indian Valleys and to maintain optimum flows for fishery enhancement. Additional releases to satisfy downstream rights for hydroelectric power will be made as required.

Operation studies show that the reservoir will be full by the first of June in most years and will not be drawn down more than 4.0 feet in the late fall of the driest year. Spillage will occur during the late winter and spring in most



ABBEY BRIDGE RESERVOIR WATER SURFACE HYDROGRAPH

FIGURE 5

years. An operation study of the reservoir from 1920 to 1939 is presented in Appendix A. Corresponding fluctuations of the reservoir water surface are shown in Figure 5.

The effects of the releases upon reservoir recreation and the downstream fishery will be observed for about five years. These observations may indicate the desirability of modifying the release schedule.

Initial Recreation Development

The recreation facilities at the lake will provide for camping, picnicking, swimming, and boating. Furthermore, there will be water supply and sanitary facilities, an administrative area, a concession area, and an overlook. Locations of the initial and future recreation developments and their relationship to peripheral roads are shown on Plate 2.

The initial recreation development has been sized to accommodate the recreation use expected within the first decade of project existence. Additional facilities will be required in subsequent decades.

The Bagley Pass area, shown on Plate 2, was selected for initial development because of a desirable combination of good access, relatively level topography with forest cover, lakeside location, scenic qualities, and nearby springs for a water supply. Initial facilities will include 125 camp units, 35 picnic units, and associated water supply and sanitary facilities. Each unit of the campground will have a parking spur, stationary wooden table, wood-burning campstove, and a leveled area for a tent. Water faucets will be located centrally to groups of four camp units.

The day use area will include centralized parking for picnickers, boat ramps and docks, and parking for boaters. Each picnic unit will be equipped with a wooden table. One stove will be adjacent to four units.

The sanitary facilities will consist of conveniently located comfort stations. A network of surfaced roads will provide internal circulation and access from the main public thoroughfares.

The remainder of the initial development will be on the northern shore of the lake designated as the Lakeside Area. Access will be by boat only. Development will consist of ten primitive camp units, with adequate sanitation and water supply, and a boat dock.

The total cost of the initial recreation facilities is estimated to be $995,000.

Below the dam, the land adjacent to the stream is owned by the U. S. Forest Service. Thus, anglers are assured of public access to the stream. Sanitary facilities could be provided at convenient places along the road. Improvements to the road downstream from the dam are not included within the project plan.

Future Recreation Development

After construction of the initial recreation facilities by the State, the recreation developments will be turned over to the U. S. Forest Service for operation, maintenance,

and future construction of facilities. Mutual agreement between the Departments of Water Resources, Parks and Recreation, and Fish and Game; the U. S. Forest Service; and Plumas County will assure good recreation management.

Additional recreation facilities at the reservoir will be developed depending upon the use after the lake is completed and in operation. The remainder of the recreation lands that are not needed for initial development will be reserved for future recreation developments and for scenic value.

The type of developments and estimated costs of the initial and future facilities are summarized in Table 6. The initial and future recreation facilities are described in more detail in Bulletin 117-4, "Abbey Bridge Reservoir - Water Resources Recreation Report".

Land Acquisition

Bulletin 117-4 includes a Land Use and Acquisition Plan which will serve as the official document authorizing the Department of Water Resources to purchase lands necessary for recreation purposes. The proposed acquisition boundary and the present status of land ownership are shown on Plate 3. This proposed private land acquisition plus the U. S. Forest Service lands around the reservoir are ample to support the recreation use anticipated for a 50-year period.

The total area of privately owned lands within the project boundaries, encompassing the reservoir, onshore recreation areas, and roads is about 2,500 acres. Furthermore,

TABLE 6

ABBEY BRIDGE RESERVOIR RECREATION FACILITIES

Recreation area	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Bagley Pass	125 camp units 35 picnic units 1 overlook 1 boat ramp (5 lanes)	115 camp units			
Lakeside Area	10 boat access camp units			5 boat access camp units	
Red Clover Valley		20 picnic units	25 picnic units 1 group picnic unit	25 picnic units 1 boat ramp (4 lanes) 1 concession area	25 picnic units 1 group picnic unit
Ramelli			50 camp units 1 group camp	60 camp units 1 group camp	65 camp units
Horton					1 group camp
DECADAL TOTAL COST	$995,000	$780,000	$525,000	$615,000	$615,000
TOTAL CAPITAL COST RECREATION FACILITIES					$3,530,000
Present Worth of Recreation Facilities*	$995,000	$485,000	$192,900	$120,000	$ 48,400
Total Present Worth of Recreation Facilities					$1,841,800

*For Analysis Period 1970-2020

not less than 2,200 acres of public lands administered by the U. S. Forest Service will be used for the reservoir and recreation areas.

Acquisition of approximately 9 acres of private land outside the main acquisition boundary, as shown in Plate 3, is proposed to provide public road access to the northeast shore of the reservoir.

These state-purchased lands will be exchanged for other U. S. Forest Service lands. The purpose of this exchange is to transfer control of the recreation developments to Plumas National Forest.

A flowage easement is proposed for about 461 acres of privately owned lands outside of the proposed acquisition boundaries which will be subject to inundation during the winter. This inundation will result from temporary surcharge storage of flood flows above the spillway crest. The highest of these lands will be inundated only by the probable maximum flood with an average recurrence interval greater than 10,000 years. Only 50 percent of these lands will be inundated by a 1,000-year flood and 20 percent by a 100-year flood. Since these lands are not required for onshore recreation, acquisition in fee title is not necessary for the project. The extent of these lands is defined on Plate 3 by a flowage easement boundary.

Access Road

Safe access for the public must be available to realize the anticipated recreation use of Abbey Bridge reservoir. Department policy is that one access road to each reservoir in the Upper Feather River Basin should be considered a part of the project works and that it will be constructed to conform with the design standards of the County Engineers' Association of California.

Several alternative routes for an access road to the reservoir area were considered. These routes generally followed those of existing unpaved roads. On the basis of cost estimates and other considerations, it was determined that the most feasible route would connect Abbey Bridge reservoir with Lake Davis by means of a relocated road over Bagley Pass. This will be an extension of the planned access road to Lake Davis from State Route 70.

The new work will consist of paving and other improvements to 2.8 miles of existing roads at Lake Davis, and construction of a new alignment 4.2 miles long over Bagley Pass. This surfaced road will end at the relocated Genesee-Beckwourth County Road (Forest Service No. 26N16) near the southwestern shore of Abbey Bridge reservoir. The routes of this access road and other proposed and existing roads are shown on Plate 4.

The route of this access road will pass through private lands in the vicinity of Bagley Pass, as shown on

Plate 4. Plumas County will provide the right-of-way and maintain the completed road.

Peripheral Roads

About eight miles of relocated roads will be required around the lake to replace county and U. S. Forest Service roads which will be inundated. The relocated Genesee-Beckwourth County Road will provide access to the south shore of the lake. U. S. Forest Service Road No. 25N05, leading to McReynolds Valley, will be relocated across the dam, thence along the northwest shore of the lake.

A new road, to be constructed to Forest Service standards, will connect Road No. 25N05 to Road No. 27N02 and provide access to the northeast shore of the lake. This road (shown on Plates 2, 3, and 4) is about six miles long.

Costs

Estimates of capital and annual costs for the aforementioned project features were prepared in 1966. Initial and future recreation development cost estimates were made by the Department of Parks and Recreation.

Capital Costs

For the economic analysis it was assumed that the dam, roads, and the initial recreation facilities will be constructed during 1968 and 1969 for use by 1970. The future

onshore facilities are staged at ten-year intervals (Table 6) to accommodate progressive increases in demand.

Estimated capital costs for the project are shown in Table 7. Design engineering, contingencies, administration, and construction supervision are included.

The total capital cost is $7,375,000 including present worth of costs of future recreation facilities.

TABLE 7

CAPITAL COSTS

Item	Capital Costs
Dam and Reservoir	
Dam	$2,764,000
Peripheral roads	1,240,000
Lands	330,000 1/
Subtotal	$4,334,000
Recreation Facilities	
Initial cost	$ 995,000
Present worth of future costs	847,000
Subtotal	$1,842,000
Access Road	$1,199,000 2/
TOTAL	$7,375,000

1/ Costs include acquisition, easements, and $20,000 for fencing.
2/ Costs include $8,000 for right-of-way and $15,000 for fencing.

Annual Equivalent Costs

Annual equivalent costs include repayment of capital investment with interest (capital recovery); operation,

maintenance, and replacement; and annual planting of fingerling trout. Capital recovery is based upon a 50-year repayment period with an interest rate of four percent per annum. Fish planting costs were estimated by the Department of Fish and Game. Summaries of average annual equivalent costs for the project are shown in Table 8. The total amount of annual equivalent cost is $484,000.

TABLE 8

AVERAGE ANNUAL EQUIVALENT ECONOMIC COSTS
(4% Interest and 50-year Repayment Period)

Item	Annual Cost
Capital Recovery	
Dam	$128,700
Peripheral roads	57,700
Lands	15,400
Recreation facilities	85,800
Access road	55,700
Subtotal	$343,300
Operation, Maintenance, and Replacement	
Dam	$ 18,000
Recreation facilities	112,500
Subtotal	$130,500
Planting of Fingerling Trout	$ 10,200
TOTAL, Average annual equivalent cost	$484,000

Accomplishments

The accomplishments of the Abbey Bridge Project will be the increase in recreation and angling use over that use which would occur without the project. Estimates over a 50-year period were presented in Chapter 2 for use without the project and for downstream use with the project. Quantitative assumptions made for estimation of use at the reservoir were also presented in Chapter 2.

Project Use

The presence of a lake will substantially increase the recreation potential of Red Clover Valley and Clover Valley. The predominant use of Abbey Bridge reservoir will be angling, with swimming and boating as minor uses. There will be some general use of the lake and adjacent lands for other purposes, such as camping, picnicking, and hiking, which will be additional to that of the use by fishermen.

The Abbey Bridge reservoir area is similar to the Frenchman Lake area with respect to topography, surface geology, and vegetation and should provide a comparable fishery. The initial level of fishing use for Abbey Bridge reservoir was estimated from data supplied by the Department of Fish and Game, based on fish productivity and angler use at Frenchman Lake. It is based upon a fingerling planting rate of 300 trout per effective surface acre per year. It was

assumed that the maximum level of productivity will occur by the end of the third year of reservoir operation, with attendant high angler use. Extremely high angling pressure should continue for several years as the natural fish production declines from its maximum level. This expected decline in fish growth has occurred at numerous other reservoirs because of a decrease in the richness of the nutrients upon which the fish feed.

By 1980, angler use should level off to match the inherent fish productivity of the reservoir. Thereafter, it is assumed that angler use will gradually increase for the remainder of the 50-year study period due to population increase and that anglers will become satisfied with less angling success. (In sizing the reservoir it was assumed that, as angling success decreases, a smaller proportion of the population would be satisfied with the decreasing success.)

Based upon Frenchman Lake survey data, it was assumed that nonangling recreation use will be 25 percent of the total reservoir recreation use in 1970. Succeeding decades are expected to show an increasing trend toward general recreation use, with nonangling use accounting for 50 percent of the total reservoir recreation use by 2020.

Hunting use of the area will not be appreciably affected by the reservoir. Summer range for deer is plentiful, and the inundation of Red Clover Valley will cause no important loss to the local deer population. It is doubtful that the

reservoir will increase the present use of the area by waterfowl. For the purpose of this evaluation, it was assumed that the estimated general use with the project includes hunter use.

Estimates of recreational use for the project are summarized in Table 9.

TABLE 9

ESTIMATED RECREATION USE WITH THE PROJECT
(In Visitor-Days)

Year	Downstream fishing	Reservoir area		Total
		Fishing	General	
1970	2,000	38,000	13,000	53,000
1972	2,000	185,000	33,000	220,000
1980	3,000	111,000	48,000	162,000
1990	4,000	125,000	67,000	196,000
2000	5,000	139,000	93,000	237,000
2010	6,000	153,000	125,000	284,000
2020	7,000	167,000	167,000	341,000

Increase in Use Due to the Project

The estimated increase in recreation use with the project over the use under nonproject conditions is shown in Table 10.

TABLE 10

ESTIMATED INCREASE IN RECREATION USE DUE TO THE PROJECT
(In Visitor-Days)

Year	Total increase
1970	49,000
1972	215,700
1980	157,200
1990	190,400
2000	230,500
2010	276,700
2020	332,900

Benefits

Benefits represent the advantages or net gains to beneficiaries from project services. Only primary or direct benefits from the Abbey Bridge Project are assigned monetary values in this evaluation. The stimulation of economic activity made possible by the project is expected to have local, county, and statewide secondary effects.

Recreation and fish and wildlife enhancement benefits are considered as the direct benefits attributed to individuals who visit the facilities at the reservoir and to anglers downstream. They are based upon the increment of use due to the project, as shown in Table 10.

To convert this increased use into benefits, a dollar value to the average individual user was estimated. This value was derived on the basis of distribution of recreationists according to distance from their homes to the reservoir and their length of stay in the area. Information on this distribution was obtained from surveys at Frenchman Lake in 1963. The average benefit per visitor-day was found to be $2.40 in 1966, the year in which cost estimates were made.

Under nonproject conditions most of the use would result from people residing less than 50 miles from Red Clover Valley. Minimal facilities probably would be provided for them. Based on these considerations, the average benefit per visitor-day under nonproject conditions was estimated to be $0.50

Application of $2.40 per visitor-day of use with the project less $0.50 per visitor-day of use without the project, over the 50-year period of study (1970 to 2020), results in an average annual equivalent benefit of $488,300.

Economic Justification

Water development projects are considered to be economically justified if estimated total benefits exceed total economic costs.

The average annual equivalent primary benefits for the Abbey Bridge Project are $488,300 and the average annual

equivalent costs are $484,000. This project is therefore economically justified.

Other Economic Considerations

Other considerations concerning the project are discussed below. They pertain to the important areas of project financing and local economic development.

Cost Allocation

All benefits credited to the Abbey Bridge Project are attributable to the project purposes of recreation and fish and wildlife enhancement. Therefore, 100 percent of the total costs are allocated to these purposes and will be funded by appropriations under the Davis-Dolwig Act.

Economic Development

The expansion of the local economy was a primary objective of the Legislature when, in 1957, the five reservoirs in the Upper Feather River Basin were authorized. Previous studies by the Department had shown the importance of recreation to the economic development of the region. These reservoirs were considered essential to the development of the recreation potential of this area.

With the stabilization of the timber and livestock industries, the economy of Plumas and adjacent counties has not kept pace with that of California as a whole. This is

illustrated by a comparison of the rate of increase in sales transactions for Plumas County with that of the State, as tabulated below.

TRANSACTIONS TAXABLE UNDER THE SALES AND USE TAX LAW
($1,000,000)

Year	State		Plumas County	
	Amount	Index	Amount	Index
1950	12,259	100	10.8	100
1954	15,295	125	9.8	91
1955	17,994	147	11.2	104
1958	19,712	161	11.5	106
1959	22,795	186	12.5	116
1960	23,361	190	13.7	127
1961	23,987	196	12.1	112
1962	25,969	212	12.5	116
1963	27,892	228	14.5	134
1964	30,265	246	14.7	137

Source: 1965 California Statistical Abstract, Board of Equalization, Research and Statistics

A further indication of economic conditions in the Upper Feather River Basin area is illustrated by the following: Plumas, Lassen, and Sierra Counties have been designated as redevelopment areas by the U. S. Department of Commerce under the Public Works and Economic Development Act of 1965. The criteria for this designation are high unemployment or low income. Such a designation means that the Secretary of Commerce is authorized to make grants for eligible public works projects in these counties. The three counties are eligible for the basic grant plus the full supplementary grant, the latter being available only to severely distressed areas.

Completion of Frenchman and Antelope Lakes and the construction of Grizzly Valley Dam have contributed to the recent expansion of the economy in the area. The influx of recreationists and construction workers has stimulated commercial establishments and services, but a continuing program for development of recreation sites and facilities is required to further this trend.

The studies of potential demand, previously presented, show that construction of Abbey Bridge reservoir is the next logical step in such a program. Aside from being justified on the basis of primary benefits from recreation use, this authorized project is desirable from the standpoint of increased local economic activities. This may in fact be the most significant consideration in connection with justification of this project.

CHAPTER 4. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are based on the results of the advance planning studies.

1. The reservoir should be operated as a recreation project to provide on-site fishery enhancement and controlled streamflow releases for downstream fishery enhancement.

2. A project with a reservoir of 45,000 acre-feet gross storage capacity will provide maximum net economic benefits. It is engineeringly feasible and economically justified.

3. Early development of a fishery at Abbey Bridge reservoir, together with necessary recreational facilities, will help meet the rapidly increasing demand for trout fishing, an important aspect of outdoor recreation.

4. The construction of three reservoirs of the State Water Project in the Upper Feather River Area has contributed to the economic development of a recognized depressed area. Early construction of the Abbey Bridge Project is needed to provide further stimulation of local business activities.

It is recommended that:

1. The design of the dam, reservoir, peripheral roads, and recreation facilities be based on plans substantially in accord with those presented herein.

2. The surfaced access to Abbey Bridge reservoir be provided by construction of a road over Bagley Pass which would connect to the Lake Davis access road.

3. The Department budget necessary funds to start construction of Abbey Bridge Dam and reservoir and access roads during Fiscal Year 1967-68, with costs adjusted to the 1967-68 base.

4. A water rights application be filed with the State Water Rights Board for the additional storage required for the proposed 45,000 acre-foot Abbey Bridge reservoir.

5. An agreement be negotiated with downstream water users on operation of Abbey Bridge reservoir.

APPENDIX A

ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR

APPENDIX A

ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR
(All Quantities in Acre-Feet)

Month and Year	Inflow (from Table 2) (1)	Gross storage on first of month (2)	Fish release1/ (3)	Net depletion of inundated reservoir area2/ (4)	Spill and other releases (5)	Monthly change in flow (6)	
1920							
Jan	780	41,150	310	100		- 470	
Feb	940	41,520	280	90		- 660	
Mar	3,470	42,090	310	160	90	-3,070	
Apr	7,350	45,000	300	210	6,840	- 210	
May	4,150	45,000	310	100	3,740	- 100	
June	270	45,000	300	220		+ 30	
July	640	44,750	620	480		- 20	
Aug	40	44,290	620	700		+ 580	
Sept	40	43,010	600	500		+ 560	
Oct	170	41,950	310	280		+ 140	
Nov	940	41,530	300	150		- 640	
Dec	5,820	42,020	310	180	2,350	-3,160	
TOTAL	24,610		4,570	3,170	13,020	-7,020	
1921							
Jan	6,200	45,000	310	110	5,780	- 110	
Feb	6,290	45,000	280	100	5,910	- 100	
Mar	16,990	45,000	310	160	16,520	- 160	
Apr	19,830	45,000	300	210	19,320	- 210	
May	8,840	45,000	310	100	8,430	- 100	
June	1,070	45,000	300	220	550	- 220	
July	220	45,000	620	480		+ 400	
Aug	130	44,120	620	700		+ 490	
Sept	100	42,930	600	500		+ 500	
Oct	190	41,930	310	280		+ 120	
Nov	260	41,530	300	150		+ 40	
Dec	2,940	41,340	310	170		-2,630	
TOTAL	63,060		4,570	3,180	56,510	-1,980	
1922							
Jan	2,880	43,800	310	110	1,260	-1,310	
Feb	4,960	45,000	280	100	4,580	- 100	
Mar	10,200	45,000	310	160	9,730	- 160	
Apr	22,320	45,000	300	210	21,810	- 210	
May	20,390	45,000	310	100	19,980	- 100	
June	2,990	45,000	300	220	2,470	- 220	
July	430	45,000	620	490		+ 190	
Aug	190	44,320	620	700		+ 430	
Sept	150	43,190	600	500		+ 450	
Oct	160	42,240	310	280		+ 150	
Nov	220	41,810	300	150		+ 80	
Dec	3,960	41,580	310	180	50	-3,600	
TOTAL	68,850		4,570	3,200	59,880	-4,400	

ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR
(All Quantities in Acre-Feet)

Month and Year	Inflow (from Table 2) (1)	Gross storage on first of month (2)	Fish Release 1/ (3)	Net depletion of inundated reservoir area 2/ (4)	Spill and other releases (5)	Monthly change in flow (6)	
1923							
Jan	2,590	45,000	310	110	2,170	- 110	
Feb	2,660	45,000	280	100	2,280	- 100	
Mar	5,680	45,000	310	160	5,210	- 160	
Apr	13,270	45,000	300	210	12,760	- 210	
May	7,190	45,000	310	100	6,780	- 100	
June	590	45,000	300	220	70	- 220	
July	180	45,000	620	480		+ 440	
Aug	110	44,080	620	700		+ 510	
Sept	100	42,870	600	500		+ 500	
Oct	60	41,870	310	280		+ 250	
Nov	60	41,340	300	150		+ 240	
Dec	430	40,950	310	170		- 120	
TOTAL	32,920		4,570	3,180	29,270	+ 920	
1924							
Jan	370	40,900	310	100		- 60	
Feb	1,060	40,860	280	90		- 780	
Mar	930	41,550	310	150		- 620	
Apr	2,270	42,020	300	190		-1,970	
May	510	43,800	310	100		- 200	
June	30	43,900	300	210		+ 270	
July	10	43,420	620	470		+ 610	
Aug	10	42,340	620	670		+ 610	
Sept	20	41,060	600	480		+ 580	
Oct	100	40,000	310	270		+ 210	
Nov	160	39,520	300	150		+ 140	
Dec	1,450	39,230	310	160		-1,140	
TOTAL	6,920		4,570	3,040	0	-2,350	
1925							
Jan	1,260	40,210	310	100		- 950	
Feb	7,270	41,060	280	100	2,950	-4,040	
Mar	5,600	45,000	310	160	5,130	- 160	
Apr	11,880	45,000	300	210	11,370	- 210	
May	4,440	45,000	310	100	4,030	- 100	
June	260	45,000	300	220		+ 40	
July	10	44,740	620	480		+ 610	
Aug	50	43,650	620	690		+ 570	
Sept	60	42,390	600	490		+ 540	
Oct	70	41,360	310	280		+ 240	
Nov	90	40,840	300	150		+ 210	
Dec	850	40,480	310	170		- 540	
TOTAL	31,840		4,570	3,150	23,480	-3,790	

ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR
(All Quantities in Acre-Feet)

Month and Year	Inflow (from Table 2) (1)	Gross storage on first of month (2)	Fish release 1/ (3)	Net depletion of inundated reservoir area 2/ (4)	Spill and other releases (5)	Monthly change in flow (6)	
1926							
Jan	630	40,850	310	100		- 320	
Feb	2,600	41,070	280	100		-2,320	
Mar	3,700	43,290	310	160	1,520	-1,870	
Apr	8,900	45,000	300	210	8,390	- 210	
May	1,590	45,000	310	100	1,180	- 100	
June	90	45,000	300	220		+ 210	
July	30	44,570	620	480		+ 590	
Aug	20	43,500	620	690		+ 600	
Sept	30	42,210	600	490		+ 570	
Oct	130	41,150	310	270		+ 180	
Nov	870	40,700	300	150		- 570	
Dec	4,210	41,120	310	180		-3,900	
TOTAL	22,800		4,570	3,150	11,090	-7,140	
1927							
Jan	3,790	44,840	310	110	3,210	- 270	
Feb	14,780	45,000	280	100	14,400	- 100	
Mar	15,540	45,000	310	160	15,070	- 160	
Apr	23,940	45,000	300	210	23,430	- 210	
May	10,610	45,000	310	100	10,200	- 100	
June	1,300	45,000	300	220	780	- 220	
July	220	45,000	620	480		+ 400	
Aug	110	44,120	620	700		+ 510	
Sept	100	42,910	600	500		+ 500	
Oct	110	41,910	310	280		+ 200	
Nov	350	41,430	300	150		- 50	
Dec	1,640	41,330	310	170		-1,330	
TOTAL	72,490		4,570	3,180	67,090	- 830	
1928							
Jan	1,580	42,490	310	110		-1,270	
Feb	2,310	43,650	280	100	580	-1,450	
Mar	23,140	45,000	310	160	22,670	- 160	
Apr	14,530	45,000	300	210	14,020	- 210	
May	5,410	45,000	310	100	5,000	- 100	
June	180	45,000	300	220		+ 120	
July	60	44,660	620	480		+ 560	
Aug	40	43,620	620	690		+ 580	
Sept	50	42,350	600	490		+ 550	
Oct	60	41,310	310	270		+ 250	
Nov	90	40,790	300	150		+ 210	
Dec	820	40,430	310	160		- 510	
TOTAL	48,270		4,570	3,140	42,270	-1,430	

APPENDIX A

ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR
(All Quantities in Acre-Feet)

Month and Year	Inflow (from Table 2) (1)	Gross storage on first of month (2)	Fish release 1/ (3)	Net depletion of inundated reservoir area 2/ (4)	Spill and other releases (5)	Monthly change in flow (6)	
1929							
Jan	510	40,780	310	100		- 200	
Feb	830	40,880	280	90		- 550	
Mar	2,190	41,340	310	150		-1,880	
Apr	3,590	43,070	300	200	1,160	-2,130	
May	2,330	45,000	310	100	1,920	- 100	
June	180	45,000	300	220		+ 120	
July	40	44,660	620	480		+ 580	
Aug	30	43,600	620	690		+ 590	
Sept	30	42,320	600	490		+ 570	
Oct	60	41,260	300	270		+ 250	
Nov	70	40,740	300	150		+ 230	
Dec	4,600	40,360	310	170		-4,290	
TOTAL	14,460		4,570	3,110	3,080	-6,810	
1930							
Jan	1,380	44,480	310	110	440	- 630	
Feb	2,890	45,000	280	100	2,510	- 100	
Mar	5,970	45,000	310	160	5,500	- 160	
Apr	10,580	45,000	300	210	10,070	- 210	
May	2,960	45,000	310	100	2,550	- 100	
June	240	45,000	300	220		+ 60	
July	60	44,720	620	480		+ 560	
Aug	40	43,680	620	690		+ 580	
Sept	50	42,410	600	500		+ 550	
Oct	40	41,360	310	280		+ 270	
Nov	60	40,810	300	150		+ 240	
Dec	330	40,420	310	160		- 20	
TOTAL	24,600		4,570	3,160	21,070	+1,040	
1931							
Jan	380	40,280	310	100		- 70	
Feb	520	40,250	280	90		- 240	
Mar	1,730	40,400	310	150		-1,420	
Apr	2,280	41,670	300	200		-1,980	
May	590	43,450	310	100		- 280	
June	410	43,630	300	210		- 110	
July	10	43,530	620	470		+ 610	
Aug	10	42,450	620	680		+ 610	
Sept	20	41,160	600	480		+ 580	
Oct	110	40,100	310	270		+ 200	
Nov	140	39,630	300	140		+ 160	
Dec	2,900	39,330	310	170		-2,590	
TOTAL	9,100		4,570	3,060	0	-4,530	

APPENDIX A

ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR
(All Quantities in Acre-Feet)

Month and Year	Inflow (from Table 2) (1)	Gross storage on first of month (2)	Fish release[1] (3)	Net depletion of inundated reservoir area[2] (4)	Spill and other releases (5)	Monthly change in flow (6)	
1932							
Jan	2,190	41,750	310	100		-1,880	
Feb	3,530	43,530	280	100	1,680	-1,570	
Mar	1,090	45,000	310	160	620	- 160	
Apr	16,380	45,000	300	210	15,870	- 210	
May	9,950	45,000	310	100	9,540	- 100	
June	1,000	45,000	300	220	480	- 220	
July	160	45,000	620	490		+ 460	
Aug	80	44,050	620	700		+ 540	
Sept	70	42,810	600	500		+ 530	
Oct	70	41,780	310	280		+ 240	
Nov	80	41,260	300	150		+ 220	
Dec	630	40,890	310	160		- 320	
TOTAL	35,230		4,570	3,170	28,190	-2,470	
1933							
Jan	490	41,050	310	100		- 180	
Feb	670	41,130	280	90		- 390	
Mar	2,780	41,430	310	150		-2,470	
Apr	6,240	43,750	300	210	4,480	-1,460	
May	2,860	45,000	310	100	2,450	- 100	
June	450	45,000	300	220		- 150	
July	60	44,930	620	490		+ 560	
Aug	30	43,880	620	700		+ 590	
Sept	40	42,590	600	500		+ 560	
Oct	50	41,530	310	280		+ 260	
Nov	50	40,990	300	150		+ 250	
Dec	820	40,590	310	160		- 510	
TOTAL	14,540		4,570	3,150	6,930	-3,040	
1934							
Jan	810	40,940	310	100		- 500	
Feb	1,340	41,340	280	90		-1,060	
Mar	3,770	42,310	310	160	610	-2,850	
Apr	3,610	45,000	300	210	3,100	- 210	
May	640	45,000	310	100	230	- 100	
June	460	45,000	300	220		- 160	
July	20	44,940	620	490		+ 600	
Aug	10	43,850	620	700		+ 610	
Sept	20	42,540	600	500		+ 580	
Oct	70	41,460	310	270		+ 240	
Nov	190	40,950	300	150		+ 110	
Dec	1,440	40,690	310	160		-1,130	
TOTAL	12,380		4,570	3,150	3,940	-3,870	

ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR
(All Quantities in Acre-Feet)

Month and Year	Inflow (from Table 2) (1)	Gross storage on first of month (2)	Fish Release 1/ (3)	Net depletion of inundated reservoir area 2/ (4)	Spill and other releases (5)	Monthly change in flow (6)	
1935							
Jan	1,590	41,660	310	100		-1280	
Feb	2,830	42,840	280	100	290	-2260	
Mar	4,790	45,000	310	160	4,320	- 160	
Apr	22,450	45,000	300	210	21,940	- 210	
May	7,930	45,000	310	100	7,520	- 100	
June	700	45,000	300	220	180	- 220	
July	100	45,000	620	490		+ 520	
Aug	60	43,990	620	700		+ 560	
Sept	50	42,730	600	500		+ 550	
Oct	80	41,680	310	280		+ 230	
Nov	100	41,170	300	150		+ 200	
Dec	780	40,820	310	160		- 470	
TOTAL	41,460		4,570	3,170	34,250	-2640	
1936							
Jan	3,670	41,130	310	100		-3360	
Feb	6,240	44,390	380	100	5,250	- 710	
Mar	8,380	45,000	310	160	7,910	- 160	
Apr	15,570	45,000	300	210	15,060	- 210	
May	17,060	45,000	310	100	16,650	- 100	
June	440	45,000	300	290		- 140	
July	80	44,920	620	490		+ 540	
Aug	50	43,890	620	700		+ 570	
Sept	50	42,620	600	500		+ 550	
Oct	50	41,570	310	280		+ 260	
Nov	60	41,030	300	150		+ 240	
Dec	510	40,640	310	160		- 200	
TOTAL	52,160		4,570	3,170	44,870	-2720	
1937							
Jan	390	40,680	310	100		- 80	
Feb	1,600	40,660	280	90		-1320	
Mar	3,820	41,890	310	160	240	-3270	
Apr	8,320	45,000	300	210	7,810	- 210	
May	14,940	45,000	310	100	14,530	- 100	
June	290	45,000	300	220		+ 10	
July	60	44,770	620	480		+ 560	
Aug	30	43,730	620	700		+ 590	
Sept	30	42,440	600	500		+ 570	
Oct	100	41,370	310	270		+ 210	
Nov	30	40,890	300	150		+ 270	
Dec	5,860	40,470	310	180	840	-4710	
TOTAL	35,470		4,570	3,160	23,420	-7480	

APPENDIX A

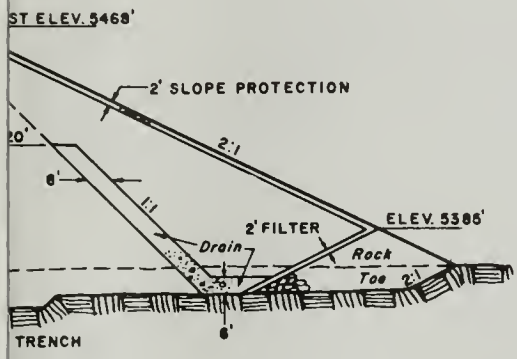
ILLUSTRATIVE OPERATION STUDY OF ABBEY BRIDGE RESERVOIR
(All Quantities in Acre-Feet)

Month and Year	Inflow (from Table 2) (1)	Gross storage on first of month (2)	Fish release 1/ (3)	Net depletion of inundated reservoir area 2/ (4)	Spill and other releases (5)	Monthly change in flow (6)	
1938							
Jan	1,690	45,000	310	110	1,270	-110	
Feb	4,740	45,000	280	100	4,360	-110	
Mar	25,540	45,000	310	160	25,070	-160	
Apr	21,550	45,000	300	210	21,040	-210	
May	40,690	45,000	310	100	40,280	-100	
June	930	45,000	300	220	410	-220	
July	190	45,000	610	480		+430	
Aug	90	44,090	620	700		+530	
Sept	90	42,860	600	500		+510	
Oct	60	41,850	310	280		+250	
Nov	80	41,320	300	150		+220	
Dec	530	40,950	310	160		-220	
TOTAL	96,180		4,570	3,170	92,430	+820	
1939							
Jan	390	41,010	310	100		- 80	
Feb	470	40,990	280	90		-190	
Mar	2,340	41,090	310	160		-2030	
Apr	4,380	42,960	300	210	1,830	-2250	
May	2,420	45,000	310	100	2,010	-100	
June	50	45,000	300	210		+250	
July	20	44,540	620	480		+600	
Aug	20	43,460	620	700		+600	
Sept	30	42,160	600	490		+570	
Oct	60	41,100	310	270		+250	
Nov	70	40,580	300	150		+230	
Dec	700	40,200	310	160		-390	
TOTAL	10,950		4,570	3,120	3,840	-2540	

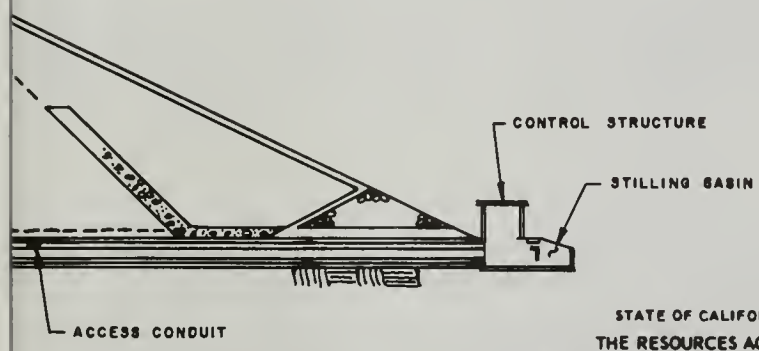
1/ As recommended by Department of Fish and Game.

2/ Evaporation less evapotranspiration losses of native vegetation which occurred under preproject conditions. Monthly unit values, in inches, are:

Jan.	0.69	May	0.63	Sept.	3.25
Feb.	0.64	June	1.34	Oct.	1.86
March	1.02	July	3.15	Nov.	1.03
April	1.29	Aug	4.47	Dec.	1.12
				Total	20.49

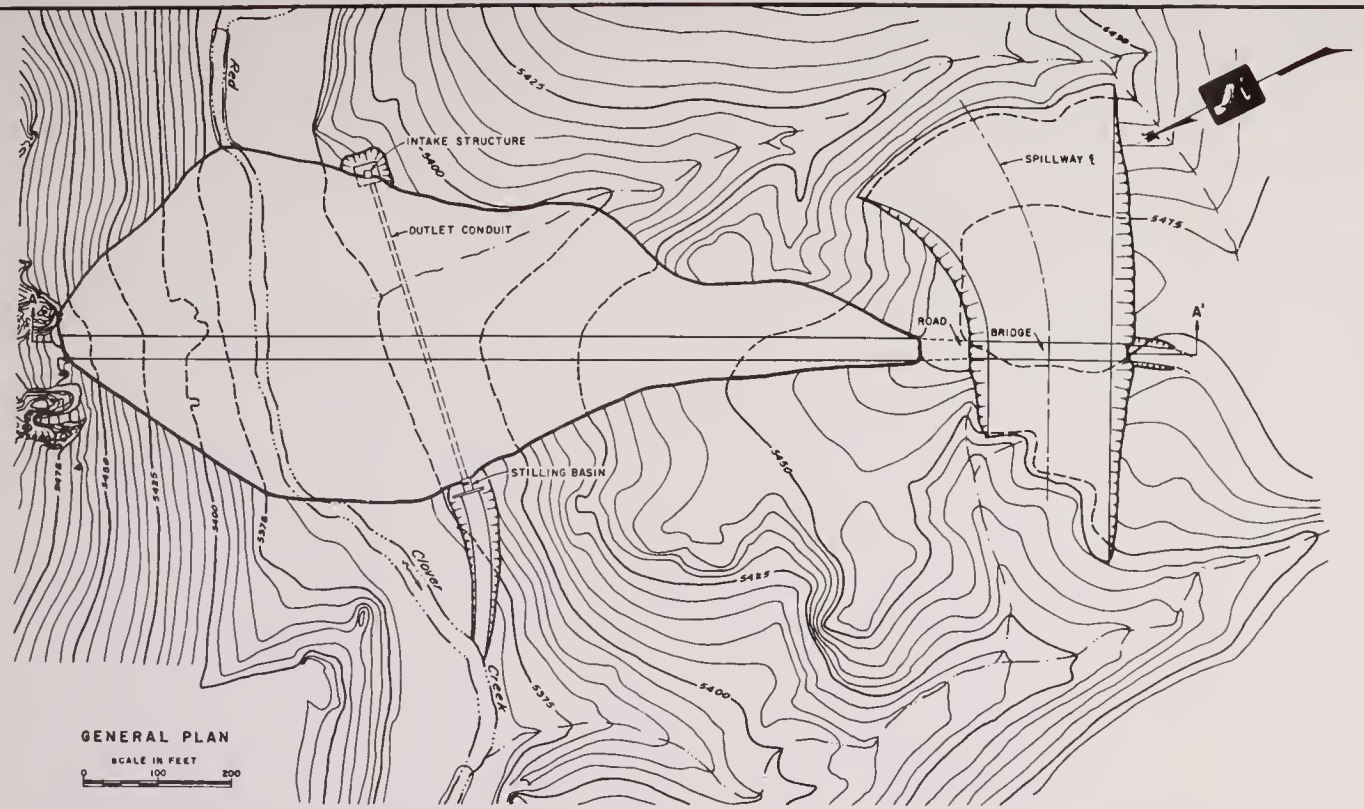


DAM



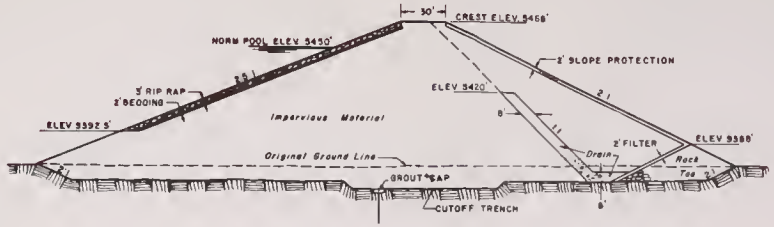
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SACRAMENTO DISTRICT
ADVANCE PLANNING REPORT
ABBEY BRIDGE DAM AND RESERVOIR

ABBEY BRIDGE DAM
PLAN, PROFILE, AND SECTION
1966



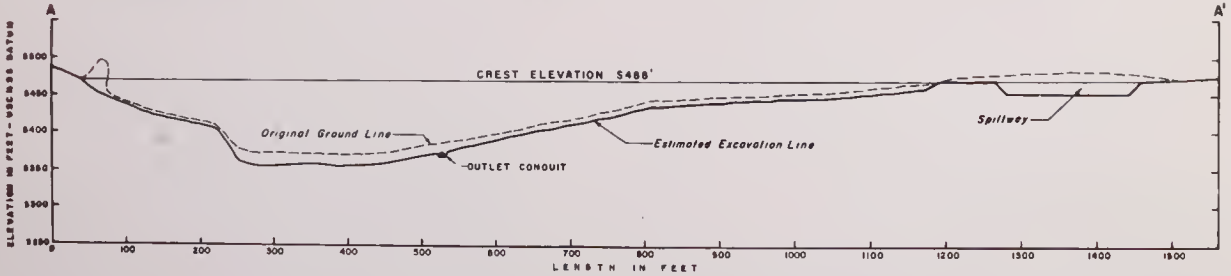
GENERAL PLAN

SCALE IN FEET
0 100 200

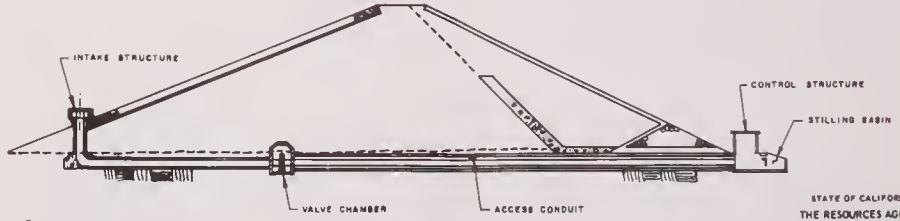


MAXIMUM SECTION OF DAM

SCALE OF FEET
0 50 100



SECTION A-A'

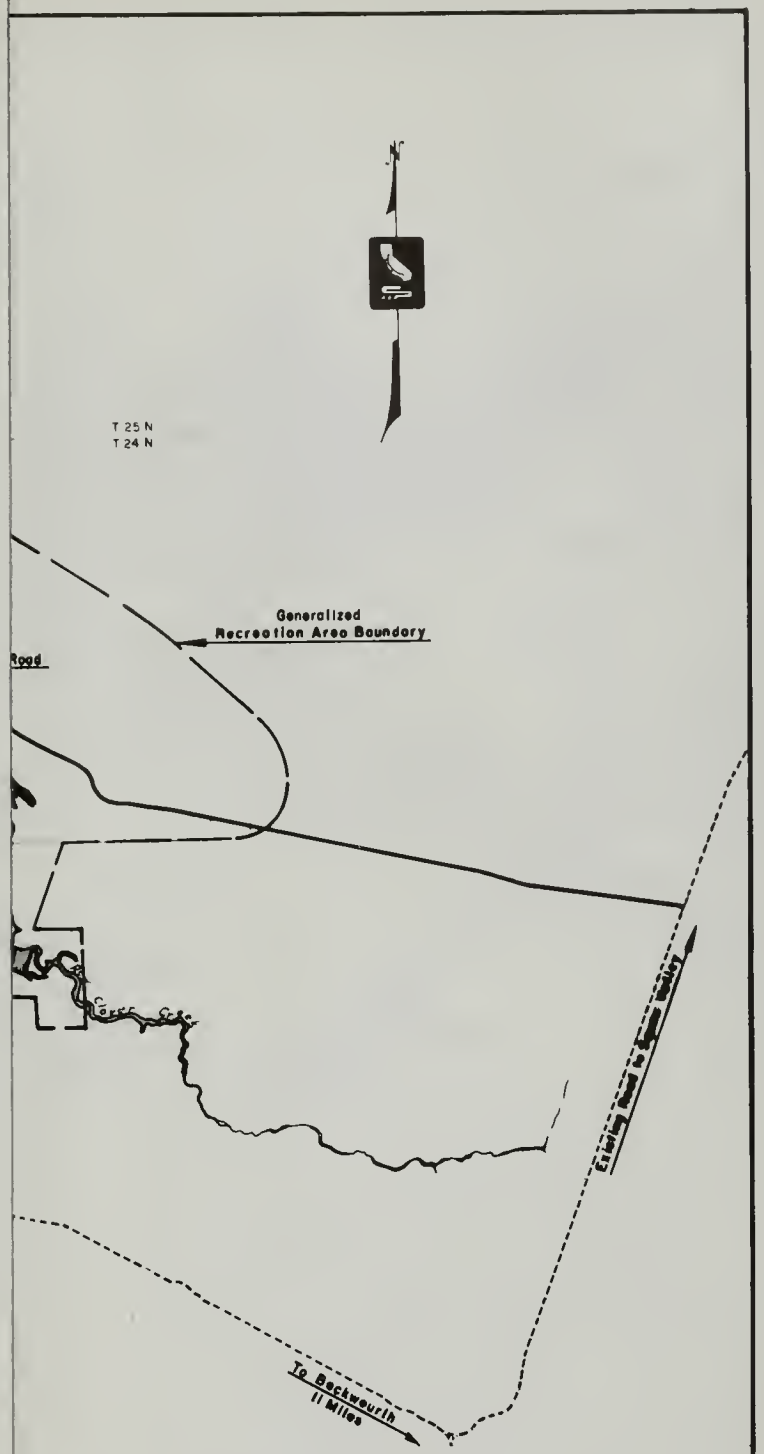


* A SECONDARY, HIGH-LEVEL OUTLET WILL ALSO BE PROVIDED

PRIMARY *
OUTLET WORKS PROFILE

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SACRAMENTO DISTRICT
ADVANCE PLANNING REPORT
ABBEY BRIDGE DAM AND RESERVOIR

ABBEY BRIDGE DAM
PLAN, PROFILE, AND SECTION
1966



STATE OF CALIFORNIA
THE RESOURCES AGENCY
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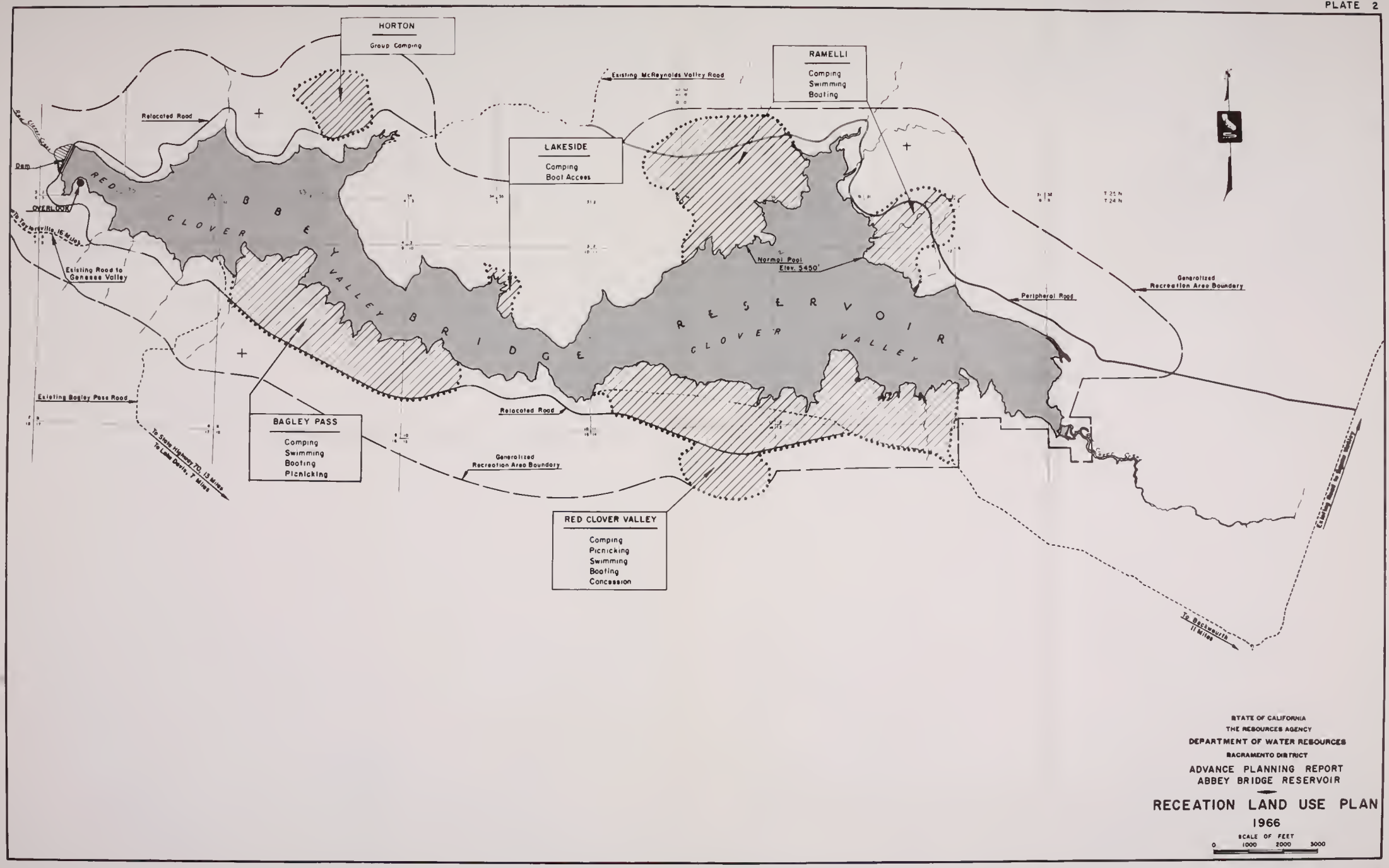
SACRAMENTO DISTRICT

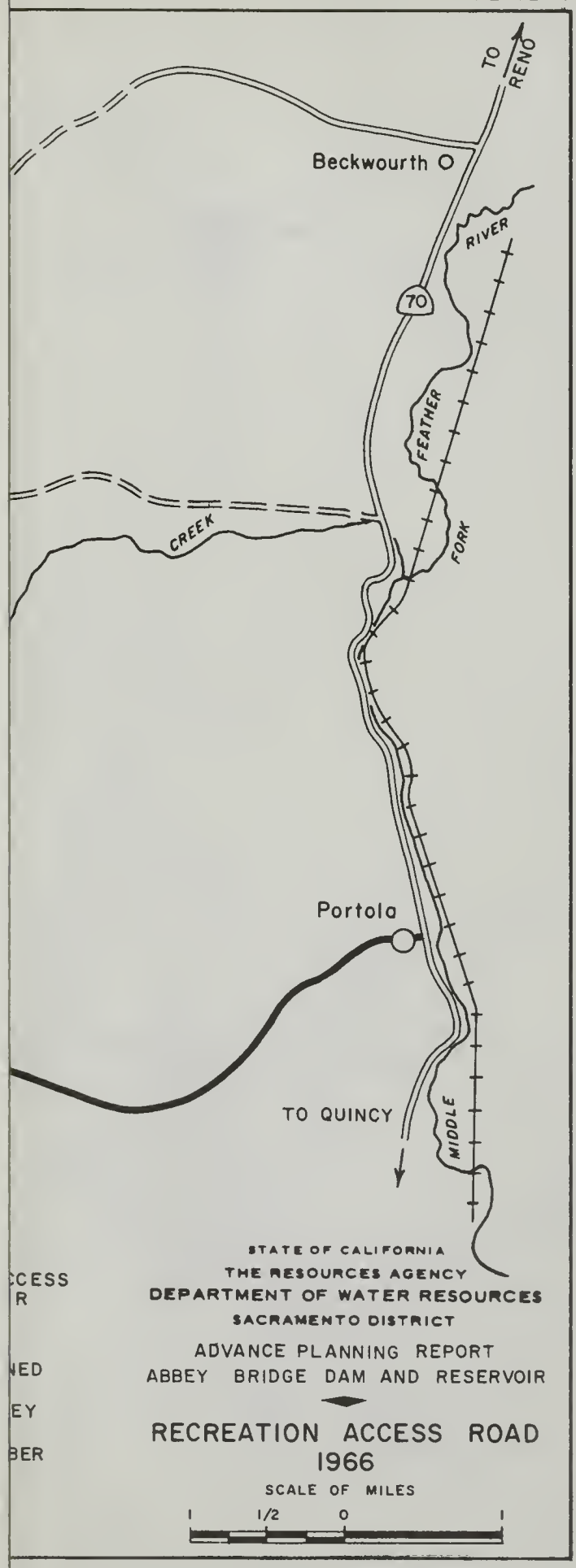
ADVANCE PLANNING REPORT
ABBEY BRIDGE RESERVOIR

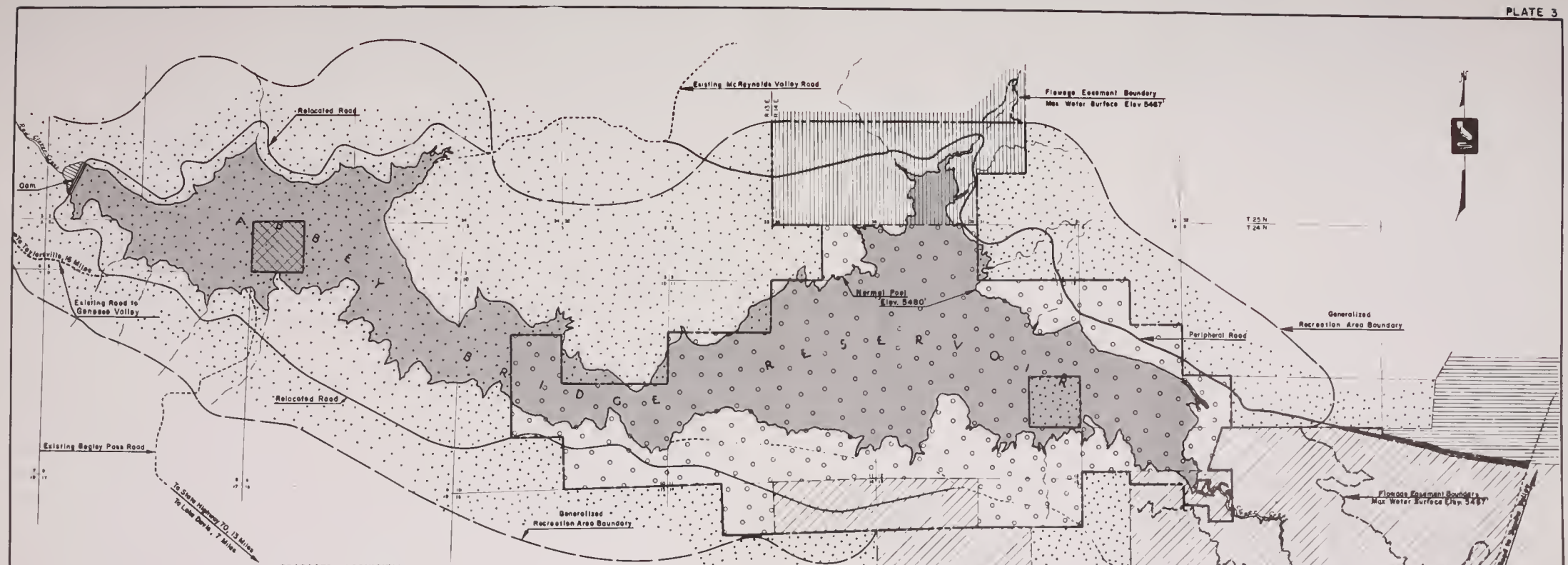
RECEATION LAND USE PLAN

1966

SCALE OF FEET
0 1000 2000 3000


HORTON
Group Camping
RAMELLI
Camping
Swimming
Boating
LAKESIDE
Camping
Boat Access
BAGLEY PASS
Camping
Swimming
Boating
Picnicking
RED CLOVER VALLEY
Camping
Picnicking
Swimming
Boating
Concession
Existing McReynolds Valley Road
Relocated Road
Dam
OVERLOOK
To Taylorville (6 Miles)
Existing Road to Genesee Valley
Existing Bagley Pass Road
To State Highway 70, 13 Miles
To Lake Davis, 7 Miles
Relocated Road
Generalized Recreation Area Boundary
Normal Pool Elev. 5450'
Peripheral Road
Generalized Recreation Area Boundary
To Beckwourth 11 Miles
ABBEY BRIDGE RESERVOIR
RED CLOVER VALLEY
CLOVER VALLEY
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SACRAMENTO DISTRICT
ADVANCE PLANNING REPORT
ABBEY BRIDGE RESERVOIR
RECEATION LAND USE PLAN
1966
SCALE OF FEET
0 1000 2000 3000


TO RENO
Beckwourth
70
RIVER
FEATHER
FORK
CREEK
Portola
TO QUINCY
MIDDLE
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SACRAMENTO DISTRICT
ADVANCE PLANNING REPORT
ABBEY BRIDGE DAM AND RESERVOIR
RECREATION ACCESS ROAD
1966
SCALE OF MILES
1 1/2 0 1



PROPOSED ACQUISITION

OWNER		ACRES TO BE ACQUIRED IN FEE	ACRES TO BE ACQUIRED FLOWAGE EASEMENT
R T Jenkins		40	
Lucky Hereford Ranch	1295	1885.78	
J & H Romelli, A Fisher		380	20
Westover Co.		223	441
	TOTAL	2518.78	461

2518
461

LEGEND

- U. & A
- R. T Jenkins L. & L Company
- Jane Romelli, Aileen Fisher & Hervey Romelli
- Acquisition Boundary
- J A Banta & S.A
- Westover Company, % E. B. Noble
- Lucky Hereford Ranch, a Corp
- Flowage Easement Boundary

STATE OF CALIFORNIA
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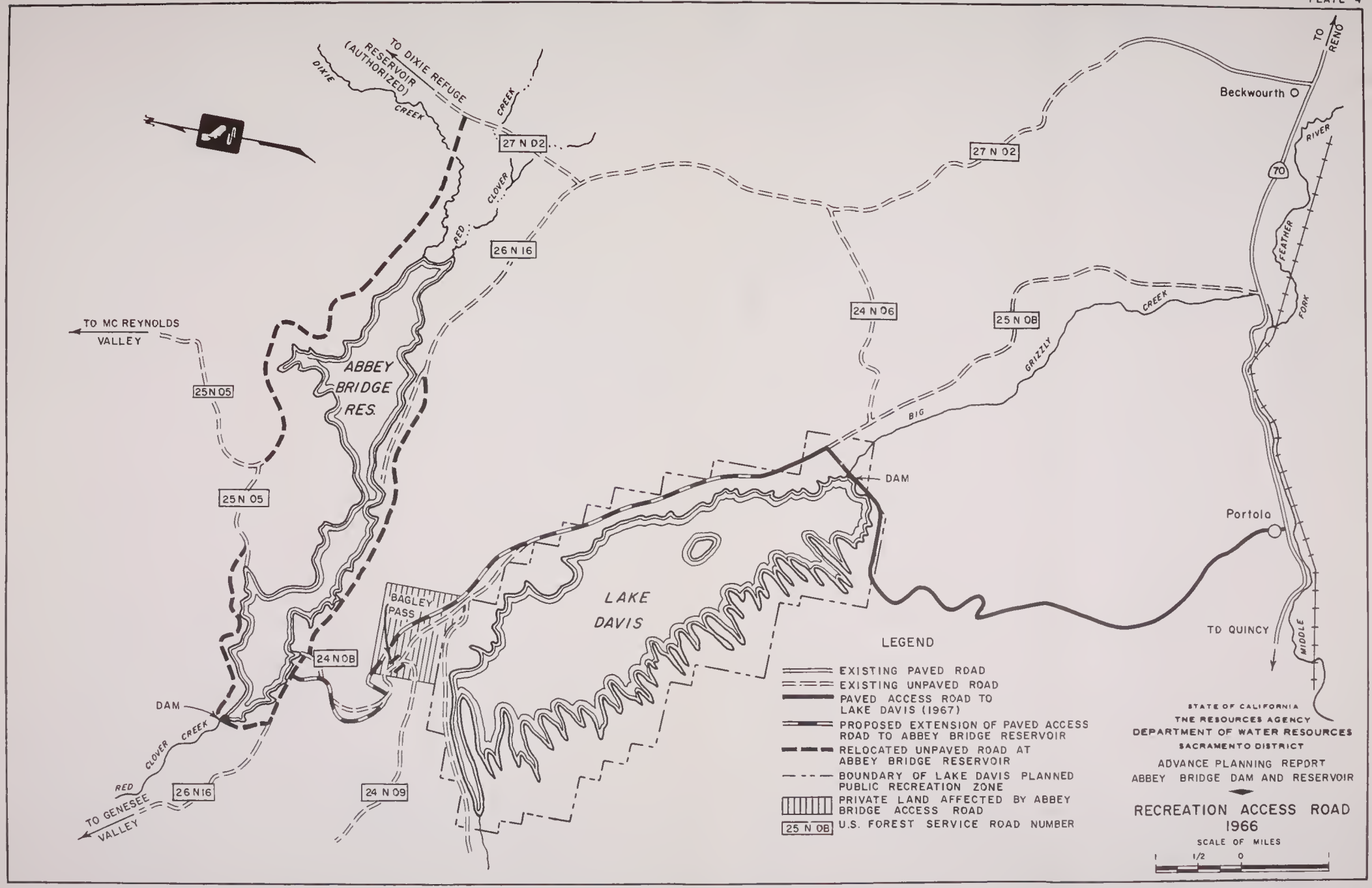
SACRAMENTO DISTRICT

ADVANCE PLANNING REPORT
ABBEY BRIDGE RESERVOIR

LAND ACQUISITION PROPOSAL
1966

SCALE OF FEET
0 1000 2000 3000


TO DIXIE REFUGE
RESERVOIR
(AUTHORIZED)
DIXIE
CREEK
CREEK
27 N 02
CLOVER
RED
26 N 16
27 N 02
24 N 06
25 N 08
CREEK
GRIZZLY
BIG
DAM
Beckwourth
TO RENO
70
RIVER
FEATHER
FORK
Portola
TO QUINCY
MIDDLE
TO MC REYNOLDS
VALLEY
25N 05
ABBEY
BRIDGE
RES.
25 N 05
BAGLEY
PASS
LAKE
DAVIS
24 N 08
DAM
CLOVER
CREEK
RED
26 N 16
24 N 09
TO GENESEE
VALLEY
LEGEND
EXISTING PAVED ROAD
EXISTING UNPAVED ROAD
PAVED ACCESS ROAD TO LAKE DAVIS (1967)
PROPOSED EXTENSION OF PAVED ACCESS ROAD TO ABBEY BRIDGE RESERVOIR
RELOCATED UNPAVED ROAD AT ABBEY BRIDGE RESERVOIR
BOUNDARY OF LAKE DAVIS PLANNED PUBLIC RECREATION ZONE
PRIVATE LAND AFFECTED BY ABBEY BRIDGE ACCESS ROAD
25 N 08 U.S. FOREST SERVICE ROAD NUMBER
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
SACRAMENTO DISTRICT
ADVANCE PLANNING REPORT
ABBEY BRIDGE DAM AND RESERVOIR
RECREATION ACCESS ROAD
1966
SCALE OF MILES
1/2
0