PHY SCI
& ENGR

TC
824
C2
A2
NO.136
PREVIEW

AL
ES
IY

UCD LIBRARY
LIBRARY
UNIVERSITY OF CALIFORNIA
DAVIS

State of California

THE RESOURCES AGENCY OF CALIFORNIA

Department of Water Resources

PREVIEW OF BULLETIN No. 136

NORTH COASTAL AREA INVESTIGATION

SEPTEMBER 1963

DEC 2 1963
LIBRARY

HUGO FISHER
Administrator
The Resources Agency of California

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources

State of California

THE RESOURCES AGENCY OF CALIFORNIA

Department of Water Resources

PREVIEW OF BULLETIN No. 136

NORTH COASTAL AREA INVESTIGATION

SEPTEMBER 1963

HUGO FISHER
Administrator
The Resources Agency of California

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources

HCD LIBRARY
LIBRARY
UNIVERSITY OF CALIFORNIA

TABLE OF CONTENTS

	Page
LETTER OF TRANSMITTAL	vi
ORGANIZATION, DEPARTMENT OF WATER RESOURCES	vii
ORGANIZATION, CALIFORNIA WATER COMMISSION	viii
CHAPTER I. INTRODUCTION	1
State Water Resources Development System	1
Need for North Coastal Area Investigation	2
Purpose of the Report	3
Statewide Water Requirement Considerations	4
North Coastal Area Water Requirements	6
Illustrative Staging of Projects	9
Possible Effects of Saline Water Conversion	10
CHAPTER II. INVESTIGATIVE ACTIVITIES	11
Hydrology and Watershed Management	11
Geology	14
Design and Cost Estimates	16
Recreation	17
Fish and Wildlife Resources	18
Economics	20
Alternative Plans of Development	20
CHAPTER III. PLANS FOR DEVELOPMENT	23
Eel River Basin Above Dos Rios	23
Clear Lake Diversion Project	26

	Page
Greater Berryessa Project	29
Trinity River Developments	30
Trinity Diversion Project	31
South Fork Trinity Project	31
Mad-Van Duzen Project	32
Paskenta-Newville Project	32
Knights Valley Project	33
Eel River Below Dos Rios	34
Klamath River Projects	35
Coastal Stream Basin Projects	37
Summary of Plans for Development	38
CHAPTER IV. COORDINATION OF DEVELOPMENTS	43
Comprehensive Statewide Planning	45
Federal-State Cooperation	46
Department Activity Following This Investigation	50
Summary of Preview Report	51

TABLES

Table No.		Page
1	Estimated Water Requirements in North Coastal Counties by the Year 2020	8
2	Summary of Possible Future Major Water Conservation Projects in the North Coastal Area and Sacramento River Basin	40

FIGURES

Figure No.		Following page
1	Possible Future Water Demands Under the State Water Resources Development System	4

FIGURES

Figure No.		Following page
2	Possible Staging of Additional Conservation Facilities Under the State Water Resources Development System	4

PLATES

Plate No.		Following page
1	Preview of Additional Facilities to the State Water Resources Development System to be Located Within the North Coastal Area and West Side Sacramento Valley	A-1

APPENDIX

Appendix		Page
A	Comments of Federal Agencies on Preview Report of Bulletin No. 136	A-1

WILLIAM E. WARNE
Director of
Water Resources

B. ABBOTT GOLDBERG
Chief Deputy Director

REGINALD C. PRICE
Deputy Director Policy

NEELY GARDNER
Deputy Director
Administration

ALFRED R. GOLZÉ
Chief Engineer

EDMUND G. BROWN
GOVERNOR OF
CALIFORNIA

HUGO FISHER
ADMINISTRATOR
RESOURCES AGENCY

ADDRESS REPLY
P. O. Box 388
Sacramento 2, C

THE RESOURCES AGENCY OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

1120 N STREET, SACRAMENTO

August 22, 1963

Honorable Edmund G. Brown, Governor
and Members of the Legislature
of the State of California

Gentlemen:

I am pleased to transmit herewith a report entitled "Preview of Bulletin No. 136, North Coastal Area Investigation."

This report previews the additional facilities of the State Water Resources Development System for which planning is in progress under the department's North Coastal Area Investigation. The report outlines the need for these additional facilities, the status of planning studies, and the necessity for close coordination between federal, state, and local agencies in the planning and future development of these water resources.

Bulletin No. 136, to be published in July 1964, will recommend more intensive studies leading toward construction of possible future staged major multipurpose water developments in the North Coastal Area.

Sincerely yours,

William E. Warne

Director

Enclosure

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

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

This report was prepared under the direction

of

DIVISION OF RESOURCES PLANNING

William L. Berry . . . . . Division Engineer, Division of Resources Planning
Albert J. Dolcini . . . . . Chief, Planning Management Branch
Meyer Kramsky . . . . . .Chief, Statewide Investigations Branch

and

OFFICE OF THE ASSISTANT CHIEF ENGINEER

John R. Teerink . . . . . .Assistant Chief Engineer
John M. Haley . . . . . Chief, Northern Branch
Stuart T. Pyle . . . . . Chief, Planning Section, Northern Branch

by

Wesley E. Steiner . . . . . Assistant to Chief Engineer
Robert A. Williams . . . . . Chief, North Coastal Investigations

Assisted by

Benson G. Scott . . . . . Senior Engineer
Robert F. Middleton, Jr. . . . . Senior Engineer
George R. Baumli . . . . . Associate Engineer
Donald W. Fisher . . . . . Associate Engineer
Wendell D. Walling . . . . . Associate Engineer
August J. Bill . . . . . Engineering Associate
Fred P. DeRose . . . . . Assistant Engineer
Richard H. Hawkins . . . . . Assistant Engineer
David N. Kennedy . . . . . Assistant Engineer
James G. Lopez . . . . . Engineering Technician I
Gordon V. Holcomb . . . . . Associate Economist
Glenn B. Sawyer . . . . . Associate Land and Water Use Analyst
Vadim Voloshin . . . . . Assistant Engineering Geologist
George McCammon . . . . . .Fisheries Biologist IV
James McDade . . . . . Recreation Planner II

CALIFORNIA WATER COMMISSION

RALPH M. BRODY, Chairman, Fresno

WILLIAM H. JENNINGS, Vice Chairman, La Mesa

JOHN W. BRYANT, Riverside

IRA J. CHRISMAN, Visalia

EDWIN KOSTER, Grass Valley

JOHN P. BUNKER, Gustine

JOHN J. KING, Petaluma

NORRIS POULSON, La Jolla

MARION R. WALKER, Ventura

-----O-----

WILLIAM M. CARAH
Executive Secretary

CHAPTER I. INTRODUCTION

The present and anticipated future dynamic growth of the State of California has placed a tremendous demand upon our water resources and has presented those responsible for the development of these resources with an unprecedented challenge.

California is blessed with sufficient natural water supplies to meet present and all probable future needs, provided these supplies are prudently controlled, conserved, and distributed. In recognition of the importance of water to the maintenance of an expanding economy and to the health and welfare of the citizenry, provisions are being made to meet this unprecedented challenge of developing the State's water resources. Federal, state, and local levels of government are proceeding vigorously toward fulfillment of this goal.

State Water Resources Development System

A primary mission of the Department of Water Resources is the implementation of the State Water Resources Development System. As defined in the California Water Resources Development Bond Act of 1959, popularly known as the Burns-Porter Act, this system includes the Central Valley Project, the State Water Facilities under construction, and the additional facilities that may be authorized by the Legislature or the Department of Water Resources to augment water supplies in the Delta and to meet local needs. These additional facilities will consist of multiple-purpose dams, reservoirs, aqueducts, and appurtenant works in the watersheds of the Sacramento, Eel, Trinity, Mad, Van Duzen, and Klamath Rivers. Implementation of the system is being accomplished by the State through construction of the State Water Facilities and

through encouragement of federal and local agency participation, to the maximum degree possible, in projects best suited to development by those agencies.

The State Water Facilities, the initial state features under the development system, are: Oroville Dam, Reservoir, and power features on the Feather River; Frenchman, Grizzly Valley, Abbey Bridge, Dixie Refuge, and Antelope Valley Dams and Reservoirs in the Upper Feather River Basin; the North and South Bay Aqueducts; the Delta Facilities; the California Aqueduct; and the federal-state joint facilities of the San Luis Division and the San Joaquin Valley Drain. Their history, description, current status, mode of operation, and method of financing are discussed in detail in the department's recent report, Bulletin No. 132-63, entitled "The California State Water Project in 1963," dated April 1963.

Need for North Coastal Area Investigation

In recognition of the necessity to specifically define major multipurpose projects to follow the Feather River Project (subsequently designated State Water Facilities by the Burns-Porter Act), and the Central Valley Project, and to establish their logical sequence of development, the department initiated the North Coastal Area Investigation in July 1958. The initial reconnaissance phase of the continuing investigation will be completed in July 1964 with publication of Bulletin No. 136. The Water Resources Development Bond Act, passed by the Legislature in 1959, and approved by the voters in 1960, provided added official recognition of the necessity of developing additional water supplies; and, within certain limitations, the act provides for the financing of succeeding additions to the State Water Resources Development System.

The objective of the North Coastal Area Investigation is to formulate plans for the optimum development of the water resources of the region, considering all potential uses, including anticipated local and export water supply needs; preservation and enhancement of fish and wildlife resources; development of hydroelectric power and water-associated recreation potential; and protection against floods.

Purpose of the Report

It is the purpose of this report to preview the additional facilities of the State Water Resources Development System for which planning is in progress under the department's North Coastal Area Investigation. This preview report will outline the need for these additional facilities; the status of the department's planning studies for them; and the necessity for close coordination between federal, state, and local agencies in the planning and future development of these water resources.

Detailed discussions and recommendations for specific future water resources developments in the North Coastal area will be incorporated into Bulletin No. 136, "North Coastal Area Investigation," scheduled for publication in July 1964.

A "Progress Report on the North Coastal Area Investigation" was published in May 1961. The purpose of that report was to inform the Legislature and others interested in the status of the investigation, of certain fundamental considerations and problems involved, and of the progress made to that date. The progress report also tentatively identified certain initial and earlier-staged major projects in the North Coastal area.

In a letter dated July 31, 1961, to the Director of Water Resources, Governor Brown approved publication of the North Coastal progress report.

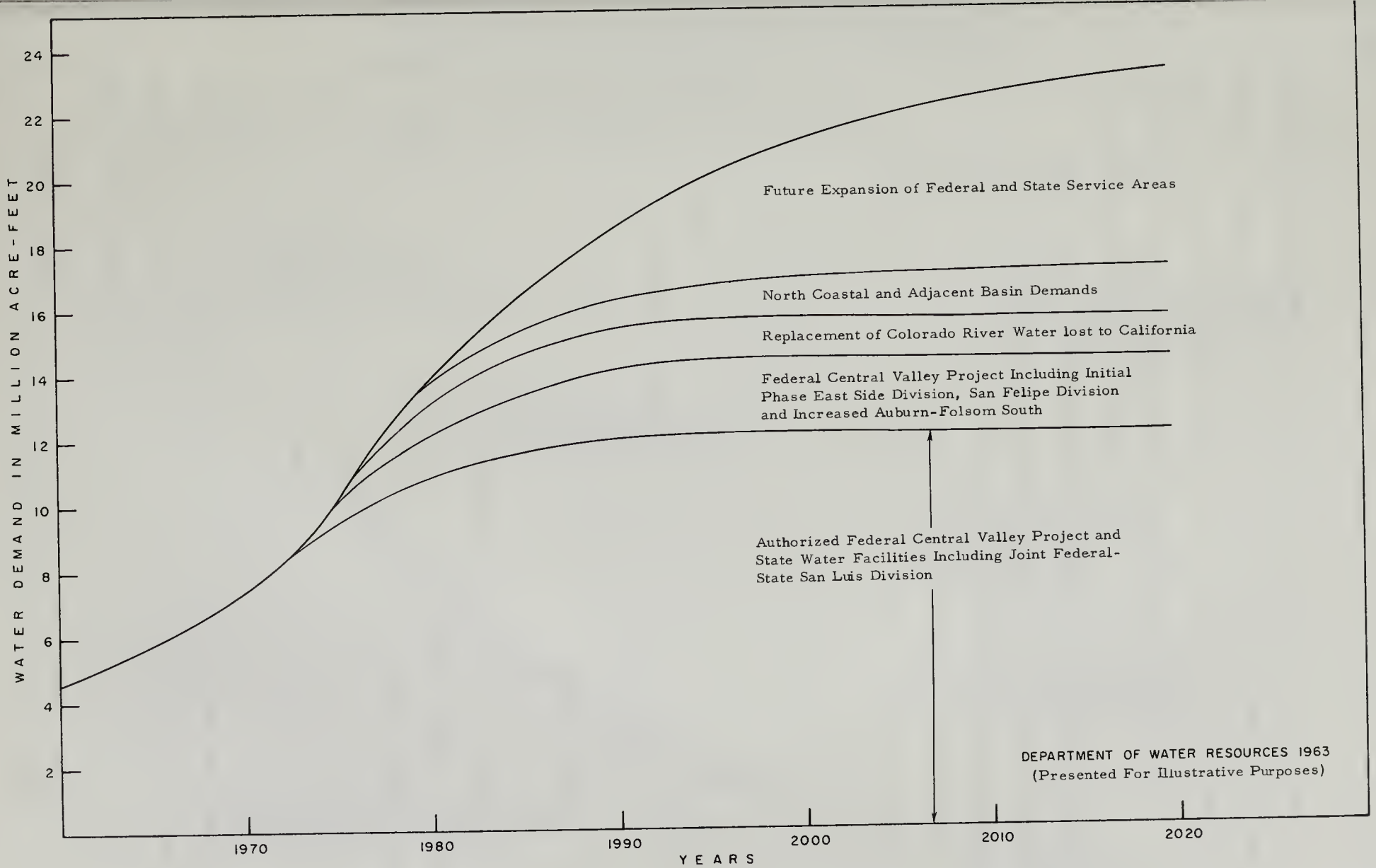
Governor Brown wrote, in part:

> "In connection with the long-range and comprehensive development of water resources in the North Coastal area, I would like to lay at rest any fears that local water needs are not protected in future North Coastal developments. Such needs will receive priority both by the terms of the Burns-Porter Act itself and by the policies of the Department of Water Resources. The department is requesting that state applications needed for the new conservation features of the State Water Facilities be made subject to a general reservation for the Counties of Origin. It is of special interest to note that, under contract provisions, export water users are required to pay for the development of additional water supplies necessary to replace withdrawals from the Delta which result from increased uses within the Counties of Origin.
>
> "I know that we have a program which, in combination with federal and local developments, can provide for our needs, both present and future. I am confidently looking to you, as Director of Water Resources, to see it well and effectively managed in the interests of all Californians."

Statewide Water Requirement Considerations

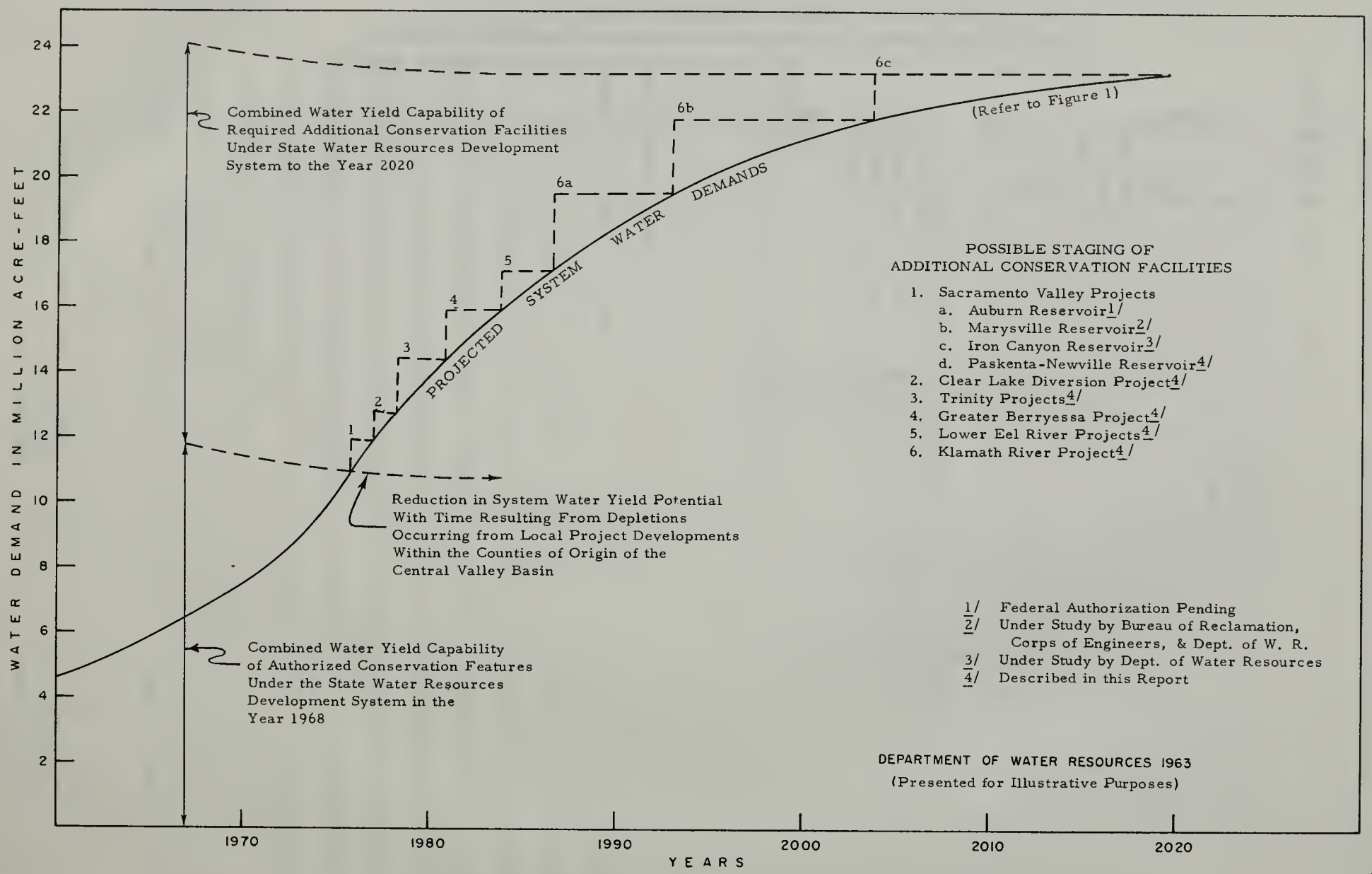
The extent of this responsibility in which all public water agencies share is vividly illustrated by Figure No. 1 of this report, entitled "Possible Future Water Demands Under the State Water Resources Development System." This figure graphically presents the relationship between projected future demand for new water supplies and anticipated time of such demand. The illustrative series of superimposed graphs depict water demands for probable future service areas of both the federal Central Valley Project and the State Water Project.

Projections of anticipated water demands in California, based upon forecasted rates of growth of population, irrigated agriculture, and industry, indicate that the water supplies presently developed and to be developed by those projects scheduled for near future construction under the California Water Resources Development System will be fully utilized by the 1980's. As depicted on Figure No. 1, the total demand for additional water supplies is expected to continue beyond the 1980's at an estimated rate of annual increase



POSSIBLE FUTURE WATER DEMANDS UNDER THE STATE WATER RESOURCES DEVELOPMENT SYSTEM TO BE SERVED BY EXISTING AND ADDITIONAL CONSERVATION FACILITIES IN THE SACRAMENTO RIVER BASIN AND NORTH COASTAL AREA

FIGURE I



POSSIBLE STAGING OF ADDITIONAL CONSERVATION FACILITIES IN THE SACRAMENTO RIVER BASIN AND NORTH COASTAL AREA TO MEET FUTURE DEMANDS UNDER THE STATE WATER RESOURCES DEVELOPMENT SYSTEM

FIGURE 2

of approximately 250,000 acre-feet per year. Forecasts of future water requirements estimates, as illustrated by this figure, are being developed in detail for the entire State as part of the department's long-range Water Requirements and Project Staging Program, recently redesignated the Coordinated Statewide Planning Program.

Figure No. 2, entitled "Possible Staging of Additional Conservation Facilities in the Sacramento River Basin and North Coastal Area," shows that the total year 1968 firm water yield capability of the authorized conservation features of the federal Central Valley Project and the State Water Facilities, as measured in the Sacramento-San Joaquin Delta, will be some 12 million acre-feet per year. The reduction in combined water yield capability with time after that date reflects estimated depletions which will occur within the Central Valley Basin through the exercise of rights by local governmental agencies under the Counties of Origin and Watershed Protection Statutes of the California Water Code. This indicated reduction in water yield capability is, in effect, the result of increased development under the Counties of Origin Statutes in areas tributary to the Sacramento-San Joaquin Delta.

Figure No. 2 indicates that additional conservation facilities may be needed by the year 1976 to meet the new water demands depicted on Figure No. 1, including those which may arise from the United States Supreme Court opinion in Arizona v. California, which was rendered June 3, 1963, and those expected to develop in the North Coastal area. While a portion of the additional water demand may be met more economically through more intensive development and use of ground water resources, it is estimated that approximately 12 million acre-feet must be provided by extensive additional development of surface water resources, predominantly within the North Coastal region of

California. The need for the current North Coastal Area Investigation of the department and for the correlative long-range North Coastal planning activities of the concerned federal agencies is therefore manifest.

Development of these resources will require the construction of many large and costly projects; projects that must not only function to conserve water, but also serve as links in a chain to transport waters to the Sacramento Valley and thence to the Sacramento-San Joaquin Delta. Hence, each project, or link, must be designed and constructed, regardless of the agency performing these services, as a part of a master plan of development, giving full cognizance to stages of development that must surely follow.

North Coastal Area Water Requirements

Development of the water resources of the North Coastal area is predicated upon meeting local requirements and upon making waters surplus to those needs available to areas of deficiency elsewhere in the State. Before an integrated and comprehensive plan of development can be formulated, it is necessary to have available a current and complete evaluation of the present and future water requirements. As previously mentioned, these water requirements data are being developed as part of the department's Coordinated Statewide Planning Program.

Data on land classification and present land and water use for every hydrographic unit in the State are being developed and will be published in reports designated the Bulletin No. 94 series. Reports in this series will be completed for the following North Coastal areas during 1963: Trinity River, Eel River, Russian River, Mad River-Redwood Creek, Mendocino Coast, Klamath River, Shasta-Scott River, and Smith River.

Forecasts of future water requirements will be based on predicted

future land uses, derived from land classification surveys, economic studies, population forecasts, projected industrial and agricultural development, and anticipated recreational needs. Agricultural water requirements will be based on unit water use by the various predicted crop types; urban and recreational requirements on per capita water use values; fish and wildlife water requirements on the preservation and possible enhancement of these resources; and industrial water requirements on measured water deliveries to various types and sizes of industries. In forecasting future industrial development, water quality problems will be given full consideration. Studies of future water requirements will be completed during 1964 for the Trinity, Eel, and Russian Rivers; Mad River-Redwood Creek; and the Mendocino Coast.

Preliminary estimates of the future water requirements for counties within the area covered by the North Coastal Area Investigation are summarized in Table No. 1, entitled "Estimated Water Requirements in North Coastal Counties." These data represent a probable upper limit of potential water requirements, since the cost to the user, as it may affect demand for water, is not reflected. The estimated year 2020 water requirement data include consideration of agricultural, municipal, industrial, and recreational uses for each of the areas. Within the Eel River area of Humboldt County and the Mendocino Coast area of Mendocino County, a substantial portion of the total water requirements are attributable to projected uses of the pulp and lumber industry.

The rights to water needed to meet requirements in the North Coastal area are guaranteed under the Counties of Origin Statutes of the Water Code. This guarantee is in effect regardless of who may be the constructing and operating agency for these possible future projects. The State has water rights applications on file for the proposed major water developments in the

TABLE 1

ESTIMATED WATER REQUIREMENTS IN NORTH COASTAL COUNTIES
BY THE YEAR 2020
(Acre-feet)

Service area	Irrigation	Other[1]	Totals
Humboldt County			
Klamath River	1,000	---	1,000
Mad River-Redwood Creek	13,000	55,000	68,000
Trinity River	7,500	4,000	11,500
Eel River	48,500	183,000	231,500
County totals	70,000	242,000	312,000
Trinity County			
Trinity River	26,500	16,500	43,000
Mad River-Redwood Creek	500	---	500
Eel River	1,500	---	1,500
County totals	28,500	16,500	45,000
Mendocino County			
Eel River	57,500	8,500	66,000
Russian River	48,000	33,000	81,000
Mendocino Coast	20,000	39,500	59,500
County totals	125,500	81,000	206,500
Sonoma County[2]			
Russian River	112,500	114,000	226,500
Mendocino Coast	500	3,000	3,500
County totals	113,000	117,000	230,000
Lake County	120,000	30,000	150,000
GRAND TOTAL	457,000	486,500	943,500

1/ Municipal, industrial, nonurban domestic, and recreational.
2/ Includes the Russian River and Coastal drainage areas of Sonoma County only.

North Coastal area. These filings, which are in custody of the California Water Commission, will not be assigned to any constructing agency, federal, state, or local, until the commission is satisfied that all necessary provisions have been made for the satisfaction of local water requirements.

Illustrative Staging of Projects

To further demonstrate the magnitude of the water development problem facing California and the need for coordinated action, an illustrative staging of additional water conservation projects required to meet projected system demands of Figure No. 1 is presented on Figure No. 2. Each project in the sequence is shown as a block of water supply yield, added consecutively in stair-step fashion to the base, which is the combined yield of authorized features of the Central Valley Project and the State Water Facilities. The staging in time of an additional increment of new water yield is required each time the composite system yield and projected demand curves coincide, i.e., when growing demand becomes equal to composite system yield.

The resulting construction costs, including the added costs of associated conveyance works and distribution systems, will far outstrip the financial capability of state and local agencies. Similarly, these costs will exceed the level of appropriations that can reasonably be anticipated for water resources development work in California by the federal agencies. The load of meeting the projected demand will be so great as to require the combined financing capacity of all levels of government, coupled with optimum efficiency in the expenditure of both funds and manpower. This situation demands a closely coordinated effort, encompassing the formulation of a development plan which all levels of government endorse, the identification of responsibilities of each agency for implementation, and the active acceptance thereof.

The problem of financing the water development works required to keep up with California's burgeoning growth and to permit this growth to continue unfettered by lack of supply is of such monumental proportion that all possibilities of federal and local assistance must be explored, and appropriate cooperative agreements and partnership arrangements developed. These matters will be discussed further in Chapter IV of this preview report on the North Coastal Area Investigation.

Possible Effects of Saline Water Conversion

The illustrative staging of projects presented on Figure No. 2 was prepared without consideration of the effects of saline water conversion. At the present time, converted sea water cannot compete economically with the conventional development of natural fresh water sources within the State. However, indications are that converted water will play an important role in the future. A dramatic breakthrough in the actual conversion process is not likely to occur. It seems more probable that the transition to economically competitive converted sea water will occur gradually, and will be primarily in those arid areas in which there is a high transportation cost associated with delivering natural fresh water.

Although it is anticipated that staging of the initial project in the North Coastal area will not be affected by the impact of saline water conversion, it is probable that staging of additional projects will. For instance, later-stage developments such as the Klamath River Project could be moved much further into the future, perhaps beyond the turn of the century.

Only through continued study and analysis of alternative water development possibilities, including saline water conversion, can it be ascertained that the most favorable means for meeting our future water needs will be selected.

CHAPTER II. INVESTIGATIVE ACTIVITIES

More than two years have elapsed since publication of the "Progress Report on the North Coastal Area Investigation" in May 1961. Since that date studies have been directed toward the development of more detailed information in the fields of hydrology, geology, topographic mapping, design and cost estimating, water requirements, recreation, fish and wildlife, and economics. Project formulation studies for the evaluation of alternative plans of development have been continued. From these studies a determination of the more favorable major projects to be recommended for early development is being made.

As stated in Chapter I, the department's current reconnaissance study of the North Coastal area is scheduled for completion in July 1964. The report of the investigation, Bulletin No. 136, will include a digest volume and supporting technical appendixes. These appendixes will cover hydrology, watershed management, geology, designs and cost estimates, recreation, fish and wildlife resources, economics, and alternative plans for development. This chapter will outline and briefly discuss the material each of the appendixes will contain. A preview of plans for development and forthcoming recommendations as to project features is included in Chapter III of this report.

Hydrology and Watershed Management

There are two hydrologic problems of major importance in the evaluation of water development projects in the North Coastal area. One is the extremely unequal distribution of runoff throughout the year; the other is the abnormally large and damaging floods which frequently occur.

The North Coastal area is the wettest region in California, and is

one of the wettest areas in the United States, exceeded only by the western slopes of the Coast Ranges in Oregon and Washington. Precipitation in the North Coastal area varies greatly, increasing generally from south to north and from east to west. The Smith River and lower Klamath River Basins experience a range of 80 to 100 inches per year (on an average seasonal basis), whereas a range of 40 to 60 inches is common in the Eel and Russian River Basins.

There have been three wet and three dry periods in Northern California during the last 70 years. A prolonged wet period occurred from 1890 to 1916, followed by an extremely dry period from 1917 to 1937. Since 1937, two wet periods and one dry period have occurred. The driest single year of record took place in 1924. Two of the wettest years on record occurred in 1956 and 1958. The long-term mean period selected for use in these studies covers the 50 years from 1911 through 1960.

Estimates of water developed by a project are based on yield derived from the reservoir during critically dry periods. The estimated yield is determined from studies in which operation of the proposed reservoir is simulated for historical dry periods. During this investigation it has been recognized that in the operation of reservoirs of high storage-inflow ratio, the 20-year dry period from 1917 to 1937 is often more critical than the commonly used seven-year dry period from 1928 to 1935. There are potentially large reservoir developments, which although full in 1917, would not have been full in 1928, thus yield estimates based on the shorter dry period may be too high.

The Hydrology Appendix to Bulletin No. 136 will contain information and data on precipitation, water supply, and floods for all key stream gaging stations and all alternative damsites in the North Coastal area. The

availability of this basic hydrologic information represents a culmination of many years of data collection and analysis. It provides a sound basis for evaluation of the water supply potential of the many alternative plans for development.

Watershed management studies are being conducted under the North Coastal Area Investigation pursuant to Senate Concurrent Resolution No. 47, adopted by the 1961 Legislature. This resolution requested the department to make a comprehensive survey of the Eel River watershed area in relation to the water, flood control, and watershed management needs of the eight counties which are members of the Eel River Flood Control and Water Conservation Association. Due to financial and manpower limitations, the studies were restricted to a reconnaissance survey of the Eel River Basin.

Watershed management has been defined as the art and science of land management and engineering for the purpose of improving the quality, quantity, and timing of runoff, with the maximum concurrent consideration of the interrelationships between the soil, vegetation, and water resources. Simply, watershed management is water-oriented land use.

The reconnaissance study of watershed management shows only a limited need for watershed management as it is popularly conceived -- that is, for the control of flood runoff and water yield through the manipulation of vegetation. However, it was found that the Eel River and its tributaries carry large volumes of sediment, derived from erosion of lands within the basin. This erosion is produced in unknown proportions by both natural and man-aggravated means. Natural erosion includes bank cutting, geologic erosion of the land surface, and landsliding in areas adjacent to flowing waters. Man-aggravated erosion is caused by road building, logging, wildfires, and grazing.

Future planning and construction of water projects in the Eel Basin

must recognize and account for the effects of land use on the water resource, especially in the realm of sediment production. Already observed occurrences forewarn of undesirable effects of land use and sediment storage which may occur with the construction of storage facilities in this area.

This study is a departure from the normal activities of the department. Watershed management is becoming more important in water development planning studies, and this endeavor will provide a basis for more detailed studies in this field. The study to be presented in an appendix to the 1964 report will outline problems of erosion, sedimentation, and landslides. It will also discuss present and suggested future land use practices within the Eel River watershed.

Geology

The three principal geomorphic provinces within the North Coastal region are the Klamath Mountains, the Northern Coast Range, and the Coast Range Foothills. Major streams providing drainage within the three regions are the Eel, Mad, Van Duzen, and Russian Rivers for the Northern Coast Range; Trinity, Klamath, and Smith Rivers for the Klamath Mountains; and Clear, Cottonwood, Thomes, and Stony Creeks for the Coast Range Foothills.

Rock units of the Klamath Mountains consist generally of igneous and metamorphic rocks which provide good foundations for the proposed earth- and rockfill dams. No extensive tunneling difficulties are anticipated in this geologic region. Adequate volumes of suitable earth and rockfill materials have been located within moderate haul distances of the proposed structures.

The Northern Coast Range is underlain almost entirely by rocks of the Franciscan group, which consists of a complex assemblage of sedimentary

and volcanic rock intruded by serpentine and cut by numerous faults. Franciscan rocks provide some of the most difficult foundation and tunneling conditions in the State. The material is weak, deeply weathered, intensely sheared, and severely fractured. Geologic investigations in this area have been directed toward the elimination of the less favorable alternative damsites and selection of sites with more favorable geology. Earth and rockfill materials in this region are often in short supply and of questionable quality, requiring detailed evaluation and testing to determine those most suitable for construction purposes.

The Coast Range Foothills are underlain by two geologic units: the Cretaceous bedrock series which consist of shale sandstone and conglomerate, and the poorly consolidated floodplain sediments of the Tehama formation. The bedrock series provide adequate foundations for the proposed fill dams, and the Tehama sediments are suitable for construction of earthfill dams of moderate height. The Tehama formation could provide virtually all the fill needed for the proposed structures in the Coast Range Foothills. Rockfill and pervious gravels are in short supply, necessitating the construction of homogeneous section dams.

The Engineering Geology Appendix to Bulletin No. 136 will cover all of the geologic investigations conducted by the department in the region since initiation of the North Coastal Area Investigation in 1958. This appendix will include 20 detailed damsite reports which will cover the foundation conditions and the availability of construction materials, in addition to discussion of special geologic problems. Tunneling conditions for ten important alternative tunnel routes will also be discussed in detail, including the estimated properties of the rock at depth, the description of anticipated areas of poor rock, and the tunneling difficulties which may be encountered. In addition

to the detailed studies, the geologic appendix will contain, partially in tabular form, a complete summary describing briefly the geologic conditions of all the alternative features of the investigation.

Design and Cost Estimates

The preparation of realistic designs and adequate cost estimates plays an important role in the economic evaluation of any water development project and in the selection of the most favorable alternative. Because of the North Coastal area's rugged topography and adverse geologic conditions, and geographic location with respect to the place of use of the developed waters, the envisioned projects are large, involving works that in some cases are more extensive than anything yet constructed. To satisfactorily provide the necessary estimates of costs for these projects, a more extensive design process is required than is usually found in a reconnaissance investigation.

Reconnaissance designs and cost estimates are now essentially completed for over 50 reservoirs and 15 tunnel alignments, as cited in the "Progress Report on North Coastal Area Investigation," published in May 1961. Following this initial phase of the work, design studies moved into more detailed evaluation of those projects, and their alternatives, that present the greatest potential for early construction. Design studies, although still at the reconnaissance level, have included the preparation of cost-capacity relationships, wherein graphs were developed showing capital cost versus reservoir capacity. The graphs are based on semidetailed estimates for at least three reservoir sizes. Particular emphasis was placed on the analysis of damsite foundation conditions, the proper use of construction materials, and logical construction sequence. Special attention also was concentrated on the development of reliable data to substantiate estimates of tunnel, power-plant, and pumping plant costs.

The appendix on Design and Cost Estimates will be complete within itself, following the general format of a conventional report. It will contain a brief description of the overall plan of development and a section on general design procedures and reconnaissance cost estimating criteria. Additional sections will describe the designs and estimated costs of the various projects which were studied and will include plates delineating general plans and details of project features. In the portion of the appendix on general design procedures, particular emphasis will be placed on design considerations associated with high rolled rockfill dams and long tunnels driven through unfavorable geologic strata.

Recreation

To a large portion of the population of California, the North Coastal area has always been synonymous with recreation. The diversified topography includes 400 miles of picturesque ocean frontage, and a forested belt immediately inland that includes a large portion of the redwood forests of California. Further inland, a mountainous area covered by a mixed coniferous forest contains some of the foremost wilderness country in California. This rugged natural beauty, coupled with some of the finest fishing streams on the continent, lures thousands of vacationers to the area each year. In addition to the natural attractions, a few small reservoir developments receive considerable recreation use.

Recreation, which is already an important segment of the North Coastal area's economy, would be greatly enhanced by the plans for water development envisioned in this report. Recreation benefits would be associated not only with the conservation projects within the North Coastal area but would also be associated with the reregulating and terminal reservoirs in the Russian and Sacramento Valley Basins.

It is anticipated that the Recreation Appendix to Bulletin No. 136 will include the following information: (1) a discussion of past, present, and estimated future recreational uses in the North Coastal region for conditions with and without construction of the proposed projects; (2) a description of methods used in estimating recreation visitor-days, in determining cost of recreation facilities, and in evaluating overall recreation potential of projects; and (3) estimates of recreation visitor-days.

Fish and Wildlife Resources

Northwestern California possesses a wealth of economically and aesthetically valuable fish and wildlife resources. These resources are mainstays of the area's recreation service industry, which is second only to lumbering in economic value. Some of the fish resources contribute substantially to the commercial fishing industry of the North Coastal area. The annual income from commercial fishing is about equal to that derived from agriculture and is exceeded only by lumbering and recreation.

The fisheries of North Coastal area streams are largely based on anadromous species: king salmon, silver salmon, and steelhead trout. The Russian, Eel, Klamath, Trinity, and Smith River systems are widely recognized for the salmon and steelhead angling they provide. The fish produced in these, and other North Coastal streams, also contribute substantially to sport and commercial salmon fisheries in the ocean.

The North Coastal area supports a wide variety of wildlife species. Deer abound in much of the area, and provide excellent public hunting where access is available. Mendocino County consistently leads the State in the number of deer harvested each year. Quail, bandtail pigeons, and waterfowl are locally abundant, and are important from an economic as well as aesthetic standpoint.

The construction and operation of dams, reservoirs, and conveyance facilities for the export of surplus water from the North Coastal area would have profound impact on the fish and wildlife resources of the area, particularly anadromous fishes. It is state policy that these resources will be preserved and, if feasible, enhanced by state-constructed water developments. To this end, Department of Fish and Game biologists, working under contract with the Department of Water Resources, currently are evaluating the effects of proposed North Coastal area water projects and are formulating recommendations for preservation and enhancement. Their findings will be published as a Fish and Wildlife Appendix to the North Coastal Area Investigation, Bulletin No. 136.

The Fish and Wildlife Appendix will contain:

1. A general description of the fish and wildlife resources of each hydrographic unit in the North Coastal area.

2. Estimates of the average population of anadromous fishes in each major river system.

3. Streamflows required at hydrographic subunit boundaries to maintain fish populations at present levels. Enhancement flows also will be recommended for stream reaches that possess a high potential for fish production.

4. Preliminary evaluations of the effects of proposed North Coastal area developments on both fish and wildlife.

5. Measures required to preserve fish and wildlife in connection with the construction of water projects or, where losses are unavoidable, measures required for compensation. Included would be such features as fish hatcheries, flow releases below dams, spawning channels, and development of new wildlife habitat.

6. Preliminary recommendations for fish and wildlife enhancement in connection with specific projects, where it is anticipated that the benefits would surpass the costs.

7. Delineation of fish and wildlife problems that would require further investigation.

Economics

Analyses of past and present economic development of the North Coastal area have been undertaken as a part of the Coordinated Statewide Planning Program. Estimates of the economic impact of selected projects also are being made. These include reconnaissance evaluations of benefits from recreation, flood control, and fisheries enhancement. These evaluations will be sufficiently definitive to permit indication of economic justification for inclusion of these project purposes in the plans for development.

Three studies of specific economic problems associated with water development in the North Coastal area have been completed. They are: (1) The Economic Impact of the Glenn Reservoir Complex on Glenn County, (2) The Present and Potential Economy of Round Valley, Mendocino County, and (3) The Present and Potential Economy of the Northwestern Pacific Railroad. Conclusions from these studies, and others in progress, will be included in the Economic Appendix to Bulletin No. 136.

This appendix will contain, in addition to the information above, discussions of economic criteria and procedures used in the evaluation of alternative plans.

Alternative Plans of Development

The appendix on Alternative Plans of Development will include detailed discussions of selected alternative major water resources projects within the

North Coastal region. Although these alternatives are judged less favorable than the projects selected for inclusion in the long-range plans for development to be recommended in the 1964 report, it is nevertheless believed desirable that the studies involved in the analysis of these alternatives also be made available to the public and preserved for reference in report form.

CHAPTER III. PLANS FOR DEVELOPMENT

The long-range development plans within the North Coastal and West Side Sacramento Valley areas which presently are favored for recommendation in Bulletin No. 136 for more intensive studies leading toward authorization and future construction are shown on Plate No. 1 and, pictorially, on Plate No. 2 of this preview report. In addition, Plate No. 2 shows other features of the State Water Resources Development System, as defined in Chapter 1, which are located within the Sacramento River Basin. The blue color on these plates indicates existing or authorized features; red designates proposed early stages of additional works; and green shows features that will be required later in time.

Proposed major additional conservation facilities in the Sacramento Valley that are shown on Plate No. 2, and listed in Table No. 2, but which are not discussed in this report, are: Auburn Reservoir on the American River, Marysville Reservoir on the Yuba River, and Iron Canyon Reservoir on the Sacramento River.

Eel River Basin Above Dos Rios

Certain significant changes in development plans from those tentatively identified in the 1961 Progress Report, particularly with regard to the Eel River Basin, will be noticed upon inspection of Plates Nos. 1 and 2.

The long-range reconnaissance studies being conducted under the North Coastal Area Investigation have indicated that the Middle Fork Eel River occupies a key position in plans for initial projects within the North Coastal region. There are two practical diversion routes by which surplus waters from the Middle Fork Eel may be exported to the Sacramento Valley.

These are: (1) by gravity diversion to Thomes or Stony Creek and the Glenn Reservoir Complex; and (2) by pumped diversion to the proposed English Ridge Reservoir on the Upper Main Stem Eel River, with subsequent gravity diversion via Clear Lake to Putah Creek and Lake Berryessa.

The information set forth in the department's "Progress Report on North Coastal Area Investigation" indicated that the most favorable initial projects within the Upper Eel River Basin would be the Thomes Creek routing of Middle Fork Eel River flows in company with a separate English Ridge Project on the Upper Main Stem Eel River. The principal purpose of this independent English Ridge Project would be to meet certain local and adjacent basin demands for project services. The Middle Fork Eel Diversion Project via either Thomes or Stony Creek would primarily provide for new water service in the Central Valley and Southern California areas.

Similar tentative conclusions regarding diversion from the Middle Fork Eel River via Stony Creek were reached by the Bureau of Reclamation from reconnaissance studies published in a 1960 report of the Pacific Southwest Field Committee, Department of the Interior, entitled "Natural Resources of Northwestern California." That report, consisting of a general volume and ten appendixes, was publicly released during 1962.

Subsequent departmental studies, as well as those of the federal government, indicate that an interconnection of Middle Fork Eel River reservoirs to English Ridge Reservoir via pumped diversion, with a subsequent gravity diversion via Clear Lake and Lake Berryessa, represents a more favorable alternative plan for development. This project system, known as the "Clear Lake Diversion Project," would include a secondary diversion to future service areas within the Russian River Basin and other regions north of San Francisco Bay.

This Upper Eel River development plan probably will be recommended as the selected initial Eel River Project in Bulletin No. 136. The choice has been based upon extensive engineering and economic comparisons with other alternatives during the past two years. These recent analyses have utilized as the basis for comparison the estimated annual unit costs of new water yield in the Sacramento-San Joaquin Delta. They also reflect the development cost of new local and adjacent basin supplies to be provided under either of the alternative projects.

It has not been possible during the current reconnaissance phase of the North Coastal Area Investigation to include quantitative evaluations of all possible benefits from probable, nonreimbursable project functions such as flood control, recreation, and fisheries enhancement; however, it is strongly indicated that these added benefits will weigh in favor of, and further increase, the comparative economic advantages to be gained by the Clear Lake-Putah Creek routing of Middle Fork Eel River flows.

While the scale and capital cost of this development would be much larger than the Middle Fork Eel Diversion Project to Thomes Creek alone, additional benefits in the categories of greater new water yield, flood control, power development, and recreation enhancement would appear to establish this project system as the economically more favorable overall development. It is believed that allocation of project costs to these purposes and the availability of power revenues from the more comprehensive Clear Lake Diversion alternative will result in no greater cost of incremental new water supplies to the Delta export user than would be possible under the Thomes Creek alternative and would simultaneously provide new water supplies to possible future local and adjacent basin users from this system at a lower cost than other possible alternatives, i.e., an independent English Ridge Project.

Other considerations which weigh in favor of the Clear Lake-Putah Creek diversion of Middle Fork Eel River flows are as follows:

1. The interconnection of Middle Fork Eel reservoirs with English Ridge on the Upper Eel, with secondary diversion to the Russian River Basin, would provide a high level of operational flexibility.

2. The routing of Middle Fork Eel River water via Clear Lake would not preclude development at an early date of elements of the Glenn Reservoir Complex. On the contrary, it may be recommended in Bulletin No. 136 that the Paskenta-Newville "compartments" of the Glenn Reservoir Complex be considered for concurrent (and possibly earlier) construction.

3. As will be discussed later in this section, the possibility of a pumped-storage operation at an enlarged Lake Berryessa (for both water conservation and power generation) appears promising as a future project based solely on further development of the water resources of the Sacramento River Basin. Utilization of this additional storage capacity on Putah Creek would be even further enhanced by imports from the Eel River Basin.

Clear Lake Diversion Project

Possible features of this project, to be located on the Middle Fork Eel River, include Spencer Reservoir and Powerplant, Dos Rios Reservoir, and Elk Creek Pumping Plant and Tunnel. Those on the Upper Main Stem Eel River include English Ridge Reservoir and conveyance facilities to the Russian River and Clear Lake Basins.

Spencer Reservoir, with a storage capacity of 850,000 acre-feet at

a water surface elevation of 1,710 feet, would be formed by construction of two dams: (1) a 385-foot high dam at the Spencer site on the Middle Fork Eel River; and (2) a 335-foot high earthfill dam at the Franciscan site on Short Creek, a tributary of the Middle Fork Eel River. Dos Rios Reservoir, with a storage capacity of 560,000 acre-feet at a water surface elevation of 1,325 feet, would be formed by construction of a 430-foot high rockfill dam in a narrow canyon of the Middle Fork Eel River, about 2 miles upstream from its confluence with the Main Stem Eel River. Elk Creek Pumping Plant would be located on Elk Creek about 4 miles upstream from its confluence with the Middle Fork Eel River. Elk Creek Tunnel, extending from Dos Rios Reservoir to English Ridge Reservoir, would be about 12 feet in diameter and 7.3 miles long.

These Middle Fork Eel River reservoirs would develop a firm annual conservation yield of about 580,000 acre-feet. Of this, 26,000 acre-feet would be made available for consumptive use in Round Valley, 54,000 acre-feet would be released for stream maintenance and fisheries preservation, and the remaining 500,000 acre-feet per year would be pumped to English Ridge Reservoir for subsequent export to the Sacramento-San Joaquin Delta. The estimated capital cost of the Middle Fork Eel River features, including Elk Creek Pumping Plant and Tunnel, is $110 million.

English Ridge Reservoir, with a storage capacity of about 1,800,000 acre-feet at a water surface elevation of 1,695 feet, would be formed by construction of a 535-foot high earth- and rockfill dam on the Upper Main Stem Eel River about 20 miles northeast of Willits. This reservoir would develop a firm annual conservation yield of about 340,000 acre-feet. It is anticipated that eventually all of this yield would be used within the Eel and Russian River Basins and in areas immediately contiguous to them. However,

during the build-up period, the demand probably would be much less than the capability of the reservoir. The excess yield, along with that diverted from the Middle Fork Eel River, could be routed via Clear Lake to Lake Berryessa and thence to the Sacramento-San Joaquin Delta for interim use under the utility concept of operation. The estimated capital cost of English Ridge Reservoir is $80 million.

The flows diverted from the Middle Fork Eel River, together with excess yield developed by English Ridge Reservoir, would be diverted to the Clear Lake Basin through Garrett Tunnel. Garrett Tunnel would be about 14 feet in diameter and would extend from English Ridge Reservoir a distance of about 12 miles to Middle Creek, a tributary of Clear Lake. Clear Lake, with diversions from the Eel River, could be operated in such a manner as to reduce high water levels during the flood season and to maintain a higher, more stable water level during the recreation season. It is anticipated that appreciable recreation and flood control benefits would accrue.

From Clear Lake, the water would be diverted by a 2-mile tunnel to Soda Creek in the Upper Putah Creek Basin. Approximately 400 feet of power head could be developed by construction of two dams on Soda Creek. The estimated capital cost of Garrett Tunnel, Soda Creek Tunnel, and the Putah Creek Basin power facilities, sized for an annual export yield of 500,000 acre-feet, is about $90 million.

Discharges from the power facilities would be released into Lake Berryessa, the storage facility of the federal Solano Project. Lake Berryessa, either existing or enlarged, could be operated in such a manner as to meet export demands from the Sacramento-San Joaquin Delta and continue to meet the Solano Project demands.

Greater Berryessa Project

Considerable water conservation and power benefits could be realized by operation of an enlarged Lake Berryessa in coordination with imports from the Eel River and with the Central Valley reservoir system. Through a direct connection with the Lower Sacramento River, it would be possible to conserve excess flows by pumping them into the enlarged lake. These flows, together with water imported from Eel River, would then be released to the Delta during periods of deficient flow. It would be possible to install reversible pumping units at the dam for generation of hydroelectric power. Reconnaissance studies indicate that significant quantities of dependable hydroelectric power could be generated by means of a pumped storage operation of an enlarged Lake Berryessa.

In addition to the other benefits, the recreation potential of the area would be enhanced by creation of a Greater Lake Berryessa. The normal water surface area of the enlarged lake would be approximately 66,000 acres, with flucuation considerably less severe than that of the present lake. Provisions would be made to relocate existing recreation developments to the shore line of the enlarged reservoir.

Although it would be possible to develop a 16,000,000-acre-foot reservoir by construction of a 650-foot high earth- and rockfill dam on Putah Creek, downstream from the existing Monticello concrete arch dam, preliminary studies indicate that Lake Berryessa should be enlarged to a gross capacity of approximately 14,000,000 acre-feet. The normal water surface elevation would be increased some 320 feet from its existing elevation of 440 feet. The cost of creating this very large reservoir would be on the order of $110 million.

An enlarged Lake Berryessa with a gross storage of 14,000,000

acre-feet could, with the pumped storage feature and coordinated with the Central Valley reservoir system, sustain a new firm annual yield in the Sacramento-San Joaquin Delta of 1,600,000 acre-feet, and provide for present and expanding demands under the Solano Project. The estimated capital cost of this Greater Berryessa Project is $360 million. This cost includes the conveyance facilities from Lake Berryessa to the Sacramento River, the cost of Greater Berryessa Dam, Reservoir, and reversible pump-generating plant.

The extremely low cost of additional large storage at Lake Berryessa, which also is located strategically with respect to the Sacramento-San Joaquin Delta and Northern California's electrical powerload center, offers a water resource development potential which should not be overlooked.

Bulletin No. 136 will recommend additional and more intensive studies of the enlargement of Lake Berryessa.

Trinity River Developments

The additional facilities of the State Water Resources Development System in the North Coastal region which will be recommended in Bulletin No. 136 to follow the Clear Lake Diversion Project are located within the Upper Trinity River and adjacent basins.

There are three projects within these basins which are susceptible to staged construction. They would produce a total net new water yield of 1,800,000 acre-feet in approximately equal increments. These projects are the Trinity Diversion Project, South Fork Trinity Project, and Mad-Van Duzen Project, shown in red on Plates Nos. 1 and 2.

All of the new conservation water yield imported from the Upper Trinity River and adjacent basin developments could be routed via the proposed Iron Canyon Reservoir and Powerplant, on the Sacramento River near Red Bluff, for additional power generation.

Trinity Diversion Project. The Trinity Diversion Project would necessitate the construction of Helena Dam to form a 2,800,000-acre-foot reservoir. Helena Reservoir would extend to the downstream toe of existing Lewiston Dam and would develop an annual new water yield of about 600,000 acre-feet, incremental to the upstream Trinity Division of the Central Valley Project. The developed water would be diverted to the Sacramento River Basin by means of a 12.8-mile long Clear Creek Tunnel No. 2, which would extend from Helena Reservoir to Clear Creek above Whiskeytown Reservoir. This tunnel would be sized to provide capacity for the two succeeding Upper Trinity Projects. From Whiskeytown Reservoir, the water would be conveyed through the federal Spring Creek Tunnel and Powerplant, initially, for generation of secondary energy. The estimated capital cost of the Trinity Diversion Project is about $150 million.

South Fork Trinity Project. This second stage of development in the Upper Trinity River Basin would include Eltapom Dam and Reservoir on the South Fork Trinity River. Eltapom Reservoir, with a gross storage capacity of 3,100,000 acre-feet, would develop an annual exportable yield of about 600,000 acre-feet.

Water would be diverted from Eltapom Reservoir via a 13-mile long Eltapom-Helena Tunnel to Helena Reservoir, with subsequent diversion to the Sacramento River Basin via the then existing Clear Creek Tunnel No. 2. The Eltapom-Helena Tunnel would be sized to provide capacity for the subsequent Mad-Van Duzen Project. The water supply from this second stage, together with the yield from the first stage, would be routed from Whiskeytown Reservoir via Clear Creek through a series of reservoirs and powerplants. The total estimated capital cost of the second stage is about $390 million.

Mad-Van Duzen Project. This project would constitute the third stage of development within the Trinity River Division. Features would include Larabee Valley and Eaton Reservoirs in the Van Duzen River Basin; Anderson Ford Diversion Dam; and an enlargement of Ruth Reservoir on the Mad River, a recently constructed facility of the Humboldt County Water District. This project would also include a reservoir at the Butler Valley site to sustain and augment the Eureka-Arcata area water supply. It would also provide necessary stream maintenance releases to the Lower Mad River.

Surplus flows of the Mad and Van Duzen Rivers, developed by these reservoirs, would be diverted through a tunnel and powerplant into Eltapom Reservoir for subsequent diversion to the Sacramento Valley. The Mad-Van Duzen Project would add another 600,000 acre-feet of new yield to the system at an estimated capital cost of $270 million.

Paskenta-Newville Project

As described in the 1961 Progress Report, the Glenn Reservoir Complex, consisting of three adjacent reservoir compartments, offers unique flexibility in the staging of future water projects. Although the primary value of the full storage potential of the complex would be for reregulation of imported water, portions of the complex could be justified on the basis of development of local runoff. Thus, routing of the Middle Fork Eel River via Clear Lake would not preclude early construction of certain elements of the complex.

Bulletin No. 136 may recommend that Paskenta-Newville Reservoir, the two northern elements of the complex, be built at an early date as a conservation project for development of flows in Thomes and North Fork Stony Creeks. Storage at Paskenta-Newville Reservoir, at an average unit capital

cost of about $25 per acre-foot, represents one of the most favorable remaining water storage projects in the Central Valley. A 1,200,000-acre-foot Paskenta-Newville Reservoir, when operated in coordination with the Central Valley reservoir system, could develop a total annual yield of about 200,000 acre-feet. Portions of this new water supply would be available for consumptive use in West Side Sacramento Valley service areas, for fisheries enhancement, and for export to the Sacramento-San Joaquin Delta. The estimated capital cost of the Paskenta-Newville Project is $30 million.

Knights Valley Project

The Knights Valley Project is the major development within the Russian River Basin to be recommended for further consideration. The storage feature of this project would be a multipurpose reservoir on Maacama Creek, a tributary of the Russian River in western Sonoma County.

The purposes of the Knights Valley Project would be:

1. To conserve, regulate, and divert new water supplies derived from Maacama Creek.

2. To provide additional flood control and recreation benefits within the Russian River Basin.

3. To provide for the possible later-staged, off-stream regulation and conservation of surplus flows from the Russian River.

In connection with water conservation, it is believed that a development at this site has attractive internal staging possibilities which should not be overlooked. These possibilities will be discussed in detail in Bulletin No. 136.

The optimum size and timing of construction for the proposed Knights Valley Project will depend upon many factors, including the rate of demand

build-up for new water supplies in the North Bay counties service areas and the staging of other proposed projects which could serve these areas. These other projects are the North Bay Aqueduct, Warm Springs Dam and Reservoir on Dry Creek, enlargement of Lake Mendocino on the East Fork of the Russian River, and English Ridge Dam and Reservoir on the Main Stem of the Eel River.

Knights Valley Reservoir is a key unit in plans for early development being formulated by both the U. S. Bureau of Reclamation and the U. S. Corps of Engineers.

Eel River Below Dos Rios

It will be recommended in Bulletin No. 136 that major water developments on the lower reaches of the Eel River below Dos Rios and above the mouth of the South Fork should not be constructed until after the more favorable North Coastal projects described in this report are built.

As stated in the department's 1961 Progress Report, the primary reason for this later staging is the enormous cost of relocating the Northwestern Pacific Railroad. This railroad parallels the Eel River from Dos Rios to the Eel Delta region and any major reservoir development on the Lower Eel River will necessitate the relocation of over 100 miles of this roadway, at an estimated cost of $130 million. This relocation, coupled with the construction problems associated with the extensive landslides within the Eel River Canyon, combine to preclude early staging of major export developments on the Lower Eel River. When the demands for additional new water supplies become sufficient to justify projects on the Lower Eel River, about 1,200,000 acre-feet of additional water could be developed. The illustrative information on Figure No. 2 suggests that these Lower Eel River projects probably will not be required before the year 1990.

Preliminary studies indicate that Bell Springs and Sequoia Reservoirs would be the most favorable projects to develop this additional new water yield. Water conserved in a 5,000,000-acre-foot Sequoia Reservoir would be pumped into Bell Springs Reservoir, capacity 1,300,000 acre-feet. The total conservation yield then would be pumped into Dos Rios Reservoir for subsequent diversion to the lower Sacramento Valley and Delta via Clear Lake and Lake Berryessa. The estimated capital cost of Bell Springs and Sequoia Reservoirs and the associated pumping facilities is $560 million, including the cost of railroad relocation and necessary additional transbasin diversion features.

Klamath River Projects

After development of the projects described above, the remaining major sources of new surface water supplies to meet the still increasing demands within the State must come from the Klamath River Basin, including the Lower Trinity River. The Klamath River has been appropriately described as California's "Water Bank Account," since at some future date some 6,000,000 acre-feet of new firm annual water supply must be developed in that basin and exported to service areas elsewhere in the State. Figure No. 2 suggests that this date may be approximately 30 years hence.

Studies of alternative plans for the development of the Lower Trinity River and of the Klamath River have not been made in as great detail as those for the probable earlier-staged North Coastal projects.

However, these preliminary studies have indicated that one of the possible favorable plans for Klamath River development would require future construction of a very large reservoir near the mouth of that river, and two reservoirs and pumping plants on the Lower Trinity River for conveyance of

the new water yield into Helena Reservoir of the Trinity Diversion Project, constructed as part of a previous stage of development. Subsequently, this new water supply would be diverted to the upper Sacramento Valley, possibly via Cottonwood Creek and the West Side Conveyance System to the Glenn Reservoir Complex. Klamath River Project features are indicated in green on Plates Nos. 1 and 2 of this report. Bulletin No. 136 will provide a summary of other alternative development possibilities.

Humboldt Reservoir, the primary conservation feature on the Lower Klamath River, with gross storage capacity of 15,000,000 acre-feet, could conserve and make available for upstream diversion some 6,000,000 acre-feet of new water supply annually. This new supply would be pumped successively into Ironside Mountain, Burnt Ranch, and Helena Reservoirs.

The transbasin diversion from Helena Reservoir would be achieved via gravity flow tunnel to Cottonwood Creek, a west side tributary of the Sacramento River. From there the water would flow via the West Side Conveyance System, also shown in green on the plates, to the Glenn Reservoir Complex. The Rancheria "compartment" of the reservoir complex would be added at that time.

The West Side Conveyance System would consist of a series of interconnected reservoirs, formed by dams and cuts on the upper reaches of Cottonwood, Red Bank, and Elder Creeks, and would completely regulate the local runoff of these water courses.

There would be numerous local water-associated benefits attributable to the West Side Conveyance System. However, the main justification for this feature appears to rest primarily with the necessity for conveyance of flows from the Klamath River to the Glenn Reservoir Complex, for reregulation compatible with needs in the Central Valley Basin.

The estimated capital cost of the Klamath River Project, including appurtenant conveyance, diversion, and reregulation features is about $1.6 billion.

Coastal Stream Basin Projects

In addition to project formulation studies for major multipurpose developments in the interior basins of the North Coastal region, reconnaissance studies have been carried forward relative to the water resources development potential within selected coastal basins. The studies of the large interior basins such as the Eel, Trinity, and Klamath, are oriented toward the development of major multipurpose projects to meet both local and out-of-basin demands for project services. Studies of the coastal basins are principally concerned with the development of locally oriented projects in the interest of recreation and fisheries enhancement.

The coastal basins under investigation include the major secondary drainages north of the Russian River Basin. They are, in a north to south order: Redwood Creek, Little, Bear, Mattole, Ten Mile, Noyo, Big, Albion, Navarro, Garcia, and Gualala Rivers. These basins encompass an area of about 3,000 square miles and account for about 4,500,000 acre-feet of surface water runoff, or about 15 percent of the total of the North Coastal area. The water resources of the basins are undeveloped. However, many streams provide excellent fish habitat in their natural state. The excellent fishing in these streams, combined with the serenity of the redwoods and the rugged beauty of the coastline, offers unparalleled recreation opportunity.

It is anticipated that in the foreseeable future, development of these streams to supply out-of-basin water demands will not be necessary. Inasmuch as the projected water requirements within these basins are relatively

small, the major justification for coastal stream projects may very well be dependent on benefits from fisheries enhancement and, to a lesser extent, recreation. Therefore, current studies are directed toward the selection of the more favorable fisheries enhancement projects in each basin. In addition to providing fisheries enhancement flows, these reservoirs could provide supplemental water supplies for local agricultural and urban uses.

Some of the more favorable fisheries enhancement projects on the coastal streams may offer economical opportunities for compensating possible fisheries detriments associated with the large multipurpose projects on the Eel, Trinity, and Klamath Rivers. The necessity for this association of the coastal basin projects with major developments located within the internal basins could provide a method for financing these smaller projects which may otherwise not be possible.

A discussion of reconnaissance studies of these coastal basins will be included in Bulletin No. 136. It is anticipated that additional, more intensive studies of selected projects within the coastal stream basins also will be initiated in July 1964.

Summary of Plans for Development

The more favorable alternative additional facilities to the State Water Resources Development System within the North Coastal region to be recommended in Bulletin No. 136 for more intensive future studies would develop a total new annual water yield of approximately 12,000,000 acre-feet. As indicated by Figure No. 1, the service areas for these future North Coastal projects will be statewide. Of this total, it is anticipated that by the year 2020 approximately 1,500,000 acre-feet will be required within the Eel, Trinity, Klamath, and Russian Rivers and adjacent basins. The remaining

10,500,000 acre-feet will be exported to service areas elsewhere in the State.

Table No. 2 summarizes data on the conservation yield potential and estimated capital cost of the projects which have been discussed in this chapter, and which will be recommended for further and more intensive studies in Bulletin No. 136. With the exception of the Greater Berryessa Project and the Paskenta-Newville Project, the annual new water yield would be distributed on a schedule of uniform monthly releases referenced to the termini of their respective conveyance facilities in the Sacramento Valley. The annual yield of the Greater Berryessa and the Paskenta-Newville Projects would be referenced to the Sacramento-San Joaquin Delta and distributed on a schedule of combined municipal, industrial, and agricultural demands.

The cost estimates tabulated in Table No. 2 include the cost of fisheries preservation facilities. They also include allowances for engineering, administration, contingencies, and interest during construction. The capitalized values of annual power revenue, pumping energy costs, and operation, maintenance, and replacement costs are not included. The cost estimates are based on reconnaissance studies only, and are subject to possible major revisions during more detailed analysis.

Special considerations associated with the North Coastal Area Investigation, including federal-state cooperation, the possibility for partnership developments within the North Coastal region, and anticipated future more intensive studies by the Department of Water Resources subsequent to the publication of Bulletin No. 136 in 1964, are discussed in the next chapter of this report.

TABLE NO. 2

SUMMARY OF POSSIBLE FUTURE MAJOR WATER CONSERVATION PROJECTS
IN THE NORTH COASTAL AREA AND SACRAMENTO RIVER BASIN

Project and Principal Features	Project Annual Yield 1,000 AF	Estimated Capital Cost $1,000,000
Auburn Reservoir Project	390	282
Marysville Reservoir Project	220	90
Iron Canyon Reservoir Project	250	165
Paskenta-Newville Project	200	30
Knights Valley Project		
Knights Valley 1st Stage	50	20
Knights Valley 2nd Stage	250	50
	300	70
Clear Lake Diversion Project		
Middle Fork Eel River Unit	580	110
English Ridge Unit	340	80
Conveyance Facilities to Lake Berryessa	---	90
	920	280
Greater Berryessa Project		
Enlarged Lake Berryessa	1,600	110
Power, Pumping, & Conveyance Features	---	250
	1,600	360
Trinity Diversion Project		
Helena Dam and Reservoir	600	82
Conveyance Facilities to Sacramento River	---	68
	600	150
South Fork Trinity Project		
Eltapom Dam and Reservoir	600	155
Conveyance Facilities to Sacramento River, including Power Recovery Features	---	235
	600	390
Mad-Van Duzen Project		
Mad and Van Duzen Unit	600	177
Conveyance Facilities to Sacramento River, including Power Recovery Features	---	93
	600	270

TABLE NO. 2
(Cont'd)

SUMMARY OF POSSIBLE FUTURE MAJOR WATER CONSERVATION PROJECTS
IN THE NORTH COASTAL AREA AND SACRAMENTO RIVER BASIN

Project and Principal Features	Project Annual Yield 1,000 AF	Estimated Capital Cost $1,000,000
Lower Eel River Projects		
Sequoia Dam and Reservoir	800	150
Bell Springs Dam and Reservoir	400	75
Railroad Relocation	---	130
Conveyance Facilities to Lake Berryessa	---	205
	1,200	560
Klamath Project		
Humboldt Dam and Reservoir	6,000	570
Conveyance Facilities to Sacramento River	---	820
West Side Conveyance System	---	130
Rancheria Dam and Reservoir	200	90
	6,200	1,610

CHAPTER IV. COORDINATION OF DEVELOPMENTS

The Department of Water Resources has definite commitments to present and anticipated future water users in areas to be served under the California Water Resources Development System. These commitments, which are spelled out in the Governor's Contracting Principles of 1960 and by the Standard Provisions of the Prototype Contract, require that water supplies to be made available through the initial State Water Facilities must be sustained as depletions in supply occur in the future, and that this basic contracted supply will be augmented as the demands to be served by the State Project are expanded. These commitments will be met through the future construction and operation of additional facilities, many of which have been described in Chapter III of this report.

The federal government, through the Bureau of Reclamation and the Corps of Engineers, also has commitments and responsibilities to present and future water users in service areas of the vast Central Valley Project and other extensive federal developments within California. Those agencies must also fulfill their responsibilities through extensive future development of water resources within the North Coastal region.

It is quite apparent that these major water agencies in California have a common objective, namely, that of enhancing the welfare of the people through development of the water resources of the State. More specifically, as stated in Chapter I of this report, the primary mission of the Department of Water Resources is the implementation of the State Water Resources Development System. The federal role is to assist in the implementation of this system such that development will be optimum from both the national and statewide viewpoint.

As an initial phase of such implementation, all agencies must cooperatively formulate a comprehensive plan to achieve this goal; a plan that will efficiently meet present and future needs for additional water project services throughout the State. This must be more than a plan formulated by the State and passively accepted by the federal agencies. The federal agencies should participate in its formulation and be committed to its conclusions. Only in this way can a high degree of efficiency be achieved in the expenditure of technical manpower and funds required to keep pace with California's growing water needs. Considerable progress has been made in this direction. However, much work remains to be done.

To a large extent, the planning, authorization, and construction of the present extensive water developments within California have been accomplished on an independent project-by-project basis by individual agencies acting unilaterally. Certainly this is not to imply that cooperation among agencies has been nonexistent in the past, for such is by no means the case. Recent examples of such cooperation are the current joint federal-state construction of the San Luis Division of the federal Central Valley Project and the State Water Project, and the Corps of Engineers-Bureau of Reclamation joint feasibility studies relative to the New Melones Project on the Stanislaus River. But with future development of a large portion of our uncommitted water resources soon to be brought into focus, as evidenced by the discussion in Chapter III of this preview report, we must improve on our present policies and procedures with respect to joint agency project formulation and development, if implementation of the State Water Resources Development System is to be accomplished in the most effective and efficient manner.

Comprehensive Statewide Planning

Comprehensive statewide planning for development of California's water resources, by definition, includes consideration of all present and future water needs and of the many possible alternatives for the satisfaction of these needs. The adequacy of any one plan of development depends on how thoroughly the net beneficial effects of that plan measure up to all other alternative project possibilities and whether the given project proposal, in fact, represents the most favorable alternative solution.

The independent accomplishments of a single local reservoir project within a particular river basin generally can be evaluated without great difficulty. However, for complex project systems, such as those being proposed for the North Coastal area, where interconnected reservoirs are to be operated in coordination with the existing and future storage and conveyance features in the Central Valley Basin, to meet both local and out-of-basin demands, the project's effects are extremely difficult to evaluate. These evaluations must be made however, if we are to achieve our objective of making the most efficient use of our remaining undeveloped water resources. These evaluations can be made only when the State's water picture is viewed in its entirety at all times.

The Coordinated Statewide Planning Program of the Department of Water Resources is developing data on present and estimated future water needs throughout the State. This program provides the basis for project formulation activities of the department. In coordination with planning studies, such as the North Coastal Area Investigation, data relative to the need for project construction, optimum sizing, and the necessary timing of construction are being developed. The department is the only agency within the State of California which now has a program of this magnitude and scope. These data

will provide a sound basis for future development of water resources, not only in the North Coastal area, but throughout the State. They are and will continue to be made available for use by all agencies.

We can no longer afford the luxury of building a project and reserving its new water yield potential for satisfaction of the needs of one area, which may not develop for 30 years, and for which economical staged alternative project possibilities for later construction exist, when another area could logically use the excess yield of the project immediately. Nor can we afford the luxury of building one project for the satisfaction of a few people, when there is a more favorable alternative development of larger scale which will satisfy the needs of many. In short, we have to plan on a comprehensive statewide basis. We must consider all the present and future water needs of every segment of the State, and determine how those needs can best be satisfied. This is a fundamental premise of the utility concept on which operation of the initial and all additional facilities of the State Water Resources Development System should be based. Under full effectuation of the "utility pricing concept," all water supplies developed in the future would be pooled and sold to early and late comers alike, without a pricing differential arising from timing of needs alone.

Federal-State Cooperation

To facilitate coordination and cooperation among water agencies, the California State-Federal Interagency Group, consisting of the Director of Water Resources, Director of Region II of the Bureau of Reclamation, Pacific Southwest Division Engineer of the Corps of Engineers, and the State Conservationist of the Soil Conservation Service, was established in 1958. Through the workings of this committee and its subcommittees, consisting of

staff members of the four agencies, frequent discussions and exchanges of information and views relative to water resources development policies, project formulation criteria and procedures, basic data, and the physical plans for development under study have transpired. Although the geographic scope of committee activities is intended to be statewide, primary effort has been directed initially toward cooperation in current planning for future major water conservation developments in Northern California. With respect to the current planning activities of the federal agencies and the Department of Water Resources in the northern part of the State, there has been free exchange of all hydrologic, geologic, topographic, and cost data. These interagency meetings have involved an exchange of ideas and concepts relative to future major water resources developments in the North Coastal area. The degree of cooperation which has resulted is evidenced by the close similarity in the physical features of reconnaissance plans formulated by the Corps of Engineers, Bureau of Reclamation, and the department, for early development within the Eel River Basin. Those minor differences which do exist in physical plans are the result of variances in fundamental financing and repayment criteria, rather than in basic project formulation techniques.

The three public agencies primarily concerned with extensive major water resources developments are essentially now in general agreement on the overall project plan to be recommended for the Upper Eel River and adjacent basins. Therefore, the next logical step toward necessary coordination in development will necessitate consideration of cooperative agreements concerning the feasibility-level planning, authorization, financing, construction, and operation of these proposed facilities.

There are at least two possible avenues which might lead to future cooperative interagency developments within California and the North Coastal

region in particular. These are: (1) the provisions of the Federal Water Supply Act of 1958; and (2) consummation of a direct federal-state partnership agreement relative to the financing and construction of future projects.

The Federal Water Supply Act of 1958 (Public Law 85-500, Title III; 72 Stat. 297, 319, 43 U.S.C. Sec. 390b; 1958 ed.) authorizes the Corps of Engineers and the Bureau of Reclamation to provide municipal or industrial water supply storage in their projects when reasonable evidence exists that there will be a future demand for this water. These federal agencies may provide such storage through modification of existing projects or by inclusion in projects which are now being planned.

In order for the Corps of Engineers or the Bureau of Reclamation to provide water supply storage for future municipal or industrial demands, the State or local interests must give reasonable assurances that project costs allocated to water supply can be paid in full during the life of the project. Payment of costs for storage required to satisfy future demands need not be made by the State or local interests until such supply is first used.

The provisions of this act open up the possibility that the State may not need to construct all of the projects required to supply future municipal water demands in state project service areas. Instead, state and local agencies may be able to participate in federal multiple-purpose projects, paying only the annual charges for the costs allocated to this use. The provisions of the act pertaining to the ten-year deferred repayment of costs for future municipal and industrial water supplies could also be of immense significance. Application of the act would lessen the need for state borrowing and the possible problems of financing those later stages of the State Water Resources Development System to be constructed by the department.

The act would be advantageous to the federal agencies also, particularly the Corps of Engineers, in that it could permit earlier construction of multipurpose projects in the interest of flood control or other urgent needs than could otherwise be justified. Another important aspect is that construction under the act would permit fuller utilization of the storage potential of our limited natural reservoir sites.

In addition to the Water Supply Act of 1958, partnership agreements somewhat analogous to the San Luis Agreement, covering joint facilities in the San Luis Division of the State Water Project, might be consummated between the State and the concerned federal agencies. For example, there are a number of physical factors which tend to make this approach attractive, initially with respect to proposed Upper Eel River Basin developments. They are: (1) The functional aspects of the plans of both the department and the federal agencies for development of the Upper Eel River Basin are essentially in agreement; and (2) The proposed staging of units could conveniently fit a partnership arrangement, i.e., the Upper Main Stem Eel River Projects and the Middle Fork Eel River Projects can be built separately. The department indicated as early as 1960 that the next export project to follow the State Water Facilities would involve development of the Middle Fork Eel River. Previous indications were that these additional imports would be needed by about 1986. With the adverse opinion in the Arizona v. California case, this need may be advanced to as early as 1976, approximately the same time as the Upper Main Stem Eel River Project may be proposed for completion by the federal government.

It would be possible, for example, to develop the Clear Lake Diversion Project on a partnership basis. Under a partnership arrangement, the federal government could build the English Ridge Unit with conveyance

facilities to Clear Lake and to Lake Berryessa designed to accommodate diversions from the Middle Fork Eel River and with the State constructing the Middle Fork Eel Unit and conveyance facilities to English Ridge Reservoir. A cost-sharing agreement covering joint use facilities similar to that established for San Luis joint facilities would be required. Operationally, during the build-up period of the Eel River service area, there would be excess yield from the federal English Ridge Unit which the State could use to satisfy its export demands. As the local demands continue to grow and exceed the capability of the federal English Ridge Unit, water could be made available for these areas through the State's Middle Fork Eel Unit. Additional facilities on the Trinity River then could be constructed, perhaps also as a joint undertaking, to sustain and augment the combined federal-state demand on the Sacramento-San Joaquin Delta and to meet those demands for project services which by that time may have occurred within the Trinity River Basin.

The San Luis Unit of the Central Valley Project is a precedent in federal-state cooperation in the development of water resources. It is believe that this relationship can and should be extended to development of water resources in the North Coastal area to the benefit of all concerned. It is anticipated that these possibilities for cooperative and partnership development in the North Coastal area will be explored further through meetings of the California State-Federal Interagency Group.

Department Activity Following This Investigation

With the publication of Bulletin No. 136 in 1964, the current reconnaissance investigation in the North Coastal area will be completed. Beginning in July 1964, departmental efforts in this area will be confined primarily

to two interrelated but distinct studies. These studies are:

1. A feasibility investigation of those projects selected for early state construction, and portions of the investigations required for those projects identified for joint state-federal development. It now is anticipated that these projects will be located in the Middle Fork Eel and Upper Eel River Basins. This study program will also include further consideration of a separate Paskenta-Newville storage development. The adverse opinion on the Arizona v. California case may very well require that more intensive study of Trinity River Projects also be initiated. The objective of the feasibility investigation would be the final formulation of a project or projects which would meet the requirements for additional facilities of the State Water Resources Development System. This investigation would terminate in 1968 in a report on specific features of the initial project or projects within and adjacent to the Eel River Basin.

2. The second study would be a continuation of the area-wide investigation of the entire North Coastal area. This area-wide investigation would be of an intermediate level of intensity directed toward the more detailed identification of future projects within the Trinity, Klamath, Mad, Van Duzen, and Lower Eel River Basins. The objective of this study will be to further define the specific features of the second and later-staged developments to be recommended in Bulletin No. 136, in anticipation of feasibility-grade studies to be initiated for them, perhaps as early as 1967.

Summary of Preview Report

California is blessed with sufficient natural water supplies to meet

present and all probable future needs, providing these supplies are properly controlled, conserved, and distributed. Most of the remaining uncontrolled water supplies of the State are located within the North Coastal region.

Satisfaction of future water demands under the State Water Resources Development System will necessitate major development of water resources in the North Coastal region by the federal government and by the State of California. All major water agencies in California have common objectives which involve implementation of the California Water Resources Development System. Information being developed by the Department of Water Resources' Coordinated Statewide Planning Program is prerequisite to the proper accomplishment of these objectives.

The reconnaissance phase of the department's long-range North Coastal project formulation program will be completed in July 1964. Bulletin No. 136, entitled "The North Coastal Area Investigation," is scheduled for publication at that time. The investigational report will include a digest volume and technical appendixes on the subjects: "Hydrology and Watershed Management," "Engineering Geology," "Designs and Cost Estimates," "Recreation, Fish, and Wildlife Resources," "Economic Considerations," and "Alternative Plans for Development."

Bulletin No. 136 will recommend more intensive studies leading towar authorization and the possible future staged construction of water development shown on Plates Nos. 1 and 2 of this preview report. The Eel River-Clear Lake Diversion Project tentatively has been selected as the initial additional facilities to the State Water Resources Development System to be recommended within the North Coastal area.

The Department of Water Resources, U. S. Bureau of Reclamation, and U. S. Corps of Engineers are all looking toward the major development of water

resources within the North Coastal area to meet their long-range responsibilities and commitments to the people of California for additional water supplies. The department is scheduling more detailed planning studies in the North Coastal area subsequent to 1964. The objectives of these studies are the final formulation of the recommended initial additional facilities to the State Water Project in the North Coastal area, and the further identification of subsequent projects.

The Bureau of Reclamation currently is in the final stages of a reconnaissance appraisal of a comprehensive plan for the development of the water resources of the Eel and Russian River Basins and more intensive studies are programed for the future. The Corps of Engineers, in addition to their current studies in the Eel, Russian, Napa River, and Sonoma Creek Basins, has received congressional authority for a comprehensive water resources study of Northern California.

The need for large additional water supplies from the North Coastal area may occur as early as 1976. If the remaining undeveloped water resources of the area are to be put to their most efficient use, it is essential that formal cooperative agreements between the three agencies be consummated at an early date. One such agreement could involve development by federal-state partnership of the Eel River-Clear Lake Diversion Project.

APPENDIX A

COMMENTS OF FEDERAL AGENCIES

Bureau of Reclamation
Corps of Engineers
Soil Conservation Service

on

Preview Report of Bulletin No. 136
"North Coastal Area Investigation"

ADDRESS ALL
COMMUNICATIONS TO
THE REGIONAL DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

REGIONAL OFFICE, REGION 2
P. O. BOX 2511
SACRAMENTO, CALIFORNIA
(TOWN AND COUNTRY AREA)

IN REPLY
REFER TO: 2-100

June 27, 1963

Mr. William E. Warne, Director
State Dept. of Water Resources
P. O. Box 388
Sacramento 2, California

Dear Bill:

The opportunity for informal advance review of the draft copy of your proposed report entitled "Preview of Bulletin No. 136, North Coastal Area Investigation" is appreciated. I find this report well prepared and quite timely.

The plans and proposals broadly outlined in this draft are generally consistent with our own plans and objectives. We are, of course, also interested in the fitting together of the comprehensive State-Wide water plans with the broader comprehensive western regions plans and consider the dual objectives compatible and practical.

I want to assure you the Bureau of Reclamation will be pleased to continue cooperation with the State along the lines indicated. I look forward to effective and productive cooperation in our joint efforts to fulfill our water resources development objectives for the State and the Region.

Sincerely yours,

R. J. Pafford Jr.

R. J. Pafford, Jr.
Regional Director

U. S. ARMY ENGINEER DIVISION, SOUTH PACIFIC
CORPS OF ENGINEERS
630 Sansome Street, Room 1216
San Francisco 11, California

In Reply Refer To SPDGP

23 August 1963

Mr. William E. Warne, Director
Department of Water Resources
State of California
P. O. Box 388
Sacramento 2, California

Dear Mr. Warne:

I have reviewed your report "Preview of Bulletin No. 136, North Coastal Area Investigation" and I am pleased to concur in your preliminary findings and tentative conclusions.

There is a need for expedited action in solving California's water problem. This need is well recognized by all agencies concerned with development of the State's water resources. Magnitude of the problem emphasizes the importance of a coordinated action program through a control group such as our Four-Agency Committee which has been so successful the past several years.

You may be assured that the Corps of Engineers is prepared to accomplish a comprehensive study of Northern California Streams in accordance with the Congressional directive contained in the 1962 Flood Control Act. I am also sure that past success of our coordinating committee can be expected to continue for the successful solution of California's water problem.

Sincerely yours,

ARTHUR H. FRYE, JR.
Brigadier General, U. S. Army
Division Engineer

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

2020 Milvia Street
Berkeley 4, California

August 16, 1963

Mr. William E. Warne, Director
Department of Water Resources
P. O. Box 388
Sacramento 2, California

Dear Mr. Warne:

We have studied your revised draft, "Preview of Bulletin No. 136, Draft No. 5, August 1963, North Coastal Area Investigation" with a good deal of interest. This is an excellent report.

We agree that the early publishing of this document is desirable in order to inform the people of California of the studies being conducted by the Department and cooperating Federal agencies on water resource development to meet California's needs. This report also goes far to set the stage for a cooperative undertaking of future water development in the North Coastal basins.

We believe the Department's conclusions regarding the essential order of water resource development in the North Coastal basins is reasonable and hope that this preliminary bulletin will be published at an early date.

We appreciate this opportunity to comment.

Sincerely,

John S. Barnes

John S. Barnes
State Conservationist

Growth Through Agricultural Progress

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

2020 Milvia Street
Berkeley 4, California

August 16, 1963

Mr. William E. Warne, Director
Department of Water Resources
P. O. Box 388
Sacramento 2, California

Dear Mr. Warne:

We have studied your revised draft, "Preview of Bulletin No. 136, Draft No. 5, August 1963, North Coastal Area Investigation" with a good deal of interest. This is an excellent report.

We agree that the early publishing of this document is desirable in order to inform the people of California of the studies being conducted by the Department and cooperating Federal agencies on water resource development to meet California's needs. This report also goes far to set the stage for a cooperative undertaking of future water development in the North Coastal basins.

We believe the Department's conclusions regarding the essential order of water resource development in the North Coastal basins is reasonable and hope that this preliminary bulletin will be published at an early date.

We appreciate this opportunity to comment.

Sincerely,

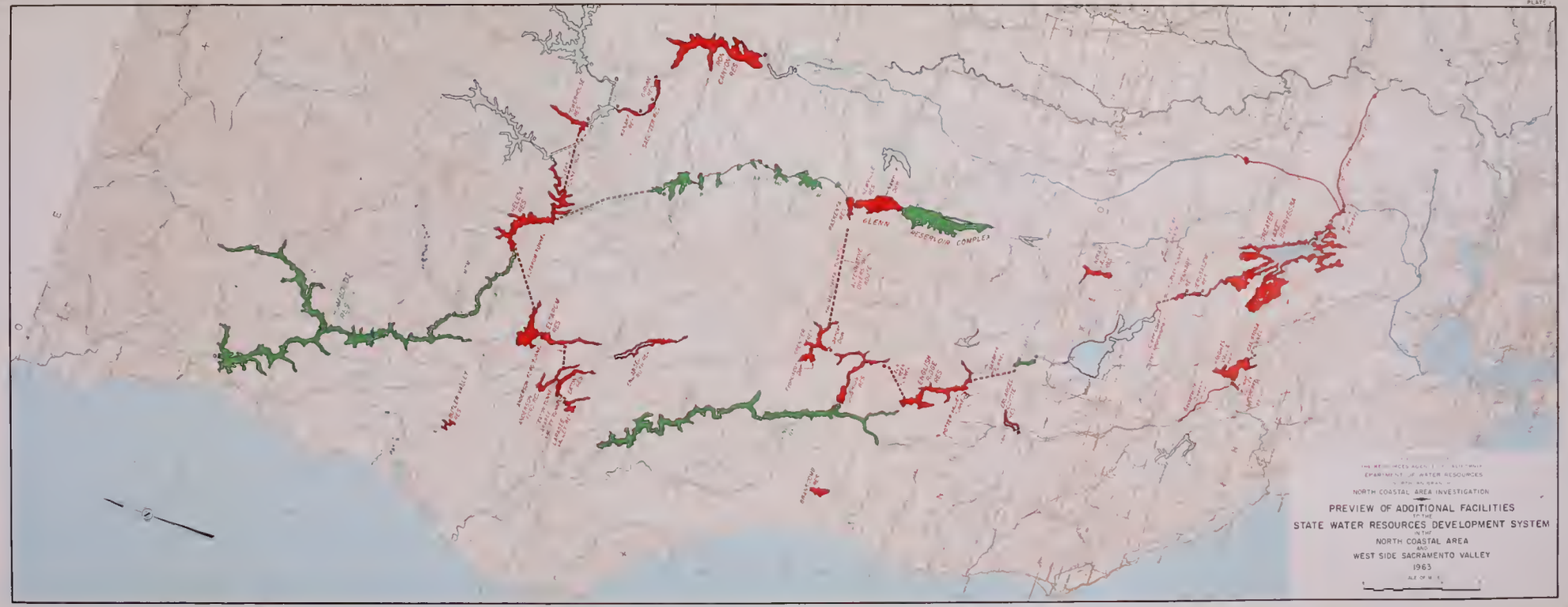
John S. Barnes

John S. Barnes
State Conservationist

Growth Through Agricultural Progress

LEGEND

FEATURE	EXISTING OR AUTHORIZED FACILITIES	PROJECTED ADDITIONAL FACILITIES EARLIER STAGES	PROJECTED ADDITIONAL FACILITIES LATER STAGES
RESERVOIRS			
CANALS AND AQUEDUCTS			
TUNNELS			
POWER PLANTS			
PUMPING PLANTS			
REVERSIBLE PUMP TURBINE UNITS			



VICINITY M

NORTH COASTA

RELATED AREA
RIVER BASIN

LEGEND

FEATURE	EXISTING OR AUTHORIZED FACILITIES	PROPOSED ADDITIONAL F	
		EARLIER STAGES	LA STA
RESERVOIRS			
CANALS AND CHANNELS			
TUNNELS			
POWER PLANTS			
PUMPING PLANTS			
REVERSIBLE PUMP-TURBINE UNITS			

VICINITY M

NORTH COASTA

RELATED AREA
RIVER BASIN

LEGEND

FEATURE	EXISTING OR AUTHORIZED FACILITIES	PROPOSED ADDITIONAL F	
		EARLIER STAGES	LA ST
RESERVOIRS			
CANALS AND CHANNELS			
TUNNELS			
POWER PLANTS			
PUMPING PLANTS			
REVERSIBLE PUMP-TURBINE UNITS			

LEGEND

FEATURE	EXISTING OR AUTHORIZED FACILITIES	PROPOSED ADDITIONAL FACILITIES	
		EARLIER STAGES	LATER STAGES
RESERVOIRS			
CANALS AND CHANNELS			
TUNNELS			
POWER PLANTS			
PUMPING PLANTS			
REVERSIBLE PUMP-TURBINE UNITS			

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
NORTHERN BRANCH
NORTH COASTAL AREA INVESTIGATION

PREVIEW OF ADDITIONAL FACILITIES TO THE STATE WATER RESOURCES DEVELOPMENT SYSTEM IN THE NORTH COASTAL AREA AND SACRAMENTO RIVER BASIN

PICTORIAL VIEW
1963

THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

RENEWED BOOKS ARE SUBJECT TO IMMEDIATE
RECALL

REC. MAR 17 1966
JAN 4 1969
REC'D OCT 26 1968
JUN 6 1969
UCD LIBRARY
DUE JUN 6 1970
JUN 30 REC'D
UCD LIBRARY
DUE JUN 12 1970
JUN 5 REC'D
JUN 1 1977
JUN 17 REC'D

JUL 10 1980
OCT 30 1987
RECEIVED
8 1987
PHYS SCI LIBRARY

LIBRARY, UNIVERSITY OF CALIFORNIA, DAVIS

Book Slip—50m-12,'64(F772s4)458

354273

California. Dept.
of Water Resources.
Bulletin.

TC824
C2
A2
no.136 A

PHYSICAL
SCIENCES
LIBRARY

LIBRARY
UNIVERSITY OF CALIFORNIA
DAVIS

3 1175 00575 0339

354273
California. Dept.
of Water Resources.
Bulletin.

Call Number:

TC824
C2
A2
no.136 A

PH
SC
LI