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ASSESSMENT OF EFFECTS  
OF ALTERED STREAMFLOWS  
ON FISH & WILDLIFE IN CALIFORNIA.

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ASSESSMENT OF EFFECTS OF ALTERED STREAMFLOWS  
ON FISH AND WILDLIFE IN CALIFORNIA

TASK II  
Individual Case Study Results and Evaluation

July 15, 1976

Prepared by

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for

U. S. Fish and Wildlife Service  
Western Energy and Land Use Team  
Fort Collins, Colorado  
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	Case Study
<u>Project</u>	<u>Number</u>
Iron Gate	1
Shasta Dam	2
Trinity-Lewiston Dams	4
Ruth Dam	6
Pit River 6 & 7 Reservoirs	71 & 72
Antelope Valley Dam	8
Rock Creek Diversion Dam	10
French Meadows Reservoir	26
Hell Hole Reservoir	27
Loon Lake Dam and Gerle Creek	28
Salt Springs Reservoir	35
Spicer Meadows Reservoir	36
Lake Tahoe Dam	75
Oroville Dam	67A
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Coyote Dam	15
San Pedro Creek	59
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Thelma Adair Keyes Reservoir	81
Whale Rock Reservoir	86
Pine Flat	64
Isabella Project	73
Friant Dam	63
New Exchequer	54
New Melones Project	50A
Hetch-Hetchy	47

<u>Project</u>	<u>Case Study Number</u>	<u>Page</u>
New Don Pedro	52	489
Snelling Project	55	500
Sand Bar Diversion	41	513
Rock Creek Diversion Dam	56	521
Bridgeport Dam	49	529
Lake Henshaw	76	541
Santa Felicia Dam	77	547
Pleasant Valley Dam	57	554
Casitas Dam	74	562
Lake Sabrina	58	569
Mojave Forks Reservoir	83	574
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A C K N O W L E D G E M E N T S

These case studies were prepared by Jones & Stokes Associates staff<sup>1/</sup> through the cooperation and assistance of numerous U. S. Fish and Wildlife Service and California Department of Fish and Game personnel. We especially wish to thank Mr. James Carson, Mr. Eric Gerstung and Mr. Charles Fisher for their review and comments on draft documents. The resources for these studies were provided by the U. S. Fish and Wildlife Service, Office of Biological Services, Western Energy and Land Use Team with project leadership from Dr. Harvey Doerksen and Mr. Robert P. Hayden.

1/ Major participants: Dr. Charles R. Hazel, Mr. Steven R. Herrera, Mr. Harry Rectenwald, and Mr. Jonathan H. Ives.

## METHOD OF INVESTIGATION

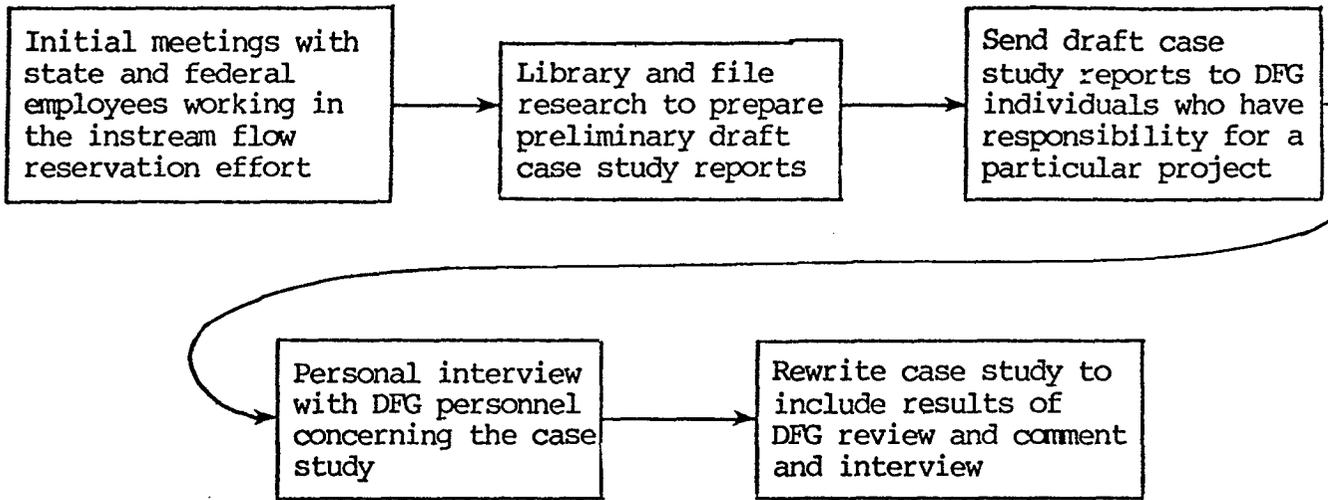
During July and August 1975, a survey was made of major projects that altered streamflows in California. Consistent with California's wet and dry seasons, and major centers of population in arid areas, great governmental and private effort is put into water projects that alter streamflows. In addition to power production, the trend is to convey water from areas of high precipitation to arid agricultural and urban areas. Thousands of surface streams have been impounded or diverted from their natural courses.<sup>1/</sup> A recent inventory of dams in California gave a count of 1,091; moreover, 16,000 water rights permits have been issued to divert surface water<sup>2/</sup> and many of these diversions affect fish and wildlife.

Using library research and contacts with federal, state and local agencies, an effort was made to discover major projects susceptible to investigation and evaluation relative to the study objectives. Eight-seven such projects were reviewed, and 50 were finally selected for intensive case study. These initial screenings are reported in the Jones & Stokes Associates report, Assessment of Effects of Altered Stream Flows on Fish and Wildlife in California, Task I: Inventory of Projects Recommended for Case Study, August 28, 1975.

After the approval of 50 projects for case study by the USFWS, an intensive effort was applied to learn as much as possible about events connected to the reservation of instream flows. This effort required visits to project sites, the review of published reports, file searches and interviews with persons who participated in projects during their developmental stage. The case studies are summarized in this report with each case study appearing according to the following outline: Project Description, Pre-Project Conditions, Project Development, Post-Project, Conclusions, Personal Contacts and Bibliography.

Case study compilation and report preparation was done mainly through information obtained from DFG and SWRCB files and from interviews with state and federal employees. The process typically followed the following scheme:

- <sup>1/</sup> Department of Water Resources, Bulletin No. 17-67, "Dams Within the Jurisdiction of the State of California".
- <sup>2/</sup> State Water Resources Control Board, Water Rights Division, file data.



Because some projects have been in operation for 50 or more years, pertinent data was often not available.

## INSTITUTIONAL CONSIDERATIONS

The agency having principal involvement in almost all streamflow altering situations is the California Department of Fish and Game (DFG), while the USFWS is most heavily involved in federally-sponsored projects. However, both agencies appear to coordinate their activities as required along with other federal and state agencies through statutory responsibilities and interagency agreements.

In California the project mitigation measure to maintain fisheries is the reservation of minimum instream flows. In the use of instream flow reservation strategies, a particular point of need is for fish and wildlife resources personnel to enter a construction project or issuance of a permit in time to influence the amount and schedule of water designated for instream flow. Consequently, in any strategies for acquiring instream flow, fish and wildlife agencies must be alerted about their opportunities and constraints to influence the planning and decision processes. Initial entry is often accomplished through notifications requesting review and comment of an application sent out by decision-making bodies. These notifications usually result from pre-established interagency agreements that describe a working protocol.

For example, in California, the issuance of water rights permits is decided by the State Water Resources Control Board with the assistance of the Board's Division of Water Rights. Upon receipt of an application for a permit, the Board forwards copies to the State Departments of Fish and Game and Water Resources and, in the case of federal projects, to the U. S. Fish and Wildlife Service. The basis for coordination among the state agencies is contained in the California Water Code (several sections declaring general responsibilities for fish and wildlife) and for the Fish and Wildlife Service in the Fish and Wildlife Coordination Act. Depending on the nature of the water rights permit application, the DFG and USFWS coordinate their activities with other federal and state agencies. Sometimes task forces, including a number of agencies, are established. Except for occasional correspondence to clarify specific points of interest, there are apparently no formal coordination or procedural agreements between state and federal agencies, although there is a long-standing informal agreement to coordinate activities.

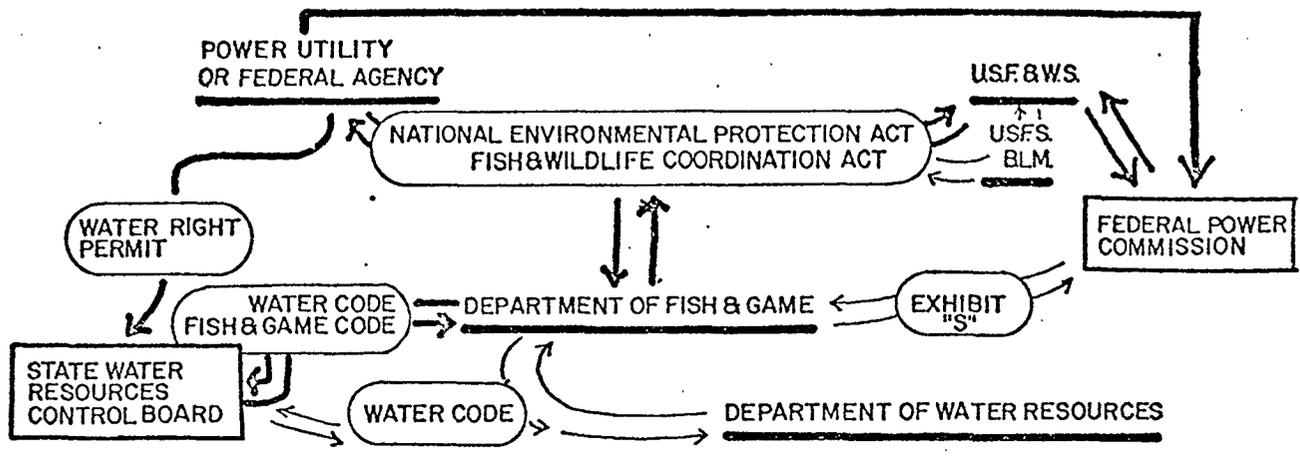
There are internal memoranda of procedures for the review and response to water rights permits within each agency. The State Water Resources Control Board (SWRCB) has administrative

procedure for water rights permits that includes an environmental assessment of possible effects on fish and wildlife. The DFG has several stages of review that may result in formal intervention into the water rights procedure of the SWRCB. The SWRCB holds public hearings on the issuance or change of a permit, and DFG, USFWS, et.al., may promulgate their objections or make mitigation requests at the hearing. The SWRCB may make an administrative decision to reserve instream flows for fish and wildlife. The SWRCB has over 16,000 water rights permits; 6,000 of these were searched and 174 were found to have conditions that reserve instream flow for fish and wildlife.

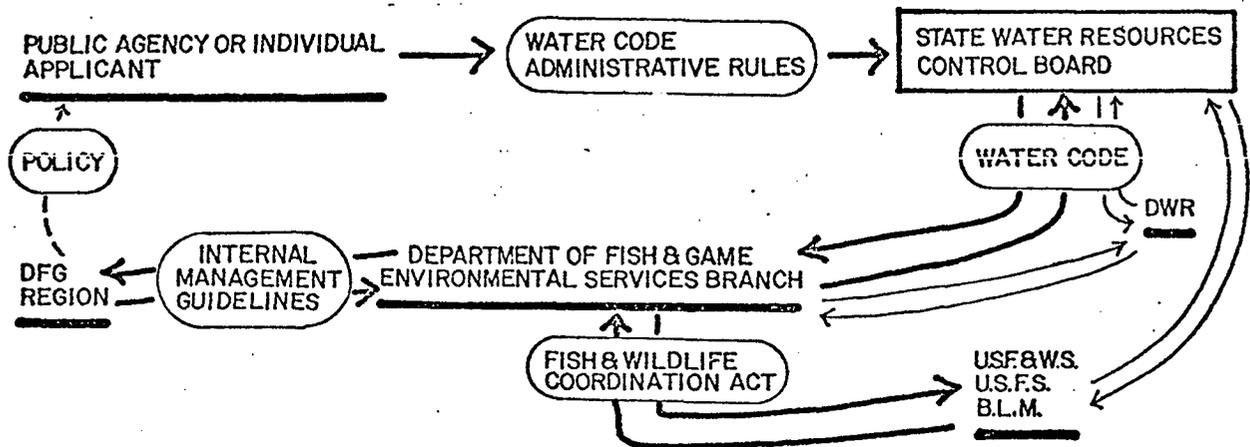
The other major institutional system used to reserve instream flow is the conditional issuance of a Federal Power Commission (FPC) license. Exhibit S requirements in FPC rules provide the framework for this decision arena. Of lesser importance are the sections of California Fish and Game Code (1601-1602) which relate to managing the alteration of streamflows. Flow chart examples of the three major institutional strategies in use are shown in Figure 1.

Other strategies that seem to offer opportunities in California are shown below, along with an estimate of their usefulness (practicality) and immediate economic burden.

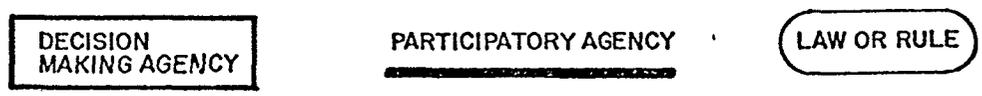
<u>Legend</u>				
S = State				
F = Federal				
U = Utility				
Strategies for Instream Flow Reservation	Known to Be in Use in California	Potential Use But Unresolved Application	Rating of Practical Usefulness	Immediate Economic Burden
Purchase of water for instream flow reservation	U		Fair	High
Obtain water right permit		S	Fair	Low
Administrative action of SWRCB	S		Excellent	Low
Conditions on permits and licenses	S&F		Excellent	Moderate
Prohibition of water appro- priation		S	Untested	Low
Limited time water permit		S&F	Good	Low
Administrative criteria to protect use by USFWS		S	Excellent	Moderate
Review of permits for com- pliance with rules		S	Fair	Moderate
Pumping of groundwater into stream		S	Poor	High
Dilution of adverse water quality	S&F		Fair	High



**U.S. GOVERNMENT: DEVELOPMENTAL OR PERMITTING AGENCIES**



**CALIFORNIA WATER RIGHT APPLICANT**



**FIGURE 1 INSTITUTIONAL INTERFACES IN THE ACQUISITION OF INSTREAM FLOW RESERVATIONS**

## ENVIRONMENTAL ORIENTATION

Because of its clear concept and intelligible interpretation, the description of California's landscape provinces, as prepared by Dr. Herbert Mason (1970), is used as a major project feature. Because of its natural diversity in relief, geology, soils, climate and complex flora and fauna, California is varied in resources and land use. Resource development and patterns of human habitation have greatly altered waterways, stream flows and fish and wildlife. Many of these alterations correspond in some characteristics with landscape provinces which makes these provinces a useful tool in subregionalization of the state. Most large resource planning efforts in the state rely to some degree on this subregionalization.

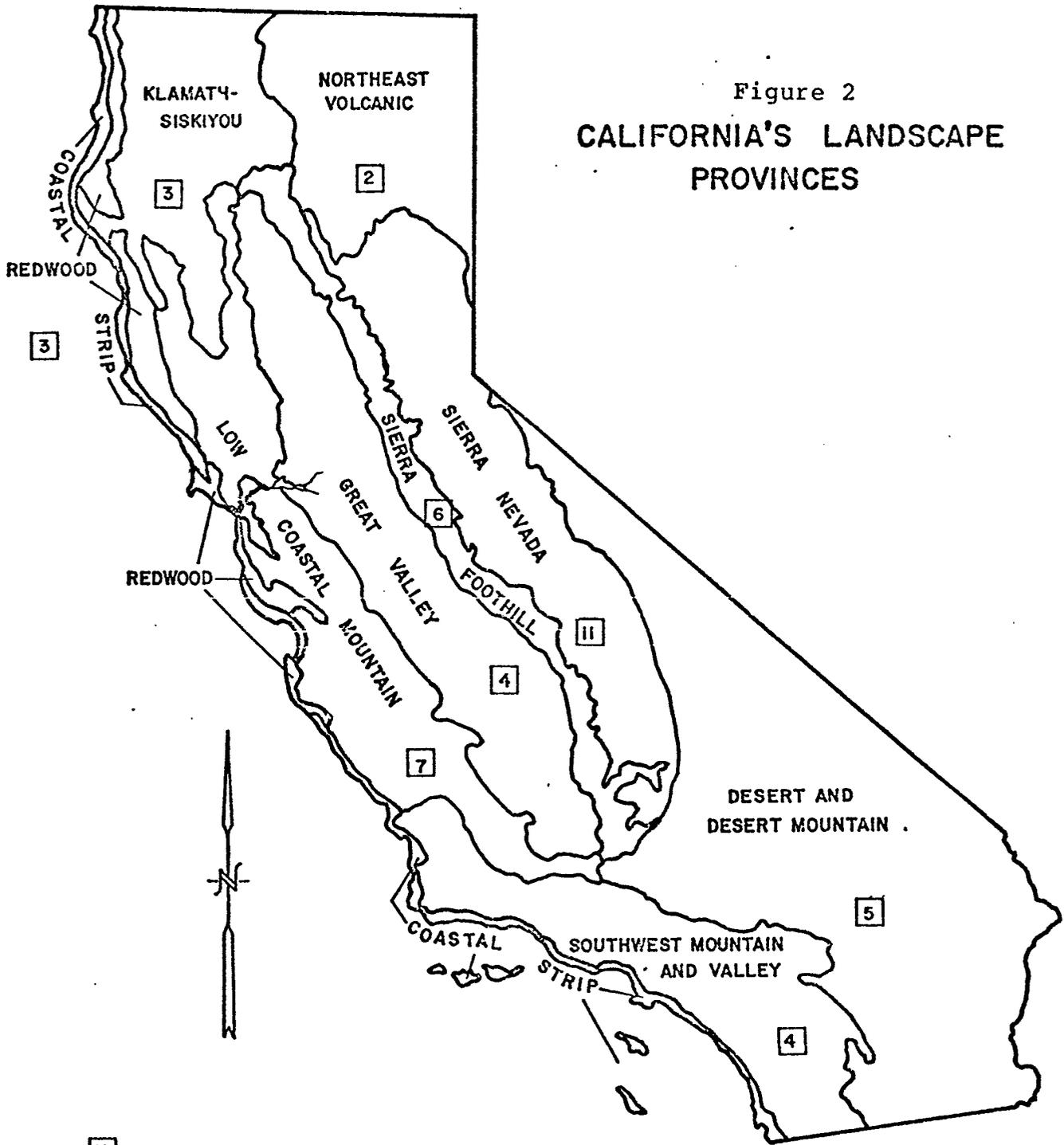
Figure 2 is a general mapping of nine provinces and also displays the number of projects in each province. Only one project (Whale Rock Dam) was identified in the coastal strip province. Short excerpts describing each province are found in Tables 1 through 9 (pages 21 through 35) of "Assessment of Effects of Altered Stream Flows on Fish and Wildlife in California - Task I, Inventory of Projects Recommended for Case Study, 1975".

Water supply and water quality management plans in California usually relate to a hydrologic subunit which is representative of major watersheds and/or hydrologic units. Hydrologic subunits have distinct environmental and cultural features which afford them particular value in water and wastewater planning. Large amounts of data and information were developed for and are referenced to subunit reports. Particular water projects become operating elements in the total SWRCB management of subunit water resources.

Stream size as indicated by flow in cubic feet per second is an important feature relatable to the magnitude of indigenous fish and wildlife resources. Depending on landscape province, whether precipitation is rain or snow and other conditions, stream flow varies greatly by season. Also, as indicated in Figure 3, seasonal patterns of discharge vary and these patterns are often modified by water projects.

California has wet and dry seasons which are dominant influences on both terrestrial and aquatic systems. Generally the wet season is between October and May; however, this time span varies significantly with location. Figure 4 illustrates

Figure 2  
**CALIFORNIA'S LANDSCAPE PROVINCES**

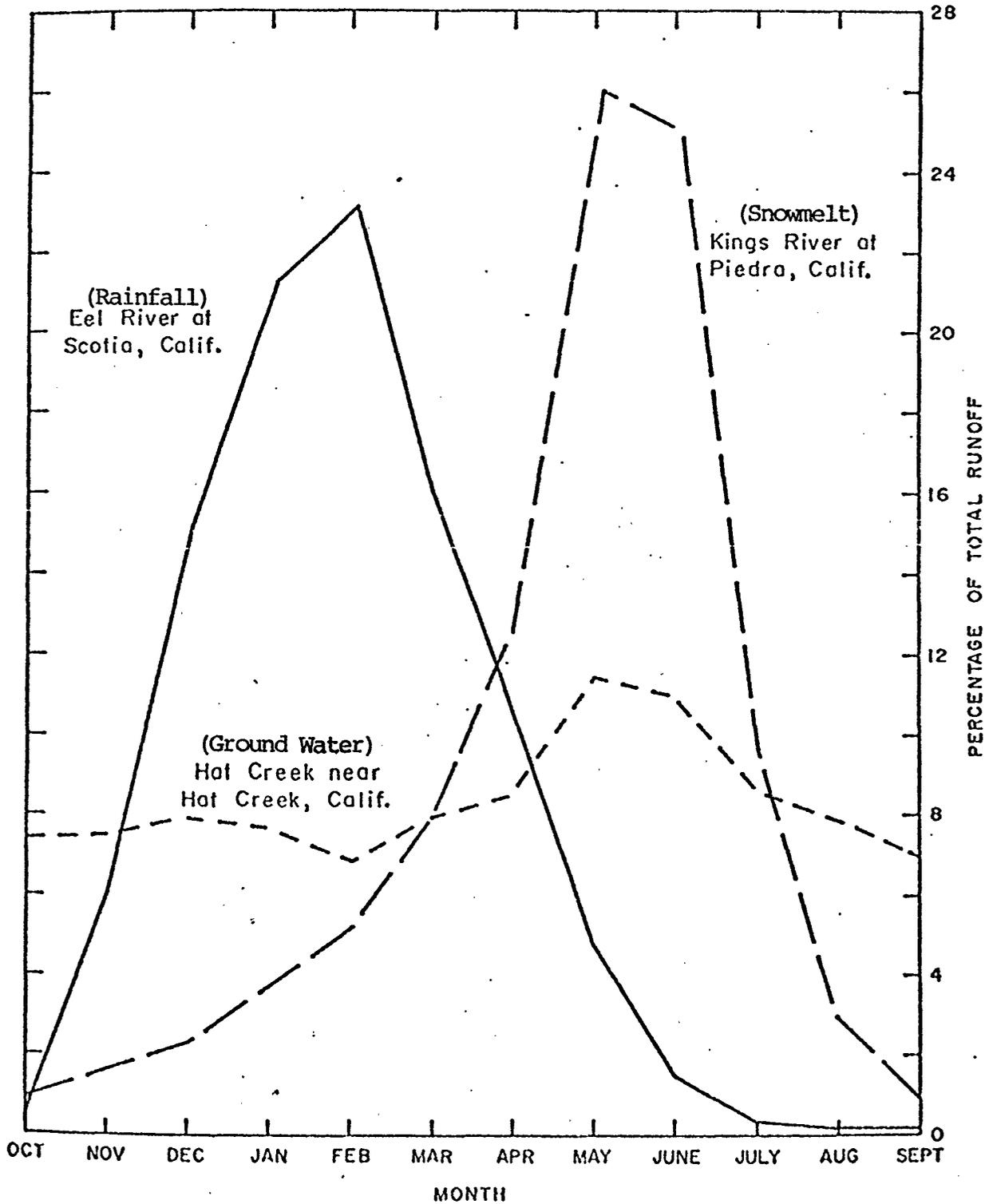


**N** NUMBER OF CASE STUDIES WITHIN EACH PROVINCE

Modified from Mason (1970)

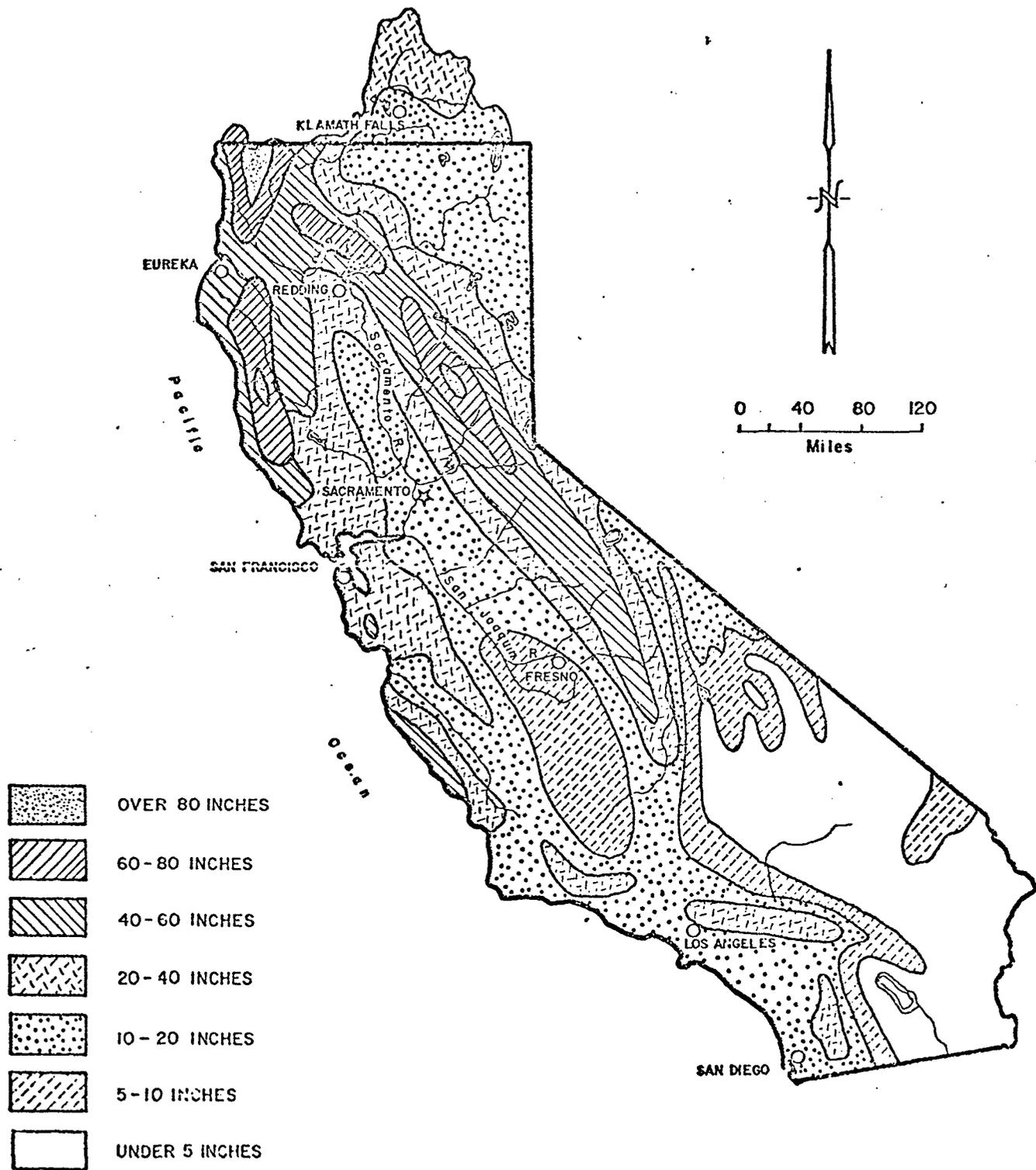
Figure 3

MEAN MONTHLY DISTRIBUTION OF RUNOFF AT THREE SELECTED GAUGING STATIONS IN THE CALIFORNIA REGION THAT REPRESENT PRINCIPAL SOURCES OF STREAMFLOW - RAINFALL, SNOWMELT AND GROUND WATER



From: Comprehensive Framework Study, California Region (1971).

Figure 4  
MEAN ANNUAL PRECIPITATION



FROM: COMPREHENSIVE FRAMEWORK STUDY, CALIFORNIA REGION (1971)

levels of precipitation in the different subareas. Stream discharge is a product of annual precipitation as discharge may be modified by soil, slope, geology, human activity and whether it occurs as rain or snow (see Figure 5). One may generalize that there is a correlation between annual precipitation and naturally occurring abundances or shortages in in-stream flow for fish and wildlife. Shortages have usually been intensified by appropriation of water, although in some cases conditions have been enhanced.

The vegetative habitat shown in Figure 6 and used in the Task I inventory is based on Jensen's (1947) classification. This typifies dominant plant associations over wide regions. Specific vegetative habitat along reaches of stream may be at variance with this mapping, but such specific conditions would be described in the case study documentation. Riparian habitats are quite variable and are generally not shown in California vegetative mapping unless done for that specific purpose. Most streams have available aerial photographs and riparian situations could be interpreted on a case-by-case basis.

Common fish corresponding to project situations can be broken into five general groups: anadromous (AD), coldwater (CF), warmwater (WF), nonharvestable (N) and endangered (E). Instream flows are usually maintained to protect or enhance one or a few harvestable species of fish. Other fish, aquatic organisms and riparian wildlife are assumed to also be adequately protected by these flows. Typical species for each harvestable group are:

Anadromous (AD)

King salmon (Oncorhynchus tshawytscha)  
Silver salmon (O. kisutch)  
Steelhead trout (Salmo gairdnerii)  
Cutthroat trout (S. clarki)  
White sturgeon (Acipenser transmontanus)  
American shad (Alosa sapidissima)  
Striped bass (Morone saxatilis)

Coldwater (CF)

Rainbow trout (Salmo gairdnerii)  
Brown trout (S. trutta)  
Brook trout (Salvelinus fontinalis)  
Golden trout (Salmo aquabonita)  
Cutthroat trout (S. clarki)  
Kokanee salmon (Oncorhynchus nerka)

Warmwater (WF)  
Smallmouth bass (Micropterus dolomieu)  
Largemouth bass (M. salmoides)  
Black crappie (Pomoxis nigromaculatus)  
Bluegill (Leopmis macrochirus)  
Channel catfish (Ictalurus punctatus)  
White catfish (I. catus)

There are also nonharvestable minnows, suckers, sculpins, smelt, etc., that fit into each of the above groups. In-stream flow may be regulated to maintain nonharvestable fish and other aquatic life, but these situations have been defined on a case basis as would water to protect endangered species of fish and wildlife.

Wildlife groups are consolidated under this one heading because during the inventory, it is not practical to determine wildlife uses except to note that they tend toward three categories: general riparian habitat, waterfowl management areas, and desert water stations.

## CASE STUDY REPORTS

The list of projects and a consolidation of some of their statistics is in Appendix A. The general locations of these projects are in Figure 7. The organization of Appendix A by DFG region reflects the manner in which the case studies are being processed. In addition to published agency reports, used to compile these statistics, most project data and information can be found in either project or stream survey files in DFG regions or in other agency files, principally the USFWS (Sacramento), U. S. Bureau of Reclamation (USBR), U. S. Geological Survey (USGS), State Department of Water Resources (DWR) and the State Water Resources Control Board, Water Rights Division (SWRCB). Appendix A cites the approximate year of instream flow reservation development, or if there is no reservation, the time when it was considered. In a few instances, the instream flow reservation occurred sometime after project development. In 18 cases where this occurred, the DFG and USFWS were permitted to reenter the instream flow reservation arena because of project alterations, FPC relicensing, application for water rights, and/or the proposed implementation of a new project upstream of an existing project.

The organization of each case study is as follows:

- I Project Description
- II Pre-Project Conditions
- III Project Development
- IV Post-Project Period
- V Conclusions
- VI Bibliography and Personal Contacts

Four subject area guidelines were used in researching and reporting cases:

1. Whether or not the original project plan for altering the flow regime was followed.
2. The extent of investigations and the methodologies used to predict effects and determine instream flow requirements.
3. The pre-project and post-project conditions and by comparison, the actual effects of the altered flow characteristics on the fish and wildlife downstream.
4. The relevancy and effectiveness of the methodologies used to the efforts to make the project compatible with fish and wildlife resources.

The degree of resolution of the questions implied by the four guidelines is quite variable. In the Task III analysis, which is in preparation, the four items will be dealt with individually for each project.

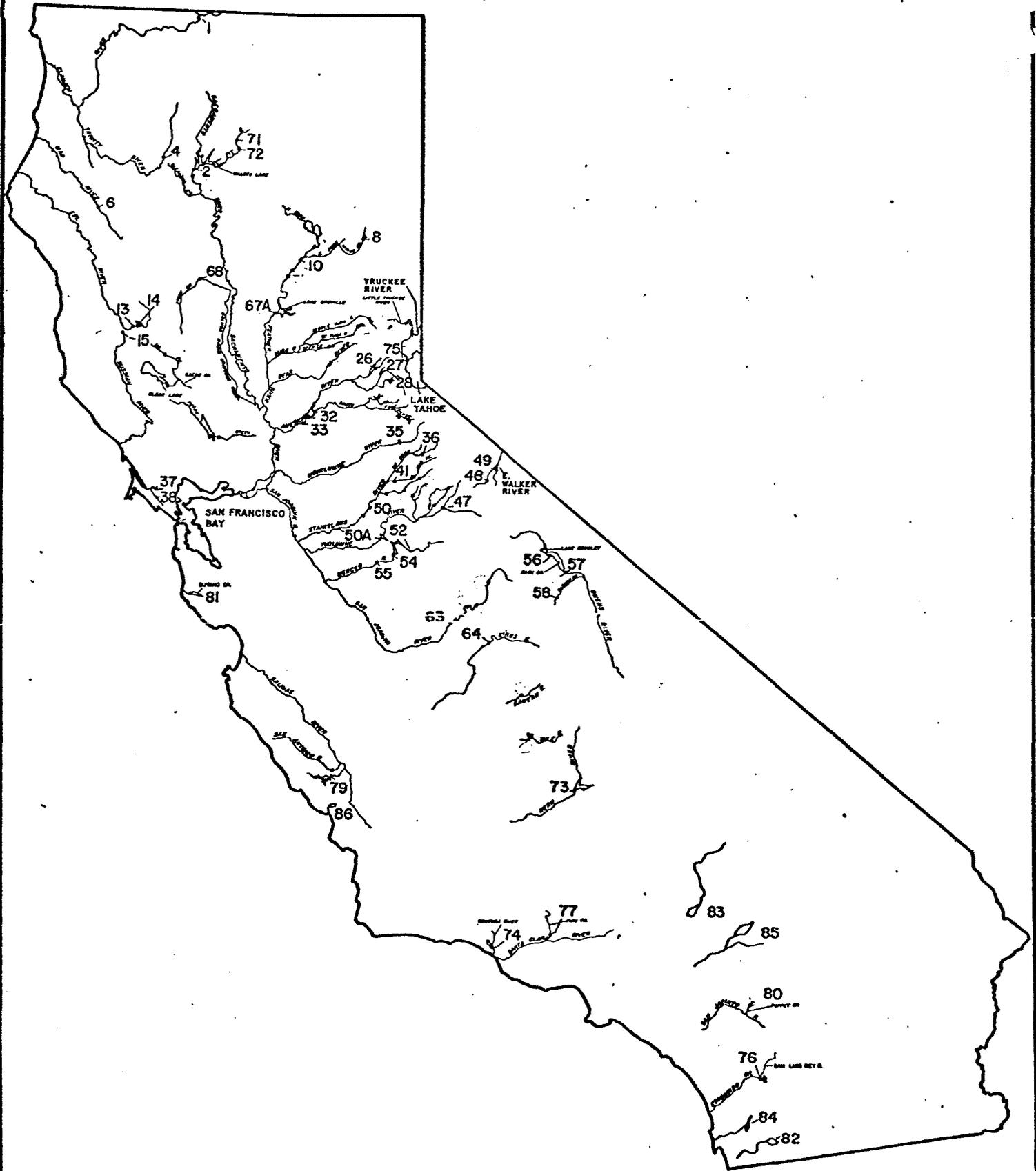


FIGURE 7  
CASE STUDY PROJECT LOCATIONS IN REFERENCE TO MAJOR RIVERS