

CALFED  
BAY-DELTA  
PROGRAM

# Affected Environment and Environmental Impacts

## Fish, Wildlife & Recreational Economics

Draft Technical Report  
September 1997

CALFED/708

C - 0 0 1 9 5 6

C-001956

# TABLE OF CONTENTS

|  | PAGE |
|--|------|
| <b>EXECUTIVE SUMMARY</b> .....                 | E-1  |
| INTRODUCTION .....                             | E-1  |
| ENVIRONMENTAL SETTING .....                    | E-1  |
| STUDY AREA .....                               | E-1  |
| DELTA REGION .....                             | E-2  |
| BAY/CALIFORNIA COAST REGION .....              | E-3  |
| SACRAMENTO RIVER REGION .....                  | E-5  |
| SAN JOAQUIN RIVER REGION .....                 | E-5  |
| SWP AND CVP SERVICE AREAS .....                | E-6  |
| <br>   |      |
| <b>CHAPTER 1. INTRODUCTION</b> .....           | 1-1  |
| <br>   |      |
| <b>CHAPTER 2. SOURCES OF INFORMATION</b> ..... | 2-1  |
| DELTA REGION .....                             | 2-1  |
| OTHER REGIONS .....                            | 2-2  |
| <br>   |      |
| <b>CHAPTER 3. ENVIRONMENTAL SETTING</b> .....  | 3-1  |
| STUDY AREA .....                               | 3-1  |
| REGULATORY CONTEXT .....                       | 3-2  |
| DELTA REGION .....                             | 3-2  |
| HISTORICAL PERSPECTIVE .....                   | 3-2  |
| CURRENT RESOURCE CONDITIONS .....              | 3-3  |
| BAY/CALIFORNIA COAST REGION .....              | 3-4  |
| HISTORICAL PERSPECTIVE .....                   | 3-4  |
| CURRENT RESOURCE CONDITIONS .....              | 3-6  |
| SACRAMENTO RIVER REGION .....                  | 3-7  |
| HISTORICAL PERSPECTIVE .....                   | 3-7  |
| CURRENT RESOURCE CONDITIONS .....              | 3-8  |
| SAN JOAQUIN RIVER REGION .....                 | 3-9  |
| HISTORICAL PERSPECTIVE .....                   | 3-9  |
| CURRENT RESOURCE CONDITIONS .....              | 3-10 |
| SWP AND CVP SERVICE AREAS .....                | 3-10 |
| HISTORICAL PERSPECTIVE .....                   | 3-10 |
| CURRENT RESOURCE CONDITIONS .....              | 3-11 |
| <br>   |      |
| <b>CHAPTER 4. CITATIONS</b> .....              | 4-1  |
| PRINTED REFERENCES .....                       | 4-1  |
| PERSONAL COMMUNICATIONS .....                  | 4-3  |

## LIST OF TABLES

| TABLE |   | FOLLOWS PAGE |
|-------|---|--------------|
| ES-1  | Summary of Estimated Current Economic Effects Related to Recreation and Ocean Sport and Commercial Fishing in the Study Area Regions .....        | ES-2         |
| 3-1   | Estimated Annual Recreation Trip-Related Expenditures in the Delta Region .....   | 3-3          |
| 3-2   | Estimated Annual Recreation Benefits Generated by Use of the Delta .....  | 3-3          |
| 3-3   | Commercial Fish Landings in the Delta and Suisun Bay, 1986 and 1995 .....   | 3-4          |
| 3-4   | Average Total Pounds of Salmon Landed Annually in California Coastal Areas, 1971-1990 .....   | 3-5          |
| 3-5   | Average Annual Ex-Vessel Value of Salmon Landed at Ports in the California Coastal Areas, 1971-1990 .....   | 3-5          |
| 3-6   | Average Income Generated Annually by the Commercial Salmon Industry Compared with Total Regional Personal Income in California Coast Region ..... | 3-5          |
| 3-7   | Economic Effects Related to Salmon Sport Fishing in California Coastal Areas .....  | 3-6          |
| 3-8   | Commercial Salmon Fishing Activity in California Coastal Areas .....  | 3-6          |
| 3-9   | Income Generated from the Salmon Industry Compared to Total Personal Income in California Coastal Areas .....                                     | 3-7          |
| 3-10  | Estimated Annual Expenditures and Benefits Related to Recreation Use at Popular Sacramento River Region Recreation Areas .....                    | 3-8          |
| 3-11  | Average Trip-Related Expenditures by Principal Recreation Activity and Spending Category .....  | 3-8          |
| 3-12  | Estimated Expenditures and Benefits Related to Recreation Use at Important San Joaquin River Region Recreation Areas .....                        | 3-10         |

# EXECUTIVE SUMMARY

## INTRODUCTION

The affected environment for fish, wildlife, and recreation economics describes economic conditions pertaining to the following activities that could be affected by implementation of the CALFED Bay-Delta Program (CALFED) programmatic actions:

- recreation at lakes and reservoirs, streams and rivers, and wildlife refuges, including water-dependent activities such as boating, fishing, rafting, swimming, hunting, and wildlife observation;
- sport fishing for anadromous species (e.g., salmon, steelhead, striped bass, and sturgeon) in bays, estuaries, rivers, and coastal waters; and
- commercial fishing for salmon in coastal waters.

The economic importance of recreation is often characterized as recreation-related expenditures and recreation benefits. These indicators are used in this report to assess the economic importance of recreation at areas potentially affected by CALFED. Recreation-related expenditures are measures of trip-related spending by recreationists traveling to, and using, a specific recreational resource. Recreation benefits are a measure of social welfare or the value placed on recreation opportunities; these values can be expressed in monetary terms. Commercial ocean fishing economics is assessed by harvest values and net income received by the harvesting sector of the commercial fishing industry.

Unless otherwise noted, all dollar values represent constant 1995 dollars. Recreation expenditures and benefits are based on recreation use levels described in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report (CALFED Bay-Delta Program [in process]).

## ENVIRONMENTAL SETTING

### STUDY AREA

The study area has been segregated into five regions: the Delta Region, the Bay Region, the Sacramento River Region, the San Joaquin River Region, and State Water Project (SWP) and Central Valley Project (CVP) services areas outside of the Central Valley (referred to as SWP and

CVP service areas). The Bay Region includes California coastal areas affected by recreational and commercial fishing for anadromous species. Coastal areas have been divided into three subregions: the North Coast Subregion, the San Francisco Subregion, and the Central Coast Subregion.

The following counties are included in the regions and subregions discussed in this section. Because some recreational resources (e.g., the Delta, the Sacramento River) border or pass through common counties, the study regions overlap in some cases.

- **Delta Region:** Contra Costa, Sacramento, San Joaquin, Solano, Yolo;
- **Bay Region:** San Francisco, Marin, Alameda, San Mateo, Sonoma;
- **North Coast Subregion:** Del Norte, Humboldt, Mendocino;
- **San Francisco Subregion:** San Francisco, Sonoma, Marin, San Mateo;
- **Central Coast Subregion:** Santa Cruz, Monterey, San Luis Obispo;
- **Sacramento River Region:** Shasta, Tehama, Butte, Yuba, Sutter, Glenn, Colusa, Yolo, Nevada, El Dorado, Placer; and
- **San Joaquin River Region:** Merced, Santa Clara, Fresno, Madera, Tuolumne, Calaveras, San Joaquin, Stanislaus, Mariposa, Kern, Kings, Tulare.

Estimated current levels of recreational spending and benefits, and ocean commercial harvest values and net income, for the five regions are summarized in Table ES-1.

## DELTA REGION

### HISTORICAL PERSPECTIVE

The system of waterways and islands that composes the Delta supports a variety of recreational activities, including sport fishing, hunting, boating, camping, swimming, picnicking, and sightseeing.

Two studies have addressed the economic effects of recreational use of the Delta prior to 1990. Cajucom et al. (1980) summarized and evaluated the results of a Delta recreation survey conducted from 1977 to 1978. Annual recreationist expenditures were estimated to total approximately \$185.2 million. The study estimated annual recreation benefits (i.e., consumer surplus) to range from \$550 to \$686 million.

Table ES-1. Summary of Estimated Current Economic Effects Related to Recreation and Ocean Sport and Commercial Fishing in the Study Area Regions

| Region                    | <u>Recreation-<br/>Regional<br/>Expenditures<sup>a</sup></u><br>(Millions of 1995 dollars) | <u>Related Effects<br/>Benefits<sup>b</sup></u><br>(Millions of 1995 dollars) |
|---------------------------|--|---|
| Delta                     | \$226.6  | \$159.9   |
| Bay                       | \$10.4   | \$8.7   |
| Sacramento River          | \$76.8   | \$40.8  |
| San Joaquin River         | \$56.8   | \$36.4  |
| SWP and CVP Service Areas | \$132.0  | \$122.0   |

| California Coast<br>Subregions | <u>Ocean Commercial Fishing-<br/>Commercial Harvest<br/>Value of Salmon<sup>c</sup></u><br>(Millions of 1995 dollars) | <u>Related Effects<br/>Total Personal Income<br/>from Salmon<sup>d</sup></u><br>(Millions of 1995 dollars) |
|--------------------------------|---|--|
| North Coast                    | \$0.1   | \$0.1  |
| San Francisco                  | \$2.9   | \$5.9  |
| Central Coast                  | \$1.8   | \$2.9  |

Notes:

- <sup>a</sup> Estimated primarily from 1992 recreation use information presented in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report.
- <sup>b</sup> Measured in terms of user's willingness to pay for recreation opportunities.
- <sup>c</sup> Based on 1992 commercial harvest levels.
- <sup>d</sup> Includes all direct, indirect, and induced income (wages, salaries, and profits) attributable to the salmon industry in 1992.

A study by Wade et al. (1987) revised and updated the recreation-use and economic estimates contained in the Cajucom study. The economic value of freshwater recreation in the Delta in 1985 was estimated by Wade using a travel-cost model. Recreation expenditures (i.e., out-of-pocket expenses and nonmonetary travel-time costs) were estimated to be \$222 million (in 1995 dollars) based on 6.95 million recreational visitor days (RVDs). Net recreation benefits (i.e., net willingness to pay) were estimated to be \$193 million based on a net benefit per recreation day of \$27.72.

Crayfish have been commercially harvested in the Delta and sold locally for many years, and other species have been harvested for commercial consumption and sold as bait; however, harvest levels and related economic activity generated by commercial harvests have represented a minor segment of the regional economy.

### **CURRENT RESOURCE CONDITIONS**

Recreational use of the Delta annually generates an estimated 7.1 million RVDs. Based on spending profiles developed for the Delta, recreationists spend an estimated \$254.2 million annually to visit the Delta, including \$226.6 million within the five-county Delta Region. Sportfishing in the Delta and Suisun Bay generate the largest portion (53%) of total spending by recreationists.

Based on existing use of the Delta, recreation benefits annually accruing from Delta recreationists are estimated at \$160 million. Boaters and others engaged in nonconsumptive recreation activities account for the majority of recreation benefits.

The Delta and Suisun Bay support the commercial harvest of crayfish and bait-fish species, such as bay shrimp and shad. Other species are harvested incidentally. Crayfish harvesting is the largest commercial fishing activity in the Delta Region. Crayfish are harvested in various locations throughout freshwater areas of the Delta, although most are offloaded at Stockton. Crayfish are sold for human consumption and a portion of the harvest is exported. Most of the bait-fish harvest is sold locally for bait fishing (Ota pers. comm.). Based on commercial landing data for 1986 and 1995 provided by the California Department of Fish and Game (DFG) (Eres pers. comm.), the commercial crayfish harvest in the Delta has remained relatively stable at about 12,000 pounds per year over the past 10 years.

### **BAY/CALIFORNIA COAST REGION**

The Bay/California Coast Region includes San Francisco and San Pablo Bays as well as California coastal areas that support recreational and commercial salmon fishing.

## HISTORICAL PERSPECTIVE

The San Francisco Bay estuary supports the principal sport fisheries for salmon and striped bass in California. Overall, recreation use related to sport fishing in the Bay Region has been declining over that of the historical period. Consequently, recreation expenditures and benefits associated with sport fishing have also decreased in their contribution to the local and regional economy. Subsequent declines in economic activity associated with potentially affected sport fisheries is also indicated by historical reductions in the number of passenger-vessel fleet operating in the Bay Region. Approximately 35 charter vessels were in operation in 1970 compared with approximately 10 vessels in 1993 (Fraser pers. comm.).

Economic activity related to the commercial and recreational salmon fisheries along the California coast has declined substantially since the early 1970s. Personal income from the ocean commercial and sport salmon fisheries along the California coast reached a low in the early 1980s and recovered in the late 1980s, although not to the levels of the late 1970s. Data for 1992 indicate near-record low levels.

## CURRENT RESOURCE CONDITIONS

(A description of economic activity generated by recreational and commercial fishing for anadromous species in San Francisco and San Pablo Bays is included within the San Francisco Subregion, discussed in this section.)

Saltwater sport fishing for salmon in the subregions composing California coastal areas accounted for an estimated 127,000 visitor days of recreation in 1992. Total use resulted in an estimated \$10.4 million in trip-related expenditures. Nearly 50% of the expenditures generated by sport fishing occurred in the San Francisco Subregion. Annual recreation benefits associated with salmon sport fishing in the subregions are estimated at \$8.7 million, based on an average benefit of \$70 per day.

Ocean commercial fishing harvest values and net income for coastal subregions are summarized in Table ES-1. Based on 1992 commercial salmon harvest levels, harvest values totaled approximately \$4.8 million among the three coastal subregions, with the San Francisco Subregion accounting for 62% of total revenue. Total (i.e., direct and secondary) personal income generated by harvests totaled an estimated \$8.9 million.

## SACRAMENTO RIVER REGION

### HISTORICAL PERSPECTIVE

Reservoirs, rivers, and wildlife refuges in the Sacramento River Region support a variety of recreational activities including sport fishing, hunting, boating, camping, swimming, picnicking, and sightseeing. As described in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report (CALFED Bay-Delta Program [in process]), recreation opportunities and resulting economic activities have been shaped by the construction of large reservoirs, such as Shasta Lake, Folsom Lake, and Lake Oroville.

Overall, recreation use at important reservoirs, rivers, and wildlife refuges in the Sacramento Valley Region has paralleled increased population growth in the region. Consequently, recreation expenditures and benefits associated with increased use by visitors to the recreation areas have become an important contributor to the local and regional economy.

### CURRENT RESOURCE CONDITIONS

Based on 1992 use levels, it is estimated that approximately \$77 million in trip-related spending is generated annually by recreationists visiting the Sacramento River Region. Recreation benefits, in addition to actual expenditures, are estimated at \$40.8 million.

## SAN JOAQUIN RIVER REGION

### HISTORICAL PERSPECTIVE

Both CVP reservoirs and non-CVP reservoirs, rivers, and wildlife refuges in the San Joaquin River Region support a variety of recreational activities, including sport fishing, hunting, boating, camping, swimming, picnicking, and sightseeing. Most of the reservoirs supporting recreational uses in the San Joaquin River Region were completed in the 1960s and 1970s.

Overall, recreation use at potentially affected reservoirs, rivers, and wildlife refuges in the San Joaquin Valley Region has been increasing since the 1940s. Consequently, recreation expenditures and benefits have been increasing and have become an important contributor to the local and regional economy.

## **CURRENT RESOURCE CONDITIONS**

Based on 1992 use levels, trip-related expenditures resulting from this recreational use of important resources in the San Joaquin River Region reached an estimated \$56.8 million. Recreation benefits associated with use at popular recreation areas are estimated at \$36.4 million.

## **SWP AND CVP SERVICE AREAS**

### **HISTORICAL PERSPECTIVE**

In addition to recreation associated with facilities constructed in the Central Valley, development of SWP and CVP created recreational opportunities at facilities constructed outside of the Central Valley. Use of these facilities has generated spending in local economies and benefits for recreationists. Most of the recreational use of SWP and CVP facilities has been centered around storage reservoirs.

Since 1960, development of SWP has resulted in the construction of 29 storage facilities in various locations of the State. Similarly, development of CVP resulted in the construction of several dams and reservoirs in the State between the 1930s and 1960s. Reservoirs are located in both northern and southern California. Spending and benefits have increased as use of these facilities has grown in relationship to population growth in northern and southern California.

### **CURRENT RESOURCE CONDITIONS**

Use levels are generally higher at reservoirs in southern California; therefore, recreational spending and benefits generated by use of reservoirs in the SWP and CVP service areas are primarily associated with reservoirs in southern California. Popular lakes in southern California include Castaic, Pyramid, Silverwood, and Perris. Recreation use of these facilities results in an estimated annual \$132.0 million in trip-related spending. Annual recreation benefits associated with these activities are estimated at \$122.0 million.

# CHAPTER 1. INTRODUCTION

The purpose of this technical report is to provide a description of the environment affected by CALFED for resources associated with fish, wildlife, and recreation economics. To accurately describe the affected environment for fish, wildlife, and recreation economics it is necessary to define not only the current conditions but also the historical conditions, which are included to place current conditions into perspective. The report describes the relevant regulatory context; historical fish, wildlife, and recreation economic trends; and existing fish, wildlife, and recreation economic conditions for the study area.

The current and historical conditions will be described in this report for each of the five regions within the study area: Delta Region, Bay Region, Sacramento River Region, San Joaquin River Region, and the SWP and CVP service areas. In addition, the fish, wildlife, and recreation economics affected environment includes coastal areas in California affected by fishing for anadromous species as part of the Bay Region. The executive summary contained in this technical report, in conjunction with other information, data, and modeling developed during prefeasibility studies, will be used to prepare the affected environment section of the CALFED Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS).

The affected environment describes economic conditions pertaining to the following fish, wildlife, and recreation activities that could be affected by implementation of CALFED programmatic actions:

- recreation at lakes and reservoirs, streams and rivers, and wildlife refuges, including water-dependent activities such as boating, fishing, rafting, swimming, hunting, and wildlife observation;
- sport fishing for anadromous species (e.g., salmon, steelhead, striped bass, and sturgeon) in bays, estuaries, rivers, and coastal waters; and
- commercial fishing for salmon in coastal waters.

The economic importance of recreation is often characterized in terms of recreation-related expenditures and recreation benefits. These indicators are used in this report to assess the economic importance of recreation at areas potentially affected by CALFED. Recreation-related expenditures generate economic activity that result in changes in personal income and employment in a region. Recreation benefits are a measure of social welfare or the value placed on recreation opportunities; these values can be expressed in monetary terms. Commercial ocean fishing is described by harvest levels and values and net income received by the commercial fishing industry.

This "Historical Perspective" sections of this report describe economic trends pertaining to recreation and commercial fishing activities prior to 1995. Because economic data are not readily available for many years of the historical record being used for CALFED reports (i.e., 1920 to 1995),

and because economic trends for periods prior to 1970 may not provide useful perspective on current economic conditions, information for the "Historical Perspective" sections generally focus on 1970-1990. The "Current Resource Conditions" sections focus on information for more-current years.

## CHAPTER 2. SOURCES OF INFORMATION

### DELTA REGION

Estimates of recreation use within the Delta Region, presented in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report (CALFED Bay-Delta Program [in process]), were used to estimate recreation trip-related spending and net recreation benefits. Estimates of historical and existing economic conditions in the Delta Region incorporate assumptions concerning the definition of RVDs and use and are made based on the recreation report. (For the Delta Region, an RVD is defined as a visit by one person to a recreation facility or area for recreational purposes during a portion or all of a 24-hour period.) Because of the lack of available annual recreation-use data for the entire Delta area for most years, data gaps exist for large portions of the historical period.

Information from surveys conducted in the Delta Region by the U.S. Fish and Wildlife Service (USFWS) (1993) and David M. Dornbusch & Company (1988), and in other recreation areas by Propst et al. (1992) was used to develop trip-related spending profiles of recreationists. All trip-related spending by residents of the Delta Region was assumed to occur within the region. The percentage of trip-related spending in the Delta Region by nonresident recreationists was estimated based on the portion of the entire trip spent recreating in the Delta (i.e., 66%). This percentage was based on survey data contained in Cajucom et al. (1980).

Information on recreation benefits was obtained from existing economic studies on important recreation activities that may be affected by CALFED actions. Recreation benefits associated with sport fishing in the Delta Region were estimated from a travel-cost model developed by Roach and Loomis (1996). This model evaluated sport fishing for many Delta species and included the Sacramento River portion of the Bay-Delta as a site destination. A benefit of \$14.50 (in 1995 dollars) per visitor-day was estimated by calculating a weighted average of the benefits estimated for sport fishing in the Delta. For waterfowl hunting, benefits developed by Cooper and Loomis (1991) were averaged and updated to estimate a benefit of \$26.06 per visitor-day. For all other recreation activities, a benefit of \$27.72 per visitor-day was used. This estimate was developed for Delta recreational uses by Wade et al. (1987) using a travel-cost model and was updated to 1995 dollars.

Data for the estimated weight (in pounds) of commercial-fish landings in the Delta area were provided by the California Department of Fish and Game (DFG) Marine Statistical Unit (Eres pers. comm.). No information on the value of commercial landings within the Delta area was available; therefore, no estimates of net income directly generated by commercial harvests were developed.

## OTHER REGIONS

The following sources were used to develop data and estimates for regions outside of the Delta (i.e., the Bay Region, the Sacramento River Region, the San Joaquin Region, and SWP and CVP service areas).

Information on area-specific levels of recreation use from the CALFED Bay-Delta Program Recreation Affected Environment Technical Report (CALFED Bay-Delta Program [in process]) was used to estimate trip-related recreation spending and net recreation benefits.

Information from surveys conducted by USFWS and the National Marine Fisheries Service (NMFS) was used to develop trip-related spending profiles for recreation users. Spending profiles and dollar values shown in this report are expressed in constant 1995 dollars unless otherwise noted.

Information on recreation benefits was obtained from existing economic studies on popular recreation areas that may be affected by CALFED actions. Data also were obtained from economic studies on recreation areas outside the study area to characterize potential recreation benefits to users of popular recreation areas.

As presented in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report (CALFED Bay-Delta Program [in process]), the following assumptions were used to convert recreation-use levels to visitor days in the analysis:

- At all reservoirs, 12 recreation visitor hours are considered, on average, equal to one RVD.
- At all river recreation areas, six visitor hours are considered, on average, equal to one RVD.
- At all other areas, one visit is considered, on average, equal to one RVD.
- Historical use data (1940-1985) are generally presented in the form originally reported.

All trip-related spending by local residents was assumed to occur in the regional economic area being visited, as was 80% of trip-related spending by nonresidents.

Information used in the commercial fishing section was obtained from publications and personal communications with agency staff and other knowledgeable individuals. The publications are as follows:

- the 1985, 1988, and 1992 reviews of salmon fisheries (Pacific Fishery Management Council [PFMC] 1986, 1989, 1993a);

- Historical Ocean Salmon Fishery Data for Washington, Oregon, and California (Pacific Fishery Management Council 1993b); and
- Fisheries of the United States (National Marine Fisheries Service 1993).

In addition, information was obtained from personal communications with DFG and PFMC.

## CHAPTER 3. ENVIRONMENTAL SETTING

### STUDY AREA

The study area has been segregated into five regions: the Delta Region, the Bay Region, the Sacramento River Region, the San Joaquin River Region, and SWP and CVP service areas. As discussed previously, the Bay Region includes California coastal areas affected by recreational and commercial fishing for anadromous species.

The Delta Region includes the Sacramento-San Joaquin Delta, which supports recreation activity occurring within the legally defined Delta, Suisun Bay (extending to Carquinez Strait), and Suisun Marsh. For purposes of the affected environment, resident recreationists are considered those who reside within the Delta Region; nonresidents are those who reside outside of the Delta Region and travel to the Delta area for recreation. Commercial-fishery harvest data was also collected for the legally defined Delta, Suisun Bay, and Suisun Marsh.

In addition to the Delta Region, conditions are described for the four other principal CALFED study regions. Coastal areas included as part of the Bay Region are subdivided into three subregions: the North Coast Subregion, San Francisco Subregion, and Central Coast Subregion.

The following counties are included in the regions and subregions discussed in this report. Because some recreational resources (e.g., the Delta, the Sacramento River) border or pass through common counties, the study regions overlap in some cases.

- **Delta Region:** Contra Costa, Sacramento, San Joaquin, Solano, Yolo
- **Bay Region:** San Francisco, Marin, Alameda, San Mateo, Sonoma
- **North Coast Subregion:** Del Norte, Humboldt, Mendocino
- **San Francisco Subregion:** San Francisco, Sonoma, Marin, San Mateo
- **Central Coast Subregion:** Santa Cruz, Monterey, San Luis Obispo
- **Sacramento River Region:** Shasta, Tehama, Butte, Yuba, Sutter, Glenn, Colusa, Yolo, Nevada, El Dorado, Placer
- **San Joaquin River Region:** Merced, Santa Clara, Fresno, Madera, Tuolumne, Calaveras, San Joaquin, Stanislaus, Mariposa, Kern, Kings, Tulare

## REGULATORY CONTEXT

Economic conditions presented in this report have been presented consistent with requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Information is presented at a level of detail to ensure compliance with applicable federal and State laws and regulations for preparation of a programmatic EIR/EIS.

PFMC has regulated commercial salmon fishing in California since 1977. This regulation has substantially affected fishing in some regions by reducing the number of days allowed for fishing compared to the traditional season (May 1 to October 1). The North Coast Subregion is located in two management areas: the United States-Mexico Border to Horse Mountain Management Area and the Horse Mountain to Humbug Mountain Management Area (also known as the Klamath Management Zone). Commercial salmon fishing has been substantially limited in recent years to protect salmon originating from the Klamath River system. Commercial salmon fishing in the San Francisco and Central Coast Subregions is subject to regulations set for the United States-Mexico Border to Horse Mountain Management Area.

No additional regulatory or institutional issues, other than those described in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report and the CALFED Bay-Delta Program Fish, Wildlife, and Recreation Technical Report (CALFED Bay-Delta Program [in process]), apply to the description of affected fish, wildlife, and recreation economic resources.

## DELTA REGION

### HISTORICAL PERSPECTIVE

#### RECREATION

The system of waterways and islands that composes the Delta supports a variety of recreational activities including sport fishing, hunting, boating, camping, swimming, picnicking, and sightseeing.

Two studies have addressed the economic effects of recreational use of the Delta prior to 1990. Cajucom et al. (1980) summarized and evaluated the results of a Delta recreation survey conducted from 1977 to 1978. Based on the findings of the survey, the study estimated recreation use, spending profiles, expenditures, and recreation benefits for Delta recreationists. The Cajucom study estimated that recreational use of the Delta totaled 11.9 million RVDs from 1977 to 1978, and projected that annual use would increase to 12.9 million RVDs by 1985. Average expenditures per person per day were estimated to be approximately \$16.50 for visitors to the Delta and \$7.90 for

residents of the Delta. Annual recreationist expenditures were estimated to total approximately \$185.2 million. The study estimated annual recreation benefits to range from \$550 to \$686 million.

A study by Wade et al. (1987) revised the recreation-use and economic estimates contained in the Cajucom study. This study arrived at new Delta recreation-use estimates for 1977 to 1978 and for 1985 by revising the Cajucom study's estimate of visitor-group size, and excluding specific non-water-dependant recreation activities. The Wade study adjusted the estimated number of visits to the Delta for freshwater recreation to 6.4 million RVDs for 1977 to 1978 and 6.95 million RVDs in 1985. The economic value of freshwater recreation in the Delta in 1985 was estimated by Wade using a travel-cost model. Recreation expenditures (i.e., out-of-pocket expenses and nonmonetary travel-time costs) were estimated to be \$222 million based on 6.95 million RVDs. Net recreation benefits were estimated to be \$193 million based on a net benefit per recreation day of \$27.72.

### COMMERCIAL FISHING

Crayfish have been commercially harvested in the Delta and sold locally for many years, and other species have been harvested for commercial consumption and sold as bait; however, harvest levels and related economic activity generated by commercial harvests have represented a minor segment of the regional economy.

## CURRENT RESOURCE CONDITIONS

### RECREATION

Recreational use of the Delta generates both spending in the regional economy and benefits reflecting the value over and above what recreationists actually spend to travel to and use recreation areas.

Recreational use of the Delta annually generates an estimated 7.1 million RVDs. Recreationists visiting the Delta for sport fishing, boating, waterfowl hunting, and other recreation activities purchase goods and supplies at food stores, eating and drinking places, and service stations; stay at hotels, motels, and campgrounds; and use various recreation services. Based on the spending profiles presented in Table 3-1, recreationists spend an estimated \$254.2 million annually to visit the Delta, including \$226.6 million within the five-county Delta Region. Sport fishing in the Delta and Suisun Bay generate the largest portion of total spending by recreationists, accounting for 53% of total spending. Spending by recreation activity is presented in Table 3-1.

Based on existing use of the Delta, recreation benefits annually accruing from Delta recreationists are estimated at \$160 million (Table 3-2). Boaters and others engaged in nonconsumptive recreation activities account for the majority of recreation benefits.

Table 3-1. Estimated Annual Recreation Trip-Related Expenditures in the Delta Region

| Recreation Activity              | Annual Visitation (visitor days) |                          |                    | Trip-Related Spending per Visitor Day <sup>c</sup> | Annual Trip-Related Spending |                          |               | Total Spending within the Delta Region <sup>e</sup> |
|----------------------------------|----------------------------------|--------------------------|--------------------|--|------------------------------|--------------------------|---------------|---|
|                                  | Resident                         | Nonresident <sup>a</sup> | Total <sup>b</sup> |  | Resident                     | Nonresident <sup>d</sup> | Total         |   |
| Sport fishing                    | \$1,843,100                      | \$867,400                | \$2,710,500        | \$49   | \$90,995,800                 | \$42,821,600             | \$133,817,400 | \$119,258,100                                       |
| Boating <sup>f</sup>             | 1,512,300                        | 711,700                  | 2,224,000          | 35.79  | 54,125,900                   | 25,471,000               | 79,596,900    | \$70,936,800  |
| Hunting                          | 81,700                           | 38,500                   | 120,200            | 43.74  | 3,575,100                    | 1,682,400                | 5,257,500     | \$4,685,500   |
| Nonconsumptive uses <sup>g</sup> | 1,370,500                        | 645,000                  | 2,015,500          | 17.65  | 24,190,000                   | 11,383,500               | 35,573,500    | \$31,703,200  |
| Total                            | 4,807,600                        | 2,262,500                | 7,070,200          | NA   | \$172,886,800                | \$81,358,500             | \$254,245,300 | \$226,583,600                                       |

Notes: All values are expressed in 1995 dollars.

<sup>a</sup> Represents estimated use by nonresidents to Contra Costa, San Joaquin, Sacramento, Solano, and Yolo Counties. Nonresident use was estimated based on a survey of Delta users (Cajucom et al. 1980), which indicated nonresident use accounted for approximately 32% of total use.

<sup>b</sup> Estimated based on annual use of 6,950,000 recreation visitor days for hunting, boating, and other nonconsumptive uses (Wade et al. 1987), and estimates of hunting days from Cajucom et al. (1980) and California Department of Water Resources (1994). Total fishing, boating, and nonconsumptive recreation visitor days were apportioned among these three categories of use based on information from California Department of Water Resources (1993).

<sup>c</sup> Sources:

Freshwater fishing: U.S. Fish and Wildlife Service and U.S. Bureau of the Census 1993.

Boating: David M. Dornbusch & Company 1988.

Waterfowl hunting: U.S. Fish and Wildlife Service and U.S. Bureau of the Census 1993.

Nonconsumptive uses: Propst et al. 1992.

<sup>d</sup> Represents spending by nonresidents inside and outside of the Delta region.

<sup>e</sup> Represents estimated spending within the Delta Region (i.e., Contra Costa, San Joaquin, Sacramento, Solano, and Yolo Counties). Includes 100% of spending by residents of the Delta Region and 66% of spending by nonresidents. Trip spending within the region by nonresidents was estimated based on the percentage of the trip spent recreating in the Delta (i.e., 66%) (Cajucom et al. 1980).

<sup>f</sup> Includes motorboating, waterskiing, sailing, and houseboating.

<sup>g</sup> Includes relaxing, sightseeing, overnight camping, picnicking, swimming, photography, bicycling, and other nonconsumptive activities.

Table 3-2. Estimated Annual Recreation Benefits Generated by Use of the Delta

| Recreation Activity              | Visitor Days <sup>a</sup> | Benefit per Visitor Day <sup>b</sup> | Total Benefits    |
|----------------------------------|---------------------------|--------------------------------------|-------------------|
| Sport fishing                    | \$2,710,500               | \$15                                 | \$39,302,300      |
| Boating <sup>c</sup>             | 2,224,000                 | 27.72                                | 61,649,300        |
| Hunting                          | 120,200                   | 26.06                                | 3,132,400         |
| Nonconsumptive uses <sup>d</sup> | <u>2,015,500</u>          | <u>27.72</u>                         | <u>55,869,700</u> |
| Total                            | \$7,070,200               | NA                                   | \$159,953,700     |

Notes:

All values are expressed in 1995 dollars.

<sup>a</sup> Estimated based on annual visitation of 6,950,000 visitor days (Wade et al. 1987), estimated hunter days (Cajucum et al. 1980, California Department of Water Resources 1984), and percentages of visitation by activity in California Department of Water Resources (1993).

<sup>b</sup> Sources:

Freshwater fishing: Jones & Stokes Associates based on Roach and Loomis 1996.

Boating: Wade et al. 1987.

Waterfowl hunting: Jones & Stokes Associates based on Cooper and Loomis 1991.

Nonconsumptive uses: Wade et al. 1987.

<sup>c</sup> Includes motorboating, waterskiing, sailing, and houseboating.

<sup>d</sup> Includes relaxing, sightseeing, overnight camping, picnicking, swimming, photography, bicycling, and other nonconsumptive activities.

## COMMERCIAL FISHING

The Delta and Suisun Bay support the commercial harvest of crayfish and bait-fish species, such as bay shrimp and shad. Other species are harvested incidentally (Table 3-3). Crayfish harvesting is the largest commercial fishing activity in the Delta Region. Crayfish are harvested in various locations throughout freshwater areas of the Delta, although most are offloaded at Stockton. Crayfish are sold for human consumption and a portion of the harvest is exported. Most of the bait-fish harvest is sold locally for fishing (Ota pers. comm.).

Based on commercial landing data for 1986 and 1995 provided by DFG (Eres pers. comm.), the commercial crayfish harvest in the Delta has remained relatively stable at about 12,000 pounds per year over the past 10 years (Table 3-3). Because commercial-fish-harvest value data are not available, no estimates of direct income generated by commercial harvests in the Delta area are available; however, crayfish provide an important source of employment and income for Delta businesses engaged in crayfish harvesting and processing.

## BAY/CALIFORNIA COAST REGION

The Bay/California Coast Region includes San Francisco and San Pablo Bays as well as California coastal areas that support recreational and commercial salmon fishing.

## HISTORICAL PERSPECTIVE

### SAN FRANCISCO AND SAN PABLO BAYS

The San Francisco Bay estuary supports the principal sport fisheries for salmon and striped bass in California. Important sport fishing use trends for these species in the Bay Region are as follows:

- sport catch of chinook salmon reached major peaks in 1955, 1968, and 1972, with annual landings of approximately 129,000, 128,000, and 152,000, respectively (Leet et al. 1992);
- sport catch of chinook salmon reached lows in 1957, 1960, and 1978, with annual landings of approximately 44,700, 37,900, and 45,600 respectively (Leet et al. 1992); and
- sport catch of white sturgeon fluctuated from a high of 2,300 fish in 1967 (Leet et al. 1992), to a low of 340 fish in 1977, and back to a high of 12,000 fish by 1985 (California Department of Water Resources 1990).

Table 3-3. Commercial Fish Landings in the Delta and Suisun Bay, 1986 and 1995

| Species     | Total Landings (in pounds) |        |
|-------------|----------------------------|--------|
|             | 1986                       | 1995   |
| Bay shrimp  | --                         | 3,884  |
| Crayfish    | 11,991                     | 11,990 |
| Sablefish   | NL                         | 1,100  |
| Salmon      | NL                         | 2,636  |
| Shad        | 2,693                      | 20,291 |
| Sole        | NL                         | 17,757 |
| Thornyheads | NL                         | 7,840  |

Notes: -- = landings of species less than 1,000 pounds.  
 NL = no landings reported.

Pounds are reported as of port of landing. A portion of the commercial harvest shown in this table may have been caught outside of the Delta and Suisun Bay.

Source: Eres pers. comm.

As described in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report (CALFED Bay-Delta Program [in process]), a sport fishery for striped bass was allowed to continue after 1935; however, by the early 1960s, most of the south San Francisco Bay was no longer producing striped bass and much of the bass angling effort shifted to the Delta area (Skinner 1962).

Overall, recreation use related to sport fishing in the Bay Region has been declining over the historical period. Consequently, recreation expenditures and benefits associated with sport fishing have also decreased in their contribution to the local and regional economy. Subsequent declines in economic activity associated with potentially affected sport fisheries is also indicated by historical reductions in the number of passenger-vessel fleet operating in the Bay Region. Approximately 35 charter vessels were in operation in 1970 compared to approximately 10 vessels in 1993 (Fraser pers. comm.).

### CALIFORNIA COASTAL AREAS

Salmon sport fishing declined substantially between 1971 and 1975. For example, average annual days spent salmon sport fishing off the California coast decreased by 31% from 1976 to 1980 compared to effort from 1971 to 1975. Fishing days decreased by an additional 14% during the period from 1981 to 1985. These declines were shared approximately equally between charter-boat fishing and private-boat fishing. Ocean salmon sport fishing activity increased during from 1986 to 1990, roughly meeting the 1971-1975 average level of effort.

Commercial fishing for salmon has occurred in the California Coast Region since the early 1890s. Table 3-4 shows the total pounds of salmon landed by coastal subregion in 5-year increments. Except in the Central Coast Subregion, total pounds landed declined through the period from 1981 to 1985 compared with the period from 1971 to 1975. During the most recent period (1986-1990), pounds landed increased in all the subregions. Pounds landed increased the most (151%) in the San Francisco Subregion.

Table 3-5 shows the ex-vessel value (in nominal and real terms) of salmon sold by region in 5-year increments. During the most recent period (1986-1990), the nominal ex-vessel value (expressed in current-year dollars) of all salmon sold in the California Coast Region exceeded sales in the period from 1976 to 1980 by \$5.4 million; however, real values declined compared with real values of the period from 1976 to 1980, averaging about \$4.0 million less for the period from 1986 to 1990.

Since 1976, PFMC has estimated the personal income generated by the commercial salmon industry. These estimates include direct, indirect, and induced income derived from landing sales and salmon processing. Table 3-6 shows the income derived from the salmon industry compared with total regional personal income.

Table 3-4. Average Total Pounds of Salmon Landed Annually in the California Coastal Areas, 1971-1990

| Subregion     | 1971-1975   | 1976-1980   | 1981-1985   | 1986-1990   |
|---------------|-------------|-------------|-------------|-------------|
| North Coast   | 4.79        | 4.25        | 2.16        | 3.06        |
| San Francisco | 2.39        | 1.83        | 1.79        | 4.49        |
| Central Coast | <u>0.88</u> | <u>0.93</u> | <u>0.97</u> | <u>1.59</u> |
| Total         | 8.06        | 7.01        | 4.92        | 9.14        |

Note: Amounts represent millions of pounds

Source: Pacific Fisheries Management Council 1993b.

Table 3-5. Average Annual Ex-Vessel Value of Salmon Landed at Ports in the California Coastal Areas, 1971-1990

| Subregion     | Nominal Value <sup>a</sup> (millions of dollars) |             |             |             | Real Value <sup>b</sup> (millions of dollars) |                         |             |             |
|---------------|--|-------------|-------------|-------------|---|-------------------------|-------------|-------------|
|               | 1971-1975  | 1976-1980   | 1981-1985   | 1986-1990   | 1971-1975                                     | 1976-1980               | 1981-1985   | 1986-1990   |
| North Coast   | NA   | 9.55        | 4.99        | 7.31        | NA  | 18.35 <sup>c</sup>      | 7.59        | 9.57        |
| San Francisco | NA   | 3.91        | 4.33        | 9.70        | NA  | 8.39 <sup>c</sup>       | 6.60        | 12.29       |
| Central Coast | <u>NA</u>  | <u>2.20</u> | <u>2.34</u> | <u>4.08</u> | <u>NA</u>                                     | <u>4.26<sup>c</sup></u> | <u>3.58</u> | <u>5.16</u> |
| Total         | NA   | 15.66       | 11.66       | 21.09       | NA  | 31.00                   | 17.75       | 27.02       |

Notes:

<sup>a</sup> Value in current-year dollars.

<sup>b</sup> Value expressed in constant 1995 dollars.

<sup>c</sup> Based on average costs per pound for 1979 and 1980.

NA No information currently available

Source: Pacific Fisheries Management Council 1993b.

Table 3-6. Average Income Generated Annually by the Commercial Salmon Industry Compared  
With Total Regional Personal Income in the California Coast Region

| Subregion     | Income from Salmon<br>(millions of 1995 dollars) |           |           | Total Regional Income <sup>a</sup><br>(millions of 1995 dollars) |           |           | Percentage of Income from Salmon<br>(percentage of total income) |           |           |
|---------------|--|-----------|-----------|--|-----------|-----------|--|-----------|-----------|
|               | 1976-1980  | 1981-1985 | 1986-1990 | 1976-1980  | 1981-1985 | 1986-1990 | 1976-1980  | 1981-1985 | 1986-1990 |
| North Coast   | 32.5   | 13.1      | 16.2      | 1,632  | 2,351     | 3,291     | 1.99   | 0.56      | 0.50      |
| San Francisco | 17.5   | 13.9      | 24.8      | 45,894   | 56,084    | 63,408    | 0.04   | 0.02      | 0.04      |
| Central Coast | 7.6  | 4.7       | 9.2       | 14,933   | 18,944    | 22,071    | 0.05   | 0.02      | 0.04      |
| Total         | 57.6   | 31.7      | 50.2      | 62,459   | 77,379    | 88,770    | 0.09   | 0.04      | 0.06      |

Note:

<sup>a</sup> Total regional income includes total income in the counties that constitute each region. Personal income estimate includes all direct, indirect, and induced income wages, salaries, and profits that are attributable to the salmon industry.

Sources:

Pacific Fisheries Management Council, 1986, 1993b; U.S. Bureau of the Census, 1992; California Department of Finance, 1993; U.S. Bureau of Economic Analysis, 1992, 1993; Seger, pers. comm.

The San Francisco and Central Coast Subregions show a very small percentage of income from the salmon industry compared with total personal income. The relatively large populations within these subregions help explain the relatively small percentages. Personal income from commercial salmon fishing in the North Coast Subregion approached 2% of total personal income in the region during the period from 1976 to 1980 but then fell more than 70% to 0.5% during the most recent period (1986-1990).

## CURRENT RESOURCE CONDITIONS

### SAN FRANCISCO AND SAN PABLO BAYS

Economic activity generated by recreational and commercial fishing for anadromous species in San Francisco and San Pablo Bays is included within the San Francisco Subregion, discussed in the following section.

### CALIFORNIA COASTAL AREAS

Saltwater sport fishing for salmon in the subregions composing California coastal areas accounted for an estimated 127,000 visitor days of recreation in 1992. Nearly 50% of the expenditures generated by sport fishing occurred in the San Francisco Subregion. Total use resulted in an estimated \$10.4 million in trip-related expenditures (Table 3-7). Annual recreation benefits associated with this salmon sport fishing are estimated at \$8.7 million, based on an average benefit of \$70 per day.

Ocean commercial-fishing landings and harvest values for coastal subregions are summarized in Table 3-8. In 1992, the North Coast Subregion accounted for less than 1% of the fishing effort, 1.3% of pounds landed, and 1.1% of the ex-vessel value of all salmon landed at ports in the three California coastal subregions. (Salmon fishing in the North Coast Subregion was severely restricted to protect salmon populations in 1992.) The San Francisco Subregion accounted for 32% of the fishing effort, 61% of the pounds of salmon landed, and 62% of ex-vessel value of all salmon landed at ports in the Pacific Coast Region. The Central Coast Subregion accounted for 68% of the fishing effort, 37% of the pounds of salmon landed, and 37% of the ex-vessel value of all salmon landed at ports in the California Coast Region.

Two important indicators of the economic importance of the commercial salmon fishing industry are the relative poundage and ex-vessel value of salmon landed in proportion to the total pounds and value for all commercial seafood landed at ports in each subregion. In 1992, salmon accounted for 0.03% of the total pounds of seafood landed and 0.13% of the total ex-vessel value of seafood landed in the North Coast Subregion (Table 3-8). Salmon accounted for 2.0% of total pounds of seafood landed and 8.0% of the ex-vessel value of all seafood landed in the San Francisco

Table 3-7. Economic Effects<sup>a</sup> Related to Salmon Sport Fishing in the California Coastal Areas

| Subregion     | Regional Expenditures <sup>b</sup><br>(millions of 1995 dollars) | Benefits <sup>c</sup><br>(millions of 1995 dollars) |
|---------------|--|---|
| North Coast   | 2.1  | 2.1   |
| San Francisco | 5.5  | 4.2   |
| Central Coast | <u>2.8</u>   | <u>2.4</u>  |
| Total         | 10.4   | 8.7   |

Notes:

- <sup>a</sup> Derived from 1992 information presented in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report.
- <sup>b</sup> Includes 80% of expenditures made by visitors from outside the local area and 100% of expenditures by visitors from the region.
- <sup>c</sup> Measured in terms of users' net willingness to pay for recreation opportunities.

Table 3- 8. Commercial Salmon Fishing Activity in California Coastal Areas

| Subregion     | Fishing Effort<br>(days fished) | Pounds of Salmon Landed<br>(thousands) | Total Pounds Landed <sup>a</sup><br>(millions) | Ex-Vessel Value of Salmon<br>(millions of 1995 dollars) | Total Ex-Vessel Value of All Seafood Landed <sup>a</sup><br>(millions of 1995 dollars) |
|---------------|---------------------------------|--|--|---|--|
| North Coast   | NA <sup>b</sup>                 | 21.5                                   | 77.2   | 0.05  | 41.9   |
| San Francisco | 6,300                           | 989.0                                  | 56.1   | 2.94  | 38.9   |
| Central Coast | <u>13,500</u>                   | <u>603.0</u>                           | <u>72.1</u>                                    | <u>1.78</u>   | <u>42.0</u>  |
| Total         | 19,900                          | 1,613.5                                | 205.4  | 4.77  | 122.8  |

## Notes:

- <sup>a</sup> Fishing effort, landings, and values represent 1992 conditions. Total pounds landed and total ex-vessel values include information on all species landed in the subregions.
- <sup>b</sup> Data for fishing effort in the subregions were unavailable but were very small in 1992 because of closure of the Klamath Management Zone to commercial fishing.
- NA No information on the subregion is currently available.

## Sources:

California Department of Finance 1993, Pacific Fisheries Management Council 1993a, U.S. Bureau of the Census 1994.

Subregion. Salmon accounted for 0.83% of the total pounds of seafood landed and 4.2% of the ex-vessel value of all seafood landed in the Central Coast Subregion.

The relative amount of personal income generated by the salmon industry also indicates the economic importance of the industry to a region. In 1992, the salmon industry (including harvesting and processing activities) in the North Coast Subregion generated \$100,000 in personal income, which accounted for less than 0.01% of the total personal income generated in this subregion (Table 3-9). In the San Francisco Subregion, the salmon industry generated \$5.9 million in 1992, which accounted for approximately 0.01% of the total personal income generated in this subregion and for 66% of all income generated by the salmon industry in the three California coastal subregions.

In the Central Coast Subregion, the salmon industry generated \$2.9 million in 1992, approximately 0.01% of the total personal income generated in this subregion and 33% of all income generated by the salmon industry in the three California coastal subregions.

## SACRAMENTO RIVER REGION

### HISTORICAL PERSPECTIVE

Reservoirs, rivers, and wildlife refuges in the Sacramento River Region support a variety of recreational activities including sport fishing, hunting, boating, camping, swimming, picnicking, and sightseeing.

As described in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report (CALFED Bay-Delta Program [in process]), recreation opportunities have been shaped by the construction of large reservoirs, such as Shasta Lake, Folsom Lake, and Lake Oroville. Historically, Shasta Lake has been the most popular reservoir, with use ranging from 1.8 million to 4 million recreation days annually between 1970 and 1985 (Petrinovich pers. comm.). During the same time period, use at Folsom Lake has fluctuated from 2 million recreation days to less than 1.1 million recreation days in 1982, and subsequently increased to nearly 2.8 million recreation days in 1985 (Petrinovich pers. comm.). Similar to Folsom Lake, Lake Oroville has experienced fluctuations in use ranging from 288,000 visitors in 1968 to 939,000 visitors in 1981, and again decreasing to 771,000 visitors in 1985.

Recreation activities along rivers in the Sacramento River Region have been modified with the construction of dams on the Sacramento, American, Feather, and Yuba Rivers. Although complete data is not available to quantify trends for all activities along each river, it can be assumed that most water-dependent and water-enhanced activities along the rivers have increased with population growth in the region. Historical data is unavailable for the Yuba River.

Table 3-9. Income Generated from the Salmon Industry Compared to Total Personal Income in the California Coastal Areas

| Subregion     | Total Personal Income from Salmon<br>(millions of 1995 dollars) | Total Personal Income in the Region<br>(millions of 1995 dollars) | Income from Salmon Industry<br>(percent of regional income) |
|---------------|---|---|---|
| North Coast   | 0.1   | 4,042   | 0.002   |
| San Francisco | 5.86  | 64,108  | 0.009   |
| Central Coast | <u>2.93</u>   | <u>22,987</u>   | <u>0.013</u>  |
| Total         | 8.89  | 91,137  | 0.01  |

Notes:

Personal income includes all direct, indirect, and induced income (wages, salaries, and profits) attributable to the salmon industry in 1992. Subregions include:

North Coast: Del Norte, Humboldt, and Mendocino.

San Francisco: Sonoma, Marin, San Francisco, and San Mateo.

Central Coast: Santa Cruz, Monterey, and Santa Barbara.

Sources:

Pacific Fisheries Management Council 1993a.

California Department of Finance 1993.

Important use trends at the three major rivers in the Sacramento River Region were as follows:

- Sport catch of anadromous fish in the Sacramento River increased from an estimated 8,000 salmon and 3,800 rainbow trout and steelhead landings in 1949 to an estimated annual average of 17,500 salmon and 17,900 steelhead landings between 1968 and 1975 (U.S. Fish and Wildlife Service 1950 and California Department of Fish and Game 1980). Recent data suggests that sport-catch landings have been declining since 1975.
- Recreation use on the American River increased to an estimated 5 million recreation user days annually by 1980, with water-dependent activities accounting for approximately 2 million recreation user days (Gold 1985).
- Sport catch of anadromous fish in the Feather River between 1968 and 1974 was estimated at an annual average of 530 striped bass, 1,800 steelhead, and 644 chinook salmon landings.

Recreation opportunities for both nonconsumptive (i.e., wildlife viewing) and consumptive (i.e., hunting and fishing) activities are provided at all wildlife refuges in the region. Important use trends at wildlife refuges in the Sacramento River Region were as follows:

- Recreation use at Gray Lodge Wildlife Management Area (WMA) and Sacramento, Colusa, Sutter, and Delevan National Wildlife Refuges (NWRs) increased from an estimated 101,200 visitor days in 1973 to an estimated 127,080 visitor days in 1985. Gray Lodge WMA was the most popular of the five refuges in the region, accounting for approximately 57% of total use.

Overall, recreation use at important reservoirs, rivers, and wildlife refuges in the Sacramento Valley Region has paralleled increased population growth in the region. Consequently, recreation expenditures and benefits associated with increased use by visitors to the recreation areas have become an important contributor to the local and regional economy.

## CURRENT RESOURCE CONDITIONS

In 1992, recreation use at the 10 recreation areas in the Sacramento River Region totaled approximately 3.6 million visitor days (Table 3-10). It is estimated that approximately \$77 million in trip-related spending resulted from this use, based on an average spending per visitor day (Table 3-11) of \$17.65 for nonconsumptive activities at reservoirs, rivers, and wildlife refuges (primary activities associated with boating, swimming, and wildlife observation); \$49.37 for sport fishing activities at reservoirs, rivers, and wildlife refuges; and \$43.74 for waterfowl hunting at wildlife refuges (U.S. Fish and Wildlife Service and U.S. Bureau of the Census 1993).

Table 3-10. Estimated Annual Expenditures and Benefits Related to Recreation Use<sup>a</sup> at Popular Sacramento River Region Recreation Areas

| Recreation Area           | Regional Expenditures <sup>b</sup><br>(millions of 1995 dollars) | Benefits <sup>c</sup><br>(millions of 1995 dollars) |
|---------------------------|--|---|
| <b>Lakes</b>              |  |   |
| Shasta                    | 46.7   | 25.3  |
| Oroville                  | 7.1  | 4.3   |
| Folsom                    | 8.5  | 3.8   |
| <b>Rivers<sup>d</sup></b> |  |   |
| Sacramento                | 7.5  | 3.1   |
| Feather                   | 3.3  | 1.3   |
| American                  | 1.3  | 0.5   |
| Yuba                      | 0.1  | 0.04  |
| Wildlife Refuges          | <u>2.3</u>   | <u>2.4</u>  |
| <b>Total</b>              | <b>76.80</b>   | <b>40.78</b>  |

Notes:

- <sup>a</sup> Estimated from 1992 use information presented in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report.
- <sup>b</sup> Includes 80% of expenditures made by visitors from outside the region and 100% of expenditures made by visitors from inside the region.
- <sup>c</sup> Measured in terms of users' net willingness to pay for recreation opportunities.
- <sup>d</sup> Includes sport fishing activities only.

Table 3-11. Average Trip-Related Expenditures by Principal Recreation Activity and Spending Category

| Business Sector                    | Saltwater Fishing <sup>a</sup>     |              |              |                                | Nonconsumptive<br>Recreation<br>Uses <sup>c</sup> |
|------------------------------------|------------------------------------|--------------|--------------|--------------------------------|---|
|                                    | Freshwater<br>Fishing <sup>b</sup> | Charter      | Private      | Waterfowl Hunting <sup>b</sup> |   |
| Food stores                        | 5.08                               | 3.78         | 4.31         | 5.31                           | 3.14  |
| Eating and drinking establishments | 10.32                              | 7.57         | 8.64         | 12.65                          | 2.35  |
| Service stations                   | 17.83                              | 12.97        | 26.07        | 13.18                          | 3.95  |
| Hotels and motels                  | 10.43                              | 7.56         | 8.62         | 4.89                           | 5.06  |
| Miscellaneous retail               | <u>5.71</u>                        | <u>73.82</u> | <u>24.58</u> | <u>6.71</u>                    | <u>3.15</u>                                       |
| Total                              | 49.37                              | 105.70       | 72.22        | 43.74                          | 17.65   |

## Notes:

Values are in 1995 dollars per visitor day.

Expenditure estimates were adjusted to constant 1995 dollars using the Consumer Price Index

## Sources:

<sup>a</sup> Thomas and Hupper, 1987.

<sup>b</sup> Service and U.S. Bureau of the Census 1993.

<sup>c</sup> Propst et al. 1992

Recreation benefits are estimated at \$40.8 million for 1992 (Table 3-5). This estimate is based on an average benefit of \$10.43 per visitor day for reservoir recreation (Spectrum Economics 1991); \$19.50 per visitor day for river recreation (Loomis and Ise 1992); and \$22.75 per visitor day for recreation activities at wildlife refuges, which represents an average value for wildlife viewing and fishing activities (valued at \$19.50 per day by Cooper and Loomis [1991]) and waterfowl hunting (valued at \$26 per day by Cooper [1990]) at wildlife refuges.

## SAN JOAQUIN RIVER REGION

### HISTORICAL PERSPECTIVE

Both CVP reservoirs and non-CVP reservoirs, rivers, and wildlife refuges in the San Joaquin River Region support a variety of recreational activities, including sport fishing, hunting, boating, camping, swimming, picnicking, and sightseeing.

Most of the popular reservoirs supporting recreational uses in the San Joaquin River Region were completed in the 1960s and 1970s. Important historical use trends at CVP facilities in the San Joaquin River Region were as follows:

- Recreation use at San Luis Reservoir increased from an estimated 33,000 visits in 1967 to an estimated 282,000 visits in 1985.
- Annual recreation use at Millerton Lake increased from an estimated 574,000 visitor days in 1970 to an estimated 667,000 visitor days in 1985.
- Annual recreation use at New Melones Reservoir, completed in 1979, increased from an estimated 250,000 visitor days in 1980 to an estimated 499,000 visitor days in 1985.

No historical use data is available for Lake Camanche; however, important use trends at other non-CVP facilities in the San Joaquin River Region were as follows.

- Annual use at Lake McClure increased from an estimated 167,700 visits in 1969 to an estimated 428,000 visits in 1985.
- Recreation use at New Don Pedro Reservoir increased from an estimated 300,000 visits to an estimated 501,000 visits in 1985.
- Recreation use at New Hogan Lake increased from an estimated 5,100 visitor days in 1963 to an estimated 262,000 visitor days in 1985 (Lykins pers. comm.).

Important rivers in the San Joaquin Valley Region include the San Joaquin, Stanislaus, Tuolumne, and Merced. Important recreation activities include sport fishing, swimming, boating, camping, and picnicking. Overall, recreation use data are limited. In 1962, DFG estimated that the Stanislaus River chinook salmon run supported an average annual use of 10,000 angler days of sport fishing. No other information or use data on angling or nonconsumptive recreation for the Stanislaus River and other important rivers in the San Joaquin River Region has been located.

Important wildlife refuges in the San Joaquin River Region include Los Banos and Volta WMA; and Kern, Kesterson, Merced, Mendota, Pixley, and San Luis NWRs. Historical use data for NWRs is not available; however, overall use trends at the NWRs probably resembles trends at WMAs. Recreation opportunities for both nonconsumptive and consumptive activities are provided at all wildlife refuges in the region. One important use trend at wildlife refuges in the San Joaquin River Region was as follows:

- Recreation use at Los Banos WMA and Volta WMA increased from an estimated 36,400 visitor days in 1973 to an estimated 69,305 visitor days in 1985.

Overall, recreation use at important reservoirs, rivers, and wildlife refuges in the San Joaquin Valley Region has been increasing since the 1940s. Consequently, recreation expenditures and benefits associated with increased use by visitors to the recreation areas have been increasing and have become an important contributor to the local and regional economy.

## CURRENT RESOURCE CONDITIONS

In 1992, recreation use at the seven reservoirs, four rivers, and five wildlife refuges in the San Joaquin River Region totaled approximately 2.9 million visitor days (Table 3-12). Trip-related expenditures resulting from this use reached an estimated \$56.8 million.

Recreation benefits associated with use at the popular recreation areas in the San Joaquin River Region in 1992 are estimated at \$36.4 million (Table 3-12).

## SWP AND CVP SERVICE AREAS

### HISTORICAL PERSPECTIVE

In addition to recreation associated with facilities constructed in the Central Valley, development of SWP and CVP created recreational opportunities at facilities constructed outside of the Central Valley. Use of these facilities has generated spending in local economies and benefits

Table 3-12. Estimated Expenditures and Benefits Related to Recreation Use<sup>a</sup>  
at Important San Joaquin River Region Recreation Areas

| Recreation Area             | Regional Expenditure <sup>b</sup><br>(millions of 1995 dollars) | Benefits <sup>c</sup><br>(millions of 1995 dollars) |
|-----------------------------|---|---|
| <b>Reservoirs and Lakes</b> |   |   |
| CVP Reservoirs              |   |   |
| San Luis                    | 5.1   | 2.2   |
| Millerton                   | 5.4   | 3.3   |
| New Melones                 | 8.4   | 5.2   |
| Non-CVP Reservoirs          |   |   |
| McClure                     | 10.2  | 6.3   |
| New Don Pedro               | 4.7   | 2.9   |
| New Hogan                   | 3.7   | 2.0   |
| Camanche                    | 4.3   | 2.7   |
| <b>Rivers<sup>d</sup></b>   |   |   |
| San Joaquin                 | 4.9   | 3.0   |
| Merced                      | 3.3   | 2.2   |
| Tuolumne                    | 2.9   | 2.9   |
| Stanislaus                  | 2.6   | 2.4   |
| <b>Wildlife Refuges</b>     | <u>1.3</u>  | <u>1.3</u>  |
| <b>Total</b>                | <b>56.8</b>   | <b>36.4</b>   |

Notes:

- <sup>a</sup> Estimated from 1992 use information presented in the CALFED Bay-Delta Program Recreation Affected Environment Technical Report.
- <sup>b</sup> Includes 80% of expenditures made by visitors from outside the region and 100% of expenditures by visitors from inside the region.
- <sup>c</sup> Measured in terms of users' net willingness to pay for recreation opportunities.
- <sup>d</sup> Includes fishing, boating, swimming, and wildlife viewing activities.

for recreationists. Most of the recreational use of SWP and CVP facilities has been centered around storage reservoirs.

Since 1960, development of SWP has resulted in the construction of 29 storage facilities in various locations of the State. Similarly, development of the CVP resulted in the construction of several dams and reservoirs in the State between the 1930s and 1960s. Reservoirs are located in both northern and southern California.

In southern California, Castaic, Pyramid, Silverwood, and Perris Lakes provide recreational opportunities. In northern California, Lake Davis, Frenchman Lake, and Antelope Lake are popular with recreational fishers. Spending and benefits have increased as use has grown in relationship to population growth in northern and southern California.

### CURRENT RESOURCE CONDITIONS

Use levels are generally higher at reservoirs in southern California; consequently, recreational spending and benefits generated by use of reservoirs in SWP and CVP service areas are also higher at reservoirs in southern California. Popular lakes in southern California include Castaic, Pyramid, Silverwood, and Perris. Recreational facilities include boat ramps, marinas, swim beaches, picnic areas, and camping areas. Recreation use of these facilities totaled approximately 3.1 million visitor days in 1992 (Higley pers. comm.), which resulted in an estimated \$132.0 million in trip-related spending based on average spending per day of \$42.57.

Annual recreation benefits associated with these activities are estimated at \$122.0 million per year, based on an average benefit of \$39.10 per day for reservoir recreation.

## CHAPTER 4. CITATIONS

### PRINTED REFERENCES

- Cajucum, E. Z., G. M. Garthe, J. E. Gehrman, M. A. Geidel, and S. J. Moore. 1980. Sacramento-San Joaquin Delta outdoor recreation survey: Sacramento, California, California State University. Report to California Department of Water Resources.
- Cooper, J. 1990. Demand for and net economic value of waterfowl hunting in California's Sacramento and San Joaquin Valley refuges. U.S. Bureau of Reclamation, Sacramento, CA..
- California Department of Fish and Game. 1980. Sacramento River Chinook salmon and steelhead trout, sport catch, 1967-68 through 1974-75. Sacramento, CA.
- California Department of Water Resources. 1990. Draft environmental impact report/environmental impact statement. North Delta Program. Sacramento, CA.
- California Employment Development Department. 1996. Annual planning information for Contra Costa, Sacramento, San Joaquin, Solano, and Yolo Counties. Sacramento, CA.
- Cooper, J., and J. Loomis. 1991. Economic value of wildlife resources in the San Joaquin Valley: Hunting and viewing values. In A. Dinar and D. Zilberman (eds.), Economics and management of water and drainage in agriculture. Kluwer Academic Publishers. Norwell, MA.
- David M. Dornbusch & Company. 1988. Economic impact of the boating industry. San Francisco, CA. Prepared for California Department of Boating and Waterways, Sacramento, CA.
- Gold, S. W. Ph.D., AICP. 1985 Recreation planning report American River Parkway. Sacramento, CA.
- Jones & Stokes Associates, Inc. 1995. Environmental impact report and environmental impact statement for the Delta Wetlands Project. Draft. September 11, 1995. (JSA 87-119.) Prepared for California State Water Resources Control Board, Division of Water Rights and U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.
- Leet, W., C. Dewees, and C. Hagen (eds.). 1992. California's living marine resources and their utilization. California Sea Grant. n.p.
- Loomis, J., and S. Ise. 1992. Net Economic value of recreational fishing on the Sacramento River in 1980. An integrated modeling of drought and global warming: impacts on selected California

resources: Davis, CA. University of California, Davis. National Institute for Global Environmental Change. Davis, CA.

Minnesota IMPLAN Group. 1993. Micro IMPLAN user's guide, version 91-F, open data file. St. Paul, MN.

National Marine Fisheries Service. 1993. Fisheries of the United States, 1992. Fisheries Service Division. U.S. Government Printing Office. Silver Springs, MD.

Pacific Fishery Management Council. 1986. Review of 1985 ocean salmon fisheries. Portland, OR.

\_\_\_\_\_. 1989. Review of 1988 ocean salmon fisheries. Portland, OR.

\_\_\_\_\_. 1993a. Review of 1992 ocean salmon fisheries. Portland, OR.

\_\_\_\_\_. 1993b. Historical ocean salmon fishery data for Washington, Oregon, and California. Portland, OR.

Propst, D. B., D. J. Stynes, J. H. Lee, and R. S. Jackson. 1992. Development of spending profiles for recreation visitors to Corps of Engineers projects. (Technical Report R-92-4.) U.S. Army Corps of Engineers, Vicksburg, MS.

Roach, B., and J. Loomis. 1996. A travel cost analysis of angler benefits by target species along four California rivers. (Draft.) Davis, CA. Prepared for Jones & Stokes Associates, Sacramento, CA.

Skinner, J. E. 1962. An historical review of the fish and wildlife resources of the San Francisco Bay Area. Sacramento, CA.

Spectrum Economics, Inc. 1991. Recreation forecasts and benefit estimates for California reservoirs: recalibrating the California travel cost model. Report to Joint Agency Recreation Committee. Sacramento, CA.

U.S. Department of Commerce, Bureau of Economic Analysis. 1996. Regional economic information system: personal income for Contra Costa County, Sacramento County, San Joaquin County, Solano County, and Yolo County. Distributed by the California Department of Finance, Sacramento, CA.

U.S. Fish and Wildlife Service. 1950. Upper Sacramento River sport fishery. (Special Scientific Report Fisheries No. 34.) Washington, D.C.

U.S. Fish and Wildlife Service and U.S. Bureau of the Census. 1993. 1991 national survey of fishing, hunting, and wildlife-associated recreation: California. Washington, DC.

Wade, W. W., G. M. McCollister, R. J. McCann, and G. M. Johns. 1987. Economic evaluation of the freshwater recreation uses of the Sacramento-San Joaquin Delta. (SWC Exhibit No. 66.) QED Research, Inc., Palo Alto, CA. Prepared for the Metropolitan Water District of Southern California.

## PERSONAL COMMUNICATIONS

Eres, Joann. Management services technician. California Department of Fish and Game, Marine Fishing Statistical Unit, Long Beach CA. August 6, 1996 - letter transmittal of unpublished commercial fishing data for 1986 and 1995.

Fraser, Keith. Owner. Loch Lomond Live Bait and Tackle. , January 3, 1994 - telephone conversation.

Higley, Judy A. Associate planner. California Department of Water Resources, Central District, November 7, 1995 - telephone conversation,

Lykins, Craig. Manager. New Hogan Lake. U.S. Army Corp of Engineers, Valley Springs, CA. December 2, 1993 - telephone conversation and unpublished data.

Ota, Becky. Marine biologist. California Department of Fish and Game, Menlo Park, CA. July 24, 1996 - telephone conversation.

Petrinovich, M. Resource planner. U.S. Bureau of Reclamation, Sacramento, CA. November 11 through December 11, 1993 - telephone conversation and unpublished data.

# TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>1.0 INTRODUCTION.....</b>                              | <b>1</b>  |
| <b>2.0 EXECUTIVE SUMMARY.....</b>                         | <b>1</b>  |
| <b>3.0 ASSESSMENT METHODS.....</b>                        | <b>2</b>  |
| <b>4.0 SIGNIFICANCE CRITERIA.....</b>                     | <b>3</b>  |
| <b>5.0 ENVIRONMENTAL IMPACTS.....</b>                     | <b>3</b>  |
| 5.1 Impact Analysis .....                                 | 3         |
| 5.1.1 Description of No-Action Resource Conditions .....  | 4         |
| Delta Region .....  | 4         |
| Bay/California Coast Region.....                          | 4         |
| Sacramento River Region .....                             | 5         |
| San Joaquin River Region.....                             | 6         |
| SWP/CVP Service Area.....                                 | 7         |
| 5.1.2 Description of Alternative Resource Conditions..... | 7         |
| Delta Region .....  | 7         |
| Bay/California Coast Region.....                          | 11        |
| Sacramento River Region .....                             | 14        |
| San Joaquin River Region.....                             | 17        |
| SWP/CVP Service Area.....                                 | 21        |
| <b>6.0 RELATED TOPICS.....</b>                            | <b>22</b> |
| <b>7.0 REFERENCES.....</b>                                | <b>23</b> |

## 1.0 INTRODUCTION

The intent of the CALFED Bay-Delta Program (Program) is to develop the long-term solutions to problems affected in the San Francisco Bay/Sacramento-San Joaquin Delta estuary in Northern California. Overall, the effect of the Program is expected to be beneficial. However, specific Program components may have potentially adverse impacts.

The purpose of this technical report is to document, in a programmatic manner, the potential impacts of the Program on fish, wildlife, and recreation economics. The objective is to describe and analyze effects on fish, wildlife, and recreation economics that could result from the no action alternative or implementing any of the three Program alternatives. This report discusses potential impacts that may occur in the five regions within the study area including the Delta Region, Bay Region, Sacramento River Region, San Joaquin River Region, and the SWP Service Area. (The California Coastal has been included with the Bay Region to analyze potential coastal fishery-related effects.) The report also contains a brief description of potential mitigation strategies designed to reduce Program impacts to a less than significant level. The executive summary contained in this technical report in conjunction with other information, data, and modeling developed during pre-feasibility will be used to prepare the environmental impacts section of the Programmatic EIR/EIS.

This assessment of the fish, wildlife, and recreation economic effects focuses on identifying the direction and magnitude of changes in assessment variables. These variables include recreation spending, recreation benefits, ocean commercial fishing harvest values, and commercial fishing net income. For each common program element and alternative variation, potential changes in assessment variables are described for the following five activities: ocean commercial fishing for salmon; sport fishing for anadromous species in coastal waters, bays, estuaries, and rivers; other water-based recreation activities at rivers; water-based activities at reservoirs; and wildlife-related recreation activities.

## 2.0 EXECUTIVE SUMMARY

The impacts of the alternatives on economic variables for fish, wildlife, and recreation economics are summarized by region in Table ES-1. All impacts are positive with no regional effects expected to be substantial (i.e., change greater than 10% relative to the no action level).

|                       | DELTA REGION |              | BAY/PACIFIC REGION |              |                           |                        | SACRAMENTO RIVER REGION |              | SAN JOAQUIN RIVER REGION |              | SWP/CVP SERVICE AREA |              |
|-----------------------|--------------|--------------|--------------------|--------------|---------------------------|------------------------|-------------------------|--------------|--------------------------|--------------|----------------------|--------------|
|                       | REC SPENDING | REC BENEFITS | REC SPENDING       | REC BENEFITS | COMM SALMON HARVEST VALUE | COMM SALMON NET INCOME | REC SPENDING            | REC BENEFITS | REC SPENDING             | REC BENEFITS | REC SPENDING         | REC BENEFITS |
| EXISTING CONDITIONS   | \$226        | \$159        | \$9                | \$8          | \$5                       | \$9                    | \$76                    | \$41         | \$60                     | \$40         | \$132                | \$122        |
| NO ACTION ALTERNATIVE | \$400        | \$270        | \$23               | \$28         | \$33                      | \$13                   | \$129                   | \$70         | \$102                    | \$68         | \$193                | \$178        |
| ALTERNATIVE 1A        | \$414-\$430  | \$277-\$286  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$77    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 1B        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$77    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 1C        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$142-\$155             | \$76-\$84    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 2A        | \$411-\$428  | \$281-\$294  | \$23-\$24          | \$28-\$29    | \$33-\$34                 | \$13-\$14              | \$135-\$142             | \$72-\$76    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 2B        | \$411-\$428  | \$281-\$294  | \$23-\$24          | \$28-\$29    | \$33-\$34                 | \$13-\$14              | \$141-\$154             | \$76-\$83    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 2C        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$76    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 2D        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$76    | \$105-\$110              | \$70-\$74    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 2E        | \$429-\$456  | \$295-\$318  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$142-\$155             | \$76-\$83    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3A/C      | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$137-\$145             | \$73-\$78    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 3B/D      | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3E        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3F        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3G        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3H        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3I        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |

(\$ IN MILLIONS)

TABLE ES-1. SUMMARY OF FISH, WILDLIFE, AND RECREATION ECONOMIC EFFECTS BY REGION

### 3.0 ASSESSMENT METHODS

Each of the major categories of Program components could potentially affect the economic value of impacts on fish, wildlife, and recreation resources. The linkages and economic variables used to conduct this analysis are shown in Figure 1.

The analysis focuses on measuring changes for four economic variables: recreation spending, net benefits to recreation users, commercial salmon harvest values, and net income to commercial salmon fishermen. All changes are measured relative to the no action levels.

The assessment was conducted in five steps, which are described below.

1. The values for the no action alternative were estimated by adjusting the existing condition levels to reflect the percentage change in population from 1995 to 2020, and to account for expected changes resulting from the projects included in the no action condition.
2. Relevant changes in physical resources were identified by alternative and region.

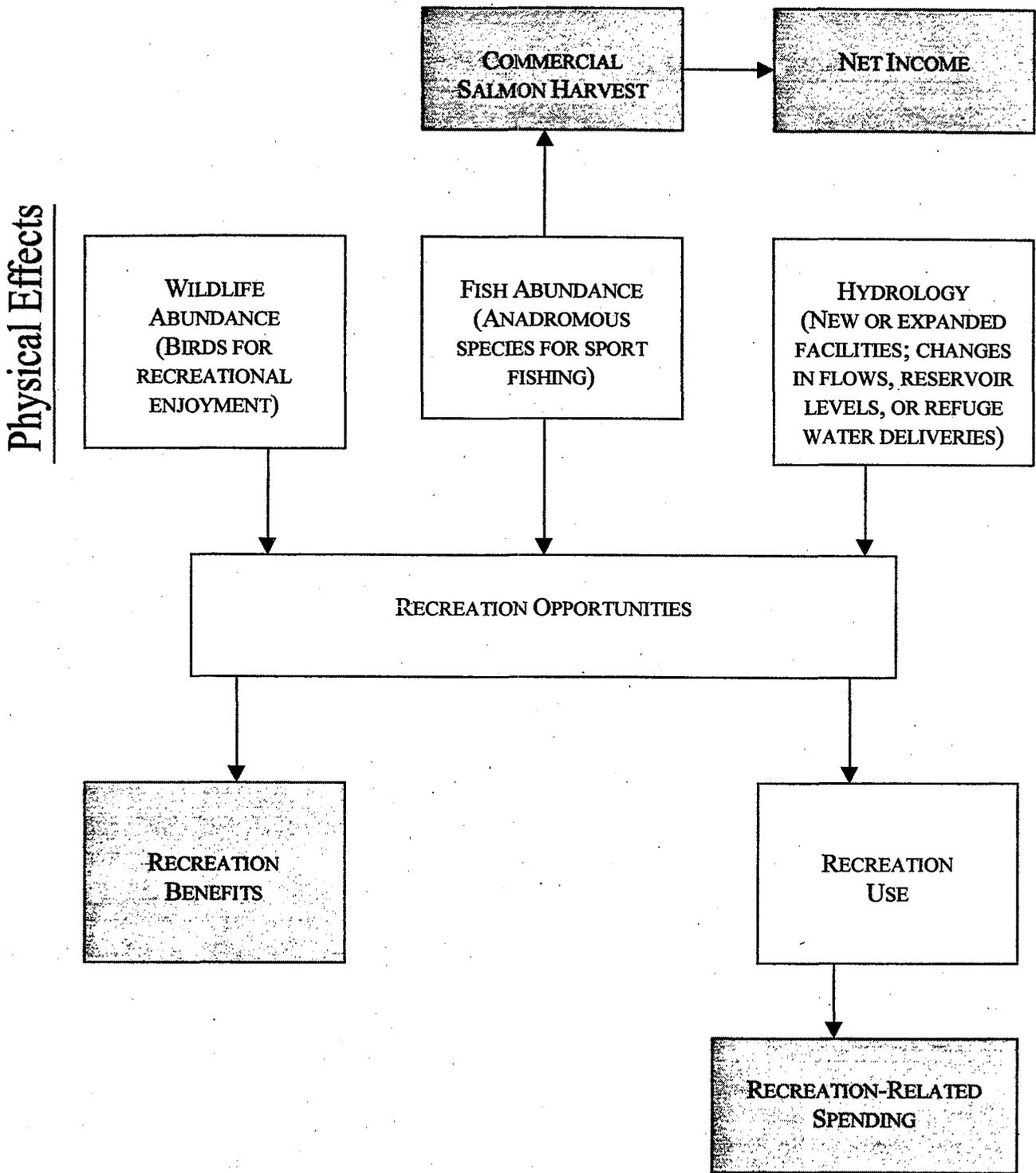
For changes in fishery resources, impacts to anadromous species were considered. The relative changes in fish abundance were considered uniform across affected regions. The results of this assessment are presented in Table A-1 of the attachment to this report.

For changes in wildlife resources, impacts focused on changes in the abundance of birds important to wildlife viewing and hunting. The species considered were waterfowl, upland game birds, and riparian birds. Because impacts were primarily related to the Ecosystem Restoration Program, impacts were not differentiated by alternative. The results of this assessment are presented in Table A-2 of the Attachment.

For changes in recreation resources, impacts focused on hydrology-related effects, including changes in river flows, reservoir storage, and water quality. Construction impacts on recreation opportunities also were considered. The results of this assessment are presented in Table A-3 of the Attachment.

All impacts on physical resources were judged to be small, moderate, or large.

FIGURE 1. SCHEMATIC OF ANALYTICAL LINKAGES IN IMPACT ANALYSIS



Shading = Parameters evaluated in the impact analysis

3. The effect of the physical changes on relevant economic activities in each region were identified. The results of this assessment are presented in Table A-4 of the Attachment.
4. The overall regional effect was then determined by considering the aggregate effect of all affected activities. The relative importance of an activity in a region (Table A-6) was considered in weighting the effects of different activities. The results of this assessment are presented in Table A-5 of the Attachment.
5. The values for the economic variables in the no action alternative were adjusted to reflect the predicted magnitude of change in the relevant economic variables. A small change was assigned a 1-4% increase relative to the no action level, a moderate change was assigned a 5-9% increase, and a large change was assigned a 10-20% increase. (All changes were positive relative to the no action level). The results of this assessment are presented in Tables 3-7 of this report.

#### **4.0 SIGNIFICANCE CRITERIA**

The California Environmental Quality Act (CEQA) requires determining the significance of impacts so that mitigation measures can be recommended to reduce impacts to less-than-significant levels. Under the National Environmental Policy Act, significance relates to whether an EIS should be prepared (i.e., is there potential for "significantly affecting the quality of the human environment"), without the mitigation requirement to reduce impacts to less-than-significant levels.

As recommended by CEQA, the results of this economic impact analysis are used to assess the significance of physical changes caused by the project. The physical changes relate to fishery resources, wildlife resources, recreation resources, and hydrologic conditions. Only adverse impacts from this economic analysis are considered for significance determination. The threshold for determining significance is a 10% reduction in the magnitude of any of the economic variables relative to the no action alternative. Positive changes in the magnitude of economic variables that exceed 10% are considered substantial effects.

#### **5.0 ENVIRONMENTAL IMPACTS**

##### **5.1 Impact Analysis**

### 5.1.1 Description of No-Action Resource Conditions

The following sections describe fish, wildlife, and recreation economic conditions for each region under the no-action alternative. Economic conditions are characterized by expected 2020 levels of recreation-related expenditures and benefits, and commercial ocean fishing harvest values and net income. Projected levels of these economic indicators reflect 1995 levels, adjusted by population growth factors and the probable effects of projects and non-project items considered as part of no-action conditions.

#### Delta Region

Population growth in the five counties that comprise the Delta Region could substantially increase recreational use of the Delta's fish, wildlife, and recreation resources resulting in increased recreation-related spending and benefits within the region. According to projections prepared by the California Department of Finance (DOF) (1997), the population of the Delta Region is projected to increase by 54% between 1995 and 2020.

Additionally, implementation of the Central Valley Project Improvement Act (CVPIA) could affect future recreation use within the Delta by improving fishing conditions for anadromous species in Delta waters. Changes in recreation spending and benefits related to sportfishing could be relatively large (i.e., exceeding 10%) with fishery habitat improvements implemented under the CVPIA.

Based on additional recreation use generated by regional population growth and increased use associated with the CVPIA, spending within the region related to recreational use of the Delta is projected to total approximately \$400 million by 2020. Benefits accruing to Delta recreationists are projected to total \$270 million under no-action conditions.

Commercial fishing for crayfish and baitfish species in the Delta and Suisun Bay would not change appreciably under no-action conditions relative to current resource conditions. Harvest revenue and net income generated by commercial fishing have not been estimated but are assumed to be minor in the context of the regional economy.

#### Bay/California Coast Region

Economic activity associated with sport and commercial fishing for anadromous species in bay and coastal waters could increase under no-action conditions due to implementation of the CVPIA. (Regional population growth, while adding pressure on the fishery, would not necessarily result in increased fishery-related economic activity because catch is regulated by state and federal resource management agencies.)

Implementation of the CVPIA could result in small (i.e., less than 4%) increases in recreation expenditures and benefits in the North Coast Subregion and large (i.e., in excess of 10%) increases in the San Francisco and Central Coast Subregions relative to current levels. (No-action levels of spending, benefits, commercial harvest revenue, and net income associated with recreational and commercial fishing for anadromous species in San Francisco Bay and San Pablo Bay are addressed as part of the San Francisco Subregion.) Levels of recreation expenditures and benefits under 2020 no-action conditions have been projected as follows:

| <u>Subregion</u> | <u>Expenditures</u><br>(in millions) | <u>Benefits</u><br>(in millions) |
|------------------|--------------------------------------|----------------------------------|
| North Coast      | \$6                                  | \$11                             |
| San Francisco    | \$8                                  | \$8                              |
| Central Coast    | \$9                                  | \$9                              |

TABLE 1. Recreation Spending and Benefits of Ocean Sport Fishing for Salmon under the No Action Conditions

Similarly, improvements in fishery habitats under the CVPIA could substantially increase ocean commercial harvest values and net income derived from the catch of salmon. Levels of harvest value and net income under 2020 no-action conditions have been projected as follows:

| <u>Subregion</u> | <u>Harvest Value</u><br>(in millions) | <u>Net Income</u><br>(in millions) |
|------------------|---------------------------------------|------------------------------------|
| North Coast      | \$16                                  | \$6                                |
| San Francisco    | \$12                                  | \$5                                |
| Central Coast    | \$5                                   | \$2                                |

TABLE 2. Harvest Values and Net Income to Commercial Salmon Fisherman under the No Action Condition

### Sacramento River Region

Under the No-Action Alternative, recreation-related expenditures and benefits would increase substantially as a result of the 69% increase in population projected by DOF (1997) for the Sacramento

River Region between 1995 and 2020. Additionally, a number of projects and actions, including reoperation of Folsom Reservoir, development of the Stone Lakes National Wildlife Refuge (NWR), and implementation of the CVPIA could affect recreation-related economic activity within the Sacramento River Region under no-action conditions.

Reoperation of Folsom Reservoir could result in impacts to existing recreation activities at the reservoir. For example, impacts could result from drawdown of the reservoir in late fall for flood protection. The extent of impacts and resulting effects on recreation spending and benefits would depend on the amount of storage required during different water years. Losses of recreation at the reservoir could be at least partially offset by benefits to recreational resources downstream of the reservoir resulting from higher releases at certain time of the year. The net effect of Folsom reoperation on recreation spending and benefits would likely be small (i.e., a reduction less than 4%).

The Stone Lakes NWR provides opportunities for non-consumptive recreation activities such as nature walks and wildlife viewing. Ultimate development of the wildlife refuge would generate a moderate (i.e., 5-9%) increase in spending and benefits associated with wildlife-related recreation within the Sacramento River Region.

Implementation of the CVPIA could result in large (i.e., more than 10%) increases in use of recreational resources such as fisheries in the Sacramento, Feather, American, and Yuba rivers and small (i.e., 1% or less) decreases in use of reservoirs such as Shasta and Oroville. Wildlife refuges in the region could experience large (i.e., 10% or more) increases in use because of improved wildlife habitat conditions in refuges related to the CVPIA.

Based on population growth and effects of projects under no-action conditions, 2020 levels of recreation-related expenditures and benefits are projected to total \$129 million and \$70 million, respectively, within the Sacramento Region.

### **San Joaquin River Region**

Under no-action conditions, economic activity generated by recreation use of regional resources would increase as a result of the 68% increase in population projected by DOF (1997) for the San Joaquin River region between 1995 and 2020.

Implementation of the CVPIA would also affect economic activity associated with recreational use of many of the region's rivers, reservoirs, and wildlife refuges. Changes in economic activities related to reservoirs would likely be small (i.e., less than 4%), with changes related to reductions in use. Spending and benefits generated by use of the region's rivers would probably increase by a small (i.e., 4% or less) amount. Spending and benefits generated by visitation at the region's

wildlife refuges would likely increase by a large (i.e., 10% or more) amount relative to existing levels.

Based on regional population growth and likely effects of the CVPIA, no-action levels of recreation-related expenditures are projected to total \$102 million and \$68 million, respectively, within the San Joaquin River Region.

### **SWP/CVP Service Area**

Spending and benefits associated with recreational use of reservoirs in the SWP and CVP service areas could be affected in the future by population growth, projects such as the CVPIA and MWD's Eastside Reservoir, and actions such as increased CVP and SWP Delta exports. Key lakes that could be affected include Castaic Lake, Pyramid Lake, Silverwood Lake, and Lake Perris.

Based on the 46% increase in population growth projected by DOF (1997) for counties containing these lakes, recreation spending and benefits could annually total a projected \$193 million and \$178 million, respectively, by 2020.

## **5.1.2 Description of Alternative Resource Conditions**

### **Delta Region**

#### **Alternative 1**

The **Ecosystem Restoration Program (ERP)** contains a number of programmatic actions that could improve spawning, rearing, and survival conditions for anadromous species caught in the Delta Region, including Chinook salmon. Improved spawning, rearing, and survival conditions should lead to increased populations of sport fish in the Delta Region. Larger populations are expected to lead to increased recreational fishing, generating positive changes in recreational spending and benefits in the Delta Region.

While these actions could lead to larger populations of Chinook salmon originating from the Central Valley river system, it is difficult to assess the extent of the economic benefit to the recreational fishing industry in the Delta Region. As discussed below in the Bay/California Coast Region, restrictions on the catch of Klamath and Snake River salmon can severely restrict the harvest of Central Valley Chinook salmon. Assuming harvest restrictions are eased in the future for protected stocks, increases in the populations of Central Valley Chinook would lead to substantially increased catch of salmon, thereby increasing spending and net benefits accruing to anglers in the Delta Region.

The ERP is also expected to result in large, positive changes in bird populations important for wildlife viewing and hunting. This impact is expected to have a corresponding positive effect on recreation spending and user benefits in the Delta Region.

Elements of the **Water Quality Program** could result in improved fishery conditions, river recreation conditions, and wildlife refuge conditions throughout the Delta Region. Improved water quality in rivers and the Delta should lead to healthier anadromous fish populations and improved conditions for water-contact recreation in the Delta Region, resulting in increased spending and user benefits.

The **Water Use Efficiency Program** would probably not result in substantial direct effects on fish, wildlife, and recreation economic variables in the Delta Region. Increasing the efficiency of agricultural, urban, and environmental water use could free up water that could enhance fish and wildlife habitats in streams, wildlife refuges, and the Delta, but these potential effects are uncertain at this time. Water transfers could have both adverse and beneficial economic effects on fishery conditions and recreation in the Delta Region. The net effect of water transfers on economic variables in the Delta Region also is uncertain at this time.

The development of levee-associated habitat (**Levee System Integrity Program**) could improve fishing conditions for anadromous species, as described for the ERP. The enhancement of opportunities for levee-associated recreation in the Delta Region could increase sport fishing from banks and increase other types of recreation along rivers in the Delta, resulting in an increase in recreation spending and user benefits.

Alternatives 1A and 1B do not include **Storage or Conveyance Components** other than the South Delta Modifications, which would have minor, if any, effect on recreation spending and user benefits in the Delta Region resulting from increases in sport fishing opportunities.

Under Alternative 1C, reservoir recreation could be enhanced by the development of surface storage upstream of the Delta and off-aqueduct storage south of the Delta, but these storage enhancements are unlikely to affect recreation spending and user benefits in the Delta Region.

Table 3 shows the predicted effect of the Alternative 1 variations on the economic variables used to assess impacts on affected activities in the Delta Region. The direction and predicted magnitude of economic effects are indicated.

|                          | OCEAN COMMERCIAL<br>SALMON FISHING |               | SPORT FISHING FOR<br>ANADROMOUS FISH |                       | OTHER WATER-BASED<br>RECREATION ACTIVITIES<br>FOR RIVERS |                         | WATER-BASED<br>ACTIVITIES AT<br>RESERVIORS |                 | WILDLIFE-BASED<br>RECREATION ACTIVITIES |                   | TOTAL       |                 |
|--------------------------|------------------------------------|---------------|--------------------------------------|-----------------------|--|-------------------------|--|-----------------|---|-------------------|-------------|-----------------|
|                          | HARVEST<br>VALUES                  | NET<br>INCOME | SPNDG                                | NET<br>BENEFITS       | SPNDG  | NET<br>BENEFITS         | SPNDG                                      | NET<br>BENEFITS | SPNDG                                   | NET<br>BENEFITS   | SPNDG       | NET<br>BENEFITS |
| EXISTING<br>CONDITIONS   | NA                                 | NA            | \$119                                | \$39                  | \$102  | \$117                   | NA   | NA              | \$5                                     | \$3               | \$226       | \$159           |
| NO ACTION<br>ALTERNATIVE |                                    |               | \$220                                | \$70                  | \$170  | \$195                   |  |                 | \$10                                    | \$5               | \$400       | \$270           |
| ALTERNATIVE<br>1A        |                                    |               | Pos, MOD<br>\$231-\$240              | Pos, MOD<br>\$74-\$76 | Pos, SM<br>\$172-\$178                                   | Pos, SM<br>\$197-203    |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$414-\$430 | \$277-\$286     |
| ALTERNATIVE<br>1B        |                                    |               | Pos, MOD<br>\$231-\$240              | Pos, MOD<br>\$74-\$76 | Pos, MOD<br>\$178-186                                    | Pos, MOD<br>\$204-\$214 |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$420-\$436 | \$284-\$297     |
| ALTERNATIVE<br>1C        |                                    |               | Pos, MOD<br>\$231-\$240              | Pos, MOD<br>\$74-\$76 | Pos, MOD<br>\$178-186                                    | Pos, MOD<br>\$204-\$214 |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$420-\$436 | \$284-\$297     |
| ALTERNATIVE<br>2A        |                                    |               | Pos, SM<br>\$222-\$230               | Pos, SM<br>\$71-73    | Pos, MOD<br>\$178-186                                    | Pos, MOD<br>\$204-\$214 |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$411-\$428 | \$281-\$294     |
| ALTERNATIVE<br>2B        |                                    |               | Pos, SM<br>\$222-\$230               | Pos, SM<br>\$71-\$73  | Pos, MOD<br>\$178-186                                    | Pos, MOD<br>\$204-\$214 |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$411-\$428 | \$281-\$294     |
| ALTERNATIVE<br>2C        |                                    |               | Pos, MOD<br>\$231-\$240              | Pos, MOD<br>\$74-\$76 | Pos, MOD<br>\$178-186                                    | Pos, MOD<br>\$204-\$214 |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$420-\$436 | \$284-\$297     |
| ALTERNATIVE<br>2D        |                                    |               | Pos, MOD<br>\$231-\$240              | Pos, MOD<br>\$74-\$76 | Pos, MOD<br>\$178-186                                    | Pos, MOD<br>\$204-\$214 |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$420-\$436 | \$284-\$297     |
| ALTERNATIVE<br>2E        |                                    |               | Pos, MOD<br>\$231-\$240              | Pos, MOD<br>\$74-\$76 | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$429-\$456 | \$295-\$318     |
| ALTERNATIVE<br>3A/C      |                                    |               | Pos, LG<br>\$241-\$264               | Pos, LG<br>\$77-84    | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$439-\$480 | \$298-\$326     |
| ALTERNATIVE<br>3B/D      |                                    |               | Pos, LG<br>\$241-\$264               | Pos, LG<br>\$77-84    | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$439-\$480 | \$298-\$326     |
| ALTERNATIVE<br>3E        |                                    |               | Pos, LG<br>\$241-\$264               | Pos, LG<br>\$77-84    | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$439-\$480 | \$298-\$326     |
| ALTERNATIVE<br>3F        |                                    |               | Pos, LG<br>\$241-\$264               | Pos, LG<br>\$77-84    | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$439-\$480 | \$298-\$326     |
| ALTERNATIVE<br>3G        |                                    |               | Pos, LG<br>\$241-\$264               | Pos, LG<br>\$77-84    | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$439-\$480 | \$298-\$326     |
| ALTERNATIVE<br>3H        |                                    |               | Pos, LG<br>\$241-\$264               | Pos, LG<br>\$77-84    | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$439-\$480 | \$298-\$326     |
| ALTERNATIVE<br>3I        |                                    |               | Pos, LG<br>\$241-\$264               | Pos, LG<br>\$77-84    | Pos, LG<br>\$187-\$204                                   | Pos, LG<br>\$215-\$235  |  |                 | Pos, LG<br>\$11-12                      | Pos LG<br>\$6-\$7 | \$439-\$480 | \$298-\$326     |

(\$ IN MILLIONS)

TABLE 3. SUMMARY OF FISH, WILDLIFE, AND RECREATION ECONOMIC EFFECTS  
IN THE DELTA REGION

## Alternative 2

Potential impacts of the **Common Program** on fish, wildlife, and recreation economics would be similar to those described under Alternative 1.

The major difference between Alternatives 1 and 2 is in the **Storage and Conveyance Components**. Under Alternative 2A, no new water storage would occur. The conveyance modifications would result in effects on recreation spending and benefits similar to Alternative 1B.

Under Alternative 2B, some minor indirect effects on recreation spending and user benefits could result from development of surface storage upstream of the Delta on Sacramento River and San Joaquin River tributaries and south of the Delta off the aqueduct. The conveyance modifications would be the same as those under Alternative 2A. The overall effect of these enhancements on recreation spending and user benefits in the Delta Region is minor.

Under Alternative 2C, storage modification would include new in-Delta storage on Holland Tract, which could generate increased hunting recreation use, spending, and benefits within and near the Delta. The conveyance modifications, including the three isolated conveyance channels and three new intakes, would result in minor, if any, effect on recreation spending and benefits in the Delta Region.

Under Alternative 2D, storage modification would include surface storage off the aqueduct south of the Delta, but these enhancements are unlikely to affect recreation spending and user benefits in the Delta Region. The conveyance modifications include an intake at Hood, a floodway along the Mokelumne River, and South Delta modification. Habitat created as part of the conveyance modifications could generate new waterfowl hunting opportunities, resulting in increased spending and user benefits in the Delta Region.

Under Alternative 2E, storage modification would include surface storage upstream of the Delta on Sacramento River and San Joaquin River tributaries and off the aqueduct south of the Delta, but these enhancements are unlikely to affect recreation spending and user benefits in the Delta Region. The conveyance modifications include modifications near Tyler Island, a floodway along the Mokelumne River, and South Delta modification. Habitat created as part of these modifications could generate new waterfowl hunting opportunities, resulting in increased spending and user benefits in the Delta Region.

Table 3 shows the predicted effect of the Alternative 2 variations on the economic variables used to assess impacts on affected activities in the Delta Region. The direction and predicted magnitude of economic effects are indicated.

### Alternative 3

The impacts of the **Common Program** on fish, wildlife, and recreation economics would be similar to those described under Alternative 1.

The major difference between Alternatives 1 and 3 is in the **Storage and Conveyance Components**. Under Alternative 3A and 3C, no new water storage would occur. The conveyance modifications, including a 5,000 cubic feet per second (cfs) open channel and North Delta and South Delta modifications, would result in minor, if any, effects on recreation spending and user benefits in the Delta Region. The impact would depend on access to the new facilities.

Under Alternative 3B and 3D, surface storage facilities could be located in numerous locations, including on Sacramento River and San Joaquin River tributaries, off the aqueduct south of the Delta, and within the Delta. New reservoirs would generate increased spending near new reservoirs and recreational benefits for users of reservoirs. In-Delta storage could also generate waterfowl hunting opportunities and new spending related to increased hunting. The conveyance modifications would be similar to those under Alternative 3A, resulting in similar minor effects on recreation spending and user benefits.

Under Alternative 3E, storage options are the same as those under Alternative 3B, resulting in minor, indirect increases in recreational spending and benefits in the Delta Region. The conveyance modifications, including North Delta and South Delta modifications and an isolated conveyance facility, would result in minor, if any, effects on recreation spending and user benefits.

Under Alternative 3F, storage options include converting seven Delta islands to storage facilities, which could substantially increase waterfowl hunting and boating opportunities, generating increased spending and benefits within the Delta Region. The conveyance modifications, including North Delta and South Delta modifications, a Delta cross channel, island conveyance facilities, and new intake facilities, would result in minor, if any, effects on recreation spending and user benefits.

Under Alternative 3G, storage modification would include surface storage upstream of the Delta on Sacramento River and San Joaquin River tributaries and off the aqueduct south of the Delta, which could provide reservoir-related recreation opportunities and increased spending near possible new reservoirs. An in-Delta storage facility could also generate economic activity associated with new waterfowl hunting and other recreational opportunities. The conveyance modifications, including North Delta and South Delta

modifications and an isolated conveyance facility, would result in minor, if any, effect on recreation spending and user benefits.

Under Alternative 3H, storage modification would include surface storage upstream of the Delta on Sacramento River and San Joaquin River tributaries and off the aqueduct south of the Delta, but these enhancements are not expected to affect recreation spending and user benefits in the Delta Region. The conveyance modifications, including modifications near Tyler Island, a floodway along the Mokelumne River, and South Delta modifications, would result in a minor effect on recreation spending and user benefits because of new waterfowl hunting opportunities.

Under Alternative 3I, storage modification would include new in-Delta storage on Holland Tract, which could generate increased hunting recreation use, spending, and benefits within and near the Delta. Storage modifications could also include surface storage upstream of the Delta on Sacramento River and San Joaquin River tributaries and off the aqueduct south of the Delta, but these enhancements are expected to result in minor, if any, effects on recreation spending and user benefits in the Delta Region. The conveyance modifications, including three isolated conveyance channels, new intakes, and South Delta modifications, would result in a minor, if any, effect on recreation spending and user benefits.

Table 3 shows the predicted effect of the Alternative 3 variations on the economic variables used to assess impacts on affected activities in the Delta Region. The direction and predicted magnitude of economic effects are indicated.

## **Bay/California Coast Region**

### **Alternative 1**

The **Ecosystem Restoration Program** contains a number of programmatic actions that could improve spawning, rearing, and survival conditions for sport species, including Chinook salmon. Improved spawning, rearing, and survival conditions should lead to increased populations of sport fish in the Bay/California Coast Region. Larger populations could lead to increased recreational fishing, generating positive changes in recreational spending and benefits in the Bay Region.

While these actions could lead to larger ocean populations of Chinook salmon originating from the Central Valley river system, it is difficult to assess the extent of the economic benefit to the recreational fishing industry in the Bay/California Coast Region. Ocean populations are comprised of salmon originating from various systems along the Pacific

Coast, including Klamath and Snake River salmon whose populations are protected by catch restrictions. Because populations are intermingled, restrictions on the catch of Klamath and Snake River salmon can severely restrict the harvest of Central Valley Chinook salmon. Assuming commercial and recreational salmon harvest restrictions are eased in the future for protected stocks, increases in populations of Central Valley chinook would lead to substantially increased salmon catch levels, spending, and net benefits.

Elements of the **Water Quality Program** could result in improved fishery conditions, river recreation conditions, and wildlife refuge conditions in the Bay Region. Improved water quality in the Bay should lead to healthier anadromous fish populations and improved conditions for water-contact recreation in the Bay Region, resulting in increased spending and user benefits.

The **Water Use Efficiency Program** and the **Levee System Integrity Program** would have minor or indirect impacts in the Bay/California Coast Region.

Alternatives 1A and 1B do not include **Storage or Conveyance Components** other than the South Delta Modifications, which would have no effect on recreation spending and user benefits in the Bay Region.

Under Alternative 1C, reservoir recreation could be enhanced by the development of surface storage upstream of the Delta and off-aqueduct south of the Delta, but these storage enhancements are unlikely to affect recreation spending and user benefits in the Bay Region.

Table 4 shows the predicted effect of the Alternative 1 variations on the economic variables used to assess impacts on affected activities in the Bay/California Coast Region. The direction and predicted magnitude of economic effects are indicated.

## **Alternative 2**

The impacts of the **Common Program** on fish, wildlife, and recreation economics would be similar to those described under Alternative 1.

The major difference between Alternatives 1 and 2 is in the **Storage and Conveyance Components**. Under Alternative 2A, no new water storage would occur and conveyance modifications would likely have no effect on recreation spending and user benefits in the Bay Region.

Under Alternative 2B, storage modifications include new surface and groundwater storage throughout the watershed, and the conveyance modifications would be the same

|                       | OCEAN COMMERCIAL SALMON FISHING |                       | SPORT FISHING FOR ANADROMOUS FISH |                       | OTHER WATER-BASED RECREATION ACTIVITIES FOR RIVERS |              | WATER-BASED ACTIVITIES AT RESERVIORS |              | WILDLIFE-BASED RECREATION ACTIVITIES |              | TOTAL     |              |
|-----------------------|---------------------------------|-----------------------|-----------------------------------|-----------------------|--|--------------|--------------------------------------|--------------|--------------------------------------|--------------|-----------|--------------|
|                       | HARVEST VALUES                  | NET INCOME            | SPNDG                             | NET BENEFITS          | SPNDG  | NET BENEFITS | SPNDG                                | NET BENEFITS | SPNDG                                | NET BENEFITS | SPNDG     | NET BENEFITS |
| EXISTING CONDITIONS   | \$5                             | \$9                   | \$9                               | \$8                   | NA   | NA           | NA                                   | NA           | NA                                   | NA           | \$9       | \$8          |
| NO ACTION ALTERNATIVE | \$33                            | \$13                  | \$23                              | \$28                  |  |              |                                      |              |                                      |              | \$23      | \$28         |
| ALTERNATIVE 1A        | POS, MOD<br>\$35-\$36           | POS, MOD<br>\$15-\$16 | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$30-\$33 |  |              |                                      |              |                                      |              | \$24-\$25 | \$30-\$33    |
| ALTERNATIVE 1B        | POS, MOD<br>\$35-\$36           | POS, MOD<br>\$15-\$16 | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$30-\$33 |  |              |                                      |              |                                      |              | \$24-\$25 | \$30-\$33    |
| ALTERNATIVE 1C        | POS, MOD<br>\$35-\$36           | POS, MOD<br>\$15-\$16 | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$30-\$33 |  |              |                                      |              |                                      |              | \$24-\$25 | \$30-\$33    |
| ALTERNATIVE 2A        | POS, SM<br>\$33-\$34            | POS, SM<br>\$13-\$14  | POS, SM<br>\$23-\$24              | POS, SM<br>\$28-\$29  |  |              |                                      |              |                                      |              | \$23-\$24 | \$28-\$29    |
| ALTERNATIVE 2B        | POS, SM<br>\$33-\$34            | POS, SM<br>\$13-\$14  | POS, SM<br>\$23-\$24              | POS, SM<br>\$28-\$29  |  |              |                                      |              |                                      |              | \$23-\$24 | \$28-\$29    |
| ALTERNATIVE 2C        | POS, MOD<br>\$35-\$36           | POS, MOD<br>\$15-\$16 | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$30-\$33 |  |              |                                      |              |                                      |              | \$24-\$25 | \$30-\$33    |
| ALTERNATIVE 2D        | POS, MOD<br>\$35-\$36           | POS, MOD<br>\$15-\$16 | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$30-\$33 |  |              |                                      |              |                                      |              | \$24-\$25 | \$30-\$33    |
| ALTERNATIVE 2E        | POS, MOD<br>\$35-\$36           | POS, MOD<br>\$15-\$16 | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$30-\$33 |  |              |                                      |              |                                      |              | \$24-\$25 | \$30-\$33    |
| ALTERNATIVE 3A/C      | POS, LG<br>\$37-\$40            | POS, LG<br>\$17-\$19  | POS, LG<br>\$25-\$28              | POS, LG<br>\$33-\$36  |  |              |                                      |              |                                      |              | \$25-\$28 | \$33-\$36    |
| ALTERNATIVE 3B/D      | POS, LG<br>\$37-\$40            | POS, LG<br>\$17-\$19  | POS, LG<br>\$25-\$28              | POS, LG<br>\$33-\$36  |  |              |                                      |              |                                      |              | \$25-\$28 | \$33-\$36    |
| ALTERNATIVE 3E        | POS, LG<br>\$37-\$40            | POS, LG<br>\$17-\$19  | POS, LG<br>\$25-\$28              | POS, LG<br>\$33-\$36  |  |              |                                      |              |                                      |              | \$25-\$28 | \$33-\$36    |
| ALTERNATIVE 3F        | POS, LG<br>\$37-\$40            | POS, LG<br>\$17-\$19  | POS, LG<br>\$25-\$28              | POS, LG<br>\$33-\$36  |  |              |                                      |              |                                      |              | \$25-\$28 | \$33-\$36    |
| ALTERNATIVE 3G        | POS, LG<br>\$37-\$40            | POS, LG<br>\$17-\$19  | POS, LG<br>\$25-\$28              | POS, LG<br>\$33-\$36  |  |              |                                      |              |                                      |              | \$25-\$28 | \$33-\$36    |
| ALTERNATIVE 3H        | POS, LG<br>\$37-\$40            | POS, LG<br>\$17-\$19  | POS, LG<br>\$25-\$28              | POS, LG<br>\$33-\$36  |  |              |                                      |              |                                      |              | \$25-\$28 | \$33-\$36    |
| ALTERNATIVE 3I        | POS, LG<br>\$37-\$40            | POS, LG<br>\$17-\$19  | POS, LG<br>\$25-\$28              | POS, LG<br>\$33-\$36  |  |              |                                      |              |                                      |              | \$25-\$28 | \$33-\$36    |

(\$ IN MILLIONS)

TABLE 4. SUMMARY OF FISH, WILDLIFE, AND RECREATION ECONOMIC EFFECTS  
IN THE BAY/PACIFIC COAST REGION

as those under Alternative 2A. The overall effect of these enhancements is that recreation spending and user benefits in the Bay Region are unlikely to be affected.

Under Alternative 2C, storage modifications would include new in-Delta storage on Holland Tract, which could generate increased hunting recreation use, spending, and benefits in the adjacent Bay Region. The conveyance modifications, including the three isolated conveyance channels and three new intakes, would result in minor effects on recreation spending and user benefits in the Bay Region.

Under Alternative 2D and 2E, storage and conveyance modifications are unlikely to affect recreation spending and user benefits in the Bay Region.

Table 4 shows the predicted effect of the Alternative 2 variations on the economic variables used to assess impacts on affected activities in the Bay/California Coast Region. The direction and predicted magnitude of economic effects are indicated.

### Alternative 3

The impacts of the **Common Program** on fish, wildlife, and recreation economics would be similar to those described under Alternative 1.

The major difference between Alternatives 1 and 3 is in the **Storage and Conveyance Components**. Under Alternative 3A and 3C, no new water storage would occur. The conveyance modifications, including North Delta and South Delta modifications, would likely result in no effect on recreation spending and user benefits in the Bay Region.

Under Alternative 3B, 3D and 3D, surface storage facilities located on Sacramento River and San Joaquin River tributaries, off the aqueduct and south of the Delta, and within the Delta, and conveyance modifications would generate minor, if any, increases in spending in the Bay Region.

Under Alternative 3F, storage options include converting seven Delta islands to storage facilities, which could substantially increase waterfowl hunting and boating opportunities, generating increased spending and benefits to residents in the adjacent Bay Region.

Under Alternative 3G, an in-Delta storage facility could generate economic activity in the adjacent Bay Region associated with new waterfowl hunting opportunities. The conveyance modifications, including North Delta and South Delta modifications and an isolated conveyance facility, would likely have no effect on recreation spending and user benefits in the Bay Region.

Under Alternative 3H, storage modification would include surface storage upstream of the Delta on Sacramento River and San Joaquin River tributaries and off the aqueduct and south of the Delta, but these enhancements are not expected to affect recreation spending and user benefits in the Delta Region. The conveyance modifications including modifications near Tyler Island, a floodway along the Mokelumne River, and South Delta modifications, would likely result in no effect on recreation spending and benefits in the Bay Region.

Under Alternative 3I, storage modification would include new in-Delta storage on Holland Tract, which could generate increased hunting recreation use, spending, and benefits in the adjacent Bay Region. The conveyance modifications, including three isolated conveyance channels, new intakes, and South Delta modifications, would likely result in no effect on recreation spending and benefits.

Table 4 shows the predicted effect of the Alternative 3 variations on the economic variables used to assess impacts on affected activities in the Bay/California Coast Region. The direction and predicted magnitude of economic effects are indicated.

## Sacramento River Region

### Alternative 1

The **Ecosystem Restoration Program** contains a number of programmatic actions that could improve spawning, rearing, and survival conditions for sport species, including Chinook salmon. Improved spawning, rearing, and survival conditions should lead to increased populations of sport fish in the Sacramento River Region. Larger populations could lead to increased recreational fishing, generating positive changes in recreational spending and benefits in the Sacramento River Region.

While these actions could lead to larger ocean populations of Chinook salmon originating from the Central Valley river system, it is difficult to assess the extent of the economic benefit to the recreational fishing industry in the Sacramento River Region. Ocean populations are comprised of salmon originating from various systems along the Pacific Coast, including Klamath and Snake River salmon whose populations are protected by catch restrictions. Because populations are intermingled, restrictions on the catch of Klamath and Snake River salmon can severely restrict the harvest of Central Valley Chinook salmon. Assuming commercial and recreational salmon harvest restrictions are eased in the future for protected stocks, increases in ocean populations of Central Valley

Chinook would lead to substantially increased recreational salmon catch levels, spending, and net benefits in the Sacramento River Region.

The ERP would generate few, if any, economic benefits associated with water-based recreation activities along rivers and at reservoirs in the Sacramento River Region. Recreational use of wildlife refuges may increase if habitat restoration occurs in areas within existing wildlife refuges.

Elements of the **Water Quality Program** could result in improved fishery conditions, river recreation conditions, and wildlife refuge conditions throughout the Sacramento River Region. The economic benefits to the recreation fishing industries of improved water quality are difficult to judge; however, improved water quality in rivers and the Delta should lead to healthier anadromous fish populations and improved conditions for water-contact recreation. The Water Quality Program would not likely affect recreational use of reservoirs in the Sacramento River Region.

The **Water Use Efficiency Program** and the **Levee System Integrity Program** would have minor or indirect impacts in the Sacramento River Region.

Alternatives 1A and 1B do not include **Storage or Conveyance Components** other than the South Delta Modifications, which would have a minor, if any, effect on recreation spending and user benefits in the Sacramento River Region.

Under Alternative 1C, reservoir recreation could be enhanced by the development of surface storage upstream of the Delta; these storage enhancements would result in increased recreation spending and user benefits in the Sacramento River Region associated with new boating, swimming and fishing opportunities.

Table 5 shows the predicted effect of the Alternative 1 variations on the economic variables used to assess impacts on affected activities in the Sacramento River Region. The direction and predicted magnitude of economic effects are indicated.

## **Alternative 2**

The impacts of the **Common Program** on fish, wildlife, and recreation economics would be similar to those described under Alternative 1.

The major difference between Alternatives 1 and 2 is in the **Storage and Conveyance Components**. Under Alternative 2A, no new water storage would occur and conveyance

|                       | OCEAN COMMERCIAL SALMON FISHING |            | SPORT FISHING FOR ANADROMOUS FISH |                       | OTHER WATER-BASED RECREATION ACTIVITIES FOR RIVERS |              | WATER-BASED ACTIVITIES AT RESERVOIRS |                       | WILDLIFE-BASED RECREATION ACTIVITIES |                     | TOTAL       |              |
|-----------------------|---------------------------------|------------|-----------------------------------|-----------------------|--|--------------|--------------------------------------|-----------------------|--------------------------------------|---------------------|-------------|--------------|
|                       | HARVEST VALUES                  | NET INCOME | SPNDG                             | NET BENEFITS          | SPNDG  | NET BENEFITS | SPNDG                                | NET BENEFITS          | SPNDG                                | NET BENEFITS        | SPNDG       | NET BENEFITS |
| EXISTING CONDITIONS   | NA                              | NA         | \$12                              | \$5                   | NA   | NA           | \$62                                 | \$34                  | \$2                                  | \$2                 | \$76        | \$41         |
| NO ACTION ALTERNATIVE |                                 |            | \$22                              | \$10                  |  |              | \$103                                | \$56                  | \$4                                  | \$4                 | \$129       | \$70         |
| ALTERNATIVE 1A        |                                 |            | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$10-\$11 |  |              | POS, MOD<br>\$108-\$113              | POS, MOD<br>\$58-\$61 | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$136-\$143 | \$72-\$77    |
| ALTERNATIVE 1B        |                                 |            | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$10-\$11 |  |              | POS, MOD<br>\$108-\$113              | POS, MOD<br>\$58-\$61 | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$136-\$143 | \$72-\$77    |
| ALTERNATIVE 1C        |                                 |            | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$10-\$11 |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$142-\$155 | \$76-\$84    |
| ALTERNATIVE 2A        |                                 |            | POS, SM<br>\$23-\$24              | POS, SM<br>\$10M      |  |              | POS, MOD<br>\$108-\$113              | POS, MOD<br>\$58-\$61 | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$135-\$142 | \$72-\$76    |
| ALTERNATIVE 2B        |                                 |            | POS, SM<br>\$23-\$24              | POS, SM<br>\$10M      |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$141-\$154 | \$76-\$83    |
| ALTERNATIVE 2C        |                                 |            | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$10-\$11 |  |              | POS, MOD<br>\$108-\$113              | POS, MOD<br>\$58-\$61 | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$136-\$143 | \$72-\$76    |
| ALTERNATIVE 2D        |                                 |            | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$10-\$11 |  |              | POS, MOD<br>\$108-\$113              | POS, MOD<br>\$58-\$61 | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$136-\$143 | \$72-\$76    |
| ALTERNATIVE 2E        |                                 |            | POS, MOD<br>\$24-\$25             | POS, MOD<br>\$10-\$11 |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$142-\$155 | \$76-\$83    |
| ALTERNATIVE 3A/C      |                                 |            | POS, LG<br>\$25-\$27              | POS, LG<br>\$11-\$12  |  |              | POS, MOD<br>\$108-\$113              | POS, MOD<br>\$58-\$61 | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$137-\$145 | \$73-\$78    |
| ALTERNATIVE 3B/D      |                                 |            | POS, LG<br>\$25-\$27              | POS, LG<br>\$11-\$12  |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$143-\$157 | \$77-\$85    |
| ALTERNATIVE 3E        |                                 |            | POS, LG<br>\$25-\$27              | POS, LG<br>\$11-\$12  |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$143-\$157 | \$77-\$85    |
| ALTERNATIVE 3F        |                                 |            | POS, LG<br>\$25-\$27              | POS, LG<br>\$11-\$12  |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$143-\$157 | \$77-\$85    |
| ALTERNATIVE 3G        |                                 |            | POS, LG<br>\$25-\$27              | POS, LG<br>\$11-\$12  |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$143-\$157 | \$77-\$85    |
| ALTERNATIVE 3H        |                                 |            | POS, LG<br>\$25-\$27              | POS, LG<br>\$11-\$12  |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$143-\$157 | \$77-\$85    |
| ALTERNATIVE 3I        |                                 |            | POS, LG<br>\$25-\$27              | POS, LG<br>\$11-\$12  |  |              | POS, LG<br>\$114-\$125               | POS, LG<br>\$62-\$68  | POS, MOD<br>\$4-\$5                  | POS, MOD<br>\$4-\$5 | \$143-\$157 | \$77-\$85    |

(\$ IN MILLIONS)

TABLE 5. SUMMARY OF FISH, WILDLIFE, AND RECREATION ECONOMIC EFFECTS  
IN THE SACRAMENTO RIVER REGION

modifications would have a minor, if any, effect on recreation spending and user benefits in the Sacramento River Region.

Under Alternative 2B, reservoir recreation could be enhanced by the development of surface storage upstream of the Delta on Sacramento River. Impacts of this new storage on recreation spending and user benefits would be similar to Alternative 1C. The impact of the conveyance modifications would be the same as those under Alternative 2A. The overall effect of these enhancements is that recreation spending and user benefits in the Sacramento River Region would be moderately affected.

Under Alternative 2C, storage modification would include new in-Delta storage on Holland Tract, which could generate increased hunting recreation use, spending, and benefits in the adjacent Sacramento River Region.. The conveyance modifications, including the three isolated conveyance channels and three new intakes, would result in minor, if any, effect on recreation spending and user benefits.

Under Alternative 2D, storage modification would include surface storage off the aqueduct south of the Delta, but these enhancements would not affect recreation spending and user benefits in the Sacramento River Region. The conveyance modifications, including an intake at Hood, a floodway along the Mokelumne River, and South Delta modification, would likely have no effect on recreation spending and user benefits in the Sacramento River Region..

Under Alternative 2E, storage modification would include surface storage upstream of the Delta on Sacramento River tributaries. These enhancements are expected to moderately affect recreation spending and user benefits associated with reservoir activities in the Sacramento River Region.

Table 5 shows the predicted effect of the Alternative 2 variations on the economic variables used to assess impacts on affected activities in the Sacramento River Region. The direction and predicted magnitude of economic effects are indicated.

### Alternative 3

The impacts of the **Common Program** on fish, wildlife, and recreation economics would be similar to Alternative 1.

The major difference between Alternatives 1 and 3 is in the **Storage and Conveyance Components**. Under Alternative 3A and 3C, no new water storage would occur. The conveyance modifications, including North Delta and South Delta modifications, would

result in minor, if any, effects on recreation spending and user benefits in the Sacramento River Region.

Under Alternative 3B, 3D and 3E, surface storage facilities located on Sacramento River would generate large increases in spending and user benefits in the Sacramento River Region.

Under Alternative 3F, storage options include converting seven Delta islands to storage facilities, which could substantially increase waterfowl hunting and boating opportunities, generating minor increased spending and benefits to residents in the adjacent Sacramento River Region.

Under Alternative 3G, an in-Delta storage facility could generate minor economic activity in the adjacent Sacramento River Region associated with new waterfowl hunting opportunities. The conveyance modifications would likely have no effect on recreation spending and user benefits in the Sacramento River Region.

Under Alternative 3H, storage modification would include surface storage upstream of the Delta on the Sacramento River. These enhancements could be expected to substantially affect recreation spending and user benefits in the Sacramento River Region. The conveyance modifications would likely have no effect on recreation spending and benefits.

Under Alternative 3I, storage modification would include new in-Delta storage on Holland Tract, which could generate minor increases in recreation spending and benefits in the adjacent Sacramento River Region. The conveyance modifications would result in no effect on recreation spending and benefits.

Table 5 shows the predicted effect of the Alternative 3 variations on the economic variables used to assess impacts on affected activities in the Sacramento River Region. The direction and predicted magnitude of economic effects are indicated.

## **San Joaquin River Region**

### **Alternative 1**

The **Ecosystem Restoration Program** contains a number of programmatic actions that could improve spawning, rearing, and survival conditions for sport species, including Chinook salmon. Improved spawning, rearing, and survival conditions should lead to increased populations of sport fish in the San Joaquin River Region. Larger populations

could lead to increased recreational fishing, generating positive changes in recreational spending and benefits in the San Joaquin River Region.

While these actions could lead to larger ocean populations of Chinook salmon originating from the Central Valley river system, it is difficult to assess the extent of the economic benefit to the recreational fishing industry in the San Joaquin River Region. Ocean populations are comprised of salmon originating from various systems along the Pacific Coast, including Klamath and Snake River salmon whose populations are protected by catch restrictions. Because populations are intermingled, restrictions on the catch of Klamath and Snake River salmon can severely restrict the harvest of Central Valley Chinook salmon. Assuming commercial and recreational salmon harvest restrictions are eased in the future for protected stocks, increases in ocean populations of Central Valley Chinook would lead to substantially increased recreational salmon catch levels, spending, and net benefits in the San Joaquin River Region.

The ERP would generate few, if any, economic benefits associated with water-based recreation activities along rivers and at reservoirs in the San Joaquin River Region. Recreational use of wildlife refuges in the San Joaquin River Region may increase if habitat restoration occurs in areas within existing wildlife refuges.

Elements of the **Water Quality Program** could result in improved fishery conditions, river recreation conditions, and wildlife refuge conditions throughout the San Joaquin River Region. The economic benefits to the recreation salmon fishing industries of improved water quality are difficult to judge; however, improved water quality in rivers and the Delta should lead to healthier anadromous fish populations and improved conditions for water-contact recreation. The Water Quality Program would not likely affect recreational use of reservoirs.

The **Water Use Efficiency Program** and the **Levee System Integrity Program** would have minor or indirect impacts in the San Joaquin River Region.

Alternatives 1A and 1B do not include **Storage or Conveyance Components** other than the South Delta Modifications, which would have a minor, if any, effect on recreation spending and user benefits in the San Joaquin River Region.

Under Alternative 1C, reservoir recreation could be enhanced by the development of surface storage off the aqueduct south of the Delta, which would moderately affect recreation spending and user benefits in the San Joaquin River Region.

Table 6 shows the predicted effect of the Alternative 1 variations on the economic variables used to assess impacts on affected activities in the San Joaquin River Region. The direction and predicted magnitude of economic effects are indicated.

## Alternative 2

The impacts of the common program on fish, wildlife, and recreation economics would be similar to those described under Alternative 1.

The major difference between Alternatives 1 and 2 is in the **Storage and Conveyance Components**. Under Alternative 2A, no new water storage would occur and the conveyance modifications would have minor, if any, effect on recreation spending and user benefits in the San Joaquin River Region.

Under Alternative 2B, reservoir recreation could be enhanced by the development of surface storage on the San Joaquin River tributaries and south of the Delta off the aqueduct. The conveyance modifications would be the same as those under Alternative 2A. The overall effect of these enhancements is that recreation spending and user benefits in the San Joaquin River Region would be substantially affected.

Under Alternative 2C, storage modification would include new in-Delta storage on Holland Tract that could generate increased hunting recreation use, which, in combination with conveyance modifications, could have minor effects on recreation spending and user benefits in the San Joaquin River Region.

Under Alternative 2D, storage modification would include surface storage off the aqueduct and south of the Delta, which are likely to substantially affect recreation spending and user benefits in the San Joaquin River Region. The conveyance modifications, including an intake at Hood, a floodway along the Mokelumne River, and South Delta modification, would result in minor increases in recreation spending and user benefits associated with wildlife activities in the San Joaquin River Region.

Under Alternative 2E, storage modification would include surface storage off the aqueduct and south of the Delta. These enhancements, combined with conveyance modifications along the Mokelumne River and South Delta, would result in a minor increase in recreation spending and user benefits in the San Joaquin River Region.

Table 6 shows the predicted effect of the Alternative 2 variations on the economic variables used to assess impacts on affected activities in the San Joaquin River Region. The direction and predicted magnitude of economic effects are indicated.

|                       | OCEAN COMMERCIAL SALMON FISHING |            | SPORT FISHING FOR ANADROMOUS FISH |              | OTHER WATER-BASED RECREATION ACTIVITIES FOR RIVERS |                     | WATER-BASED ACTIVITIES AT RESERVOIRS |                       | WILDLIFE-BASED RECREATION ACTIVITIES |                    | TOTAL       |              |
|-----------------------|---------------------------------|------------|-----------------------------------|--------------|--|---------------------|--------------------------------------|-----------------------|--------------------------------------|--------------------|-------------|--------------|
|                       | HARVEST VALUES                  | NET INCOME | SPNDG                             | NET BENEFITS | SPNDG  | NET BENEFITS        | SPNDG                                | NET BENEFITS          | SPNDG                                | NET BENEFITS       | SPNDG       | NET BENEFITS |
| EXISTING CONDITIONS   | NA                              | NA         | NA                                | NA           | \$14   | \$11                | \$42                                 | \$25                  | \$4                                  | \$4                | \$60        | \$40         |
| NO ACTION ALTERNATIVE |                                 |            |                                   |              | \$25   | \$19                | \$70                                 | \$42                  | \$7                                  | \$7                | \$102       | \$68         |
| ALTERNATIVE 1A        |                                 |            |                                   |              | POS, SM<br>\$25-\$26                               | POS, SM<br>\$19-20  | POS, MOD<br>\$73-\$76                | POS, MOD<br>\$44-\$46 | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$105-\$110 | \$70-\$74    |
| ALTERNATIVE 1B        |                                 |            |                                   |              | POS, SM<br>\$25-\$26                               | POS, SM<br>\$19-20  | POS, MOD<br>\$73-\$76                | POS, MOD<br>\$44-\$46 | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$105-\$110 | \$70-\$74    |
| ALTERNATIVE 1C        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 2A        |                                 |            |                                   |              | POS, SM<br>\$25-\$26                               | POS, SM<br>\$19-20  | POS, MOD<br>\$73-\$76                | POS, MOD<br>\$44-\$46 | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$105-\$110 | \$70-\$74    |
| ALTERNATIVE 2B        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 2C        |                                 |            |                                   |              | POS, SM<br>\$25-\$26                               | POS, SM<br>\$19-20  | POS, MOD<br>\$73-\$76                | POS, MOD<br>\$44-\$46 | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$105-\$110 | \$70-\$74    |
| ALTERNATIVE 2D        |                                 |            |                                   |              | POS, SM<br>\$25-\$26                               | POS, SM<br>\$19-20  | POS, MOD<br>\$73-\$76                | POS, MOD<br>\$44-\$46 | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$105-\$110 | \$70-\$74    |
| ALTERNATIVE 2E        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 3A/C      |                                 |            |                                   |              | POS, SM<br>\$25-\$26                               | POS, SM<br>\$19-20  | POS, MOD<br>\$73-\$76                | POS, MOD<br>\$44-\$46 | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$105-\$110 | \$70-\$74    |
| ALTERNATIVE 3B/D      |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 3E        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 3F        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 3G        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 3H        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |
| ALTERNATIVE 3I        |                                 |            |                                   |              | POS, MOD<br>\$26-\$27                              | POS, MOD<br>\$20-21 | POS, LG<br>\$77-\$84                 | POS, LG<br>\$46-\$50  | POS, SM<br>\$7-\$8                   | POS, SM<br>\$7-\$8 | \$110-\$119 | \$73-\$79    |

(\$ IN MILLIONS)

TABLE 6. SUMMARY OF FISH, WILDLIFE, AND RECREATION ECONOMIC EFFECTS  
IN THE SAN JOAQUIN RIVER REGION

### Alternative 3

The impacts of the **Common Program** on fish, wildlife, and recreation economics would be similar to those described under Alternative 1.

The major difference between Alternatives 1 and 3 is in the **Storage and Conveyance Components**. Under Alternative 3A and 3C, no new water storage would occur. The conveyance modifications, including North Delta and South Delta modifications, would result in minor, if any, effects on recreation spending and user benefits in the San Joaquin River Region.

Under Alternative 3B, 3D and 3E, surface storage facilities located on tributaries to the San Joaquin River and off the aqueduct south of the Delta would generate substantial increases in spending and user benefits in the San Joaquin River Region.

Under Alternative 3F, storage options include converting seven Delta islands to storage facilities, which would substantially increase waterfowl hunting and boating opportunities in the Delta, would generate minor increases in spending and benefits to residents in the adjacent San Joaquin River Region.

Under Alternative 3G, an in-Delta storage facility could generate minor economic activity in the adjacent San Joaquin River Region associated with new waterfowl hunting opportunities. The conveyance modifications would likely have no effect on recreation spending and user benefits in the San Joaquin River Region.

Under Alternative 3H, storage modification would include surface storage on San Joaquin tributaries and off the aqueduct and south of the Delta. These enhancements could be expected to substantially affect recreation spending and user benefits in the San Joaquin River Region. The conveyance modifications would likely have no effect on recreation spending and benefits.

Under Alternative 3I, storage modification would include new in-Delta storage on Holland Tract, which could generate increased hunting use, spending, and benefits in the adjacent San Joaquin River Region. The conveyance modifications would likely result in no effect on recreation spending and benefits.

Table 6 shows the predicted effect of the Alternative 3 variations on the economic variables used to assess impacts on affected activities in the San Joaquin River Region. The direction and predicted magnitude of economic effects are indicated.

## SWP/CVP Service Area

### Alternative 1

The **Water Use Efficiency Program** is expected to increase yields of water deliveries, resulting in improved reservoir conditions that support recreation activities. This impact should generate more spending and user benefits at reservoirs in the SWP/CVP service area.

Elements of the **Water Quality Program** could result in improved reservoir conditions in the SWP/CVP service area. The economic benefits of improved water quality are higher quality recreation opportunities, resulting in greater spending and net benefits at reservoirs in the SWP/CVP service area.

The **Ecosystem Restoration Program** and the **Levee System Integrity Program** would have minor or indirect impacts in the SWP/CVP service area.

Alternatives 1A and 1B do not include **Storage or Conveyance Components** other than the South Delta Modifications, which would likely have no effect on recreation spending and user benefits in the SWP/CVP service area.

Under Alternative 1C, water deliveries would be increased resulting in improved conditions for reservoir recreation and associated increases in recreation spending and user benefits..

Table 7 shows the predicted effect of the Alternative 1 variations on the economic variables used to assess impacts on affected activities in the SWP/CVP service area. The direction and predicted magnitude of economic effects are indicated.

### Alternative 2

The major difference between Alternatives 1 and 2 is in the **Storage and Conveyance Components**.

Under Alternative 2 variations, water deliveries to urban areas would be increased, resulting in improved conditions for reservoir recreation and associated increases in recreation spending and user benefits.

|                       | OCEAN COMMERCIAL SALMON FISHING |            | SPORT FISHING FOR ANADROMOUS FISH |              | OTHER WATER-BASED RECREATION ACTIVITIES FOR RIVERS |              | WATER-BASED ACTIVITIES AT RESERVOIRS |                         | WILDLIFE-BASED RECREATION ACTIVITIES |              | TOTAL       |              |
|-----------------------|---------------------------------|------------|-----------------------------------|--------------|--|--------------|--------------------------------------|-------------------------|--------------------------------------|--------------|-------------|--------------|
|                       | HARVEST VALUES                  | NET INCOME | SPNDG                             | NET BENEFITS | SPNDG  | NET BENEFITS | SPNDG                                | NET BENEFITS            | SPNDG                                | NET BENEFITS | SPNDG       | NET BENEFITS |
| EXISTING CONDITIONS   | NA                              | NA         | NA                                | NA           | NA   | NA           | \$132                                | \$122                   | NA                                   | NA           | \$132       | \$122        |
| NO ACTION ALTERNATIVE |                                 |            |                                   |              |  |              | \$193                                | \$178                   |                                      |              | \$193       | \$178        |
| ALTERNATIVE 1A        |                                 |            |                                   |              |  |              | Pos, MOD<br>\$203-\$212              | Pos, MOD<br>\$187-\$196 |                                      |              | \$203-\$212 | \$187-\$196  |
| ALTERNATIVE 1B        |                                 |            |                                   |              |  |              | Pos, MOD<br>\$203-\$212              | Pos, MOD<br>\$187-\$196 |                                      |              | \$203-\$212 | \$187-\$196  |
| ALTERNATIVE 1C        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 2A        |                                 |            |                                   |              |  |              | Pos, MOD<br>\$203-\$212              | Pos, MOD<br>\$187-\$196 |                                      |              | \$203-\$212 | \$187-\$196  |
| ALTERNATIVE 2B        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 2C        |                                 |            |                                   |              |  |              | Pos, MOD<br>\$203-\$212              | Pos, MOD<br>\$187-\$196 |                                      |              | \$203-\$212 | \$187-\$196  |
| ALTERNATIVE 2D        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 2E        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 3A/C      |                                 |            |                                   |              |  |              | Pos, MOD<br>\$203-\$212              | Pos, MOD<br>\$187-\$196 |                                      |              | \$203-\$212 | \$187-\$196  |
| ALTERNATIVE 3B/D      |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 3E        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 3F        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 3G        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 3H        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |
| ALTERNATIVE 3I        |                                 |            |                                   |              |  |              | Pos, SM<br>\$195-\$202               | Pos, SM<br>\$180-\$186  |                                      |              | \$195-\$202 | \$180-\$186  |

(\$ IN MILLIONS)

TABLE 7. SUMMARY OF FISH, WILDLIFE, AND RECREATION ECONOMIC EFFECTS IN THE SWP/CVP SERVICE AREA

Table 7 shows the predicted effect of the Alternative 2 variations on the economic variables used to assess impacts on affected activities in the SWP/CVP service area. The direction and predicted magnitude of economic effects are indicated.

### **Alternative 3**

The major difference between Alternatives 1 and 3 is in the **Storage and Conveyance Components**.

Under Alternative 3 variations, water deliveries to urban areas would be increased, resulting in improved conditions for reservoir recreation and associated increases in recreation spending and user benefits.

Table 7 shows the predicted effect of the Alternative 3 variations on the economic variables used to assess impacts on affected activities in the SWP/CVP service area. The direction and predicted magnitude of economic effects are indicated.

#### **5.1.3 Summary of Comparisons by Region**

Table 8 shows a comparison of impacts by region. As shown, all impacts are positive.

Effects on recreation spending and user benefits are the largest in regions where several recreation-related activities would be impacted. Effects are generally highest in the Delta Region (increases of \$14-80 million annually) where the existing recreation industry is sizeable (1995 spending estimated at \$226 million). Effects are the smallest in the Bay/Pacific Coast Region (\$3-12 million annually) and SWP/CVP service area (\$2-19 million annually) where only one or two activities would be impacted

## **6.0 RELATED TOPICS**

The assessment of impacts on fish, wildlife, and recreation economics is closely linked to several other resource topics. Potential changes in river flows, reservoir levels, and deliveries to wildlife refuges are described in the Water Management Facilities and Operations Technical Report. Impacts on fisheries resources are described in the Fisheries Environmental Impact Technical Report. Impacts on bird populations are described in the

|                       | DELTA REGION |              | BAY/PACIFIC REGION |              |                           |                        | SACRAMENTO RIVER REGION |              | SAN JOAQUIN RIVER REGION |              | SWP/CVP SERVICE AREA |              |
|-----------------------|--------------|--------------|--------------------|--------------|---------------------------|------------------------|-------------------------|--------------|--------------------------|--------------|----------------------|--------------|
|                       | REC SPENDING | REC BENEFITS | REC SPENDING       | REC BENEFITS | COMM SALMON HARVEST VALUE | COMM SALMON NET INCOME | REC SPENDING            | REC BENEFITS | REC SPENDING             | REC BENEFITS | REC SPENDING         | REC BENEFITS |
| EXISTING CONDITIONS   | \$226        | \$159        | \$9                | \$8          | \$5                       | \$9                    | \$76                    | \$41         | \$60                     | \$40         | \$132                | \$122        |
| NO ACTION ALTERNATIVE | \$400        | \$270        | \$23               | \$28         | \$33                      | \$13                   | \$129                   | \$70         | \$102                    | \$68         | \$193                | \$178        |
| ALTERNATIVE 1A        | \$414-\$430  | \$277-\$286  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$77    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 1B        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$77    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 1C        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$142-\$155             | \$76-\$84    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 2A        | \$411-\$428  | \$281-\$294  | \$23-\$24          | \$28-\$29    | \$33-\$34                 | \$13-\$14              | \$135-\$142             | \$72-\$76    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 2B        | \$411-\$428  | \$281-\$294  | \$23-\$24          | \$28-\$29    | \$33-\$34                 | \$13-\$14              | \$141-\$154             | \$76-\$83    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 2C        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$76    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 2D        | \$420-\$436  | \$284-\$297  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$136-\$143             | \$72-\$76    | \$105-\$110              | \$70-\$74    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 2E        | \$429-\$456  | \$295-\$318  | \$24-\$25          | \$30-\$33    | \$35-\$36                 | \$15-\$16              | \$142-\$155             | \$76-\$83    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3A/C      | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$137-\$145             | \$73-\$78    | \$105-\$110              | \$70-\$74    | \$203-\$212          | \$187-\$196  |
| ALTERNATIVE 3B/D      | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3E        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3F        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3G        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3H        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |
| ALTERNATIVE 3I        | \$439-\$480  | \$298-\$326  | \$25-\$28          | \$33-\$36    | \$37-\$40                 | \$17-\$19              | \$143-\$157             | \$77-\$85    | \$110-\$119              | \$73-\$79    | \$195-\$202          | \$180-\$186  |

(\$ IN MILLIONS)

TABLE 8. SUMMARY OF FISH, WILDLIFE, AND RECREATION ECONOMIC EFFECTS BY REGION

Vegetation and Wildlife Environmental Impacts Technical Report. Impacts on recreation resources are described in the Recreation Environmental Impacts Technical Report.

## 7.0 REFERENCES

ATTACHMENT A

TABLE A-1. POTENTIAL CHANGES IN ANADROMOUS FISH ABUNDANCE, BY ALTERNATIVE

| WEIGHTING FACTOR | ACTIONS AND EFFECTS            | IMPACTS OF ALTERNATIVES AND VARIATIONS |          |          |          |          |          |          |          |           |           |           |           |           |           |           |
|------------------|--------------------------------|--|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                  |                                | 1A                                     | 1B       | 1C       | 2A       | 2B       | 2C       | 2D       | 2E       | 3A<br>3C  | 3B<br>3D  | 3E        | 3F        | 3G        | 3H        | 3I        |
| 5                | COMMON PROGRAMS                | +                                      | +        | +        | +        | +        | +        | +        | +        | +         | +         | +         | +         | +         | +         | +         |
| 3                | ADDITIONAL HABITAT RESTORATION |  |          |          |          |          |          | +        | +        |           |           |           |           |           |           |           |
| 2                | INCREASED QWEST                |  |          |          | +        | +        |          | +        | +        | +         | +         | +         | +         | +         | +         | +         |
| 1                | HABITAT LOSS                   |  |          |          | -        | -        |          | -        |          |           |           |           |           | -         |           |           |
| 1                | REDUCED SACRAMENTO RIVER FLOW  |  |          |          | -        | -        |          | -        | -        | -         | -         | -         | -         | -         | -         | -         |
| 1                | ADULT MIGRATION DELAY          |  |          |          | -        | -        |          | -        |          |           |           |           |           |           |           |           |
| 3                | NATURAL FLOW DIRECTION         |  |          |          | -        | -        |          | -        | -        | +         | +         | +         | +         | +         | +         | +         |
| 3                | INCREASED PRODUCTIVITY         |  |          |          |          |          |          |          |          | +         | +         | +         | +         | +         | +         | +         |
| 3                | CHANGE IN ENTRAINMENT          |  |          |          |          |          |          |          |          | +         | +         | +         | +         | +         | +         | +         |
|                  | WEIGHTED EFFECT                | 5<br>(M)                               | 5<br>(M) | 5<br>(M) | 1<br>(S) | 1<br>(S) | 5<br>(M) | 4<br>(M) | 6<br>(M) | 15<br>(L) | 15<br>(L) | 15<br>(L) | 15<br>(L) | 14<br>(L) | 18<br>(L) | 15<br>(L) |

Each + and - has a value of 1 and is weighted by the weighting factor. S=Small; M=Moderate; L=Large

TABLE A-2. POTENTIAL CHANGES IN BIRD ABUNDANCE, BY REGION

| WEIGHTING FACTOR <sup>1</sup> | SPECIES TYPE      | POTENTIAL CHANGE IN BIRD ABUNDANCE<br>REGION |                   |                  |                   |                      |
|-------------------------------|-------------------|--|-------------------|------------------|-------------------|----------------------|
|                               |                   | DELTA  | BAY               | SACRAMENTO RIVER | SAN JOAQUIN RIVER | CVP/SWP SERVICE AREA |
| 3                             | WATERFOWL         | ++++   | ++                | +                | +                 | +                    |
| 1.5                           | UPLAND GAME BIRDS | -  | +                 | ++               | +                 | +                    |
| 1                             | RIPARIAN BIRDS    | +  | +                 | +++              | +                 | +                    |
| OVERALL EFFECT <sup>2</sup>   |                   | 11.5<br>(LARGE)                              | 8.5<br>(MODERATE) | 9<br>(MODERATE)  | 5.5<br>(SMALL)    | 5.5<br>(SMALL)       |

<sup>1</sup> – Composite weighting based on importance of species type for wildlife viewing and hunting.

<sup>2</sup> – Each + and – has a value of 1 and is weighted by the weighting factor.

TABLE A-3A. POTENTIAL CHANGES IN HYDROLOGY-RELATED OPPORTUNITIES FOR RECREATION, BY ALTERNATIVE (RIVER ACTIVITIES OTHER THAN SPORT FISHING: DELTA REGION)

| WEIGHTING FACTOR | ACTIONS AND EFFECTS        | IMPACTS OF ALTERNATIVES AND VARIATIONS |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
|------------------|----------------------------|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                  |                            | 1A                                     | AB       | 1C       | 2A       | 2B       | 2C       | 2D       | 2E       | 3A<br>3C | 3B<br>3D | 3E       | 3F       | 3G       | 3H       | 3I       |
| 1                | CONSTRUCTION IMPACTS       | --                                     | --       | --       | --       | --       | --       | --       | --       | --       | --       | --       | --       | --       | --       | --       |
| 3                | RIVER FLOWS                | +                                      | ++       | ++       | ++       | ++       | ++       | ++<br>+  | ++<br>+  | ++       | ++       | ++       | ++       | ++       | ++       | ++       |
| 3                | RESERVOIR STORAGE/CAPACITY |  |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| 1                | WATER QUALITY/CLARITY      | +                                      | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        |
|                  | WEIGHTED EFFECT            | 2<br>(S)                               | 5<br>(M) | 5<br>(M) | 5<br>(M) | 5<br>(M) | 4<br>(M) | 8<br>(L) | 8<br>(L) | 4<br>(M) | 5<br>(M) | 5<br>(M) | 5<br>(M) | 5<br>(M) | 5<br>(M) | 5<br>(M) |

Each + and - has a value of 1 and is weighted by the weighting factor and summed.  
 (S)=Small; (M)=Moderate; (L)=Large

C-002032

**TABLE A-3B. POTENTIAL CHANGES IN HYDROLOGY-RELATED OPPORTUNITIES FOR RECREATION, BY ALTERNATIVE (RIVER ACTIVITIES OTHER THAN SPORT FISHING: SACRAMENTO RIVER REGION)**

| WEIGHTING FACTOR | ACTIONS AND EFFECTS        | IMPACTS OF ALTERNATIVES AND VARIATIONS |          |           |          |           |          |          |           |          |           |           |           |           |           |           |
|------------------|----------------------------|--|----------|-----------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                  |                            | 1A                                     | AB       | 1C        | 2A       | 2B        | 2C       | 2D       | 2E        | 3A<br>3C | 3B<br>3D  | 3E        | 3F        | 3G        | 3H        | 3I        |
| 1                | CONSTRUCTION IMPACTS       |  |          | -         |          | -         |          |          | -         |          | -         | -         | -         | -         | -         | -         |
| 3                | RIVER FLOWS                |  |          | -         |          | -         |          |          | -         |          | -         | -         | -         | -         | -         | -         |
| 3                | RESERVOIR STORAGE/CAPACITY |  |          | -         |          | -         |          |          | -         |          | -         | -         | -         | -         | -         | -         |
| 1                | WATER QUALITY/CLARITY      | +                                      | +        | +         | +        | +         | +        | +        | +         | +        | +         | +         | +         | +         | +         | +         |
|                  | WEIGHTED EFFECT            | 1<br>(S)                               | 1<br>(S) | -6<br>(M) | 1<br>(S) | -6<br>(M) | 1<br>(S) | 1<br>(S) | -6<br>(M) | 1<br>(S) | -6<br>(M) | -6<br>(M) | -6<br>(M) | -6<br>(M) | -6<br>(M) | -6<br>(M) |

Each + and - has a value of 1 and is weighted by the weighting factor and summed.  
 (S)=Small; (M)=Moderate; (L)=Large

C-002033

TABLE A-3C. POTENTIAL CHANGES IN HYDROLOGY-RELATED OPPORTUNITIES FOR RECREATION, BY ALTERNATIVE (RIVER ACTIVITIES OTHER THAN SPORT FISHING: SAN JOAQUIN RIVER REGION)

| WEIGHTING FACTOR | ACTIONS AND EFFECTS        | IMPACTS OF ALTERNATIVES AND VARIATIONS |          |           |          |           |          |          |           |          |           |           |           |           |           |           |
|------------------|----------------------------|--|----------|-----------|----------|-----------|----------|----------|-----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
|                  |                            | 1A                                     | AB       | 1C        | 2A       | 2B        | 2C       | 2D       | 2E        | 3A<br>3C | 3B<br>3D  | 3E        | 3F        | 3G        | 3H        | 3I        |
| 1                | CONSTRUCTION IMPACTS       |  |          | -         |          | -         |          |          |           | -        |           | -         | -         | -         | -         | -         |
| 3                | RIVER FLOWS                |  |          | -         |          | -         |          |          |           | -        |           | -         | -         | -         | -         | -         |
| 3                | RESERVOIR STORAGE/CAPACITY |  |          | -         |          | -         |          |          |           | -        |           | -         | -         | -         | -         | -         |
| 1                | WATER QUALITY/CLARITY      | +                                      | +        | +         | +        | +         | +        | +        | +         | +        | +         | +         | +         | +         | +         | +         |
|                  | WEIGHTED EFFECT            | 1<br>(S)                               | 1<br>(S) | -6<br>(M) | 1<br>(S) | -6<br>(M) | 1<br>(S) | 1<br>(S) | -6<br>(M) | 1<br>(S) | -6<br>(M) | -6<br>(M) | -6<br>(M) | -6<br>(M) | -6<br>(M) | -6<br>(M) |

Each + and - has a value of 1 and is weighted by the weighting factor and summed.  
 (S)=Small; (M)=Moderate; (L)=Large

C-002034

TABLE A-3D. POTENTIAL CHANGES IN HYDROLOGY-RELATED OPPORTUNITIES FOR RECREATION, BY ALTERNATIVE  
(RESERVOIR ACTIVITIES: DELTA REGION)

| WEIGHTING FACTOR | ACTIONS AND EFFECTS        | IMPACTS OF ALTERNATIVES AND VARIATIONS |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
|------------------|----------------------------|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                  |                            | 1A                                     | AB       | 1C       | 2A       | 2B       | 2C       | 2D       | 2E       | 3A<br>3C | 3B<br>3D | 3E       | 3F       | 3G       | 3H       | 3I       |
| 1                | CONSTRUCTION IMPACTS       | -                                      | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        | -        |
| 3                | RIVER FLOWS                |  | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        |
| 3                | RESERVOIR STORAGE/CAPACITY | +                                      | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        |
| 1                | WATER QUALITY/CLARITY      | +                                      | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        |
|                  | WEIGHTED EFFECT            | 3<br>(S)                               | 6<br>(M) |

Each + and - has a value of 1 and is weighted by the weighting factor and summed.  
(S)=Small; (M)=Moderate; (L)=Large

TABLE A-3E. POTENTIAL CHANGES IN HYDROLOGY-RELATED OPPORTUNITIES FOR RECREATION, BY ALTERNATIVE (RESERVOIR ACTIVITIES: SACRAMENTO RIVER REGION)

| IMPACTS OF ALTERNATIVES AND VARIATIONS |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |    |
|--|----------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|
| WEIGHTING FACTOR                       | ACTIONS AND EFFECTS        | IMPACTS OF ALTERNATIVES AND VARIATIONS |       |       |       |       |       |       |       |       |       |       |       |       |       |       |    |
|  |                            | 1A                                     | AB    | 1C    | 2A    | 2B    | 2C    | 2D    | 2E    | 3A    | 3B    | 3D    | 3E    | 3F    | 3G    | 3H    | 3I |
| 1                                      | CONSTRUCTION IMPACTS       |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |    |
|  |                            | -                                      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -  |
| 3                                      | RIVER FLOWS                |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |    |
|  |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |    |
| 3                                      | RESERVOIR STORAGE/CAPACITY | ++                                     | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++ |
|  |                            | +                                      | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +  |
| 1                                      | WATER QUALITY/CLARITY      | +                                      | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +  |
|  |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |    |
|  | WEIGHTED EFFECT            | (M) 7                                  | (M) 7 | (L) 9 | (M) 7 | (L) 9 | (M) 7 | (L) 9 | (L) 9 | (M) 7 | (L) 9 |    |

Each + and - has a value of 1 and is weighted by the weighting factor and summed. (S)=Small; (M)=Moderate; (L)=Large

C-002036

C-002036

TABLE A-3F. POTENTIAL CHANGES IN HYDROLOGY-RELATED OPPORTUNITIES FOR RECREATION, BY ALTERNATIVE (RESERVOIR ACTIVITIES: SAN JOAQUIN RIVER REGION)

| IMPACTS OF ALTERNATIVES AND VARIATIONS |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|--|----------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| WEIGHTING FACTOR                       | ACTIONS AND EFFECTS        | IMPACTS OF ALTERNATIVES AND VARIATIONS |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|  |                            | 1A                                     | AB    | 1C    | 2A    | 2B    | 2C    | 2D    | 2E    | 3A    | 3B    | 3D    | 3E    | 3F    | 3G    | 3H    | 3I    |
| 1                                      | CONSTRUCTION IMPACTS       | -                                      | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     | -     |
|  |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 3                                      | RIVER FLOWS                |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|  |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 3                                      | RESERVOIR STORAGE/CAPACITY | ++                                     | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    | ++    |
|  |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 1                                      | WATER QUALITY/CLARITY      | +                                      | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     | +     |
|  |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|  | WEIGHTED EFFECT            | (M) 6                                  | (M) 6 | (L) 9 | (M) 7 | (L) 9 | (M) 6 | (L) 9 | (M) 6 | (L) 9 | (L) 9 |
|  |                            |  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |

Each + and - has a value of 1 and is weighted by the weighting factor and summed. (S)=Small; (M)=Moderate; (L)=Large

C-002037

C-002037

TABLE A-3G. POTENTIAL CHANGES IN HYDROLOGY-RELATED OPPORTUNITIES FOR RECREATION, BY ALTERNATIVE  
(RESERVOIR ACTIVITIES: SWP/CVP SERVICE AREA)

| WEIGHTING FACTOR | ACTIONS AND EFFECTS        | IMPACTS OF ALTERNATIVES AND VARIATIONS |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
|------------------|----------------------------|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
|                  |                            | 1A                                     | AB       | 1C       | 2A       | 2B       | 2C       | 2D       | 2E       | 3A<br>3C | 3B<br>3D | 3E       | 3F       | 3G       | 3H       | 3I       |
| 1                | CONSTRUCTION IMPACTS       |  |          | -        |          | -        |          | -        | -        |          | -        | -        | -        | -        | -        | -        |
| 3                | RIVER FLOWS                |  |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
| 3                | RESERVOIR STORAGE/CAPACITY | +                                      | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        |
| 1                | WATER QUALITY/CLARITY      | +                                      | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        | +        |
|                  | WEIGHTED EFFECT            | 4<br>(M)                               | 4<br>(M) | 3<br>(S) | 4<br>(M) | 3<br>(S) | 4<br>(M) | 3<br>(S) | 3<br>(S) | 4<br>(M) | 3<br>(S) | 3<br>(S) | 3<br>(S) | 3<br>(S) | 3<br>(S) | 3<br>(S) |

Each + and - has a value of 1 and is weighted by the weighting factor and summed.  
(S)=Small; (M)=Moderate; (L)=Large

C-002038

**TABLE A-4A. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(OCEAN COMMERCIAL SALMON FISHING: BAY/PACIFIC COAST REGION)**

| ALTERNATIVE | FISHERIES  | WILDLIFE | HYDROLOGY | OVERALL EFFECT |
|-------------|------------|----------|-----------|----------------|
| 1A          | POS, MOD   |          |           | POS, MOD       |
| 1B          | POS, MOD   |          |           | POS, MOD       |
| 1C          | POS, MOD   |          |           | POS, MOD       |
| 2A          | POS, SMALL |          |           | POS, SMALL     |
| 2B          | POS, SMALL |          |           | POS, SMALL     |
| 2C          | POS, MOD   |          |           | POS, MOD       |
| 2D          | POS, MOD   |          |           | POS, MOD       |
| 2E          | POS, MOD   |          |           | POS, MOD       |
| 3A/C        | POS, LARGE |          |           | POS, LARGE     |
| 3B/D        | POS, LARGE |          |           | POS, LARGE     |
| 3E          | POS, LARGE |          |           | POS, LARGE     |
| 3F          | POS, LARGE |          |           | POS, LARGE     |
| 3G          | POS, LARGE |          |           | POS, LARGE     |
| 3H          | POS, LARGE |          |           | POS, LARGE     |
| 3I          | POS, LARGE |          |           | POS, LARGE     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4B. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(SPORT FISHING FOR ANADROMOUS FISH: DELTA REGION)**

| ALTERNATIVE | FISHERIES  | WILDLIFE | HYDROLOGY | OVERALL EFFECT |
|-------------|------------|----------|-----------|----------------|
| 1A          | POS, MOD   |          |           | POS, MOD       |
| 1B          | POS, MOD   |          |           | POS, MOD       |
| 1C          | POS, MOD   |          |           | POS, MOD       |
| 2A          | POS, SMALL |          |           | POS, SMALL     |
| 2B          | POS, SMALL |          |           | POS, SMALL     |
| 2C          | POS, MOD   |          |           | POS, MOD       |
| 2D          | POS, MOD   |          |           | POS, MOD       |
| 2E          | POS, MOD   |          |           | POS, MOD       |
| 3A/C        | POS, LARGE |          |           | POS, LARGE     |
| 3B/D        | POS, LARGE |          |           | POS, LARGE     |
| 3E          | POS, LARGE |          |           | POS, LARGE     |
| 3F          | POS, LARGE |          |           | POS, LARGE     |
| 3G          | POS, LARGE |          |           | POS, LARGE     |
| 3H          | POS, LARGE |          |           | POS, LARGE     |
| 3I          | POS, LARGE |          |           | POS, LARGE     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4C. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(SPORT FISHING FOR ANADROMOUS FISH: BAY/PACIFIC COAST REGION)**

| ALTERNATIVE | FISHERIES  | WILDLIFE | HYDROLOGY | OVERALL EFFECT |
|-------------|------------|----------|-----------|----------------|
| 1A          | POS, MOD   |          |           | POS, MOD       |
| 1B          | POS, MOD   |          |           | POS, MOD       |
| 1C          | POS, MOD   |          |           | POS, MOD       |
| 2A          | POS, SMALL |          |           | POS, SMALL     |
| 2B          | POS, SMALL |          |           | POS, SMALL     |
| 2C          | POS, MOD   |          |           | POS, MOD       |
| 2D          | POS, MOD   |          |           | POS, MOD       |
| 2E          | POS, MOD   |          |           | POS, MOD       |
| 3A/C        | POS, LARGE |          |           | POS, LARGE     |
| 3B/D        | POS, LARGE |          |           | POS, LARGE     |
| 3E          | POS, LARGE |          |           | POS, LARGE     |
| 3F          | POS, LARGE |          |           | POS, LARGE     |
| 3G          | POS, LARGE |          |           | POS, LARGE     |
| 3H          | POS, LARGE |          |           | POS, LARGE     |
| 3I          | POS, LARGE |          |           | POS, LARGE     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4D. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(SPORT FISHING FOR ANADROMOUS FISH: SACRAMENTO RIVER REGION)**

| ALTERNATIVE | FISHERIES  | WILDLIFE | HYDROLOGY | OVERALL EFFECT |
|-------------|------------|----------|-----------|----------------|
| 1A          | POS, MOD   |          |           | POS, MOD       |
| 1B          | POS, MOD   |          |           | POS, MOD       |
| 1C          | POS, MOD   |          |           | POS, MOD       |
| 2A          | POS, SMALL |          |           | POS, SMALL     |
| 2B          | POS, SMALL |          |           | POS, SMALL     |
| 2C          | POS, MOD   |          |           | POS, MOD       |
| 2D          | POS, MOD   |          |           | POS, MOD       |
| 2E          | POS, MOD   |          |           | POS, MOD       |
| 3A/C        | POS, LARGE |          |           | POS, LARGE     |
| 3B/D        | POS, LARGE |          |           | POS, LARGE     |
| 3E          | POS, LARGE |          |           | POS, LARGE     |
| 3F          | POS, LARGE |          |           | POS, LARGE     |
| 3G          | POS, LARGE |          |           | POS, LARGE     |
| 3H          | POS, LARGE |          |           | POS, LARGE     |
| 3I          | POS, LARGE |          |           | POS, LARGE     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4E. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(SPORT FISHING FOR ANADROMOUS FISH: SAN JOAQUIN RIVER REGION)**

| ALTERNATIVE | FISHERIES  | WILDLIFE | HYDROLOGY | OVERALL EFFECT |
|-------------|------------|----------|-----------|----------------|
| 1A          | POS, MOD   |          |           | POS, MOD       |
| 1B          | POS, MOD   |          |           | POS, MOD       |
| 1C          | POS, MOD   |          |           | POS, MOD       |
| 2A          | POS, SMALL |          |           | POS, SMALL     |
| 2B          | POS, SMALL |          |           | POS, SMALL     |
| 2C          | POS, MOD   |          |           | POS, MOD       |
| 2D          | POS, MOD   |          |           | POS, MOD       |
| 2E          | POS, MOD   |          |           | POS, MOD       |
| 3A/C        | POS, LARGE |          |           | POS, LARGE     |
| 3B/D        | POS, LARGE |          |           | POS, LARGE     |
| 3E          | POS, LARGE |          |           | POS, LARGE     |
| 3F          | POS, LARGE |          |           | POS, LARGE     |
| 3G          | POS, LARGE |          |           | POS, LARGE     |
| 3H          | POS, LARGE |          |           | POS, LARGE     |
| 3I          | POS, LARGE |          |           | POS, LARGE     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

TABLE A-4F. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
 FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
 (RIVER ACTIVITIES OTHER THAN SPORT FISHING: DELTA REGION)

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY  | OVERALL EFFECT |
|-------------|-----------|----------|------------|----------------|
| 1A          |           |          | POS, SMALL | POS, SMALL     |
| 1B          |           |          | POS, MOD   | POS, MOD       |
| 1C          |           |          | POS, MOD   | POS, MOD       |
| 2A          |           |          | POS, MOD   | POS, MOD       |
| 2B          |           |          | POS, MOD   | POS, MOD       |
| 2C          |           |          | POS, MOD   | POS, MOD       |
| 2D          |           |          | POS, LARGE | POS, LARGE     |
| 2E          |           |          | POS, LARGE | POS, LARGE     |
| 3A/C        |           |          | POS, MOD   | POS, MOD       |
| 3B/D        |           |          | POS, MOD   | POS, MOD       |
| 3E          |           |          | POS, MOD   | POS, MOD       |
| 3F          |           |          | POS, MOD   | POS, MOD       |
| 3G          |           |          | POS, MOD   | POS, MOD       |
| 3H          |           |          | POS, MOD   | POS, MOD       |
| 3I          |           |          | POS, MOD   | POS, MOD       |

NOTES:

POS = POSITIVE IMPACT  
 NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
 MOD = MODERATE IMPACT  
 LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4G. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(RIVER ACTIVITIES OTHER THAN SPORT FISHING: SACRAMENTO RIVER REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY  | OVERALL EFFECT |
|-------------|-----------|----------|------------|----------------|
| 1A          |           |          | POS, SMALL | POS, SMALL     |
| 1B          |           |          | POS, SMALL | POS, SMALL     |
| 1C          |           |          | NEG, MOD   | NEG, MOD       |
| 2A          |           |          | POS, SMALL | POS, SMALL     |
| 2B          |           |          | NEG, MOD   | NEG, MOD       |
| 2C          |           |          | POS, SMALL | POS, SMALL     |
| 2D          |           |          | POS, SMALL | POS, SMALL     |
| 2E          |           |          | NEG, MOD   | NEG, MOD       |
| 3A/C        |           |          | POS, SMALL | POS, SMALL     |
| 3B/D        |           |          | NEG, MOD   | NEG, MOD       |
| 3E          |           |          | NEG, MOD   | NEG, MOD       |
| 3F          |           |          | NEG, MOD   | NEG, MOD       |
| 3G          |           |          | NEG, MOD   | NEG, MOD       |
| 3H          |           |          | NEG, MOD   | NEG, MOD       |
| 3I          |           |          | NEG, MOD   | NEG, MOD       |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4H. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(RIVER ACTIVITIES OTHER THAN SPORT FISHING: SAN JOAQUIN RIVER REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY  | OVERALL EFFECT |
|-------------|-----------|----------|------------|----------------|
| 1A          |           |          | POS, SMALL | POS, SMALL     |
| 1B          |           |          | POS, SMALL | POS, SMALL     |
| 1C          |           |          | NEG, MOD   | NEG, MOD       |
| 2A          |           |          | POS, SMALL | POS, SMALL     |
| 2B          |           |          | NEG, MOD   | NEG, MOD       |
| 2C          |           |          | POS, SMALL | POS, SMALL     |
| 2D          |           |          | POS, SMALL | POS, SMALL     |
| 2E          |           |          | NEG, MOD   | NEG, MOD       |
| 3A/C        |           |          | POS, SMALL | POS, SMALL     |
| 3B/D        |           |          | NEG, MOD   | NEG, MOD       |
| 3E          |           |          | NEG, MOD   | NEG, MOD       |
| 3F          |           |          | NEG, MOD   | NEG, MOD       |
| 3G          |           |          | NEG, MOD   | NEG, MOD       |
| 3H          |           |          | NEG, MOD   | NEG, MOD       |
| 3I          |           |          | NEG, MOD   | NEG, MOD       |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4I. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(RESERVOIR ACTIVITIES: DELTA REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY  | OVERALL EFFECT |
|-------------|-----------|----------|------------|----------------|
| 1A          |           |          | POS, SMALL | POS, SMALL     |
| 1B          |           |          | POS, MOD   | POS, MOD       |
| 1C          |           |          | POS, MOD   | POS, MOD       |
| 2A          |           |          | POS, MOD   | POS, MOD       |
| 2B          |           |          | POS, MOD   | POS, MOD       |
| 2C          |           |          | POS, MOD   | POS, MOD       |
| 2D          |           |          | POS, MOD   | POS, MOD       |
| 2E          |           |          | POS, MOD   | POS, MOD       |
| 3A/C        |           |          | POS, MOD   | POS, MOD       |
| 3B/D        |           |          | POS, MOD   | POS, MOD       |
| 3E          |           |          | POS, MOD   | POS, MOD       |
| 3F          |           |          | POS, MOD   | POS, MOD       |
| 3G          |           |          | POS, MOD   | POS, MOD       |
| 3H          |           |          | POS, MOD   | POS, MOD       |
| 3I          |           |          | POS, MOD   | POS, MOD       |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4J. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(RESERVOIR ACTIVITIES: SACRAMENTO RIVER REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY  | OVERALL EFFECT |
|-------------|-----------|----------|------------|----------------|
| 1A          |           |          | POS, MOD   | POS, MOD       |
| 1B          |           |          | POS, MOD   | POS, MOD       |
| 1C          |           |          | POS, LARGE | POS, LARGE     |
| 2A          |           |          | POS, MOD   | POS, MOD       |
| 2B          |           |          | POS, LARGE | POS, LARGE     |
| 2C          |           |          | POS, MOD   | POS, MOD       |
| 2D          |           |          | POS, MOD   | POS, MOD       |
| 2E          |           |          | POS, LARGE | POS, LARGE     |
| 3A/C        |           |          | POS, MOD   | POS, MOD       |
| 3B/D        |           |          | POS, LARGE | POS, LARGE     |
| 3E          |           |          | POS, LARGE | POS, LARGE     |
| 3F          |           |          | POS, LARGE | POS, LARGE     |
| 3G          |           |          | POS, LARGE | POS, LARGE     |
| 3H          |           |          | POS, LARGE | POS, LARGE     |
| 3I          |           |          | POS, LARGE | POS, LARGE     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4K. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(RESERVOIR ACTIVITIES: SAN JOAQUIN RIVER REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY  | OVERALL EFFECT |
|-------------|-----------|----------|------------|----------------|
| 1A          |           |          | POS, MOD   | POS, MOD       |
| 1B          |           |          | POS, MOD   | POS, MOD       |
| 1C          |           |          | POS, LARGE | POS, LARGE     |
| 2A          |           |          | POS, MOD   | POS, MOD       |
| 2B          |           |          | POS, LARGE | POS, LARGE     |
| 2C          |           |          | POS, MOD   | POS, MOD       |
| 2D          |           |          | POS, MOD   | POS, MOD       |
| 2E          |           |          | POS, LARGE | POS, LARGE     |
| 3A/C        |           |          | POS, MOD   | POS, MOD       |
| 3B/D        |           |          | POS, LARGE | POS, LARGE     |
| 3E          |           |          | POS, LARGE | POS, LARGE     |
| 3F          |           |          | POS, LARGE | POS, LARGE     |
| 3G          |           |          | POS, LARGE | POS, LARGE     |
| 3H          |           |          | POS, LARGE | POS, LARGE     |
| 3I          |           |          | POS, LARGE | POS, LARGE     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4L. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(RESERVOIR ACTIVITIES: SWP/CVP SERVICE AREA)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY  | OVERALL EFFECT |
|-------------|-----------|----------|------------|----------------|
| 1A          |           |          | POS, MOD   | POS, MOD       |
| 1B          |           |          | POS, MOD   | POS, MOD       |
| 1C          |           |          | POS, SMALL | POS, SMALL     |
| 2A          |           |          | POS, MOD   | POS, MOD       |
| 2B          |           |          | POS, SMALL | POS, SMALL     |
| 2C          |           |          | POS, MOD   | POS, MOD       |
| 2D          |           |          | POS, SMALL | POS, SMALL     |
| 2E          |           |          | POS, SMALL | POS, SMALL     |
| 3A/C        |           |          | POS, MOD   | POS, MOD       |
| 3B/D        |           |          | POS, LARGE | POS, LARGE     |
| 3E          |           |          | POS, SMALL | POS, SMALL     |
| 3F          |           |          | POS, SMALL | POS, SMALL     |
| 3G          |           |          | POS, SMALL | POS, SMALL     |
| 3H          |           |          | POS, SMALL | POS, SMALL     |
| 3I          |           |          | POS, SMALL | POS, SMALL     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

TABLE A-4M. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
 FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
 (WILDLIFE-RELATED RECREATION ACTIVITIES: DELTA REGION)

| ALTERNATIVE | FISHERIES | WILDLIFE   | HYDROLOGY | OVERALL EFFECT |
|-------------|-----------|------------|-----------|----------------|
| 1A          |           | POS, LARGE |           | POS, LARGE     |
| 1B          |           | POS, LARGE |           | POS, LARGE     |
| 1C          |           | POS, LARGE |           | POS, LARGE     |
| 2A          |           | POS, LARGE |           | POS, LARGE     |
| 2B          |           | POS, LARGE |           | POS, LARGE     |
| 2C          |           | POS, LARGE |           | POS, LARGE     |
| 2D          |           | POS, LARGE |           | POS, LARGE     |
| 2E          |           | POS, LARGE |           | POS, LARGE     |
| 3A/C        |           | POS, LARGE |           | POS, LARGE     |
| 3B/D        |           | POS, LARGE |           | POS, LARGE     |
| 3E          |           | POS, LARGE |           | POS, LARGE     |
| 3F          |           | POS, LARGE |           | POS, LARGE     |
| 3G          |           | POS, LARGE |           | POS, LARGE     |
| 3H          |           | POS, LARGE |           | POS, LARGE     |
| 3I          |           | POS, LARGE |           | POS, LARGE     |

NOTES:

POS = POSITIVE IMPACT  
 NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
 MOD = MODERATE IMPACT  
 LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4N. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(WILDLIFE-RELATED RECREATION ACTIVITIES: BAY/PACIFIC COAST REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY | OVERALL EFFECT |
|-------------|-----------|----------|-----------|----------------|
| 1A          |           | POS, MOD |           | POS, MOD       |
| 1B          |           | POS, MOD |           | POS, MOD       |
| 1C          |           | POS, MOD |           | POS, MOD       |
| 2A          |           | POS, MOD |           | POS, MOD       |
| 2B          |           | POS, MOD |           | POS, MOD       |
| 2C          |           | POS, MOD |           | POS, MOD       |
| 2D          |           | POS, MOD |           | POS, MOD       |
| 2E          |           | POS, MOD |           | POS, MOD       |
| 3A/C        |           | POS, MOD |           | POS, MOD       |
| 3B/D        |           | POS, MOD |           | POS, MOD       |
| 3E          |           | POS, MOD |           | POS, MOD       |
| 3F          |           | POS, MOD |           | POS, MOD       |
| 3G          |           | POS, MOD |           | POS, MOD       |
| 3H          |           | POS, MOD |           | POS, MOD       |
| 3I          |           | POS, MOD |           | POS, MOD       |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-40. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(WILDLIFE-RELATED RECREATION ACTIVITIES: SACRAMENTO RIVER REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE | HYDROLOGY | OVERALL EFFECT |
|-------------|-----------|----------|-----------|----------------|
| 1A          |           | POS, MOD |           | POS, MOD       |
| 1B          |           | POS, MOD |           | POS, MOD       |
| 1C          |           | POS, MOD |           | POS, MOD       |
| 2A          |           | POS, MOD |           | POS, MOD       |
| 2B          |           | POS, MOD |           | POS, MOD       |
| 2C          |           | POS, MOD |           | POS, MOD       |
| 2D          |           | POS, MOD |           | POS, MOD       |
| 2E          |           | POS, MOD |           | POS, MOD       |
| 3A/C        |           | POS, MOD |           | POS, MOD       |
| 3B/D        |           | POS, MOD |           | POS, MOD       |
| 3E          |           | POS, MOD |           | POS, MOD       |
| 3F          |           | POS, MOD |           | POS, MOD       |
| 3G          |           | POS, MOD |           | POS, MOD       |
| 3H          |           | POS, MOD |           | POS, MOD       |
| 3I          |           | POS, MOD |           | POS, MOD       |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4P. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(WILDLIFE-RELATED RECREATION ACTIVITIES: SAN JOAQUIN RIVER REGION)**

| ALTERNATIVE | FISHERIES | WILDLIFE   | HYDROLOGY | OVERALL EFFECT |
|-------------|-----------|------------|-----------|----------------|
| 1A          |           | POS, SMALL |           | POS, SMALL     |
| 1B          |           | POS, SMALL |           | POS, SMALL     |
| 1C          |           | POS, SMALL |           | POS, SMALL     |
| 2A          |           | POS, SMALL |           | POS, SMALL     |
| 2B          |           | POS, SMALL |           | POS, SMALL     |
| 2C          |           | POS, SMALL |           | POS, SMALL     |
| 2D          |           | POS, SMALL |           | POS, SMALL     |
| 2E          |           | POS, SMALL |           | POS, SMALL     |
| 3A/C        |           | POS, SMALL |           | POS, SMALL     |
| 3B/D        |           | POS, SMALL |           | POS, SMALL     |
| 3E          |           | POS, SMALL |           | POS, SMALL     |
| 3F          |           | POS, SMALL |           | POS, SMALL     |
| 3G          |           | POS, SMALL |           | POS, SMALL     |
| 3H          |           | POS, SMALL |           | POS, SMALL     |
| 3I          |           | POS, SMALL |           | POS, SMALL     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-4Q. EFFECT OF CHANGES IN RESOURCE CONDITIONS ON  
FISH, WILDLIFE, AND RECREATION ECONOMIC ACTIVITIES  
(WILDLIFE-RELATED RECREATION ACTIVITIES: SWP/CVP SERVICE AREA)**

| ALTERNATIVE | FISHERIES | WILDLIFE   | HYDROLOGY | OVERALL EFFECT |
|-------------|-----------|------------|-----------|----------------|
| 1A          |           | POS, SMALL |           | POS, SMALL     |
| 1B          |           | POS, SMALL |           | POS, SMALL     |
| 1C          |           | POS, SMALL |           | POS, SMALL     |
| 2A          |           | POS, SMALL |           | POS, SMALL     |
| 2B          |           | POS, SMALL |           | POS, SMALL     |
| 2C          |           | POS, SMALL |           | POS, SMALL     |
| 2D          |           | POS, SMALL |           | POS, SMALL     |
| 2E          |           | POS, SMALL |           | POS, SMALL     |
| 3A/C        |           | POS, SMALL |           | POS, SMALL     |
| 3B/D        |           | POS, SMALL |           | POS, SMALL     |
| 3E          |           | POS, SMALL |           | POS, SMALL     |
| 3F          |           | POS, SMALL |           | POS, SMALL     |
| 3G          |           | POS, SMALL |           | POS, SMALL     |
| 3H          |           | POS, SMALL |           | POS, SMALL     |
| 3I          |           | POS, SMALL |           | POS, SMALL     |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT

NC = NO CHANGE

**TABLE A-5A. CHANGES IN ECONOMIC ACTIVITY BY REGION  
(DELTA REGION)**

| ALTERNATIVE | OCEAN<br>COMMERCIAL<br>SALMON<br>FISHING | SPORT FISHING<br>FOR<br>ANADROMOUS<br>FISH | OTHER RIVER<br>ACTIVITIES | RESERVOIR<br>ACTIVITIES | WILDLIFE<br>RECREATION<br>ACTIVITES | OVERALL<br>EFFECT |
|-------------|--|--|---------------------------|-------------------------|-------------------------------------|-------------------|
| 1A          |  | POS, MOD                                   | POS, SMALL                | POS, SMALL              | POS, LARGE                          | POS, MOD          |
| 1B          |  | POS, MOD                                   | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, MOD          |
| 1C          |  | POS, MOD                                   | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, MOD          |
| 2A          |  | POS, SMALL                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, MOD          |
| 2B          |  | POS, SMALL                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, MOD          |
| 2C          |  | POS, MOD                                   | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, MOD          |
| 2D          |  | POS, MOD                                   | POS, LARGE                | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 2E          |  | POS, MOD                                   | POS, LARGE                | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 3A/C        |  | POS, LARGE                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 3B/D        |  | POS, LARGE                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 3E          |  | POS, LARGE                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 3F          |  | POS, LARGE                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 3G          |  | POS, LARGE                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 3H          |  | POS, LARGE                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, LARGE        |
| 3I          |  | POS, LARGE                                 | POS, MOD                  | POS, MOD                | POS, LARGE                          | POS, LARGE        |

NOTES:

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT  
NC = NO CHANGE

**TABLE A-5B. CHANGES IN ECONOMIC ACTIVITY BY REGION  
(BAY/PACIFIC COAST REGION)**

| ALTERNATIVE | OCEAN<br>COMMERCIAL<br>SALMON<br>FISHING | SPORT FISHING<br>FOR<br>ANADROMOUS<br>FISH | OTHER RIVER<br>ACTIVITIES | RESERVOIR<br>ACTIVITIES | WILDLIFE<br>RECREATION<br>ACTIVITIES | OVERALL<br>EFFECT |
|-------------|--|--|---------------------------|-------------------------|--------------------------------------|-------------------|
| 1A          | POS, MOD                                 | POS, MOD                                   |                           |                         | POS, MOD                             | POS, MOD          |
| 1B          | POS, MOD                                 | POS, MOD                                   |                           |                         | POS, MOD                             | POS, MOD          |
| 1C          | POS, MOD                                 | POS, MOD                                   |                           |                         | POS, MOD                             | POS, MOD          |
| 2A          | POS, SMALL                               | POS, SMALL                                 |                           |                         | POS, MOD                             | POS, SMALL        |
| 2B          | POS, SMALL                               | POS, SMALL                                 |                           |                         | POS, MOD                             | POS, SMALL        |
| 2C          | POS, MOD                                 | POS, MOD                                   |                           |                         | POS, MOD                             | POS, MOD          |
| 2D          | POS, MOD                                 | POS, MOD                                   |                           |                         | POS, MOD                             | POS, MOD          |
| 2E          | POS, MOD                                 | POS, MOD                                   |                           |                         | POS, MOD                             | POS, MOD          |
| 3A/C        | POS, LARGE                               | POS, LARGE                                 |                           |                         | POS, MOD                             | POS, LARGE        |
| 3B/D        | POS, LARGE                               | POS, LARGE                                 |                           |                         | POS, MOD                             | POS, LARGE        |
| 3E          | POS, LARGE                               | POS, LARGE                                 |                           |                         | POS, MOD                             | POS, LARGE        |
| 3F          | POS, LARGE                               | POS, LARGE                                 |                           |                         | POS, MOD                             | POS, LARGE        |
| 3G          | POS, LARGE                               | POS, LARGE                                 |                           |                         | POS, MOD                             | POS, LARGE        |
| 3H          | POS, LARGE                               | POS, LARGE                                 |                           |                         | POS, MOD                             | POS, LARGE        |
| 3I          | POS, LARGE                               | POS, LARGE                                 |                           |                         | POS, MOD                             | POS, LARGE        |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT  
NC = NO CHANGE

TABLE A-5D. CHANGES IN ECONOMIC ACTIVITY BY REGION  
(SAN JOAQUIN RIVER REGION)

| ALTERNATIVE | OCEAN<br>COMMERCIAL<br>SALMON<br>FISHING | SPORT FISHING<br>FOR<br>ANADROMOUS<br>FISH | OTHER RIVER<br>ACTIVITIES | RESERVOIR<br>ACTIVITIES | WILDLIFE<br>RECREATION<br>ACTIVITIES | OVERALL<br>EFFECT |
|-------------|--|--|---------------------------|-------------------------|--------------------------------------|-------------------|
| 1A          |  | POS, MOD                                   | POS, SMALL                | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 1B          |  | POS, MOD                                   | POS, SMALL                | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 1C          |  | POS, MOD                                   | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, SMALL        |
| 2A          |  | POS, SMALL                                 | POS, SMALL                | POS, MOD                | POS, SMALL                           | POS, SMALL        |
| 2B          |  | POS, SMALL                                 | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, SMALL        |
| 2C          |  | POS, MOD                                   | POS, SMALL                | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 2D          |  | POS, MOD                                   | POS, SMALL                | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 2E          |  | POS, MOD                                   | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, SMALL        |
| 3A/C        |  | POS, LARGE                                 | POS, SMALL                | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 3B/D        |  | POS, LARGE                                 | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, MOD          |
| 3E          |  | POS, LARGE                                 | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, MOD          |
| 3F          |  | POS, LARGE                                 | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, MOD          |
| 3G          |  | POS, LARGE                                 | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, MOD          |
| 3H          |  | POS, LARGE                                 | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, MOD          |
| 3I          |  | POS, LARGE                                 | POS, MOD                  | POS, LARGE              | POS, SMALL                           | POS, MOD          |

NOTES:

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT  
NC = NO CHANGE

TABLE A-5E. CHANGES IN ECONOMIC ACTIVITY BY REGION  
(SWP/CVP SERVICE AREA)

| ALTERNATIVE | OCEAN<br>COMMERCIAL<br>SALMON<br>FISHING | SPORT FISHING<br>FOR<br>ANADROMOUS<br>FISH | OTHER RIVER<br>ACTIVITIES | RESERVOIR<br>ACTIVITIES | WILDLIFE<br>RECREATION<br>ACTIVITIES | OVERALL<br>EFFECT |
|-------------|--|--|---------------------------|-------------------------|--------------------------------------|-------------------|
| 1A          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 1B          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 1C          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 2A          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 2B          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 2C          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 2D          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 2E          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3A/C        |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 3B/D        |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3E          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3F          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3G          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3H          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3I          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |

NOTES:

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT  
NC = NO CHANGE

**TABLE A-5E. CHANGES IN ECONOMIC ACTIVITY BY REGION  
(SWP/CVP SERVICE AREA)**

| ALTERNATIVE | OCEAN<br>COMMERCIAL<br>SALMON<br>FISHING | SPORT FISHING<br>FOR<br>ANADROMOUS<br>FISH | OTHER RIVER<br>ACTIVITIES | RESERVOIR<br>ACTIVITIES | WILDLIFE<br>RECREATION<br>ACTIVITIES | OVERALL<br>EFFECT |
|-------------|--|--|---------------------------|-------------------------|--------------------------------------|-------------------|
| 1A          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 1B          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 1C          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 2A          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 2B          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 2C          |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 2D          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 2E          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3A/C        |  |  |                           | POS, MOD                | POS, SMALL                           | POS, MOD          |
| 3B/D        |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3E          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3F          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3G          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3H          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |
| 3I          |  |  |                           | POS, SMALL              | POS, SMALL                           | POS, SMALL        |

**NOTES:**

POS = POSITIVE IMPACT  
NEG = NEGATIVE IMPACT

SMALL = SMALL IMPACT  
MOD = MODERATE IMPACT  
LARGE = LARGE IMPACT  
NC = NO CHANGE

TABLE A-6. RELATIVE IMPORTANCE OF ACTIVITIES TO REGIONAL ECONOMICS

| ACTIVITY                             | REGION |                   |                  |                   |                      |
|--------------------------------------|--------|-------------------|------------------|-------------------|----------------------|
|                                      | DELTA  | BAY/PACIFIC COAST | SACRAMENTO RIVER | SAN JOAQUIN RIVER | CVP/SWP SERVICE AREA |
| OCEAN COMMERCIAL SALMON FISHING      | NA     | H                 | NA               | NA                | NA                   |
| SPORT FISHING FOR ANADROMOUS SPECIES | H      | H                 | M                | L                 | L                    |
| OTHER RIVER ACTIVITIES               | H      | NA                | M                | M                 | L                    |
| RESERVOIR ACTIVITIES                 | NA     | NA                | H                | H                 | H                    |
| OTHER WILDLIFE-RELATED ACTIVITIES    | M      | M                 | L                | L                 | L                    |

NA = NOT APPLICABLE

H = HIGH

M = MODERATE

L = LOW

NOTE: Rating based on contribution relative to other activities in the region.

*Printed by  
Department of Water Resources  
Reprographics*

C - 0 0 2 0 6 2

C-002062