AUBURN-FOLSOM SOUTH UNIT
CENTRAL VALLEY PROJECT

TECHNICAL MEMORANDUM

Economic Benefits Update

Conducted by:

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

June 2006

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TECHNICAL MEMORANDUM
ECONOMIC BENEFIT UPDATE

AUBURN-FOLSOM SOUTH UNIT
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ABBREVIATIONS AND ACRONYMS

AF	Acre Foot
ASRA	Auburn State Recreation Area
AW	Applied Water
CALSIM II	California Water Resources Simulation Model
CFS	cubic feet per second
CVM	Contingent Valuation Method
CVP	Central Valley Project
CVPM	Central Valley Production Model
CWBS	Civil Works Breakdown Structure
DPR	California Department of Parks and Recreation
DWR	State of California Department of Water Resources
EAD	Expected Annual Damages
EM	Engineering Manual
ER	Engineering Regulation
ETAW	Evapotranspiration of Applied Water
FC	Flood Control
FLSRA	Folsom Lake State Recreation Area
GWh	gigawatt hour – 1 million kilowatt hours
HEC-FDA	Hydrologic Engineering Center's Flood Damage Analysis Software
KWH	Kilowatt hours
LCPSIM	Least Cost Planning Simulation Model
MMBTU	One million British thermal units
MSL	Mean sea level
M&I	Municipal and Industrial
MW	megawatt
O&M	Operations and Maintenance
P&G	Principles & Guidelines for Water & Related Land Resources Studies
PFP	Probable Failure Point
PG&E	Pacific Gas and Electric
PMF	Probable Maximum Flood
PMP	Positive Mathematical Programming
PNP	Probable Non-Failure Point
SAFCA	Sacramento Area Flood Control Agency
SIR	Supplemental Information Report
SRA	State Recreation Area
SWP	State Water Project
TAF	one thousand acre feet
TCM	Travel Cost Method
TM	Technical Memorandum
UDV	Unit Day Value
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WAPA	Western Area Power Administration

SECTION I
INTRODUCTION

BACKGROUND

The Auburn-Folsom South Unit was authorized in September 1965 by Public Law 89-161 as an operationally and financially integrated part of the Central Valley Project (CVP). Authorized features of the Auburn-Folsom South Unit include the following:

- Auburn Dam, Reservoir, and Powerplant on the North Fork of the American River
- Folsom South Canal
- Sugar Pine Dam, Reservoir, and conveyance
- County Line Dam, Reservoir, and conveyance

Congressional authorization of construction of the Auburn-Folsom South Unit was based upon approval of the feasibility report titled, Auburn-Folsom South Unit Supplemental Report, published by the Bureau of Reclamation in 1963. Construction on the Auburn-Folsom South Unit was initiated 1967. Sugar Pine Dam, Reservoir, and conveyance have been completed. Construction of the first two reaches of the Folsom South Canal, about 27 miles, was completed in 1973 but further construction has been suspended. Construction has not been initiated on the County Line Dam and associated features. Construction of the Auburn Dam portion of the Auburn-Folsom South Unit was deferred following an earthquake in 1975 near Oroville.

In Section 209 of the Energy and Water Development Appropriations Act of 2005, the Secretary of the Interior was directed to complete a Special Report to update the analysis of costs and associated benefits of the Auburn-Folsom South Unit. This Technical Memorandum has been developed as a technical appendix to the Special Report.

PURPOSE AND SCOPE

The primary purpose of this Technical Memorandum (TM) is to identify changes in environmental conditions and planning methods that would likely result in changes to the benefit values identified in previous analyses (principally the 1963 authorizing Feasibility Report and associated Economic Analysis Appendix) and to provide a preliminary estimate of potential project benefits under current conditions and price levels.

The benefit update will focus on benefits attributable to completion of Auburn Dam only. The other three elements of the Auburn-Folsom South Unit are not included in this update. The scope of this TM includes:

(1) Documenting economic benefits reported in prior Auburn-Folsom South Unit reports;

(2) Identifying significant changes that would impact the benefit updates for Auburn Dam;

(3) Defining the methodologies and modeling required to develop a preliminary estimate of potential current benefits; and

(4) Displaying the results of the analyses, discussing the level of detail, and discussing limitations of the methodologies applied.

ORGANIZATION OF TECHNICAL MEMORANDUM

This TM is organized into ten sections as follows:

- Section I: Introduction - Describes the background of the Auburn-Folsom South Unit, and the purpose and scope of this TM.
- Section II: Economic Benefits Cited in Prior Reports - Presents benefit estimates from various different agency reports regarding Auburn Dam and/or Auburn-Folsom South Unit.
- Section III: Updated Irrigation Benefits - Provides a discussion of past and current methodologies applied for estimating agricultural water supply benefits, including preliminary results and limitations of approach.
- Section IV: Updated M&I Benefits - Provides a discussion of past and current methodologies applied for estimating municipal and industrial water supply benefits, including preliminary results and limitations of approach.
- Section V: Updated Hydropower Benefits - Provides a discussion of past and current methodologies applied for determining hydroelectric power from Auburn Dam, including preliminary results and limitations of approach.
- Section VI: Updated Flood Control Benefits - Provides a discussion of past and current methodologies applied for determining flood damage reduction directly attributable to Auburn Dam, including preliminary results and limitations of approach.
- Section VII: Updated Recreation Benefits - Provides a discussion of past and current methodologies applied for estimating recreation benefits for both Auburn and Folsom State Recreation Areas, including preliminary results and limitations of approach.
- Section VIII: Updated Fish and Wildlife Benefits – Provides a discussion of past analysis of potential fish and wildlife benefits, including a discussion of the limitations of prior approaches and data needs to assess the potential for such benefits under current environmental conditions.
- Section IX: Summary of Preliminary Benefit Update
- Section X: References

SECTION II
ECONOMIC BENEFITS CITED IN PRIOR REPORTS

This section documents the benefits found in several of the prior reports on Auburn-Folsom South Unit. These reports include:

- Auburn Unit – A Report on the Feasibility of Water Supply Development, U.S. Bureau of Reclamation; January 1960.
- Folsom South Unit – A Report on the Feasibility of Water Supply Development, U.S. Bureau of Reclamation; January 1960
- Auburn-Folsom South Unit Supplemental Report, U.S. Bureau of Reclamation; 1963.
- Auburn Dam Report Bureau of Reclamation, July 1987
- US Army Corps of Engineers (USACE) Reports:
    - American River Watershed Investigation Feasibility Report; February 1992
    - American River Watershed Project Supplemental Information Report; March 1996

BUREAU OF RECLAMATION FEASIBILITY REPORTS 1960

Auburn Unit – A Report on the Feasibility of Water Supply Development, January 1960

In 1960, there were two separate Feasibility Reports with separable benefits attributable to (1) the Auburn Unit and (2) the Folsom South Unit. Benefits listed in the Auburn Unit document were for an Auburn Dam with a total capacity of 1,000,000 acre feet. The 1960 report credited the proposed Auburn Dam with providing an additional 265,000 acre feet of water for irrigation and municipal and industrial (M&I) purposes, adding 250,000 acre feet of flood control space to the 400,000 acre feet already provided at Folsom Dam, adding a 155,000 kilowatt powerplant, providing new recreational opportunities associated with Auburn Dam and Reservoir, and improving the existing recreation at Folsom Lake. Benefits estimated for the Auburn Unit (in 1958 price level) included:

- Irrigation Benefits: $3,078,000 annual equivalent
- Municipal and Industrial Water Supply Benefits: $1,757,300 annual equivalent
- Hydropower Benefits: $5,338,000 annual equivalent
- Flood Control Benefits: $375,000 annual equivalent
- Fish and Wildlife Benefits: no measurable benefit
- Recreation Benefits: $608,100 annual equivalent

- Other Benefits: Transportation $100,000 and Savings in Operation and Maintenance $10,000

Total annual equivalent benefits for the Auburn Dam in this 1960 report were $13,560,400 based on 100-year period of analysis discounted using a 2 ½% percent federal interest rate.

Folsom South Unit – A Report on the Feasibility of Water Supply Development, January 1960

This report states that the principal feature of this project was a 67.5 mile canal from Lake Natoma to Lone Tree Creek in San Joaquin County that could convey 852,000 acre feet to serve an area of about 500,000 acres in Sacramento and San Joaquin Counties. Benefits estimated for the Folsom South Unit (in 1958 price level) included:

- Irrigation Benefits: $21,791,000 annual equivalent
- Municipal and Industrial Benefits: $381,300 annual equivalent
- Hydropower Benefits Forgone: Project would reduce power available for sale $206,000 annual equivalent loss
- Flood Control Benefits: None
- Fish and Wildlife: $44,000 annual equivalent
- Recreation: None
- Irrigation Benefits Creditable to Storage: $518,800 of the irrigation benefits need to be deducted from Folsom South Unit as they are attributable to Folsom Reservoir

Total annual equivalent benefit, for the Folsom South Unit in this 1960 report, were $21,491,500 based on a 100-year period of analysis discounted using a 2 ½% federal interest rate. The two 1960 reports indicate that if combined, these two projects would have provided a total of $35,051,900 in annual equivalent benefits.

AUBURN-FOLSOM SOUTH UNIT SUPPLEMENTAL REPORT 1963

There were several changes in both project features and benefits in the 1963 Supplemental Report when compared to the 1960 feasibility study reports. In the 1963 Supplemental Report, the two projects were combined and benefits were not separated between the accomplishments of Auburn Dam and the Folsom South Unit. At the time of the 1963 Supplemental Report, projections regarding development and population growth in the Central Valley indicated that demand for M&I water service, recreation and fishery service, and electric power had increased significantly.

The 1963 report recommended an increase in reservoir capacity at Auburn to 2,500,000[1] acre feet and changes to the powerplant to provide additional power generation capacity. Sugar Pine and County Line Dams and Reservoirs were also added providing water benefits for the

[1]The 1963 Report recommended an increase from 1.0 MAF to 2.5 MAF at Auburn to meet demand. In the 1987 Report, the largest dam referenced was 2.326 MAF. All current benefits in this analysis were based 2.326 MAF.

Foresthill Divide ($853,000) and Folsom-Malby ($545,000) areas, respectively. The benefits listed in the 1963 report were the basis of the 3.71 to 1 benefit-cost ratio establishing federal feasibility for the Auburn-Folsom South Unit, as authorized in September 1965. The benefit categories from this report are summarized below (benefits presented in 1958 price level) and discussed in more detail in the following sections of this report.

Auburn-Folsom South Unit: Benefit Categories Included in the 1963 Report

- Irrigation Benefits: Benefits were based on increasing water deliveries over time, starting at a low of 71,000 acre feet in 1968 and reaching the maximum of 713,000 acre feet at full development in the year 1982. Irrigation benefits per acre foot were valued at $66.78 per acre foot, providing $47,617,000 total annual irrigation benefits under full development. Annual equivalents over the 100-year period of analysis from 1972-2072 using a discount rate of $2^{7}/_{8}$% provided $45,537,000 in irrigation benefits for Auburn Dam and Folsom South Unit combined. A portion of the irrigation water included in the benefit calculations would be made available from existing CVP facilities. A corresponding portion of the costs of these facilities were subtracted from the benefit total for Auburn-Folsom South Unit. These included equivalent annual capital costs of $207,000 and operation and maintenance of $11,000 for a total loss of $218,000 creditable benefit. This reduces the total irrigation benefits attributable to the Auburn-Folsom South Unit to $45,319,000.
- Municipal and Industrial Water Supply Benefits: M&I benefits were based on the construction cost of a single-purpose M&I project. A lower cost, smaller Folsom South Unit capable of delivering the M&I water supply portion (estimated at $9,474,000) and the Alder Creek Dam (estimated at $13,071,000) would be required to supply the single purpose 139,000 acre feet of M&I provided by the full multi-purpose Auburn Folsom South Unit project. Benefits for M&I were determined to be the costs avoided of constructing the single purpose project. The listed construction costs ($22,545,000) plus interest during construction and operation & maintenance were amortized of the 100-year period of analysis using a discount rate of $2^{7}/_{8}$% to derive an equivalent annual benefit for M&I at $879,000.
- Hydropower Benefits: Benefits were based on the construction and operation of a power plant with three 80,000 kilowatt turbines for a total capacity of 240 megawatts. Power benefits were estimated for the CVP with and without Auburn-Folsom South unit. Benefits were determined as a function of both dependable capacity and usable commercial energy. Dependable capacity was valued at $23.39 per kilowatt hour per year (based on annual equivalent cost of equivalent power plant) and usable commercial energy at 3.19 mills per kilowatt hour (based on costs of generation) or 0.319 cents per kilowatt hour. Usable energy was the estimated average annual generation minus project use requirements. Average annual generation was determined to decrease over time as more water was released for irrigation purposes. Usable energy also decreased as project use increased due to irrigation pumping. Annual equivalent benefits of commercial hydropower for the CVP with Auburn based on a 100-year period of analysis and a discount rate of $2^{7}/_{8}$% were determined to be $31,567,000. The benefits for the base CVP (without Auburn) were $25,021,000, with the difference of $6,546,000 representing the hydropower benefit of Auburn.

- Flood Control Benefits: At the time of the study, Folsom Dam had an allocation of 400,000 acre feet for flood control storage. The Auburn Dam would effectively add 250,000 additional acre feet of flood control storage for a total of 650,000 acre feet between the two reservoirs. Without the construction of Auburn Dam, the areas along the Lower American River had an estimated 1 in 200 chance of flooding in any year at the time of the study. USACE, using a 100-year period of analysis and a discount rate of $2^{7}/_{8}$%, had estimated the existing average annual flood damages at $487,000 without Auburn Dam. With the addition of Auburn, the area could withstand what the USACE referred to at the time as the 'standard project flood' and would reduce annual flood damage estimates to $112,000 providing $375,000 in average annual flood damage reduction benefits.
- Recreation Benefits: Benefits were derived from both the anticipated use of Auburn Reservoir and the increased visitation at Folsom Lake due to higher minimum pool levels. Recreation benefits were based primarily on the difference in visitor days under with- and without-project conditions over a 100-year period of analysis. Benefits included general water related recreation and camping. Values were set at $0.66 per day for general use under both with and without project conditions and $0.50 per day for camping. Identified increases in recreation benefits were a function of projected visitation, which was forty times greater with Auburn Dam (estimated at 2 million in 1962 and 5 million in 1985.) Folsom visitation was also projected to increase with Auburn Dam and benefits were estimated for the visitation attributable to the expanded Folsom storage. Recreation benefits for both reservoir areas were estimated to increase over time and these estimates were discounted over the 100-yr period of analysis at a discount rate of $2^{7}/_{8}$% to provide a total of $6,574,000 in benefits.
- Fish and Wildlife Benefits: A total of $478,000 annual equivalent benefits were estimated for the Auburn-Folsom South Unit based on a 100-year period of analysis and a discount rate of $2^{7}/_{8}$%. Values were provided at the time of the study by the Fish and Wildlife Service and represent improvements in upland game (quail and pheasant) and fishing at Auburn and Folsom Reservoirs and improved conditions downstream in the American River (Spring Run Salmon and Steelhead Trout.)
- Savings in Transportation Costs: Relocation of State Highway and Forest Hill Divide, both necessary as part of the Auburn Dam project, would reduce travel times. This savings was estimated to be $100,000
- Savings in Operation Costs: The North Fork Debris Dam on the American River would be inundated by Auburn and would be no longer needed. The savings in operation and maintenance was estimated at $10,000 per year.

Total annual equivalent benefits for the Auburn-Folsom South Unit in this 1963 report were $60,281,000 based on 100-year period of analysis discounted using $2^{7}/_{8}$% percent federal interest rate.

OTHER REPORTS –AUBURN DAM

Auburn Dam Report Bureau of Reclamation, July 1987

This report was primarily released in response to the floods of 1986, which tested the limits of the American River levees and the capacity of Folsom Reservoir. The 1987 report looked at five reservoir sizes at Auburn with the full-size 2,326,000 acre foot alternative the closest configuration to the dam authorized in 1965 but with different storage allocations to address changes in flood control and regulated minimum releases for the American River. Total annual equivalent benefits for the large multiple-purpose Auburn project were estimated at $211.7 million with $86.9 million for flood control, $53.1 million for M&I water, $67.4 million for power and $4.3 million for general recreation. All benefits were based on January 1987 prices and annualized based on an 8⅞% federal discount rate over a 100-year period of analysis and did include any irrigation uses in the water supply benefits.

US Army Corps of Engineers Reports 1991 and 1996

In both 1991 and 1996 USACE recommended various sized single-purpose flood damage reduction detention dams at Auburn as the most economically efficient alternatives to solve flooding problems along the Lower American River. The 1991 Feasibility report identified $118 million in flood damage reduction benefits directly attributable to 545,000 acre foot capacity flood detention facility near Auburn. In the 1996 Supplemental Information Report, it was estimated that $146 million in benefits were directly attributable to an 894,000 acre foot single-purpose flood damage reduction detention facility at Auburn. This project would provide increased flood protection for Sacramento from 1 in 100 chance under without project conditions to about a 1 in 625 chance of levee failure in any given year with the completion of the Auburn Detention Dam.

PREVIOUS DATA USED FOR BASIS OF BENEFITS UPDATE

Of the previous reports, the update of economic benefits for this Special Report focuses on the benefits as reported in the 1963 authorizing Supplemental Report and economic technical appendix. The 1965 Authorization of Auburn Dam was justified based on accomplishments and benefits as described in that report. These benefits are summarized by category in Table II-1.

TABLE II-1: BENEFITS ATTRIBUTABLE TO AUBURN DAM AND FOLSOM SOUTH UNIT 1963 REPORT

Benefit Category	Annual Equivalent Benefits (In $1,000's, 1958 Price Levels)
Irrigation[1]	45,319
Municipal &Industrial Water Supply	879
Hydropower	6,546
Flood Control	375
Recreation[2]	6,574
Fish & Wildlife	478
Savings in Transportation Costs	100
Savings in Operation Costs- North Fork Debris Dam	10
Total	60,281

[1]This irrigation estimate includes the gross irrigation of $45,537,000 minus the $218,000 attributable to existing CVP facilities. This $218,000 was listed as a separate benefit line item in the 1963 report.

[2]In the analyses documented in the 1963 Supplemental Report, annual operation, maintenance and repair costs of $1,167,000 were subtracted from the total benefits for a reported benefit estimate of $5,407,000. Under current procedures, these would be addressed as a project cost and not a reduction in benefit.

Benefits Updated by Price Level

The simplest approach for updating the benefits from the 1963 report would be to adjust benefits for the basic effects of inflation. The benefits found in the 1963 report could be updated for price level using common factors such as consumer or producer price indexes. It was determined that this method would lead to an unrealistic estimate of benefits that was not consistent with current conditions. Price level updates would not represent any changes in without project conditions, interest rates, assumptions, economic development, or design.

For example, limiting the benefit update to only price level factors would not account for population growth, changes in land use, changes in demand for water resources, technology, or other changes in the existing and future without project conditions. In the last forty years, significant changes have occurred which impact the possible accomplishments of the Auburn-Folsom South Unit as described in the 1963 report.

Of the benefit categories in Tables II-1, Irrigation, Municipal & Industrial Water Supply, Hydropower, Flood Control, Recreation, and Fish and Wildlife were evaluated in this update. Both savings in transportation costs and savings in O&M on the North Fork Debris Dam have been dropped from further analysis. These were the least significant categories, providing less

than 0.2 % of the total annual benefits. Traffic patterns in the area and a proposed alignment of Highway 49 have changed since the 1963 report. In addition, with debris capture at the North Fork Dam no longer a purpose, O&M benefits would need to be reformulated. Based on the minimal benefits, these two marginal categories are not included in the following sections.

Population Changes

Of particular interest for this preliminary benefits update are changes in the demands for water resources since the time of the conditions documented in the 1963 report. The biggest impact on demands for water resource use is population growth both in the state and local communities directly impacted by Auburn Dam. As noted in the 1963 Supplement Report, rapid population growth from the 1950's to the 1960's lead to reformulating and identification of a more optimally-sized Auburn Dam (from the smaller 1,000,000 acre foot dam described in the 1960 study to the 2,500,000 acre foot dam authorized in 1965.) Further growth from the 1960's to the present, has again created a shift in the needs for water resources and the various benefit categories. Table II-2 shows population growth from 1950 to 2005 for the State of California, the City of Sacramento, and several counties that would have received the most direct benefit from the 1965 authorized project. Based on number of persons per household, the population growth from 1960 to 2005 represents over 7 million new homes in California and nearly a half million in Sacramento and San Joaquin Counties combined. Table II-3 displays projected growth out to the year 2050.

Beneficial irrigation uses listed in the 1963 report were primarily tied to Sacramento and San Joaquin County due to high demand and conveyance provided by the Folsom South Unit. Statewide deliveries were limited to existing conveyance at the time. Current irrigation, M&I and hydropower demands are affected by growth throughout the state. Flood control benefits were derived primarily from the City of Sacramento with some inclusion of the Sacramento County areas. Recreation demand at both Folsom and Auburn is most affected by growth in the three counties of El Dorado, Placer and Sacramento. Further discussion of impacts beyond price level for each of the benefit categories will be found in Sections III through VIII of this TM.

TABLE II-2: POPULATION GROWTH FROM 1950 TO 2005

	1950	1960	1970	1980	1990	2000	2005
CALIFORNIA	10,586,223	15,717,204	19,971,069	23,667,764	29,760,021	33,871,648	36,132,147
Annual Rate of Change		4.8%	2.7%	1.9%	2.6%	1.4%	1.3%
SACRAMENTO CITY	137,572	191,667	257,105	275,741	369,365	407,018	454,330
Annual Rate of Change		3.9%	3.4%	0.7%	3.4%	1.0%	2.3%
PLACER COUNTY	41,649	56,998	77,632	117,247	172,796	248,399	317,028
Annual Rate of Change		3.7%	3.6%	5.1%	4.7%	4.4%	5.5%
EL DORADO COUNTY	16,207	29,390	43,833	85,812	125,995	156,299	176,841
Annual Rate of Change		8.1%	4.9%	9.6%	4.7%	2.4%	2.6%
SAN JOAQUIN COUNTY	200,750	249,989	291,073	347,342	480,628	563,598	664,116
Annual Rate of Change		2.5%	1.6%	1.9%	3.8%	1.7%	3.6%
SACRAMENTO COUNTY	277,140	502,778	634,373	783,381	1,041,219	1,223,499	1,363,482
Annual Rate of Change		8.1%	2.6%	2.3%	3.3%	1.8%	2.3%

Source: US Bureau of Census

TABLE II-3: PROJECTED POPULATION GROWTH TO 2050

	2010	2015	2020	2030	2040	2050
CALIFORNIA	39,246,767	41,570,908	43,851,741	48,110,671	51,538,596	54,777,700
Projected Annual Rate of Change		1.2 %	1.1 %	1.0 %	0.7 %	0.6 %
PLACER COUNTY	349,113	402,384	456,040	544,690	603,637	657,385
Projected Annual Rate of Change		3.1 %	2.7 %	1.9 %	1.1 %	0.9 %
EL DORADO COUNTY	188,471	205,077	221,289	250,173	266,788	282,331
Projected Annual Rate of Change		1.8 %	1.6 %	1.3 %	0.7 %	0.6 %
SAN JOAQUIN COUNTY	747,149	864,319	989,462	1,229,757	1,457,128	1,707,599
Projected Annual Rate of Change		3.1 %	2.9 %	2.4 %	1.8 %	1.7 %
SACRAMENTO COUNTY	1,555,848	1,749,024	1,946,679	2,293,028	2,579,720	2,858,427
Projected Annual Rate of Change		2.5 %	2.3 %	1.8 %	1.3 %	1.0 %

Source: California Department of Finance, Demographic Research Unit, Population Projections by Race /Ethnicity for California and its Counties 2000-2050

SECTION III
UPDATED IRRIGATION BENEFITS

1963 EVALUATION METHODOLOGY FOR IRRIGATION BENEFITS

In the 1963 study, irrigation benefits were combined for both the Auburn Dam and Folsom South Unit. It was estimated that these two components combined would provide 713,000 acre feet per year at full development by 1982. Of this total, 365,000 af was to be supplied from storage at Auburn Reservoir with the remaining 348,000 af from Folsom Dam. Without the completion of the Folsom South Unit this total quantity could not be delivered. The criteria used in the 1963 study differed from the 1960 feasibility report as it called for the measurement of irrigation benefits at the midpoint of the analysis period, corresponding to the 713,000 acre feet full development level. Benefits were categorized as direct irrigation benefits, indirect irrigation benefits and general benefits associated with improvement in community facilities and services. All these benefits are related to the fact that with the project more land would be irrigated than under the without project conditions, including the transfer of existing dry farm acreage to irrigated farmland.

Direct benefits measured increases in farm family living allowance, payment capacity, and equity value. Direct benefits were calculated as the difference in net income (gross farm income minus total expenses) expected to result from the project. Indirect benefits measured increases in net income from processing, transporting and merchandizing of local produce gains and increases in sales of goods and services to local farmers. These indirect benefits were identified as differences between incomes under irrigation as opposed to the pre-project dry-farm conditions and assigned a percentage due to the project based on proportion of water supplied by the project and by land class. Then they were assigned an indirect benefit factor based on previous studies. General benefits were measured as increases in tax revenue for Sacramento and San Joaquin counties as a percent due to the project by land class.

As noted above, benefits from the 1963 study were not separated or distributed between Auburn Dam and the Folsom South Unit based on contribution. Auburn Dam alone would not be able to provide the irrigation benefits of 365,000 af without additional conveyance capabilities. Under full development, direct annual irrigation benefits were estimated at $30,129,000 and annual indirect and public benefits were estimated at $17,488,000. Adjusted for benefits attributable to existing CVP storage and amortized over the 100-year period of analysis at $2^{7}/_{8}$%, the Auburn Dam and Folsom South Unit combined were estimated to provide $45,319,000 in annual equivalent irrigation benefits.

CHANGES AFFECTING BENEFIT ESTIMATION

In the 1963 study, both Auburn Dam and the Folsom South Unit were combined in the benefit estimations. The increase in water storage at Auburn was intended to be delivered to new farms (converted from dry pasture to irrigated farmland) in Sacramento and San Joaquin counties

through the added conveyance of the Folsom South Canal. Completion of the Canal was halted in 1973, with less than 40% of the canal completed. In addition to the current limitations on direct conveyance to the proposed new farms discussed in the 1963 Supplemental Report, land uses in Sacramento and San Joaquin counties have changed dramatically since the 1960's. Current irrigation demand for these two counties has not been determined but may not be equivalent to the 713,000 acre feet as described in the 1963 report. Both counties have become more urbanized with farmlands actually going out of production with harvested land decreasing in both counties (over 25,000 less acres in Sacramento County from 1998 to 2004 and 21,000 less in San Joaquin from 1990 to 2002.)

In the 1963 report, irrigation benefits were attributable to the conversion of dry farming to intensified irrigated farming in Sacramento and San Joaquin Counties. Under current conditions, additional irrigation water made available from the construction of Auburn Dam would reduce costs and increase reliability of delivery for existing farms throughout the state and would not be limited to Sacramento and San Joaquin Counties. With the CVP and SWP providing conveyance, additional supply could be used throughout the state of California including agricultural uses south of the delta. Benefits for the current analysis are based on either reducing existing costs or increasing production based on comparing with and without project conditions by region and by crop type.

METHODOLOGY FOR PRELIMINARY UPDATE

Agricultural economic analysis of benefits from irrigation was performed for this preliminary benefits update. This analysis was based on estimated water deliveries from CALSIM II modeling studies. CALSIM is a generalized water resources simulation model for evaluating operational alternatives of large, complex river systems. CALSIM II[2] is the latest application of CALSIM to simulate SWP and CVP operations. The modeling studies specify deliveries in the 73 years of historical hydrology under the without project and with project scenarios. Year types were categorized as 'wet', 'average', and 'dry' with varying probabilities based on historical record. Water output was measured based on adjusted increased deliveries based on CALSIM II input.

Two with project scenarios were considered for the irrigation analysis. In Scenario 1 there is greater emphasis on increasing deliveries to agricultural regions. In Scenario 2 there is greater emphasis on increasing deliveries to Municipal and Industrial (M&I) regions. Increases in deliveries to irrigation with Auburn Dam are shown in Table III-1. These expected average deliveries are less than the quantities described in the 1963 study for several reasons. First, without the completion of the Folsom South Unit, conveyance to new uses is limited. The quantities listed are based on demand functions in CALSIM II. Shortages, in all but the driest years, are much less than the 365,000 acre feet described in the 1963 study.

[2] Further description of the CALSIM II modeling effort can be found in the Water Supply, Power, and Water Temperature Analysis Appendix of this Special Report.

TABLE III-1: AVERAGE INCREASES IN IRRIGATION DELIVERIES

CVPM Year Type	Scenario 1 (in acre feet)	Scenario 2 (in acre feet)
Wet	64,500	44,500
Average	166,200	102,600
Dry	318,300	201,100
Expected Average[1]	195,400	122,400

[1] *The Expected Average increase is a function of both the increase in af per water year type and the probability of occurrence.*

The Central Valley Production Model (CVPM) was used to estimate the irrigation benefits of Auburn Dam. The CVPM is a regional economic model of irrigated agricultural production that simulates the decisions of agricultural producers (farmers) in the Central Valley of California from Shasta/Redding area to Kern County Water Agency/Bakersfield area. The model includes 22 crop production regions in the Central Valley and 20 categories of crops. A map of the regions appears as Figure III-1. Descriptions of each of the regions and crop types are provided in Tables III-2 and III-3, respectively. The CVPM predicts cropping patterns, land use, net income, and water use within the Central Valley by considering land availability, water availability and cost, irrigation technology, market conditions, and production costs.

Economic theory suggests that economic decisions are based on marginal conditions, and that these differ from the average conditions. Positive Mathematical Programming (PMP) is a technique developed to incorporate both marginal and average conditions into an optimization model. In the conventional case of diminishing economic returns, productivity declines as output increases. Therefore, the marginal cost of producing another unit of crop increases as production increases and the marginal cost exceeds the average cost. The PMP technique uses this idea to reproduce the variety of crops observed in the data. Several possible or combined reasons for crop diversity are: diverse growing conditions that cause variation in production costs or yield; crop diversity to manage and reduce risk; and constraints in marketing or processing capacity.

CVPM assumes that the diversity of crop mix is caused by factors that can be represented as increasing marginal production cost for each crop at a regional level. For example, CVPM costs per acre increase for cotton farmers as they expand production onto more acreage. The PMP approach used in CVPM uses empirical information on acreage responses and shadow prices—implicit prices of resources—based on standard linear programming techniques and a calibration period data set. For this study the calibration period is 1998, 2000, and 2001. The acreage response coefficients and shadow prices are used to calculate parameters of a quadratic cost function that is consistent with economic theory. The calibrated model will then predict exactly the original calibration data set, and can be used to predict impacts of specified policy changes such as changes in water supplies.

The CVPM includes tradeoff functions, or isoquants, between water use and irrigation system cost. For purposes of the CVPM irrigation tradeoff functions, water use is defined as applied water (AW) divided by evapotranspiration of applied water (ETAW). This ratio is referred to as Relative AW, and is the inverse of the most commonly used measure of field-level irrigation efficiency. Because ETAW varies regionally, using the ratio of AW to ETAW in the estimation allows the parameters of the tradeoff functions to be more site independent.

In the CVPM, both applied water and irrigation system cost are decision variables. Profit maximizing (or cost minimizing) conditions require that the ratio of water price to irrigation technology price be equal to the ratio of the marginal products of water and irrigation technology.

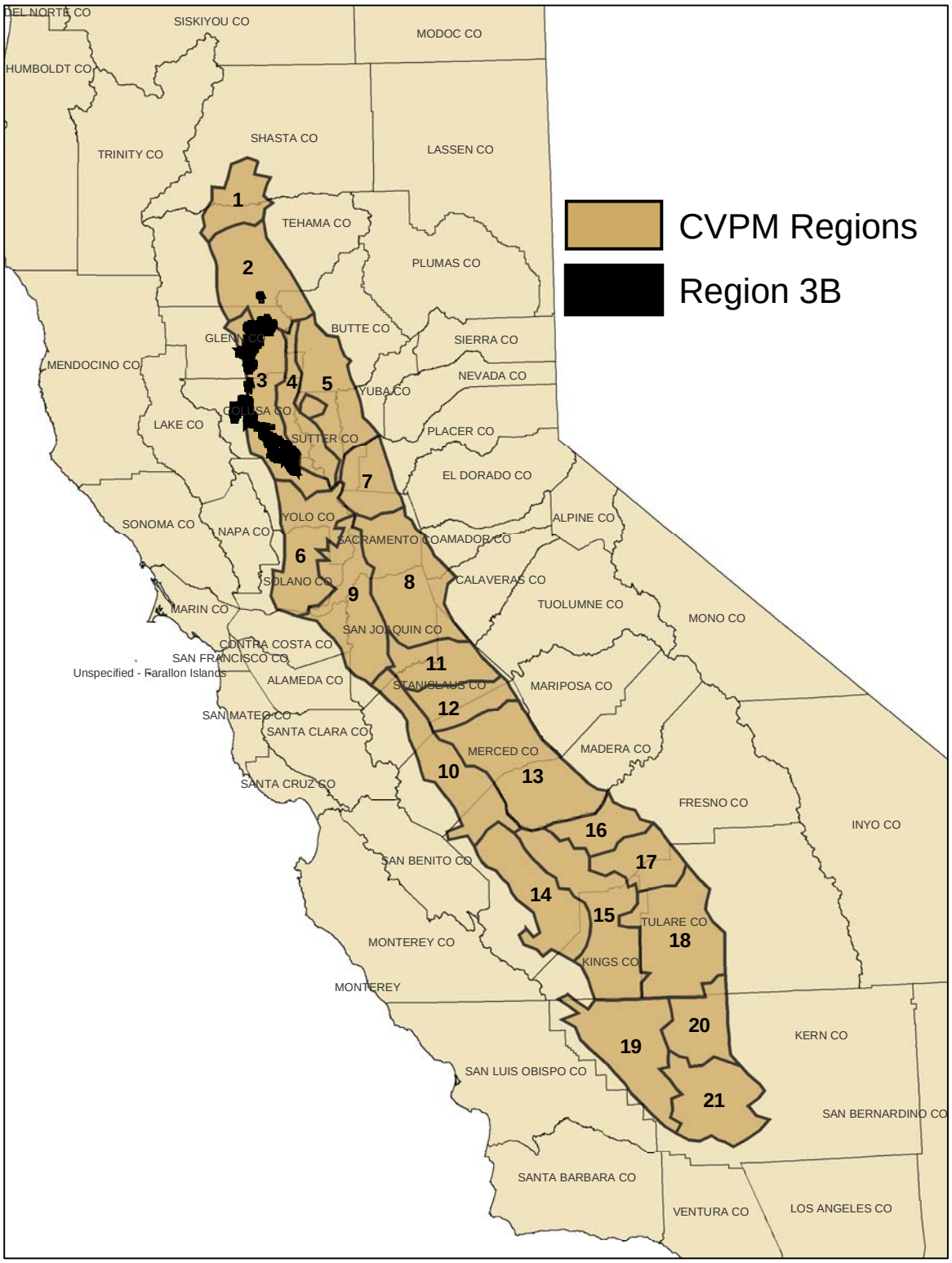


FIGURE III-1: AGRICULTURAL AREAS MODELED BY CVPM

TABLE III-2: CVPM REGIONS AND DESCRIPTIONS

CVPM Region	Description of Major Users
1	CVP Users: Anderson Cottonwood, Clear Creek, Bella Vista, Sacramento River
2	CVP Users: Corning Canal, Kirkwood, Tehama, Sacramento River miscellaneous users.
3	CVP Users: Glenn Colusa ID, Provident, Princeton-Codora, Maxwell, and Colusa Basin Drain MWC.
3b	Tehama Colusa Canal Service Area. CVP Users: Orland-Artois WD, most of County of Colusa, Davis, Dunnigan, Glide, Kanawha, La Grande, Westside WD.
4	CVP Users: Princeton-Codora-Glenn, Colusa Irrigation Co., Meridian Farm WC, Pelger Mutual WC, Recl. Dist. 1004, Recl. Dist. 108, Roberts Ditch, Sartain M.D., Sutter MWC, Swinford Tract IC, Tisdale Irrigation, Sac River miscellaneous users.
5	Most Feather River Region riparian and appropriative users.
6	Yolo, Solano Counties. CVP Users: Conaway Ranch, Sac River Miscellaneous users.
7	Sacramento Co. north of American River. CVP Users: Natomas Central MWC, Sac River miscellaneous users, Pleasant Grove-Verona, San Juan Suburban.
8	Sacramento Co. south of American River, San Joaquin Co.
9	Delta Regions. CVP Users: Banta Carbona, West Side, Plainview.
10	Delta Mendota Canal. CVP Users: Panoche, Pacheco, Del Puerto, Hospital, Sunflower, West Stanislaus, Mustang, Orestimba, Patterson, Foothill, San Luis WD, Broadview, Eagle Field, Mercy Springs, Pool Exchange Contractors, Schedule II water rights, more.
11	Stanislaus River water rights: Modesto ID, Oakdale ID, South San Joaquin ID.
12	Turlock ID.
13	Merced ID. CVP Users: Madera, Chowchilla, Gravely Ford.
14	CVP Users: Westlands WD.
15	Tulare Lake Bed. CVP Users: Fresno Slough, James, Tranquillity, Traction Ranch, Laguna, Real. Dist. 1606.
16	Eastern Fresno Co. CVP Users: Friant-Kern Canal. Fresno ID, Garfield, International.
17	CVP Users: Friant-Kern Canal. Hills Valley, Tri-Valley Orange Cove.
18	CVP Users: Friant-Kern Canal, County of Fresno, Lower Tule River ID, Pixley ID, portion of Rag Gulch, Ducor, County of Tulare, most of Delano Earlimart, Exeter, Ivanhoe, Lewis Cr., Lindmore, Lindsay-Strathmore, Porterville, Sausalito, Stone Corral, Tea Pot Dome, Terra Bella, Tulare.
19	Kern Co. SWP Service Area.
20	CVP Users: Friant-Kern Canal. Shafter-Wasco, S. San Joaquin.
21	CVP Users: Cross Valley Canal, Friant-Kern Canal. Arvin Edison.

TABLE III-3: CVPM CROP GROUPINGS

Category	Proxy Crop
Grain	Wheat
Rice	Rice
Cotton	Cotton
Sugar Beets	Sugar Beets
Corn	Corn Silage
Dry Beans	Dry Beans
Safflower	Safflower
Other Field	Sudan Grass
Alfalfa	Alfalfa Hay
Pasture	Irrigated Pasture
Processing Tomatoes	Processing Tomatoes
Fresh Tomatoes	Fresh Tomatoes
Cucurbits	Cantaloupes
Onions And Garlic	Dry Onions
Potato	White Potato
Other Truck	Broccoli
Almonds And Pistachios	Almonds
Other Deciduous	Walnuts
Subtropical	Oranges
Vine	Wine Grapes

RESULTS OF PRELIMINARY UPDATE

The CALSIM II water deliveries were applied to the PMP calibrated CVPM model and the model was run with demands based on 2030 level of development for the base case (without project condition) and each with project scenario. The following assumptions and decision criteria were made for the agricultural analysis:

- The potential sources for agricultural water include: CVP contract supply, CVP water rights and exchange supply, SWP contract supply, SWP interruptible supply, local surface water, and local groundwater.
- Wet year shadows values were used to value Article 21 deliveries.
- No analysis was performed to determine the economic value to the agricultural sector of water transferred from agriculture to urban or of water transferred from urban to agriculture.
- The local surface and groundwater levels for the calibration and PMP CVPM model runs were estimated by subtracting project deliveries from total field applied water and then multiplying this difference by a ratio of groundwater to local deliveries used in a previous CVPM study.
- The local surface and groundwater levels for the CALSIM II augmented CVPM model runs were estimated by subtracting project deliveries from total field applied water and then multiplying this difference by a ratio of groundwater to local deliveries used in a previous CVPM study, with adjustments made for dry and wet year type conditions.

Table III-4 reports the expected change in net income for each CVPM region. The values in the table were calculated as a weighted average of the average, dry, and wet year type net incomes for all 22 CVPM regions.

The results are reported in Table III-5 by year type for each scenario. Overall irrigation benefits are measured in terms of the expected change in social value. Social value is the sum of producer profits and consumer surplus. Producer profits are equal to total revenue minus total costs. Consumer surplus represents the additional value consumers receive when they purchase a good at lower price than what they are willing to pay. In many cases people are often willing to pay more for the good, and thus their perceived value for that good exceeds market prices. This value above market prices is called consumer surplus. The overall annual equivalent benefits have an estimated value of $42.5 million for Scenario 1 and $25.4 million for Scenario 2.

TABLE III-4: ANNUAL CHANGE IN NET INCOME BY CVPM REGION

WEIGHTED AVERAGE EXPECTED CHANGE IN NET INCOME ($ thousands, 2006 Prices)		
CVPM Region	**Scenario 1**	**Scenario 2**
Region 1	-159	-161
Region 2	1,205	1,375
Region 3	-713	-710
Region 3B	4,073	4,576
Region 4	-9	-104
Region 5	-38	-34
Region 6	-13	-4
Region 7	21	19
Region 8	7	10
Region 9	-217	-306
Region 10	2,233	1,201
Region 11	-18	-12
Region 12	-29	-18
Region 13	-86	-51
Region 14	31,003	16,540
Region 15	1,548	564
Region 16	-5	-2
Region 17	94	96
Region 18	1,623	1,629
Region 19	426	188
Region 20	91	-15
Region 21	724	13
TOTALS	41,763	24,795

TABLE III-5: AVERAGE ANNUAL IRRIGATION BENEFITS

BENEFITS FOR ALL 22 CVPM REGIONS - EXPECTED CHANGE IN NET INCOME ($ thousands, 2006 Prices)				
		Avg Year Type	**Dry Year Type**	**Wet Year Type**
Scenario 1		41,374	62,047	15,015
Scenario 2		25,236	37,712	9,214
Year Type Probabilities		0.33	0.38	0.29
Scenario 1	Expected Change In Net Income			$41,763
	Expected Change In Consumer Surplus			$991
	Adjustments For Changes In Article 21 Water Deliveries			-$243
	Expected Change In Social Value			**$42,511**
Scenario 2	Expected Change In Net Income			$24,795
	Expected Change In Consumer Surplus			$641
	Adjustments For Changes In Article 21 Water Deliveries			-$155
	Expected Change In Social Value			**$25,412**

LIMITATIONS OF UPDATE APPROACH

Irrigation benefits in this analysis were based solely on the increased storage capacity. These increases were added to the existing CVP and SWP using demands estimated in year 2030. Changes in system wide allocations, conveyance, and pumping capacities would lead to varying benefit estimates. The latest version of the CVPM was used to estimate the irrigation benefits. Both CALSIM II and CVPM models are currently being revised and updated at the time of this report. Water quantities were based on CALSIM II data using 2020 development. Neither model has been optimized for the addition of Auburn Dam. Variation in the allocation of pool space or the optimum size of Auburn Dam was not considered in this benefit update analysis. Further studies would be needed to show the full range of benefits of potential irrigation deliveries made possible by increased storage at Auburn Dam.

SECTION IV
UPDATED M&I WATER SUPPLY BENEFITS

1963 EVALUATION METHODOLOGY FOR M&I BENEFITS

Benefits attributable to municipal and industrial (M&I) water supply from Auburn Dam were based on the annual equivalent costs for the least cost single-purpose M&I project. These costs included the construction of a reservoir with a capacity of 110,000 acre feet on Alder Creek and a portion of the proposed Folsom South Unit needed to handle the M&I deliveries. Deliveries would have reduced the dependency on pumping of groundwater, which was the only source of M&I for several communities in the service area such as the City of Stockton at the time of the study. In the 1963 study, these single-purpose costs were estimated at $13.1 million for Alder Creek Dam and $9.5 million for the smaller Folsom South canal required to meet the M&I accomplishments of Auburn Folsom South Unit. Amortized over 100-years, these avoided costs provided an estimated annual equivalent M&I benefit of $879,000.

CHANGES AFFECTING BENEFIT ESTIMATION

For this preliminary benefit update analysis, it is assumed that the Folsom South Canal will not be completed prior to or as part of the Auburn Dam project. Without the Folsom South Canal, Sacramento and San Joaquin County water users as identified in the 1963 Supplemental Report may no longer be the primary customers of the M&I deliveries. Some of the original demand, referred to in the 1963 study, has been met by new sources including the completion of the New Melones Dam. An example of new ways local entities are meeting their increasing M&I needs is the City of Stockton, who started to use treated water from the Calaveras and Stanislaus rivers in 1977 to replace the potential deliveries that would have come from The Auburn Folsom South Unit.

More efficient and diverse deliveries of M&I water throughout the state are now possible with the completion of the California Aqueduct to Southern California in mid 1970's and extensions to the central coast in the mid 1990's. Water from Auburn Dam could help in meeting demands throughout the state delivered through both the CVP and SWP. Benefits for these deliveries would be measured based on reduction in costs of alternative sources to include the costs of conservation and recycling.

METHODOLOGY FOR PRELIMINARY UPDATE

The M&I analysis uses the same CALSIM II data inputs as described in Section III. Initially the Least-Cost Planning Simulation Model (LCPSIM) was going to be used to estimate the M&I economic benefits to for this study. LCPSIM is a yearly time-step simulation/optimization model that was developed to assess the economic benefits and costs of enhancing urban water service reliability at the regional level. However, because the current version of LCPSIM has only been developed to utilize the CALSIM II data provided for one region, the model was determined to

be inappropriate for this preliminary update. The current version could not provide benefits for Sacramento Valley, Central Coast, Bay Area, or San Joaquin Valley urban areas. Instead, to account for demands throughout the state, foregone groundwater conjunctive use operations were used to estimate the per acre foot benefits for M&I deliveries. Note that by reducing the amount of groundwater pumping, benefits beyond just reduced water costs could be attributed to the project. Many of these benefits may be non-monetary and were not estimated or included in this limited update.

RESULTS OF PRELIMINARY UPDATE

M&I benefits were determined for the same two project scenarios as applied in the Irrigation Analysis described in Section III. In Scenario 1 there is greater emphasis on increasing deliveries to agricultural regions. In Scenario 2 there is greater emphasis on increasing deliveries to Municipal and Industrial (M&I) regions.

As noted above, all M&I benefits in this analysis are based on foregone groundwater conjunctive use operations. The cost of these operations is an estimated $140 per acre-foot. It was also assumed that CVP and SWP average delivery cost are $30 per acre-foot. The cost difference of $110 indicates the minimum price per acre foot local urban water users would be willing to pay for additional water (assuming that without the project, local water users will need to expand local conjunctive use activities). Table IV-1 summarizes the increases in M&I deliveries for each scenario by year type due to the addition of storage at Auburn. Benefits are determined as a function of the change in total average annual water deliveries, comparing without project and with project deliveries.

TABLE IV-1: SUMMARY OF URBAN WATER SUPPLY DELIVERY CHANGES

Year Type	Scenario 1 (values in acre feet)	Scenario 2 (values in acre feet)
Wet	8,300	34,800
Normal	19,800	71,100
Dry	68,700	158,200
Expected Average	35,200	94,100

Table IV-2 shows the calculated M&I benefits for each scenario.

TABLE IV-2: AVERAGE ANNUAL M&I BENEFITS

	Scenario 1 (in $)	Scenario 2 (in $)
Increase in acre feet delivered	35,200	94,100
$ per acre feet	110	110
Total	**3,872,000**	**10,351,000**

LIMITATIONS OF UPDATE APPROACH

As with the irrigation benefits identified in section III, the updated M&I benefits from the completion of the Authorized Auburn Dam are based solely on the increased storage capacity. Due to lack of specific regional modeling the same value per acre foot was applied to all regions. Changes in system wide allocations, conveyance, and pumping capacities would lead to varying benefit estimates. None of the models used have been optimized for the addition of Auburn Dam. Completion of Folsom South Unit was not included in this update. Potential future urban water users might provide additional benefit if direct dedicated conveyance systems were completed.

Both irrigation and M&I benefits are dependant on allocation of available water supply. In this analysis, even under Scenario 2 only a limited supply was directed towards M&I. In formulation, the optimal trade-off between irrigation and M&I should be examined. In addition, variation in the allocation of pool space or the optimum size of Auburn Dam was not considered in the analysis for this preliminary update. Further studies would be needed to show the full range of benefits of potential M&I deliveries made possible by increased storage from the American River.

SECTION V
UPDATED HYDROPOWER BENEFITS

1963 EVALUATION METHODOLOGY FOR HYDROPOWER BENEFITS

Hydropower benefits in the 1963 report were based on a power plant with 3-80 Megawatt (MW) turbines for a total plant capacity of 240 MW. The electric power benefits were measured in terms of the cost of achieving the same power generation results by the most likely alternate means that would exist in absence of the project. The most likely alternative source of power in 1963 was assumed to be a modern steam-electric power plant, built and operated by a privately financed, taxpaying corporation located in the San Francisco area. Benefits were determined as a function of both dependable capacity and average annual commercial energy production.

Dependable capacity was based on the equivalent steam-electric power plant which would produce the equivalent annual power generation during the dry cycle as the Auburn-Folsom power plant. The dry cycle used was from July 1930 to December 1933. The estimated equivalent cost of a steam-electric power plant to produce the capacity was determined to be $23.39 per Kilowatt hour (kWh). The cost includes a 5% increment for increased dependability of hydropower and a tax component of $7.86 per kW.

The usable average annual power generation was based on the average annual CVP power production for the period of record from 1922 to 1954. The usable power generation was reduced over time to account for the buildup of both the base CVP power capacity and the project specific irrigated agriculture served by the project. The reduction of usable power due to agriculture build-up was assumed to increase linearly for the first 38 years of the project life. The reduction in power was related both to the power needed to pump the irrigation water to the Folsom South Canal and the incidental loss of power generation due to irrigation demand timing.

The annual benefits were determined for a 100-year project life using a $2^{7}/_{8}$% federal discount rate. Total system power generation benefits were estimated for the CVP with and without Auburn-Folsom South Unit. The overall power generation for the CVP project was determined using the established power delivery contacts in place with Pacific Gas and Electric (PG&E) at the time. The annual power benefits for the CVP without Auburn Folsom was determined to be $25,021,000 and the CVP with Auburn Folsom was determined to be $31,567,000. The benefit for hydropower generation at Auburn-Folsom power plant was determined as the difference between the without project and with project conditions at $6,546,000.

CHANGES AFFECTING BENEFIT ESTIMATION

One basic change affecting the benefit estimation is the available data in terms of period of record. Available hydrologic data has been extended to include 40 additional years of data. Technology has also advanced providing different least cost alternative power sources in addition to more efficient generation. The alternative power source is now based on natural gas

turbine generation. Changes in infrastructure, such as additions to the Western Interconnect allow for widespread distribution of electricity.

METHODOLOGY FOR PRELIMINARY UPDATE

The power benefits for the preliminary update were for a proposed 4-unit 800 MW Auburn Reservoir power plant. The hydropower generation benefits were based on the annual cost of constructing and running an equivalent sized natural gas turbine power plant. Annual Benefits were determined as a function of both dependable capacity and average annual commercial energy production. Annual benefits were determined for a 100-year project life using a $5^{1}/_{8}$% interest rate.

Power Generation Scenarios

The power generation potential at a hydropower plant is unique to the each facility. Extensive analysis is required to develop power generation equations for a specific facility. This type of analysis has not been completed for the proposed Auburn Reservoir power plant. Instead three scenarios were developed to provide a range of possible values using a general power equation and the power equation developed for a reference hydropower facility to encompass the probable power generation potential of the facility. The scenarios encompass the highest and lowest likely power generation using conventional general hydropower generation equations and the power curve for a similar reference facility.

The three scenarios investigated are listed below.

A. New Melones Power Equation - The first scenario was based on the power curve developed for the New Melones Power Plant. New Melones is a 300 MW facility with a reservoir of similar dimensions and volume to the proposed Auburn Reservoir. The power curve equation was adjusted for the difference in power plant size. The power curve for the New Melones power plant is based on the available gross head, an efficiency factor, and the discharge through the turbines.

B. 4-Unit Power Equation - The second scenario was based on a conventional general hydropower power generation equation for the full 4-unit 800MW Auburn power plant. The general power plant equation is based on the available gross head, an efficiency factor, monthly operating hours, and the discharge through the turbines.

C. 2-Unit Power Equation - The final scenario was based on the conventional general hydropower generation equation based on a 2-unit 400 MW power plant. A 2-unit power plant scenario was included since the simulated operation of the reservoir, acting in conjunction with Folsom, does not have consistently higher water level conditions for continuous and reliable operation at the full power generation potential. The 2-unit scenario would give the lower bound of the power generation potential and assumes that the remaining 2 units may be used for peak power production when available. This peak power production is not measurable within the available monthly time steps and was not included in this scenario.

All of the above power generation scenarios were used with the following assumptions to determine the Auburn-Folsom power plant generation:

1. Proposed Auburn Dam has two penstock elevations: 625 and 800 feet MSL.
2. The proposed power plant consists of four 200MW units with a rated discharge of 5760 CFS each.
3. The upper penstock elevation is exclusively used for the power calculations.
4. Gross head is calculated from the 625 foot elevation penstock elevation.
5. Turbine discharge is rated from 3,100 to 23,000 CFS and based on an assumption that increased power generation scales with increased storage elevation.
6. For a 2-unit Auburn facility, turbine discharge is rated from 2,000 to 11,800 CFS and based on the same assumption that increased power generation scales with increased storage elevation.

Dependable Capacity

Dependable capacity is based on the equivalent natural gas power plant which would produce the same annual power generation during the dry cycle as the Auburn-Folsom plant. The dry cycle used was the period from July 1930 to December 1933. The following table lists the resulting average annual power generation for the three power generation scenarios over the CALSIM II period of record of July 1930 to December 1933.

The average annual power generation for the dry cycle was converted to an equivalent natural gas power plant sized in megawatts using the following equation:

$$PS(MW) = Pg / (365 * 24 * E)$$

With: PS(MW) = plant size in megawatts
Pg = average annual power generation, in kWh
E = plant operational efficiency (65%)

Average Annual Power Generation

The average annual power generated from the Auburn power plant was determined using power generation equations for each of the scenarios based on the average monthly outflows and reservoir elevations from the CALSIM II model.

Unit Costs

The estimated capital and operational cost of a natural gas power plant was taken from data available in Appendix E of The Market Based Advanced Coal Power Systems Analysis completed by the Department of Energy, dated May 1999. The cost for the natural gas power plant was based on a 1998 price level. This pricing was updated to 2006 price level using the U.S. Army Corps of Engineers Civil Works Construction Index System EM 1110-2-1304 dated September 30, 2005. The price level increase was based on the cost basis for the Civil Works Breakdown Structure (CWBS) Code 07 - Power Plants for 2nd quarter 1998 and 2nd quarter

2006. The following table lists the 1998 cost and updated 2006 cost for a natural gas fired power plant.

TABLE V-1: UNIT COST FOR NATURAL GAS POWER PLANT

Cost	Unit of Measure	Cost basis	
		1998[1]	2006[2]
		458.84	565.99
Power Plant Cost			
Capital Cost	$/kW	$495.00	$610.59
Total O&M	$/kW-yr	$15.90	$19.61
Fixed O&M	$/kW-yr	$10.35	$12.77
Variable O&M	$/kWh	$0.001	$0.0012
Consumables Cost			
Water	$/kWh	$0.0002	$0.00025
Chemicals	$/kWh	$0.0001	$0.00012

[1]Cost from Appendix E of The Market Based Advanced Coal Power Systems Analysis completed by the Department of Energy, dated May 1999
[2]Cost updated using Cost Basis from U.S. Army Corps of Engineers Civil Works Construction Index System EM 1110-2-1304 dated September 30, 2005.

The cost of natural gas is the largest annual cost in power production for a natural gas power plant. The cost of natural gas is based on the projected price of natural gas for power generation as reported in the Comparative Cost of California Central Station Electricity Generation Technologies dated 6/5/2003. The cost for natural gas for 2006 was reported as $4.11/MMBtu. The total annual cost of fuel for the natural gas power plant was based on the following equation.

$$\$NG_{ann} = AP(GWh) * HR * \$NG$$

With: $\$NG_{ann}$ = annual cost of natural gas
AP(GWh) = Annual production in gigawatt hours
HR = heat exchange rate, 6396 Btu/kWh
$NG = cost of natural gas, $/MMBtu

RESULTS OF PRELIMINARY UPDATE

The power benefits were calculated as the cost of achieving the same power generation results by the most likely alternate means that would exist in absence of the project. The capital cost of construction for the equivalent power plant was based on the size of plant needed to produce the dependable capacity. The cost of operating a facility was based on the average annual power generation output of the power plant.

The following table V-2 lists the resulting average annual power generation for the three scenarios for the dependable capacity dry cycle and the resulting equivalent natural gas power plant size in megawatts.

TABLE V-2: DEPENDABLE CAPACITY POWER PLANT SIZE

Scenario	Dry Cycle Average Annual Power Generation, GWh[1]	Equivalent Dependable Capacity Power Plant, MW
New Melones Power Equation	1541	271
4-Unit Power Equation	1201	211
2-Unit Power Equation	808	142

[1]GWh = 1,000,000 kWh

The following Table V-3 lists the resulting average annual power generation for the three scenarios over the CALSIM II period of record 1922 to 1994.

TABLE V-3: AVERAGE ANNUAL GENERATION FOR AUBURN POWER PLANT

Scenario	Average Annual Power Generation, GWh[1]
New Melones Power Equation	3618
4-Unit Power Equation	2822
2-Unit Power Equation	1667

[1]GWh = 1,000,000 kWh

Table V-4 shows the resulting estimates of benefits for the 3 scenarios. The power generation benefits are based on a total annualized cost of $31.50 per kW of dependable power capacity. This cost includes the replacement of the natural gas power plant after a useful life of 60 years. The remaining fixed and variable costs used in the analysis are listed in Table V-1. The scenarios analyzed represent the most likely envelope of the actual power generation potential for the Auburn Reservoir power plant. The resulting annual power generation benefits based on the construction and operating cost of an equivalent natural gas power plant range from $53 to $113 million.

TABLE V-4: POWER GENERATION BENEFITS FOR AUBURN POWER PLANT

Scenario	New Melones Power Equation	4-Unit Power Equation	2-Unit Power Equation
Equivalent Dependable Capacity Power Plant, MW	271	211	142
Average Annual Power Generation, GWh[1]	3618	2822	1667
Annual Benefits, x $1000	**$113,000**	**$88,000**	**$53,000**
Annual Capital Construction Costs, x $1000	$8,518	$6,638	$4,466
Fixed O&M, x $1000	$3,456	$2,694	$1,812
Variable O&M, x $1000	$4,463	$3,481	$2,056
Water, x $1000	$892	$696	$411
Chemicals, x $1000	$446	$348	$206
Fuel, x $1000	$95,114	$74,183	$43,821
$/kWhr	0.0288	0.0288	0.0290

[1]GWh = 1,000,000 kWh

LIMITATIONS OF UPDATE APPROACH

The power generation benefits described in this section are dependent on many variables. The two variables which have the largest effect on the power generation benefits are the operation of the reservoir and the price of natural gas, which represents the variable cost of the alternative power source. The operation of the dam dictates the amount of flow that is released from the reservoir at any given time and the amount of flow available to run through the turbines. As seen in the Table V-4, if the operation results in insufficient flow to operate all four of the power generating turbines, the power generation and associated benefits are greatly reduced. The costs associated with power generation account for the majority of the annual power benefits. Approximately 84% of this cost is related directly to the cost of the natural gas. Changes in the price of natural gas can greatly influence the alternative cost of the power produced.

SECTION VI
UPDATED FLOOD CONTROL BENEFITS

1963 EVALUATION METHODOLOGY FOR FLOOD CONTROL BENEFITS

In the 1963 Supplemental Report, flood control benefits were determined based on Auburn Dam effectively adding 250,000 acre feet of flood control space to the existing flood control measures. Folsom Dam had 400,000 acre feet dedicated to flood control and the 1965 authorization allowed for half of this space to be shifted to Auburn Dam. Without Auburn, the areas along the Lower American River had an estimated 1 in 200 chance of flooding in any year at the time of the study. Benefits were calculated as the difference between the existing equivalent annual damages of $487,000 and the residual damages of $112,000 (with the additional 250,000 acre feet of flood control storage to the system that Auburn Dam would provide). The difference between these two values represents the $375,000 in average annual flood damage reduction benefits found in Table II-1. These benefits were obtained for the 1963 report from the USACE and reflect flood damages prevented. The benefits were computed in accordance with the agencies procedures that were in place at the time and limited to existing development within the standard project flood plain at the time. The baseline flood damage estimates were based on Folsom Reservoir, Planning Report 1955 prepared by the Sacramento USACE District office. This report claimed that there were about 6,000 people within the flood plain and damages prevented by Auburn Dam from a single event (the project design flood) would have been around $55 million dollars based on existing 1955 conditions and prices.

CHANGES AFFECTING BENEFIT ESTIMATION

Many changes have occurred since the 1963 Auburn Dam Supplemental Report that have a significant impact on potential flood damage reduction benefits. These include development in the study area, changes in existing hydrologic and hydraulic conditions, completed and proposed (authorized) project components on the Lower American River, and the methodology the Federal government currently uses to compute flood damages.

Development in the Area – Population Growth

The area at risk of flooding from the American River (that would benefit from additional flood control space at Auburn) lies primarily within the City and County of Sacramento. The benefits found in the 1963 report were based on population from the mid 1950's. As shown in Table II-3, Sacramento County has grown by over 270% since 1960 and the City of Sacramento has grown by nearly 240% in the same time period. Much of this growth has occurred in areas that could not be developed prior to the completion of Folsom Dam and the extension of levees along the Lower American River.

In comparison, there are now nearly 270,000[3] people at risk of direct flooding from a potential levee failure along the American River, a significant increase from the 6,000 described in the 1955 USACE Planning Report.

Changes in Existing Hydrologic and Hydraulic Conditions

The four largest floods recorded along the American River have occurred in the last fifty years. Adding this data to the hydrologic modeling has caused a significant change in the without project hydrologic conditions by shifting the probability discharge curve. This has increased the known flood risk, making the predicted probability of flooding greater than what was expected at the time of the 1963 study. With Folsom Dam completed in 1954, it was believed at the time that the dam provided flood protection along the Lower American River up to the 1 in 500 year event. But in the following year 1955, the largest flood of record occurred and the chance of flooding was revised to be 1 in 200 in any given year (as reported in the 1963 feasibility report.) From 1963 to 1986, three larger events than the 1955 event occurred, again revising the frequency of flood risk to 1 in 70 chance of flooding as reported in the USACE 1991 Feasibility Study.

In addition to the change in frequency of flooding, the magnitude of the risk has also increased. Based on the hydraulics from the 1991 Feasibility report, the existing 400-year flood plain would cover an area of over 110,000 acres (including Natomas) compared to the 9,000 acres inundated from the 1950 flood (largest recorded event prior to the completion of Folsom Dam.) Current estimates of damage from a single 1 in 400 chance event (based on conditions described in the 1991 feasibility report - flood plain areas are shown in figure VI-1) are over $17 billion compared to the largest flood from the 1955 study estimated at only $55 million. While much of this change is due to the growth in Sacramento area population and increases in the value of property at risk, the increases in floodplain extent and depths inundated based on more recent hydrologic and hydraulic modeling are also a significant factor in the increased magnitude of potential flood damages.

Completed and Authorized Projects on the American River

There are several projects that have been completed in since the 1963 report that reduce the current flood risk along the Lower American River. In addition, there are two authorized projects that could be completed prior to construction of Auburn Dam. The following lists those completed American River Watershed flood damage reduction projects:

- Re-operation of Folsom Dam – from a fixed 400,000 acre foot dedicated flood control space as originally authorized to a 400/670k acre foot variable operation
- Natomas – SAFCA North Area Local Project – Completed levee project reduced risk of flooding from the American River to the Natomas and North Sacramento area to 1 in 200 (Natomas is still at risk of more frequent flooding from the Sacramento River)

[3]This population number does not include the areas of Natomas or North Sacramento. With existing American River improvements, these areas have a more frequent flood risk from the Sacramento River and the Dry Creek tributaries respectively. Including all areas that could benefit from flood damage reduction at Auburn would increase the population affected to 400,000.

- Common Features - Lower American Levee Improvements - allows for greater emergency releases by raising the probable failure point of the existing Lower American River levees

In addition to the constructed projects there are two additional flood damage reduction projects that are authorized for construction and may be completed prior to Auburn Dam.

- Folsom Modifications – Authorized modification to the 8 existing outlets at Folsom plus the addition of two new outlets allowing for early release capacity of 115,000 cfs. USACE Sacramento District is currently completing a study looking at several outlet modification alternatives with 4 new outlets at a proposed auxiliary spillway as the most likely selection
- Folsom 7 foot Dam Raise – Authorized project that will provide additional flood control space and provide dam safety by allowing the facility to pass the probable maximum flood (PMF)

These proposed projects impact without project conditions from which flood damage reduction benefits for Auburn Dam would be derived. Because the exact configuration and completion dates are uncertain for these projects, the future without project condition for Auburn could vary.

Dam Safety

With the changes in hydrology over the last fifty years, the existing Folsom Dam and the authorized Auburn Dam (as formulated in the 1963 study) no longer have the capacity to safely pass the PMF. As mentioned, there are projects proposed by both USACE and by Bureau of Reclamation that will modify Folsom Dam to meet this dam safety requirement. The construction of Auburn Dam would also help Folsom Dam meet the PMF requirement. Unfortunately, with the increase in potential flows, the authorized flood storage space of 250,000 acre feet for Auburn would not be adequate to pass the current PMF on the North Fork without either modification to operations or modification to the design of the dam or both.

Current Approved Methodology for Computing Flood Damages

Based on USACE policies and required procedures, all flood damage reduction studies will adopt a risk-based analysis as described in ER 1105-2-101. This is the biggest difference in methodology in the current analysis when compared to the 1963 report. The 1996 USACE American River Supplemental Information Report (SIR) was the first study involving Folsom and Auburn dams to utilize risk-based analysis. In risk-based analysis, the basic parameters determining annual damages and flood risk include uncertainty, and are described in statistical terms such as mean and standard deviation vs. single estimated values.

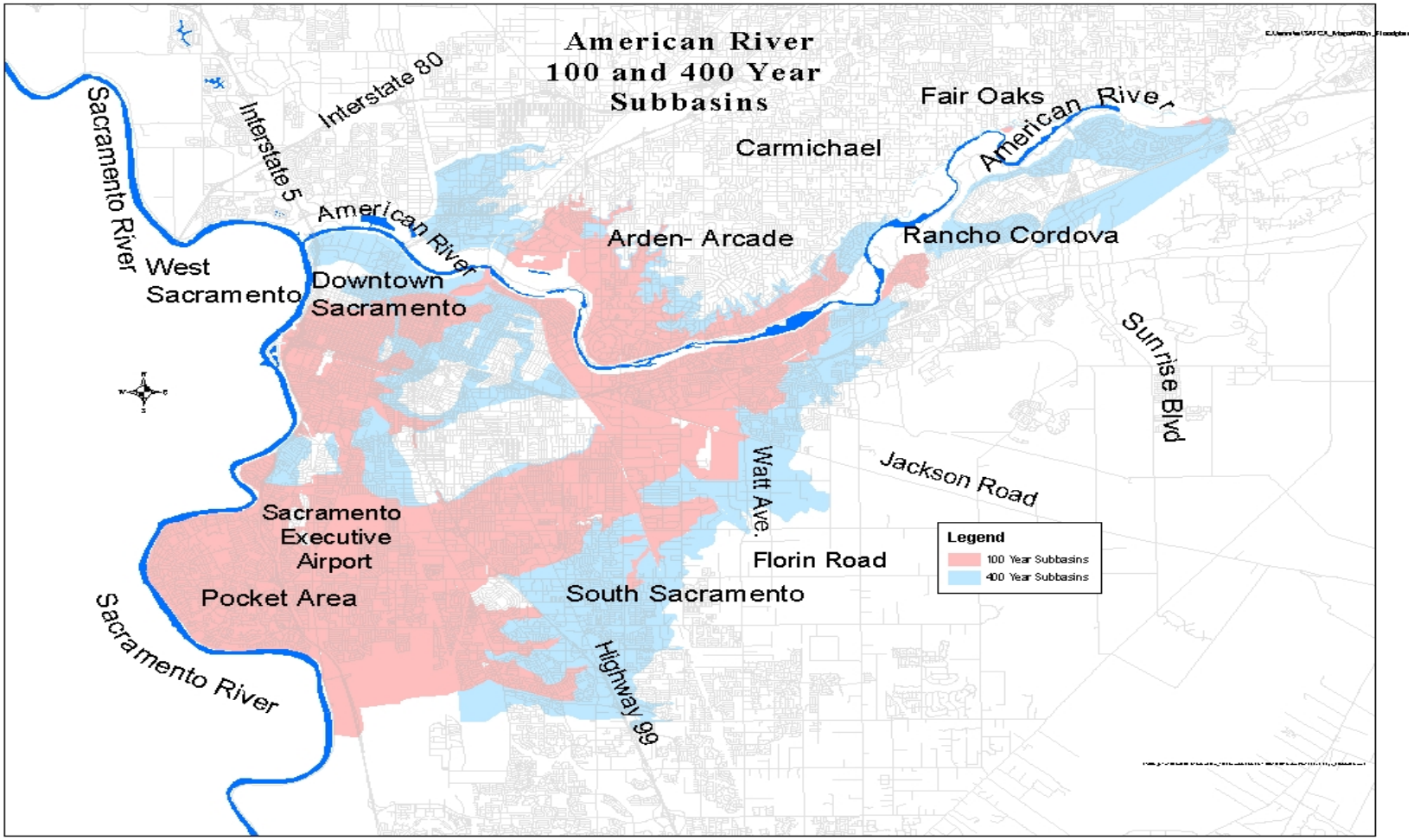


FIGURE VI-1: AMERICAN RIVER WATERSHED FLOOD PLAIN AREAS FROM THE 1991 USACE FEASIBILITY STUDY

METHODOLOGY FOR PRELIMINARY UPDATE

The existing economic and flood damage models currently being used on the USACE American River Folsom Modifications Limited Re-evaluation Report 2002 are the basis for determining flood damage reduction accomplishments for this preliminary update of Auburn Dam benefits. The without project condition from this study serves as the baseline for estimating the number of structures at risk, value of damageable property, and potential flood damages from specific events.

The economic flood damage model HEC-FDA (version 1.3), the standard USACE risk-based analysis program developed by the Hydrologic Engineering Center in Davis, CA, was used for determining expected annual damages (EAD). HEC-FDA is a Monte Carlo simulation program that integrates hydrology, hydraulics, geotechnical, and economic relationships to determine potential damages, flooding risk and project performance. Uncertainty is incorporated for each relationship (see Figure VI-2), and the model samples from a distribution for each observation to estimate damage and flood risk. The American River Folsom Modifications model includes the following relationships for each project condition:

- Probability-Discharge (with uncertainty determined by period of record)
- Stage-Discharge (stage in the channel with estimated standard error in feet)
- Stage-Damage (mean and standard deviation for each damage category)
- Levee Failure Probability (Probable Non-Failure - 15% and Probable Failure Points - 85%); see Figure VI-3
- Regulated Curve – Inflow vs. Outflow (with most likely, minimum and maximum outflow); see Figure VI-4

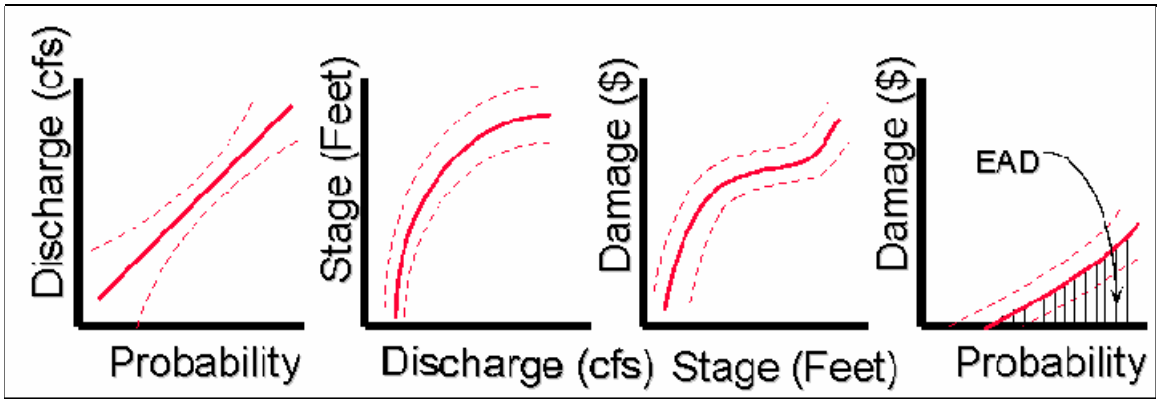


FIGURE VI-2: UNCERTAINTY IN DISCHARGE, STAGE AND DAMAGE IN DETERMINATION OF EXPECTED ANNUAL DAMAGES

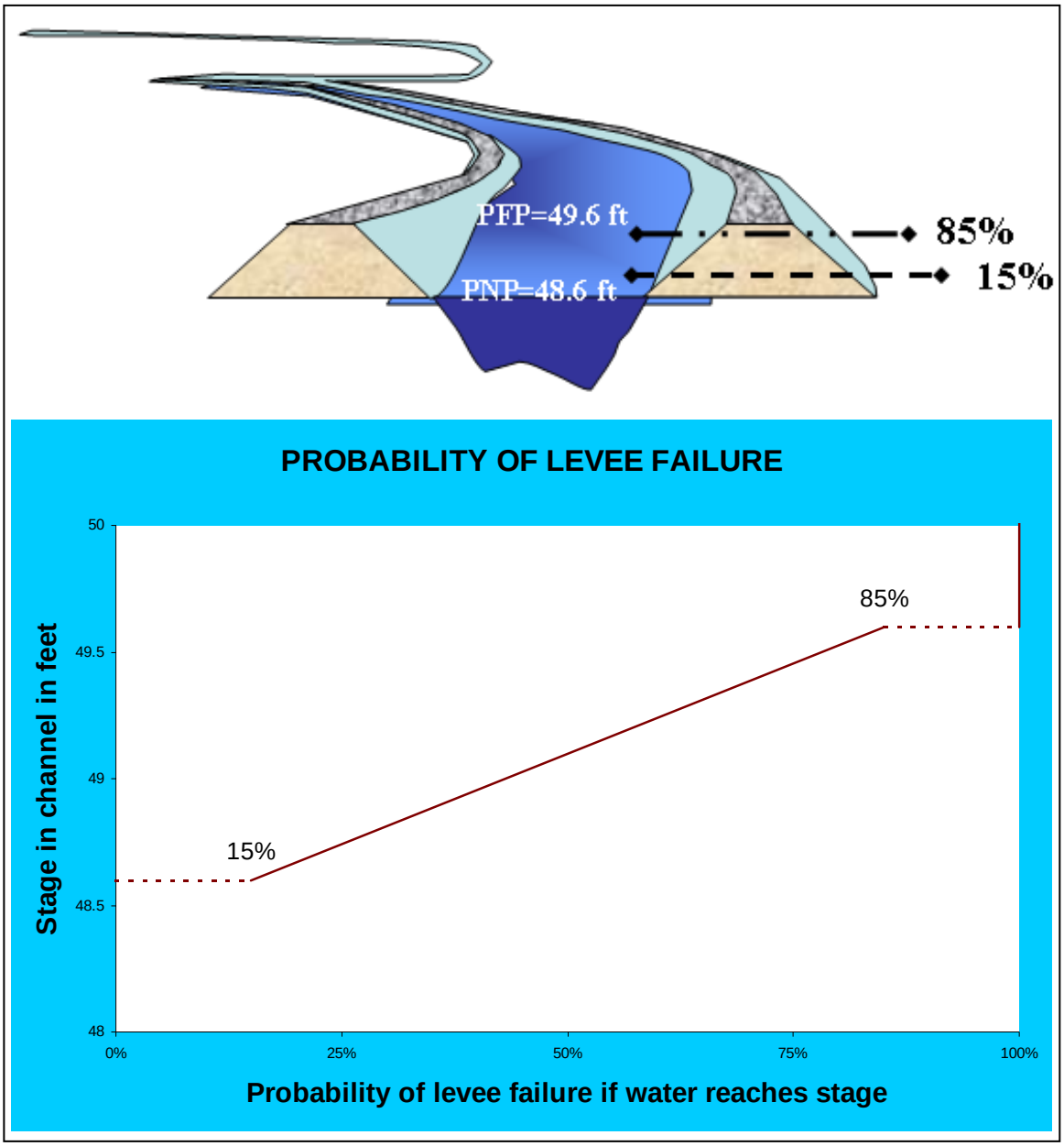


FIGURE VI-3: LEVEE FAILURE UNCERTAINTY USE OF PNP AND PFP IN HEC-FDA MODEL

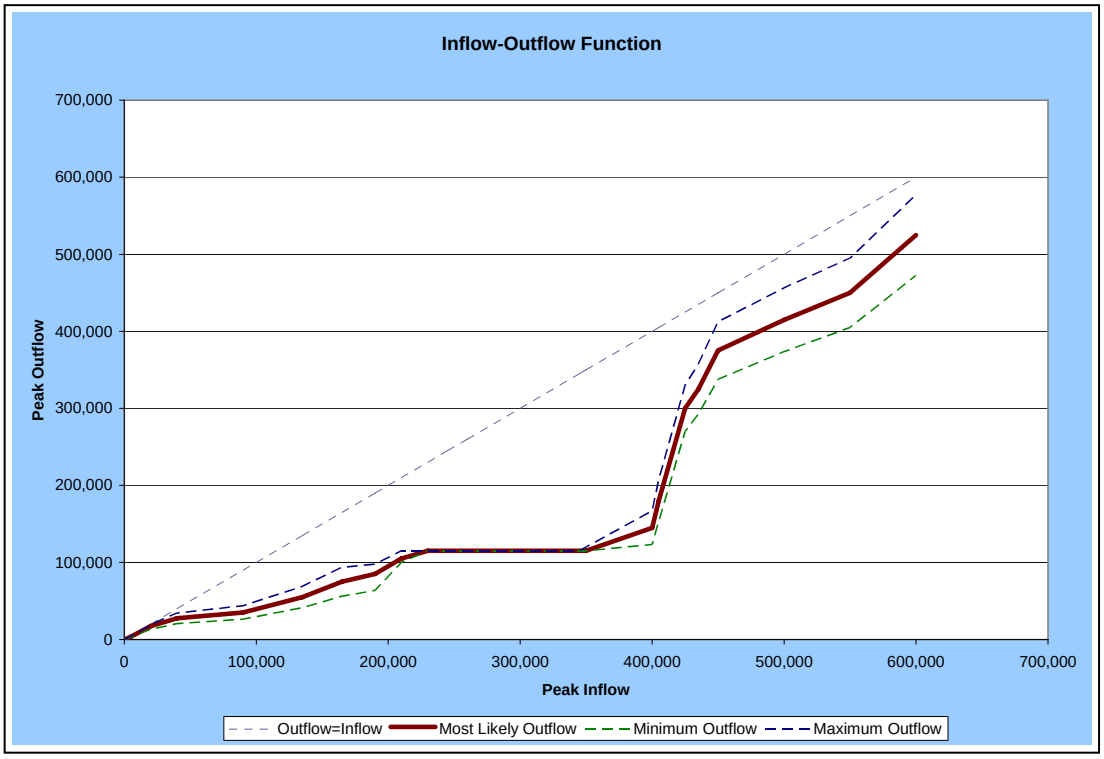


FIGURE VI-4: INFLOW VS OUTFLOW EXAMPLE REGULATION CURVE WITH UNCERTAINTY

Structures at Risk of Flooding

The original flood plains for this study included 100-year and 400-year frequency delineations (see Figure VI-1). While these frequencies have changed due to new flow-frequency relationships and completed project elements, the corresponding outflows still would produce similar flooding characteristics (same depths, area extent, duration) but at less likely frequencies. Structural inventory at risk was gathered and assigned to four land use types to include residential, commercial, industrial and public. The numbers representing structures within the original 400-year flood plain are shown in Table VI-1. Values in the table represent both structure and content values and have been updated to October 2006 price levels.

TABLE VI-1: STRUCTURES AT RISK OF FLOODING, LOWER AMERICAN RIVER; VALUES IN $ MILLIONS, OCTOBER 2006 PRICES

Land Use- Damage Category	Number Of Structures Inundated in Original 400-yr Floodplain	Value of Damageable Property (Structure + Content)
Residential	104,900	19,200
Commercial	4,600	13,000
Industrial	200	600
Public	1,200	3,900
TOTAL	110,900	$ 36,700

Without Project Conditions – Future Action without Auburn Dam

Flood damage reduction benefits for an Auburn Dam are dependant on possible future without project conditions. Current operations at Folsom allow for a variable flood control space from 400,000 to 670,000 acre feet depending on storage in several upstream reservoirs. Prior to this re-operation, flood storage at Folsom was set at a fixed 400,000 acre feet. This 400k fixed operation was the baseline for the 1965 authorization and has been considered as the with project operation under both 1991 and 1996 USACE studies identifying single purpose flood storage detention at Auburn. Auburn accomplishments in this update have considered both operations in determining benefits. In addition to operation, two proposed authorized projects could be completed either in conjunction with or without Auburn. As such, three without project conditions (without Auburn Dam) have been considered as possible future scenarios for this analysis:

- *Without Project A:* Based on existing conditions – current without project for the baseline Folsom Modifications analysis – This condition is based on the Lower American Common Features in place and use 400,000 to 670,000 acre feet re-operation.

- *Without Project B:* Same as "A" above but using 400,000 acre feet fixed operation.

- *Without Project C:* Most likely alternative Future Federal Action. Includes the completion of Folsom Modifications using 4 new auxiliary spillway outlets plus the proposed 7 foot Dam Raise and 400,000 to 600,000 acre feet re-operation.

Single Event Damages by Frequency

Damages from individual events were estimated based on the depth of flooding relative to the first floor and the value of the structure and contents at risk. Depth damage relationships were used to determine the percent of value damaged at a given depth. Uncertainties in structure and

content values, first floor elevation, and percent damaged were used in Monte Carlo simulation. These results were then linked to corresponding channel stages to create stage-damage functions with uncertainty and integrated with the Probability-Discharge (with inflow vs. outflow), Stage-Discharge, and Levee Failure Probability functions (all with uncertainty) to derive damages by computed frequency. Single event mean damages are shown in Table VI-2 below.

TABLE VI-2: SINGLE EVENT MEAN DAMAGES UNDER VARYING PROJECT CONDITIONS; VALUES IN $ MILLIONS, OCTOBER 2006 PRICES

Exceedance Probability (Event)	Without Project A	Without Project B	Without Project C	Operations Allowed Below FC Elevation[1]		Operations Restricted To Top Of FC Elevation[2]	
				With Auburn D	With Auburn E	With Auburn D	With Auburn E
1in 50	0	0	0	0	0	0	0
1 in 100	48	101	0	0	0	0	0
1 in 111	62	131	0	0	0	0	0
1 in 125	3,877	3,351	0	0	0	16	0
1 in 143	4,078	4,361	278	4	0	106	0
1 in 167	4,211	5,552	1,292	4	0	648	0
1 in 200	4,267	6,537	1,716	334	0	3,359	1,098
1 in 250	5,376	7,546	2,271	991	146	4,048	5,227
1 in 500	7,425	8,451	5,240	4,912	4,975	5,335	7,057
1 in 1000	8,602	9,761	7,381	7,357	6,943	6,935	8,675

[1]These with project results are based on operations that drop the reservoir below the flood storage elevation described in the 1965 authorization. This would have negative impacts on other benefit categories.

[2]These results are based on Auburn Dam project with flood control operation restricted to authorized flood control (FC) pool. This operation will require that either: 1) discharges from rare events are allowed to exceed capacity and overtop the dam or 2) modifications to design of the Dam to pass the larger flows. Impacts are potential increases in costs of Auburn Dam.

RESULTS OF PRELIMINARY UPDATE

As described above, the HEC-FDA model uses Monte Carlo simulation to integrate the hydrologic, hydraulic, geo-technical and economic relationships to determine expected annual damages and project performance. To simulate both the various without and with project conditions, the regulated (inflow vs. outflow) flow curves with uncertainty were modified to represent the changes in releases from Folsom Dam.

With Project Conditions- Future Actions with Auburn Dam

As with the future without project actions, there is more than one possible future condition that includes the Auburn Dam with flood control space as described in the 1965 Authorization. The most likely with project conditions are listed below:

- *With Auburn Dam-Condition D:* Completed Auburn Dam with a total flood control space between Folsom and Auburn set at 650,000 acre feet. The actual operation allows for

125,000 acre feet to be interchangeable between Auburn and Folsom Reservoirs. This with project condition does not include Folsom Modification and Dam Raise assuming that they are either not constructed prior to Auburn Dam or that these projects are discontinued.

- *With Auburn Dam-Condition E:* Folsom Modifications using 4 new auxiliary spillway outlets plus the proposed 7 foot Dam Raise are included and completed as part of the without project. Auburn Dam is then added, completed, and operated as described in condition "D."

HEC-FDA Model Results- Expected Annual Damages

As described above, HEC-FDA runs up to 500,000 iterations creating various frequency-damage functions representing the ranges of values based on the uncertainties in probability-discharge, inflow-outflow at Folsom Dam, stage-discharge, stage-damage and levee failure probabilities for each with and without project condition. These frequency-damage functions are then integrated and mean values represent the expected annual damages.

Operations at Auburn Dam

Auburn Dam if operated for flood damage reduction as described in the 1963 study without either modification to flood control pool elevation or modification to the design will provide significantly less flood protection than described in earlier studies. Using the defined flood control pool elevation of 1083.4 feet MSL without redefining spillway operations and coordinating operation with Folsom[4], may cause the Auburn Dam to overtop. This created a problem for modeling the flow routings without reformulating Auburn. The compromise was to create two scenarios, both having potential impacts either on other benefit categories, dam safety, or increased project costs. The water management section at Sacramento District USACE provided two sets of modeled routings.

The first scenario allowed operations to drop the reservoir below the flood control elevation of 1083.4 feet to keep the dam from overtopping for all modeled events. In effect, this scenario is utilizing more than the 250,000 acre feet of additional flood control space described in the authorization. The impact on economic benefits with this operation would be a reduction in the storage available for water supply and hydropower, potentially causing an overestimation in total project benefits.

A second routing scenario was run restricting releases from dropping the reservoir below the flood control elevation and allowing flows for rare events to exceed capacity. Without design modifications, these flows would overtop Auburn Dam. These model routings would keep the flood control pool within the storage described in the authorization and would not have any negative impacts on the other benefit categories. However, additional construction costs may be required to modify Auburn Dam so these flows could be passed safely. Preliminary results based on these routings from both scenarios are shown in Table VI-3.

[4]Coordinated operations of Folsom and Auburn using current hydrology to meet optimal flood operations and dam safety could be examined in a more detailed feasibility level study.

TABLE VI-3: EXPECTED ANNUAL DAMAGES UNDER VARYING PROJECT CONDITIONS - OPERATIONS ALLOWED BELOW FC ELEVATION FOR DAM SAFETY; VALUES IN $ MILLIONS, OCTOBER 2006 PRICES

Condition	Description	Expected Annual Damages	
		Scenario 1[1] Auburn Operations Allowed Below FC Pool	Scenario 2[2] Auburn Operations Restricted to Top of FC Pool
Without A	Existing Conditions – Common Features 400/670k Re-operation	111.2	111.2
Without B	Common Features – 400k Fixed Operation	117.8	117.8
Without C	Folsom with 4 new Auxiliary Spillway Outlets + 7' Dam Raise 400/600k Re-operation	66.0	66.0
With Auburn D	Auburn Dam	42.8	64.5
With Auburn E	Auburn Dam + Folsom Mods (4 aux outlets) + Dam Raise	36.0	56.4

[1]These with project results are based on operations that drop the reservoir below the flood storage elevation described in the 1965 authorization (total flood storage space exceeds 650k af). This would have negative impacts on other benefit categories.

[2]These results are based on Auburn Dam project with flood control operation restricted to authorized flood control pool. This operation will require that either: 1) discharges from rare events are allowed to exceed capacity and overtop the dam or 2) modifications to design of the Dam to pass the larger flows. Impacts are potential increases in costs of Auburn Dam.

Flood Damage Reduction Benefit Results

Benefits were estimated based on comparing the residual with project flood damages to the three without project conditions. Option 1 is based on the current existing without project condition-with the Common Features in place and Folsom Dam with the variable 400,000-670,000 acre feet operation. The with project condition for this option is to provide a total of 650,000 acre feet of flood control space between Auburn and Folsom. Option 2 is based on the same with project condition but the without project has Folsom fixed at 400,000 acre feet. Option 3 assumes that the most likely future without Auburn condition includes the completion of the Folsom Mods project with 4 auxiliary outlets plus a 7 foot Dam Raise. The with project conditions 'D" and "E" are dependant on the selection of one of the three without project conditions. These are described in this update as flood damage options 1, 2 and 3.

- Option 1 – Computed Without A – Computed With Project D
- Option 2 - Computed Without B – Computed With Project D
- Option 3 - Computed Without C – Computed With Project E

Flood damage reduction benefits are measured as the difference between the without project expected annual damages and the with project residual damages. The HEC-FDA program computes both mean expected annual damages reduced and the probability that damage reduced exceeds an indicated value. In other words, the model provides a range of flood damage reduction benefits for each Option listed. Preliminary results are shown in Table VI-4. The range of benefits is dependant on both the selected without project condition and the operating scenario. Completion of the currently proposed Folsom Dam projects (Option 3) significantly limits the available flood damage reduction benefits that can be attributed to Auburn by reducing the expected annual damages. While Auburn still provides added protection, these flood damages reduced by the additional Auburn project are less frequent, therefore provide less expected annual benefit.

TABLE VI-4: EXPECTED ANNUAL BENEFITS - FLOOD DAMAGE REDUCTION FROM AUBURN DAM; VALUES IN $ MILLIONS, OCTOBER 2006 PRICES

Option or Alternative	Expected Annual Damage			Probability Damage Reduced Exceeds Indicated Values		
	Without Project	With Project	Benefits-Damage Reduced	75 %	50 %	25 %
With Project Conditions Based on Operations Below Flood Control Elevation[1]						
1) Without A – With D	111.2	42.8	**68.4**	43.8	62.4	87.0
2) Without B – With D	117.8	42.8	**75.0**	48.1	68.4	95.2
3) Without C – With E	66.0	36.0	**30.0**	17.5	26.3	38.6
With Project Conditions Based on Restricting Operation to Flood Control Pool[2]						
1) Without A – With D	111.2	64.5	**46.7**	30.2	42.9	59.2
2) Without B – With D	117.8	64.5	**53.3**	34.5	48.9	67.4
3) Without C – With E	66.0	56.4	**9.6**	5.3	8.3	12.4

[1]These with project EAD estimates are from Table VI-3. This operation would reduce storage available for water supply and hydropower and could lower total project benefits.

[2]These with project EAD estimates are from Table VI-4. This operation would not impact other benefit categories but would have an impact on project costs.

HEC-FDA Model Results - Project Performance

In addition to damage estimates, the HEC-FDA program reports flood risk in terms of project performance. Three statistical measures are provided, in accordance with USACE ER 1105-2-101, to describe performance risk in probabilistic terms. In basic terms, these statistics describe the chance of a flood occurring, the chance of being flooded during a fixed period such as a 30-year mortgage, and for a given size flood what is the chance the levees will fail. The specific required statistics include annual exceedance probability, long-term risk, and conditional non-exceedance probability by events.

- Annual exceedance probability measures the chance of having a damaging flood in any given year
- Long-term risk provides the probability of having one or more damaging floods over a period of time
- Conditional non-exceedance probability indicates the chance of not having a damaging flood given a specific magnitude event

Project performance statistics for the various with and without project conditions are displayed in Tables VI-5 and VI-6.

Under current conditions, (Without A) the American River has a 1 in 125 chance of flooding in any year. But the common misconception is that this translates to a 125 year 'level of protection'. Over a thirty year period, under without project conditions, Sacramento has over a 20 percent chance of a catastrophic flood. Sacramento also has over a 1 in 4 chance of flooding from a '100-year event' under without project conditions. By comparison, with Auburn (not including any modifications at Folsom) the chance of damages with a '100-year event' decrease to a range of 1 in 12 to 1 in 50 (depending on operation listed).

TABLE VI-5: PROJECT PERFORMANCE STATISTICS - ANNUAL EXCEEDANCE PROBABILITY & LONG TERM RISK

Condition	Annual Exceedance Probability	Chance of Flooding in a Given Year	Long Term Risk		
			Over 10 Years	Over 30 Years	Over 50 Years
Without A	0.0080	1 in 125	7.7 %	21.4 %	33.1 %
Without B	0.0085	1 in 118	8.2 %	22.6 %	34.7 %
Without C	0.0045	1 in 222	4.4 %	12.7 %	20.3 %
With Project Conditions Based on Operations Below Flood Control Elevation[1]					
With D	0.0026	1 in 385	2.5 %	7.4 %	12.0 %
With E	0.0020	1 in 500	2.0 %	5.9 %	9.7 %
With Project Conditions Based on Restricting Operation to Flood Control Pool[2]					
With D	0.0051	1 in 196	5.0 %	14.3 %	22.7 %
With E	0.0045	1 in 222	4.4 %	12.7 %	20.2 %

[1]This operation would reduce storage available for water supply and hydropower and could lower total project benefits.
[2]This operation would not impact other benefit categories but would have an impact on project costs.

TABLE VI-6: PROJECT PERFORMANCE STATISTICS - CONDITIONAL NON-EXCEEDANCE PROBABILITY

Condition	Conditional Non-Exceedance Probability by Events				
	4% (1 in 25)	2% (1 in 50)	1% (1 in 100)	0.4% (1in 250)	0.2% (1 in 500)
Without A	100 %	98.1 %	73.4 %	16.6 %	2.1 %
Without B	100 %	97.3 %	69.6 %	14.0 %	1.7 %
Without C	100 %	99.8 %	93.6 %	49.3 %	15.1 %
With Project Conditions Based on Operations Below Flood Control Elevation[1]					
With D	100 %	100 %	98.3 %	71.6 %	32.6 %
With E	100 %	100 %	98.7 %	75.1 %	36.4 %
With Project Conditions Based on Restricting Operation to Flood Control Pool[2]					
With D	100 %	99.7 %	92.1 %	43.8 %	11.8 %
With E	100 %	99.9 %	95.0 %	52.6 %	16.6 %

[1]This operation would reduce storage available for water supply and hydropower and could lower total project benefits.
[2]This operation would not impact other benefit categories but would have an impact on project costs.

LIMITATIONS OF UPDATE APPROACH

The preliminary flood damage reduction benefits found in this update are based on the best available information at this time. However there are several limiting factors regarding the evaluation of flood damage reduction benefits for Auburn Dam.

- At the time of this report, the baseline economics from the American River Folsom Modifications Report upon which data in this preliminary benefits update was derived is still under review and refinement. Damage estimates and project performance for the without project could still be revised. Elements that could impact the without project condition:

    a. Hydrologic model is currently under a full Independent Technical Review
    b. Folsom Modifications options are still being evaluated. Most likely preferred alternative based on current data is 4 new auxiliary outlets but alternative optimization is not yet completed.
    c. The Dam Raise at Folsom is still being optimized for both flood damage reduction and dam safety considerations.
    d. New Flood plains and Structural Inventory. The USACE is currently considering revising the existing conditions hydraulics and economics. Flood plains used in the damage model have been modified based on frequency to reflect current conditions but are based on models from the 1991 Feasibility study.

    These four elements could change the without project damages and could have impacts on the feasibility of not only Auburn but the proposed modifications to Folsom Dam. It would be very difficult to predict how significant the impacts would be without the Corps completing their current analysis. It is unlikely that combined

these changes would make further flood damage reduction projects infeasible but could change plan formulation and optimization.

- Operations between Folsom and Auburn for the authorized 650,000 acre feet flood control space have not been optimized. Conditions, primarily current projects added since the 1965 authorization and hydrology, have significantly changed and could impact the effectiveness of the operations modeled in this update.
- Considerations of various allocations of the available space of the Authorized Auburn Dam have not yet been modeled. With changes in resource demands, the 250,000 in additional flood control space from the 2.5 million acre feet for the authorized dam may not lead to the optimal solution.
- Optimal sizing of Auburn to reflect current conditions, costs and demands was not considered in this update.

SECTION VII
UPDATED RECREATION BENEFITS

1963 RECREATION BENEFITS AND EVALUATION METHODOLOGY

As presented in Section II, in 1963 the Secretary of Interior submitted a Supplemental Report on the Auburn-Folsom South Unit, Central Valley Project, California to Congress. This report resulted in Congressional authorization of construction of the Auburn Folsom South Unit. The economic benefits documented in this Supplemental Report for project justification included recreational benefits. The Supplemental Report's summary of project benefits stated:

> *"Recreation Benefits. – …annual equivalent recreation benefits attributable to Auburn Reservoir are evaluated at $6,574,000, which also includes the increase in use of Folsom Reservoir because of a higher minimum pool."*

The recreation benefit evaluation methodology documented in the 1963 Supplemental Report (including the Economic Analysis Appendix and Supporting Schedules) involved multiplying expected recreation visits by recreational user day values. The key factors and assumptions for the analysis included:

- Economic factors applied in the 1963 recreation analysis included a 100-year period of analysis (1973-2072) and a discount rate of $2^{7}/_{8}$%.
- Future benefits were converted to their present values in a common base year (1973) using the discount rate
- Demand for outdoor recreation facilities in the Central California area was expected to increase rapidly, primarily due to population growth and more leisure time.
- Without project recreation at the Auburn Dam site was estimated at approximately 50,000 visitor days in 1962, increasing to approximately 86,000 visitor days in 1973, and 125,000 visitor days by 1985.
- The 125,000 estimate for without project visitor days was applied from 1985 through the end of the period of analysis (2072); capping visitation at 125,000 visitor days for without-project conditions.
- User day values of $.66/day were applied to derive without-project recreation benefit estimates.
- The proposed 2,500,000 acre foot reservoir, as described in the 1963 report, was expected to provide for many new recreational opportunities at the Auburn site and was also expected to make Folsom Reservoir more attractive to recreationists due to more stable water levels.
- It was assumed that Auburn Reservoir would be operated such that storage at Folsom Reservoir would not drop below 600,000 acre feet except during critical dry years.
- With-project visitation estimates used in the analysis for Auburn and Folsom combined included approximately 3,800,000 visitor days in 1962 increasing to approximately 10,850,000 visitor days in 1985

- Visitation for Auburn and Folsom combined was held constant at approximately 10,850,400 visitor days per year over the period from 1985 to 2072.
- Recreation visitation estimates were generally split with approximately 90% of the visitor days being water related recreation and the remaining 10% camping.
- User day values of $.66/day for water related recreation and $.50/day for camping were applied to derive with-project recreation benefit estimates.

Characterization of Without-Project Recreational Use in 1963 Supplemental Report

The recreation analysis in the 1963 Supplemental Report was based in large part on the *Project Report on the Recreation Resources of the Auburn-Folsom South Unit*, produced by the National Park Service in 1963 for the Bureau of Reclamation and included as Part VIII of the Supplemental Report. The report cites relatively little recreational use of the proposed Auburn Dam inundation area; in part due to lack of access. The report states:

> *"The fundamental purpose of the proposed reservoir would be the impoundment of 2,500,000 acre-feet of water of the North and Middle forks of the American River. While the lower portions of the reservoir, in the vicinity of Auburn, are readily accessible by U.S. Highway 40 and State Highway 49, only a few minor roads lead down to the existing reservoir, known as Lake Clementine, where minor boating facilities have been constructed. This reservoir would be inundated by the proposed project. It is estimated that approximately 50,000 annual visitor-days are now spent in the entire proposed Auburn reservoir area."*

The report estimated the value of existing recreation (50,000 visitor days) at the Auburn Dam site in 1962 at $33,000 based upon a unit day value of $0.66 per visitor day. The report estimated that recreation would increase to a level of 125,000 visitor days by 1985, valued at $82,500. The estimated 1985 level of visitation was held constant from 1985-2072. The present value in the study period's base year (1973) of this stream of without project recreation over the 100 year period of analysis (1973-2072) had a value of $3,870,000 (with an average annual equivalent value of approximately $120,000 per year).

Expected With-Project Recreational Use in 1963 Supplemental Report

Recreational use at Auburn and Folsom Reservoirs with Auburn Dam was estimated and documented in the 1963 Supplemental Report. The report provided the following overview of with-project conditions relative to recreation:

> *"Auburn Dam would be located on the American River near the town of Auburn. Its 2.5 million acre-feet capacity reservoir would back water up the North and Middle Forks of the American River creating a reservoir surface of 10,390 acres, with approximately 143 miles of shoreline. The upper extremity of existing Folsom Reservoir would reach to the tailrace of the Auburn dam powerplant. The proposed reservoir would be low in altitude and within easy driving distance of concentrations of population. Day use would probably predominate in the following order: sightseeing, boating, water skiing, picnicking, hiking, swimming, fishing and horseback riding. Family camping and organized group use would*

become popular in the more level portions overlooking the dam as well as along the more secluded high Forest Hill Divide area, providing this area is made easily accessible by roads and bridges."

The report estimated 2,000,000 general recreation visitor days and 500,000 camping days would have occurred in 1962 with Auburn Dam in place (assuming all facilities required for achieving the recreational benefits were in place). The analysis in the report assumed that visitation at Auburn Dam would increase to an estimated level of approximately 5,000,000 general recreation visitor days and 770,000 camping days by 1985.

Additionally, incremental recreation use at Folsom Lake State Recreation Area (FLSRA) with Auburn Dam in place was estimated at 1,263,500 additional general recreation visitor days and 45,600 camping days in 1962. The analysis in the report assumed that visitation at Auburn Dam would increase to an estimated level of approximately 4,900,000 general recreation visitor days and 182,000 camping days by 1985. As with Auburn, Folsom visitation levels were held at the 1985 level for the remainder of the period of analysis.

Net Recreation Benefits Presented in 1963 Supplemental Report

In the 1963 analysis, the 1962 visitation estimates identified above for with and without project recreation were escalated to provide visitation estimates for each year in the period of analysis (1973-2072). As noted above, visitation was estimated to increase from 1973 through 1985 and then was held constant at the 1985 level through 2072.

The economic value of recreation was calculated by multiplying the visitation estimates by unit day values ($0.66 for general recreation, and $.50 for camping recreation). The net value of the projected visitation was calculated by subtracting the without project recreation value estimates at the Auburn Dam site from the with project value estimates.

Net benefits over the period of analysis were converted to their value in a common base year (1973). The discounted value of net recreation from each year in the period of analysis was summed to derive an estimate of the total present value of net recreation benefits over the 100 year period of analysis. This present value was then converted to its average annual equivalent value using the $2^{7}/_{8}$% discount rate.

Table VII-1 summarizes the 1963 recreation benefit estimate as presented in the Supplemental Report. Note that these values are presented in a 1958 price level and were calculated over a 100 year period of analysis.

TABLE VII -1: RECREATION BENEFIT ESTIMATE IN 1963 SUPPLEMENTAL REPORT

Fiscal Year	Project Year	Annual Benefits ($) or Annual Increase[1]	Present Worth Factor (2-7/8%)	Present Worth ($) at 2-7/8%
		AUBURN RESERVOIR		
1973 – 1985[2]	1- 12	2,524,371	10.029	25,317,000
1973 – 1985[3]	1- 12	89,761	61.806	5,548,000
1986 - 2072	13-100	3,601,500	22.710	81,790,000
Total (Auburn)		---	---	112,655,000
Annual equivalent (Auburn)			---	3,441,000
		FOLSOM RESERVOIR		
1973 - 1985[b]	1- 12	2,037,296	10.029	20,432,000
1973 - 1985[c]	1- 12	107,326	61.806	6,633,000
1986 - 2072	13-100	3,325,200	22.710	75,515,000
Total (Folsom)		---	---	102,580,000
Annual equivalent (Folsom)			---	3,133,000
Total present worth in 1958 price level (Auburn and Folsom)				215,235,000
Annual equivalent in 1958 price level (Auburn and Folsom)				6,574,000

[1]Recreation benefit estimates net out lost recreation estimated to be valued at approximately $57,000 in 1973 and increasing to an annual value of $82,500 in years 1985 through 2072.

[2]Values given on these lines represent the level of accomplishment in fiscal year 1973 and do not include any build-up during the 12-year period from 1973 to 1985.

[3]Values given on these lines represent the build-up in accomplishments between 1973 and 1985. The level existing in 1973 is not included.

SOURCE: Table reproduced from Auburn Folsom South Unit Central Valley Project, California – Economic Analysis Appendix Supporting Schedule 6-B Annual Equivalent Recreation Benefits – Auburn and Folsom Reservoirs; U.S Department of the Interior, Bureau of Reclamation Region 2; Sacramento California, March 1963.

PRIMARY CHANGES AFFECTING BENEFIT ESTIMATION

Significant changes in demographic and socioeconomic conditions, as well as recreational use associated with the study area have occurred since the time of the analysis documented in the Supplemental Report. The most significant changes affecting the previous recreational estimates include changes in without-project recreational use, changes in expected visitation, and current user day values for recreation in the study area. Additionally, assumptions applied in the 1963 analysis regarding recreational visitation capacity of Auburn Dam and Folsom Lake resulted in much higher estimates of visitation than currently considered feasible by the California Department of Park and Recreation (DPR).

At the time of the Supplemental Report, relatively little recreation use was documented in the inundation area of the proposed Auburn Dam. The main recreational activity in the area was water related recreation occurring at Lake Clementine. The lands acquired for Auburn Dam construction and operation have been under the management of DPR since entering into an agreement with the U.S. Bureau of Reclamation in 1977. The project lands managed by DPR were later designated as the Auburn State Recreation Area (ASRA). Today, the ASRA provides a natural area offering a wide variety of recreation opportunities to over 900,000 visitors annually, including:

- Hiking
- Swimming
- Boating
- Fishing
- Camping
- Mountain Biking
- Gold Panning
- Off-Highway Vehicle Riding

  (Source: California State Parks, 2003)

To better estimate the magnitude of potential recreational benefits of construction of Auburn Dam under current conditions, a revised evaluation methodology was applied based upon updated factors and assumptions as documented below.

METHODOLOGY FOR PRELIMINARY UPDATE

The U.S. Water Resources Council published the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G) in 1983 to guide the formulation and evaluation studies of the major Federal water resources development agencies. The P&G identifies procedures for evaluating the beneficial and adverse effects of actions on recreation. The P&G identifies a nine step framework for evaluating recreation benefits as shown in Figure VII-1. This framework was applied in this preliminary benefits update.

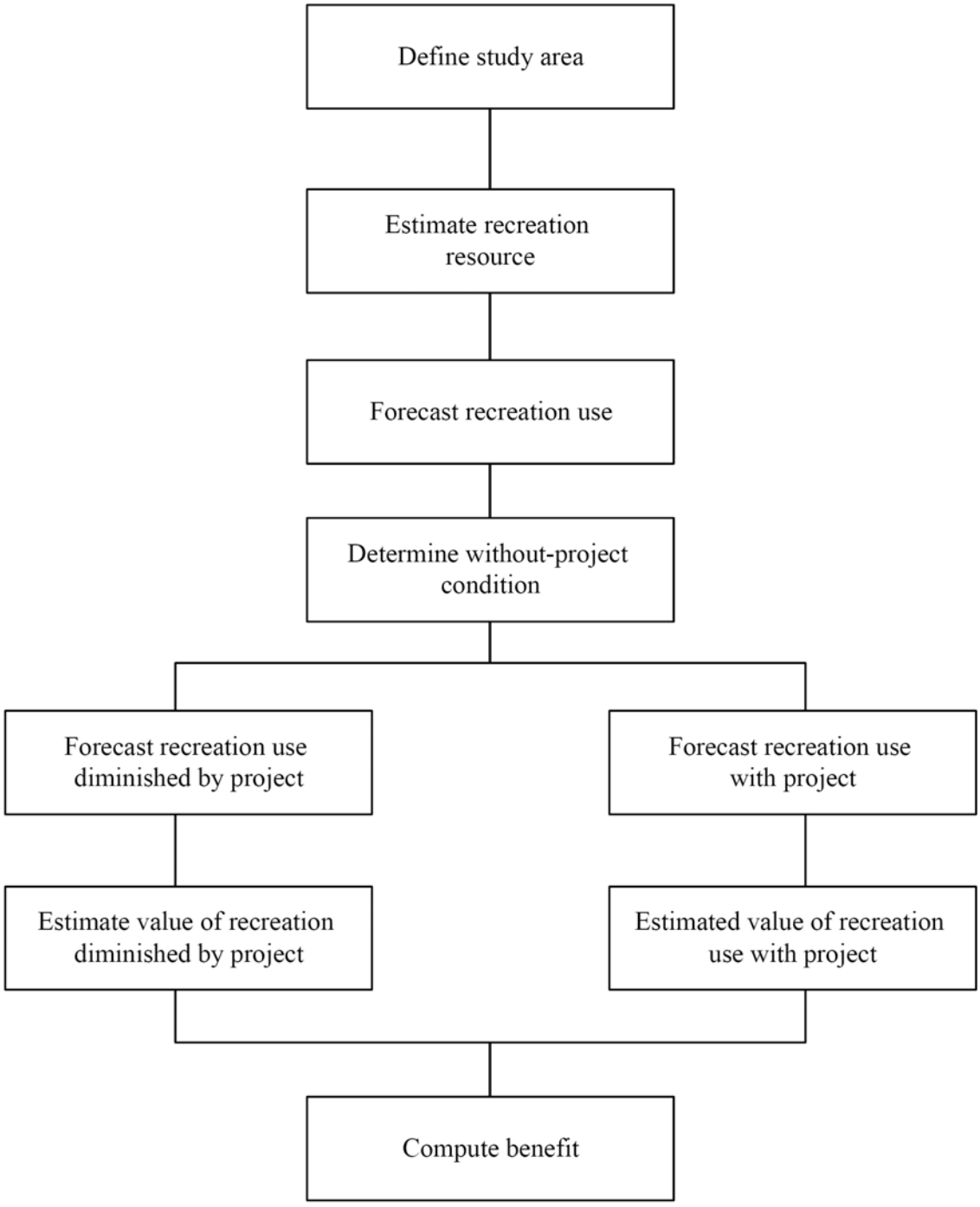


FIGURE VII-1: RECREATION BENEFIT EVALUATION FRAMEWORK

Economic Factors Applied in Benefit Calculations

This benefit update was based upon a one-hundred year period of analysis and the Fiscal Year 2006 Federal discount rate of 5⅛%. Values are presented in an October 2006 price level. For the purposes of economic analysis for this update, the base year (year when benefits of dam construction begin to accrue) is assumed to be 2025. For this recreation analysis, it is further assumed that all recreation infrastructure required to achieve estimated benefits would be in place at the time of the base year.

Study Area

For the purposes of this recreation benefits update, the study area includes the Auburn State Recreation Area (ASRA) and the Folsom Lake State Recreation Area (FLSRA). The study area also includes the recreation demand area for the state recreation areas. The primary recreation demand area was defined as the counties of Placer, El Dorado, and Sacramento. This study area is within 2 to 3 hours travel time of the San Francisco Bay Area and is within 40 minutes travel time of the Sacramento metropolitan area.

Population and demographic trends for this area are included in Section II of this report. Population growth has occurred at an average annual combined rate of 1.37% for the three counties (Placer, El Dorado, and Sacramento) over the period of 1960-2005 (from a population of 589,166 in 1960 to 1,857,351 in 2005). Population in the three counties is projected to grow at an average annual rate of 1.14% over the period of 2005 through 2050 (to a projected total of 3,798,143 in 2050). Continued population growth and urbanization in the demand area is expected to result in increased regional recreation demand over the period of analysis.

Recreation Resource and Use

This section provides an overview of recreational opportunities at the ASRA and FLSRA as well as an overview of similar recreational opportunities within the region.

Auburn State Recreation Area

As noted above, The ASRA is made up of the lands set aside for the Auburn Dam. DPR administers the area under contract with the U.S. Bureau of Reclamation. The current suite of recreational features, activities, and facilities provided at the ASRA are summarized in Table VII-2. The locations and features of specific individual recreational sites within ASRA are shown in Figure VII-2.

TABLE VII-2: ASRA RECREATIONAL FEATURES, ACTIVITIES, AND FACILITIES

• Bike Trails	• Boat Mooring
• Family Campsites	• Boat Ramps
• Fishing and Hunting	• Boat-in Camps
• Hiking Trails	• Picnic Areas
• Horseback Trails	• Swimming
• Gold Panning	• Whitewater Rafting
• Off-Highway Vehicle Trails	• Annual Events

Some of the park's key recreational opportunities are summarized in the following paragraphs: (Source: California State Parks, 2003 and 2006).

Hiking & Horse Trails: Over 100 miles of hiking and horse trails wind through the steep American River canyons and along the North and Middle Forks of the American River. The most famous trail is the Western States Trail, which runs 100 miles from Lake Tahoe to Auburn, with over 20 miles in the park. Major trail heads within the ASRA are summarized below.

- Auburn Staging Area trail head is located on Pleasant Avenue in Auburn City. This trail head connects with trails going to Cool, Foresthill and other park trails in El Dorado County. The trail is the end of the Western States Trail. Parking (including horse trailer parking) is provided.

- Maidu Drive trail head is located off Auburn-Folsom Road in Auburn. This trail connects to the Auburn-Folsom-Sacramento trail system and includes limited parking.

- Highway 49 trail head is located on the North Fork American River at the Old Foresthill Road. Known as the "Confluence", due to the meeting of the North and Middle Forks, this area is the main trail head area for hiking & mountain biking. Trails from this area lead to Lake Clementine, Mammoth Bar, Auburn (Russell Road) and along the North Fork. Roadside parking is available. This trail is often very crowded on summer weekends.

- Quarry Road Trail trail head is located on Highway 49, approximately 1/4 mile south of the North Fork American River. This trail head connects with Western States Trail and all trails in El Dorado County. Limited parking is provided. This trail is open to equestrian, hiking, and biking uses.

- Cool trail head is located in El Dorado County, behind the Cool fire station. This is the trail head for the 10 mile Omstead Loop and connector trails. Parking is provided. The trail is open to equestrian, hiking and biking uses.

- Foresthill Divide Loop Trail is open to equestrian, hiking, and biking.

Mountain Biking: Mountain biking is a popular activity at the ASRA. Mountain biking and other bicycling is allowed on the following roads and trails.

- Stagecoach Trail runs from Russell Road in Auburn to the Old Foresthill Road Bridge on the North Fork of the American River and connects with the fire road to the west end of the big Foresthill Bridge.

- Old Lake Clementine Road Trail runs from the Old Foresthill Road Bridge to Lake Clementine Road.

- The Fire Break Trail runs from Lake Clementine Road to the Auburn Foresthill Road near the Foresthill Bridge, with the connecting Culvert Trail to Mammoth Bar.

- Trails and roads in the Mammoth Bar off-highway vehicle area are located off the Old Foresthill Road.

- Mammoth Bar to the Confluence trail.

- Quarry Road Trail, from Hwy. 49 to Poverty Bar on the North Fork American River.

- The Omstead Loop trail starts behind the fire station in Cool, on Highway 49, in El Dorado County.

Camping: Five primitive campgrounds are available in the Auburn State Recreation Area. Lake Clementine boat-in campsites are also available. The amenities offered at each site are summarized below.

- Mineral Bar Camp is located off Iowa Hill Road on the east side of the North Fork of the American River, where the Colfax Iowa Hill Road crosses the river. There are 17 designated campsites with tables, fire pits, and dry toilets. No drinking water is available. A narrow paved road serves the camp.

- Ruck-a-Chucky Camp is located on Drivers Flat Road (off Foresthill Road). There are five designated primitive campsites located on the Placer County side of the Middle Fork of the American River. Toilets and trash cans are provided. No drinking water is available. The campground is at the end of a 2.5 mile gravel/dirt road.

- Cherokee Bar Camp is located on Sliger Mine Road. At the time of this report, the camp is closed to over night camping due to public safety issues but is open for day use.

- Boat-in Camping at Lake Clementine: Campground is located on Lake Clementine Road off of Foresthill Road and includes 15 primitive boat-in campsites and 2 boat-in group sites, with pit toilets, picnic tables, and fire rings. There is no vehicle access to the camp areas. No drinking water is available. The boat-in camp is open from Memorial Day to mid September.

- River-Trail Camps: Camping Permits are available for camping in some areas outside of the designated campgrounds. Information and permits are available at the ASRA office.

- **Lake Clementine:** Lake Clementine is located off Foresthill Road, approximately two miles from Auburn. This small lake features a boat launch ramp, marina and boat-in campsites as described above in the ASRA Camping Section. Lake Clementine was created when the North Fork Dam was completed in 1939 by the Army Corps of Engineers. The dam rises 155 feet above the foundation and has a crest elevation of 718 feet. The reservoir has a capacity of 14,700 acre-feet, and a surface area of 280 acres. The reservoir is approximately 3.5 miles long and has very narrow steep canyon walls.

Gold Panning & Rock Hounding: Recreational gold panning and rock hounding is allowed in permanent running stream beds in the ASRA.

Mammoth Bar OHV Area: Mammoth Bar OHV (Off-Highway Vehicle) Area is part of the ASRA. It is located in the Sierra Nevada foothills about thirty miles northeast of Sacramento. This motorcycle/ATV riding area has been used by OHV enthusiasts for nearly 25 years and offers a wide range of trails and conditions adjacent to the Middle Fork of the American River. Some OHV motorcycle/ ATV trails are open for two-way traffic and others are one way only. OHV's are restricted to designated signed trails, to the motocross tracks, and to the PIT (Pacific International Trials) areas.

Hunting: Limited hunting is allowed in some areas and for some species in the ASRA. In general, deer, turkey and upland game birds are open to hunting from September through January; and turkey hunting during the spring season. Generally, the area open to hunting is east of the junction of the old and new Auburn-Foresthill Roads, excluding Lake Clementine, Mammoth Bar, campgrounds, trails, and property under grazing lease.

Whitewater Recreation: The North and Middle Forks of the American River can provide boaters with a quality wilderness whitewater experience. These two stretches of river present scenic vistas, great whitewater, high-quality side hikes, and river camping opportunities.

The North Fork, which has no dams or diversions upstream, offers the river boater an opportunity to experience a wide range of seasonal flows. The 13-mile run from the Iowa Hill Bridge to Upper Lake Clementine provides three different river segments. Road access at the start and end of each segment allows the boater to choose to either run one, two or all three segments. Each segment has its own level of difficulty and offers a variety of scenery and experiences.

The Middle Fork stretch starts at Oxbow Reservoir and flows 24 miles to its confluence with the North Fork American River. The river moves predominantly though a canyon wilderness and semi-wilderness area. Scattered throughout the canyon are hints of the gold rush era including the remains of a large 1915 gold dredge. This river stretch offers the whitewater boater a variety of boating experiences in three segments. These vary from a dangerous Class VI portage to a Class II float. Camping, through the river camp permit system, provides the opportunity for overnight boating. Whitewater boating outfitters offer commercial boating trips on both rivers.

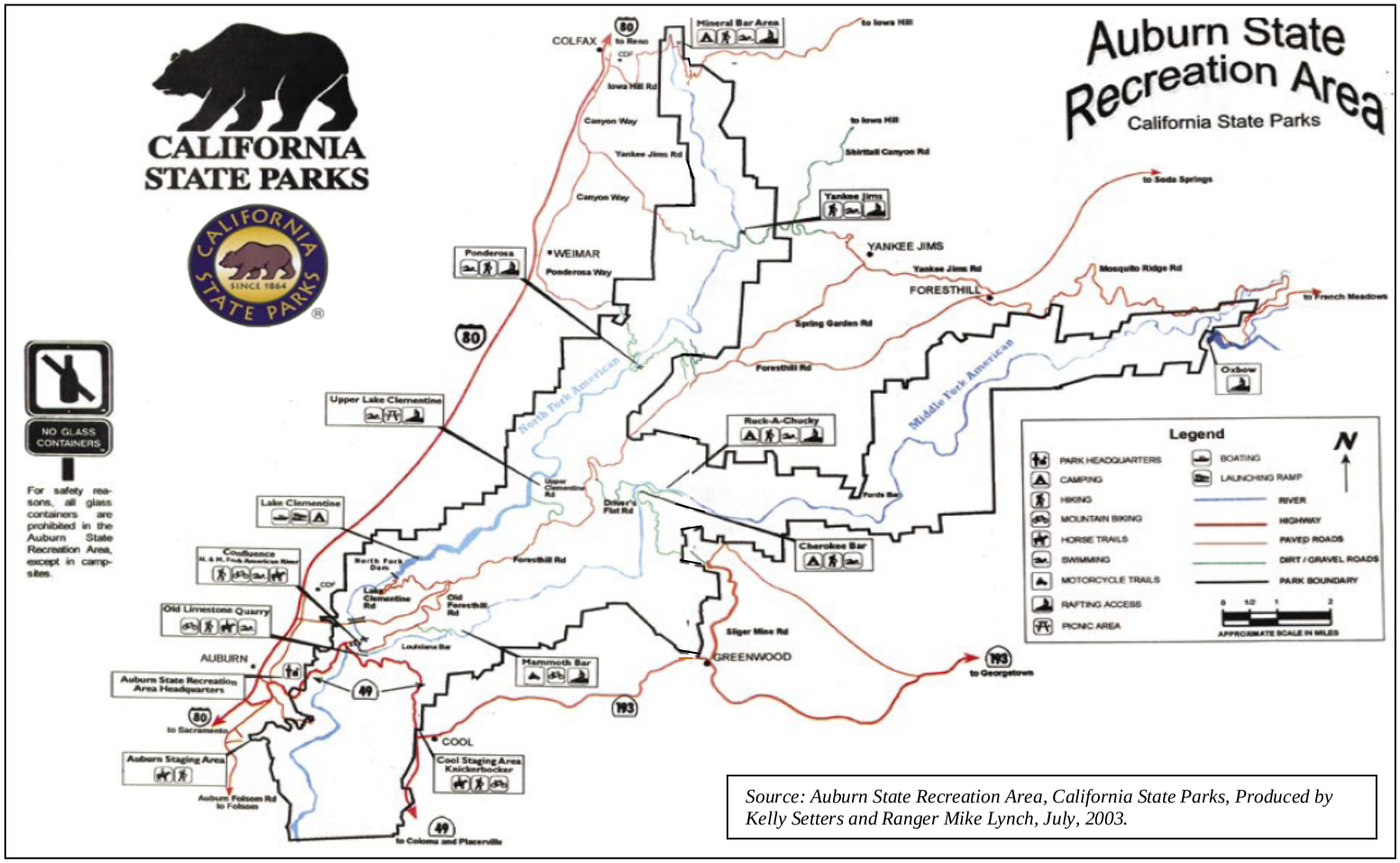
Annual Special Events: There are many special events that occur annually at the ASRA. These include:

- Western States 100 Mile Trail Ride "Tevis Cup"
- Western States 100 Mile Endurance Run
- American River Confluence Festival
- Cool Mt. Bike Race
- American River 50 Run & Endurance Ride events
- Various other long distance runs

Visitation: Attendance estimates of the California Department of Parks and Recreation over the period of 1995-2005 for the ASRA are provided in Table VII-3

TABLE VII-3: ASRA VISITATION

Fiscal Year	ASRA Visitation
1995/96	320,738
1996/97	308,466
1997/98	481,003
1998/99	545,576
1999/00	781,935
2000/01	1,024,702
2001/02	959,878
2002/03	1,094,342
2003/04	881,998
2004/05	935,566
10-year Total	7,334,204
10-year Average	733,420
5-year Total	4,896,486
5-year Average	979,297



Source: Auburn State Recreation Area, California State Parks, Produced by Kelly Setters and Ranger Mike Lynch, July, 2003.

FIGURE VII-2: ASRA EXISTING RECREATION OPPORTUNITIES

Folsom Lake State Recreation Area

The FLSRA is located in the Sierra-Nevada foothills about 25 miles east of Sacramento via either Highway 50 or I-80. The FLSRA includes both Folsom Lake and Lake Natoma. There are many access points and entrances. The primary recreation season coincides with the spring and summer months when temperatures are in the 80s, 90s, and 100s.

FLSRA offers opportunities for hiking, biking, running, camping, picnicking, horseback riding, fishing, water-skiing and boating. For cyclists, there is a 32-mile long bicycle path that connects Folsom Lake with many Sacramento County parks before reaching Old Sacramento. The park also includes Lake Natoma, downstream from Folsom Lake, which is popular for crew races, sailing, kayaking and other aquatic sports.

The water level at Folsom Lake dictates the type of recreation and length of the season. During years with normal precipitation, the main summer recreational season is June through September. During the remaining months of the year, use of Folsom Lake drops considerably. The desired reservoir elevation for recreation is approximately 435' to 455'. Above 455' less beach is available for swimmers and sunbathers, and below 435' feet the waterline is too great a distance from parking areas. Another problem with lower lake levels is that, at 426', boat ramps around the lake go out of service, and the only marina at the lake cannot moor most boats when the lake level is below an elevation of 412 feet.

The current suite of recreational features, activities, and facilities provided at the FLSRA are summarized in Table VII-4. Figure VII-3 shows the locations of the Lake's boat launches and the Folsom Lake Marina at Brown's Ravine.

TABLE VII-4: FLSRA RECREATIONAL FEATURES, ACTIVITIES, AND FACILITIES

• Beach Wheelchair Access	• Wildlife Viewing
• Bike Trails	• Windsurfing
• Environmental Campsites	• Boat Ramps
• Exhibits and Programs	• Campers (Max. Length) 31'
• Family Campsites	• Food Service
• Fishing	• Parking
• Group Campsites	• Picnic Areas
• Hiking Trails	• Restrooms
• Horseback Trails	• RV Dump Station
• Nature Trails	• Trailers (Max. Length) 31'
• Swimming	• Visitor Center

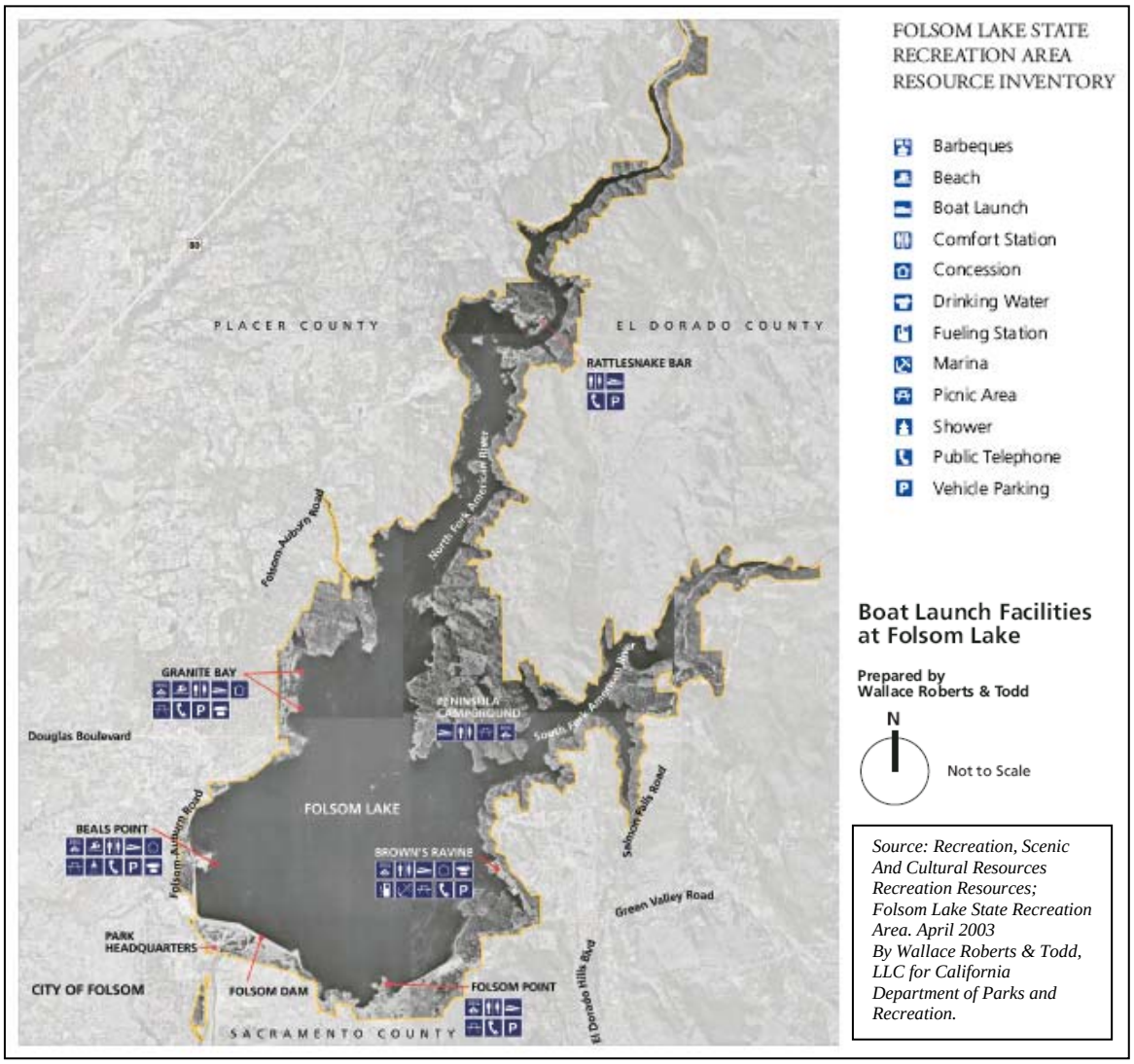


FIGURE VII-3: FLSRA – BOAT LAUNCH FACILITIES AT FOLSOM LAKE

Some of FLSRA's key recreational opportunities are summarized in the following paragraphs: (Source: California State Parks, 2006).

Granite Bay: Granite Bay provides a sandy beach, buoyed swim area, and lifeguard services during the summer season. Barbecue pits, shaded areas and large grassy areas can accommodate family picnics and other activities. The Granite Bay snack bar also rents beach equipment, including non motorized watercraft and jet skis.

Beal's Point: Barbecue pits, shade areas and large grassy areas are provided at Beal's Point, one of two locations on the lake that allows overnight camping in the campground (see FLSRA Camping Section, below). Another popular feature at this site is access to the American River bicycle trail. The 32-mile paved trail starts at Beal's Point and follows the American River to Old

Sacramento. The Beal's Point Snack Bar rents beach equipment, non-motorized watercraft and jet skis.

Marina: Folsom Lake Marina is one of the largest inland marinas in California. The marina is located in Browns Ravine in the FLSRA. It is the only Marina on Folsom Lake and is open year round. The whole Browns Ravine area is operated by a concessionaire for the State Park System. The marina has 685 wet slips and 175 dry slips, which can accommodate boats up to 26 feet in length. There is currently a waiting list for all size slips of one to three years, depending on the size of the boat. The Marina is located at the south end of the lake and has an earth filled breakwater protecting it from the main part of the lake. The main launch ramp has four lanes and two courtesy docks to assist boaters in the launching and retrieval of their boats. The Hobie Cove ramp is a low water ramp that goes into operation when the lake elevation drops to elevation 435'. It also is a four lane paved ramp with two courtesy docks. Picnic tables and barbecue grills are located throughout the Browns Ravine area. Swimming and sun bathing in the Hobie Cove area of Browns Ravine is a popular activity.

Camping: Folsom Lake has three campgrounds. Beal's Point and Peninsula campgrounds are located on Folsom Lake and Negro Bar campground is located at Lake Natoma. Beal's Point and Negro Bar are developed campgrounds. The park also offers hike-in camping opportunities at Avery Pond.

- Beal's Point: Located just north of Folsom Dam, Beal's Point has 69 family campsites that will accommodate trailers and motor homes up to 31 feet long. Hookups are not provided in individual campsites, but there is a trailer dump station. Piped drinking water and wheelchair accessible rest rooms with showers are available. Beal's Point is open year round.

- Peninsula: This secluded campground is located near the end of the peninsula between the north and south forks of the American River. The campground is accessible by boat or by car. The campground has 100 family campsites that will accommodate trailers up to 18 feet in length and motor homes up to 24 feet. There are two launch ramps and a day-use area near the campground.

- Negro Bar: Two group campgrounds located at Negro Bar can accommodate up to 50 people each. A third group camp is designed for 25 people.

- Avery Pond: Folsom Lake has two hike-in environmental campsites at Avery's Pond. Each site will hold a maximum of 8 people. Parking for the campsites is at Rattlesnake Bar; the campsites are approximately 1.1 miles up the trail to Avery's Pond. The environmental sites do not have water or trash cans.

Boat Camping: On board camping is allowed in the following areas:

- South Fork (Deep Ravine to Higgins Point)

- North Fork (Bear Cove to Mormon Ravine)

- Brown's Ravine (Slip renters at the marina are allowed to camp on their boats in their slips overnight with registration)

Fishing: Fish and crustaceans (crayfish or crawdads) may be taken from FLSRA. All reptiles (lizards, snakes, etc.) and amphibians (frogs, salamanders, etc.) are protected. Fishing species regulations at the time of this report are presented in Tale VII-5.

TABLE VII-5: FLSRA FISHING SPECIES REGULATIONS (FOLSOM LAKE AND LAKE NATOMA)

Species	Season	Size	Bag Limit
Bass	all year	12-inch minimum	5
Trout (includes Kokanee Salmon)	all year	no minimum	5
Catfish	all year	no minimum	no limit
Bullhead	all year	no minimum	no limit
Sunfish (Crappies, Bluegill)	all year	no minimum	no limit
Crayfish	all year	no minimum	no limit

Visitation: Recreation visitation estimates of the California Department of Parks and Recreation over the period of 1995-2005 for the FLSRA are provided in Table VII-6

TABLE VII-6: FLSRA VISITATION

Fiscal Year	Folsom Lake SRA
1995/96	912,552
1996/97	533,442
1997/98	1,127,350
1998/99	1,492,342
1999/00	1,662,456
2000/01	1,684,667
2001/02	1,758,331
2002/03	1,309,138
2003/04	1,144,966
2004/05	878,000
10-year Total	12,503,244
10-year Average	1,250,324
5-year Total	6,775,102
5-year Average	1,355,020

Similar Regional Recreation Opportunities

The regional recreation resource for like types of water and land-based recreational opportunities includes:

Lake Berryessa: Lake Berryessa was formed when the Bureau of Reclamation built Monticello Dam on Putah Creek in 1957. Project purposes included flood control, municipal and industrial water supply, and irrigation water supply. Lake Berryessa is owned by the Bureau of Reclamation and operated under a cooperative agreement by the Solano County Water Agency/Solano Irrigation District. The project provides flood control protection to the city of Winters and other downstream communities and water supply for irrigation and the cities of Vacaville, Suisun City, Vallejo, and Fairfield. At capacity, Lake Berryessa stores 1.6 million acre feet of water and is one of the largest bodies of fresh water in California. The lake is 23 miles long, 3 miles wide, with 165 miles of shoreline. Reclamation and the California Department of Fish and Game jointly manage a 2,000-acre wildlife area along the east side of the lake. The Bureau of Reclamation provides several free recreation locations including two large day use areas (Oak Shores and Smittle Creek); Capell Cove launch ramp; and many smaller dispersed day use areas. The Bureau of Reclamation enters into contracts with concessionaires to provide additional recreational opportunities at Lake Berryessa such as camping, overnight accommodations, day use, food service, and boating facilities. Lake Berryessa is approximately 50 miles from Sacramento and approximately 80 miles from the ASRA by road. (USBR 2006)

Harry L Englebright Lake: Englebright Lake, managed by the Sacramento District, U.S. Army Corps of Engineers, is located in the Yuba River canyon of the Sierra Nevada foothills. The lake is located between Grass Valley and Yuba City off State Route 20. The lake offers boat-in camping, sport fishing, wildlife viewing, and year round water-based recreational activities. Englebright Lake is approximately 70 miles from Sacramento and approximately 50 miles from the ASRA by road. (Recreation.Gov 2006)

Lake Oroville: Lake Oroville, managed by the California Department of Water Resources, is part of the State Water Project (SWP). Lake Oroville is the SWP's largest reservoir (and the state's second largest reservoir), with a capacity of 3.5 million acre-feet. (CDWR, 2006) Recreation at the Lake is managed through the California Department of Parks and Recreation's Lake Oroville State Recreation Area (LOSRA). The LOSRA offers a wide variety of outdoor activities including camping, picnicking, horseback riding, hiking, sail and power boating, water-skiing, fishing, swimming, boat-in camping, floating campsites and horse camping. Lake Oroville Visitor Center has a museum, exhibits, videos and a store. (California State Parks 2006) Lake Oroville is approximately 70 miles from Sacramento and approximately 90 miles from the ASRA by road.

Sugar Pine Reservoir: Recreation at Sugar Pine Reservoir is managed by Tahoe National Forest under an agreement with the Bureau of Reclamation. Sugar Pine Reservoir was created by Sugar Pine Dam across Shirttail Creek. The dam is a feature of the Central Valley project, American River Division, Folsom Auburn Unit. The reservoir offers four main recreation areas around the lake, including two campgrounds, a boat ramp, hiking trails, a picnic area, a swimming beach, and a trailer dump station. The facilities are operated under a concession agreement issued by the

U.S. Forest Service. Sugar Pine Reservoir is located off Foresthill Road northeast of the city of Auburn. Sugar Pine is approximately 65 miles from Sacramento and approximately 35 miles from the ASRA by road. (Recreation.Gov 2006)

Eldorado National Forest: The Eldorado National Forest is located in the central Sierra Nevada. Portions of Alpine, Amador, El Dorado, and Placer counties lie within the Forest Boundary. The forest is bordered on the north by the Tahoe National Forest, on the east by the Lake Tahoe Basin Management Unit, on the southeast by the Humboldt-Toiyabe, and to the south by the Stanislaus National Forest. Sacramento is located within 1 - 1 1/2 hours driving time from the forest with a population of over 1,000,000 people. The forest is located within 3 - 4 hours driving time from the San Francisco Bay Area. The Eldorado National Forest provides diverse recreational opportunities to the public, including (USFS 2006):

- Over 70 developed camping facilities including family and group campgrounds, picnic areas, boat ramps, and rental cabins
- Dispersed camping
- Many coldwater reservoirs, rivers, lakes and streams including some with developed boating access ramps and campgrounds
- Fishing
- Motorized (OHV) use trails
- Non-motorized use trails (many non-motorized trails are open to hikers, cyclists and equestrian users)
- Rental cabins
- 2 designated Wilderness Areas (Desolation Wilderness and Mokelumne Wilderness)
- Backpacking or horse packing
- Winter sports

Without-Project and With-Project Conditions

The methodology applied for this recreational benefit update is based upon estimating the difference in the values of recreational benefits with and without the construction of Auburn Dam (referred to as "with-project" and "without-project" conditions and benefits) over the 100-year period of analysis.

Evaluation Methodology

The unit day value (UDV) method for estimating the value of recreation benefits was applied for this benefit update. When the UDV method is used for economic evaluations, planners select a specific value from the range of values provided in the most current published schedule. Application of the selected value to estimated annual use over the period of analysis, in the context of the with- and without-project framework of analysis, provides the estimate of recreation benefits. The UDV method relies on expert or informed opinion and judgment to develop point ratings for the alternative future conditions in the study area as they relate to

recreation. For this study, DPR staff of the Auburn and Folsom State Recreation Areas developed the point ratings for with- and without-project conditions at both the SRAs.

The published point rating method in the P&G was applied to guide the selection of the appropriate recreation value from the published range. The factors in this point rating method are described in Table VII-7. The corresponding range of monetary values that were applied are provided in Table VII-8. The resultant unit day monetary values are then multiplied by projected visitor use days at the two SRAs to estimate recreational benefits.

TABLE VII-7: POINT RATING SYSTEM FOR DETERMINING UNIT DAY VALUE

Evaluation Criteria	Rating Factors
Recreation Experience (0 to 30 points)	Number of recreation activities and quality of activities
Availability of Opportunity (0 to 18 points)	Number of similar recreational sites within recreation demand area and distance to those sites
Carrying Capacity (0 to 14 points)	Level of facility development to support intended recreation uses without resource or experience deterioration.
Accessibility (0 to 18 points)	Level and quality of access to site and within site to accommodate intended recreational activities.
Environmental Quality (0 to 20 points)	Aesthetic quality and its impact on recreational experience.

Source: Principles and Guidelines for Water and Related Land Resource Studies, U.S. Water Resources Council, 1983.

TABLE VII-8: FY2006 UNIT DAY VALUE TABLE

Point Values	General Recreation Values	General Hunting and Fishing Values	Specialized Recreation Values
0	$3.19	$4.59	$12.96
10	$3.79	$5.18	$13.76
20	$4.19	$5.58	$14.75
30	$4.79	$6.18	$15.95
40	$5.98	$6.78	$16.95
50	$6.78	$7.38	$19.14
60	$7.38	$8.17	$21.14
70	$7.78	$8.57	$25.52
80	$8.57	$9.17	$29.71
90	$9.17	$9.37	$33.90
100	$9.57	$9.57	$37.88

Source: U.S. Army Corps of Engineers, Economic Guidance Memorandum 06-03; Unit Day Values for Recreation, Fiscal Year 2006; Published 24 October, 2005.

Key Assumptions

For this preliminary recreation benefits update, without-project recreational features and facilities at the ASRA and FLSRA were assumed to remain similar to those provided under current conditions. It was also assumed that the projected population growth within the region would result in growth in the demand for recreation at the two SRAs over the 100-year period of analysis; although expected to occur at a lesser rate than the projected growth in population. Projected visitation was not allowed to exceed visitation capacity limits identified by DPR for each SRA under both with- and without-project conditions.

The evaluation of with-project conditions assumed that the recreational features and facilities at the FLSRA would remain the same as those assumed for without project conditions at the site. Estimated differences in the quantity and quality of recreational use at FLSRA under with project conditions was assumed to be a function of the average annual days that the lake would be drawn below 430' (corresponding to storage volume of approximately 600,000 acre-feet) which would impede the use of recreational infrastructure around the lake. The results of an analysis of modeled lake elevations under with- and without-project conditions are presented in Table VII-9.

For the evaluation of with-project conditions at ASRA, it was assumed that the existing recreational features and uses at the ASRA as documented above would be replaced with a new suite of recreational opportunities as identified in the 1978 General Plan for the Auburn Reservoir Project prepared by the California Department of Parks and Recreation. The recreational features of this plan are summarized in Table VII-10 and shown in Figure VII-5.

TABLE VII-9: STORAGE AT FOLSOM RESERVOIR DURING RECREATION SEASON WITH AND WITHOUT AUBURN DAM

Percent of time that end of month storage is greater than 600,000 acre-feet (June through September)[1]			
Month	**Without Project**	**With Project**	**Change**
June	64%	90%	26%
July	45%	82%	37%
August	42%	74%	32%
September	38%	73%	34%
Estimated days that storage is over 600,000 acre feet (June through September)[2]			
Month	**Without Project**	**With Project**	**Change**
June	19	27	8
July	14	25	11
August	13	23	10
September	12	22	10
	Total Change:		39
Total Change in Days as % of Days in Season:			32%

[1]Based upon average end of month water elevations (1922-1994) using recorded measurements for "without project" and simulation model outputs for "with-project".
[2]Based upon end of month exceedance percentage times number of days in month.

With- and Without-Project Unit Day Point Ratings

As noted above, application of the unit day value method requires expert judgment to develop point ratings for with- and without-project conditions at the defined recreation area(s). For this study, the defined recreation evaluation areas were the FLSRA and the ASRA. The experts who developed the point ratings were planners/recreation specialists from California State Parks Department representing the two SRAs with 30 years collective experience at the projects (dating to 1977). The point ratings for each evaluation criteria are summed for without- and for with-project conditions to arrive a total point rating for each site under each condition. Tables VII-11 through VII-14 show the results of (and rationale for) the point score ratings for the 2 SRAs. These results are summarized in VII-15.

TABLE VII-10: AUBURN DAM RECREATION SITES/FEATURES IDENTIFIED IN 1978 GENERAL PLAN

Robie Point
- Picnic area – 15 sites
- Bicycle trail

El Dorado Street
- Trail staging area
- Bicycle trail
- Ferry excursion terminal
- 20 vehicles total

Clementine Road
- Car-top launch
- 15 vehicles total

Murderers Gulch
- Access check station
- Picnic area – 40 sites
- Swim floats and sunbathing decks
- 140 vehicles total

Hidden Canyon
- Access check station
- Motorcycle trail staging area – 50 vehicles
- Motorcycle trail
- Picnic area – 10 sites
- 50 vehicles total

Ponderosa Way
- Car-top launch – 20 vehicles
- Trail staging area – 20 vehicles
- 40 vehicles total

Bunch Canyon
- Access check station
- Boat launch ramp – 2 lanes, 80 vehicles
- Picnic area – 10 sites
- Trail staging area – 15 vehicles
- 95 vehicles total

Colfax-Iowa Hill Bridge
- Picnic area – 20 sites
- Car-top launch – 20 vehicles
- Trail staging area – 20 vehicles
- 40 vehicles total

Oxbows (Indian Bar)
- Picnic area - 15 sites
- Car-top launch - 20 parking
- Trail staging area - 20 parking
- 40 vehicles total

Cherokee Flat
- Access check station
- Picnic area - 35 sites
- Car-top launch - 20 vehicles
- Trail staging area - 15 vehicles
- 70 vehicles

Drivers Flat
- Entrance station
- Campground - 100 sites
- RV sanitation station
- Trail stating area - 20 vehicles
- 4-WD lake access route
- Interpretive facilities - 10 parking
- 130 vehicles total

Cave Valley
- Boat launch ramp - 6 lanes - 240 vehicles
- R&H trail staging area – 30 parking
- Picnic area – 30 sites
- Bicycle trails
- Marina
    - Ferry excursion
    - Boat rental
    - Snack bar/fuel/supplies/etc.
- 470 vehicles total

Salt Creek
- Entrance station
- Boat launch ramp – 6 lanes – 240 vehicles
- Picnic area (near ramp) – 30 sites – 45 parking
- Campground – 180 sites
- RV sanitation station
- Multi-use areas (3) – 30 vehicles each
- Campfire center
- Bicycle trails
- Administrative headquarters – 30 vehicles public parking
- 585 vehicles total

Knickerbocker Creek
- Picnic areas – 40 sites
- Stables/bicycle rental – 60 vehicles
- Trail staging area – 50 vehicles
- Bicycle trails
- Observation point/picnic area – 20 vehicles
- California Indian site museum – 60 parking
- Other day use – 140 vehicles
- Interpretive facilities
- 330 vehicles total

USBR Visitor Center
- Interpretive facilities
- Trail staging area, bicycle, R&H
- Bicycle trail
- 200 vehicles total

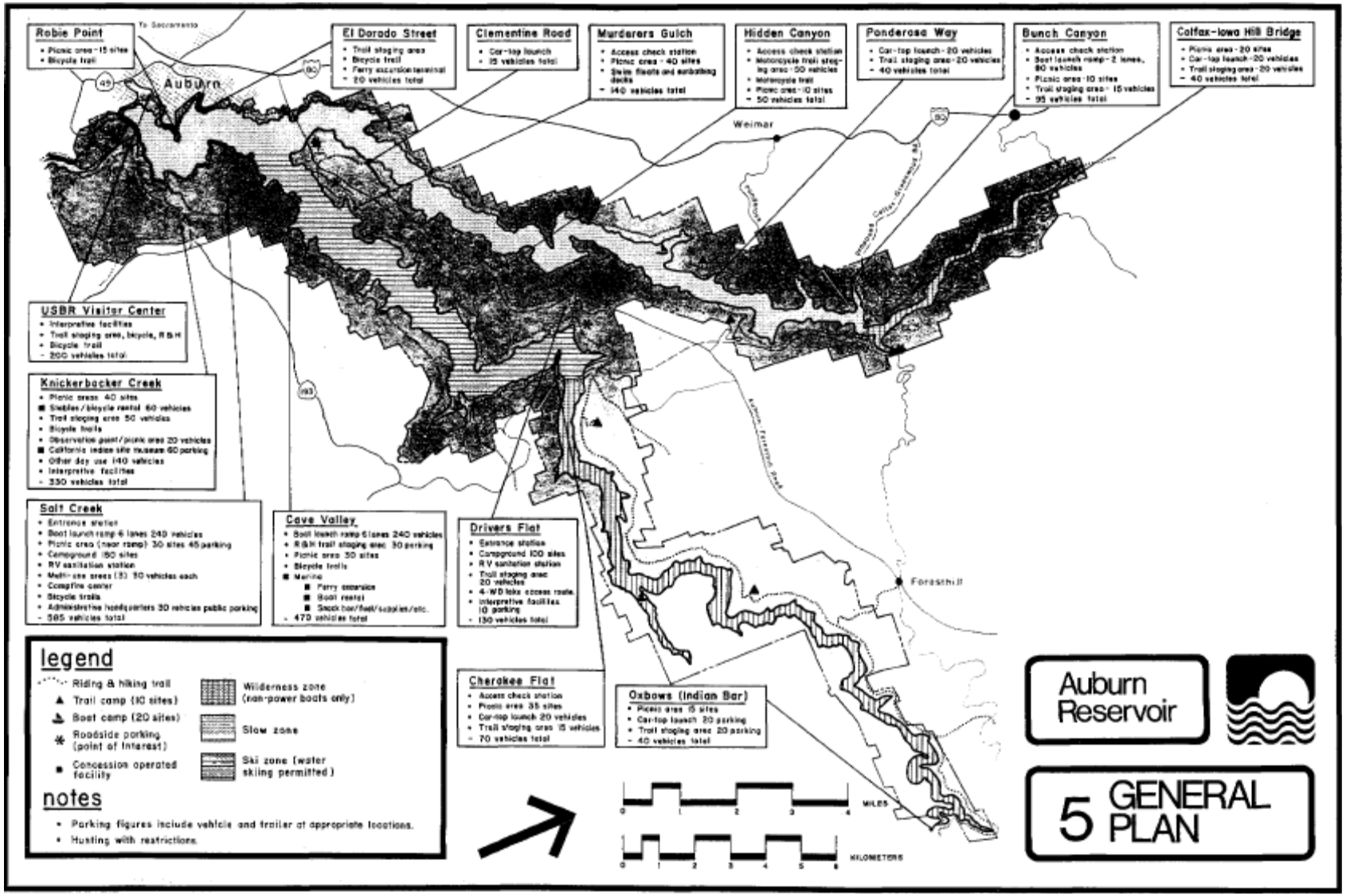


FIGURE VII-4: 1978 GENERAL PLAN FOR AUBURN RESERVOIR

TABLE VII-11: ASRA WITHOUT-PROJECT RATINGS

Criteria:	1)	Recreation experience (0 to 30 points)	
Score:	24	Rationale:	For the evaluation criteria of Recreation Experience, ASRA was rated at 24 of 30 points due to the availability of numerous "high quality" and other more "general" recreation activities at the site. The rating framework defined "high-quality" activities as those that are not common to the region and that are usually of high quality. The rating framework defined "general" activities as those that are common to the region and that are usually of normal quality, including picnicking, camping, hiking, riding, and cycling. The ASRA under without project conditions exhibits numerous high quality recreational activities such as white water recreation on both forks, hiking in wild and scenic deep river canyons on some of the trails, hiking on the historic Western States Trail, specialized mountain biking opportunities on some trails, and a designated off-highway vehicle recreation area. The ASRA also offers other "general" recreational opportunities such as motorized boating, sightseeing, and lower quality hiking, biking, and equestrian opportunities in the trail network. Under without project conditions, ASRA's recreational experiences are enhanced by their "in wilderness" qualities.
Criteria:	2)	Availability of opportunity (0 to 18 points)	
Score:	9	Rationale:	For the evaluation criteria of Availability of Opportunity, ASRA was rated at 9 of 18 points based on the availability of some activities (such as hiking, motorized boating, sightseeing, biking) within one hour, while the unique qualities of many of the current "high quality" activities place substitute activities farther away.
Criteria:	3)	Carrying capacity (0 to 14 points)	
Score:	7	Rationale:	For the evaluation criteria of Carrying Capacity, ASRA was rated at 7 of 14 points based on the provision of adequate facilities for the more primitive recreation experiences offered. The recreational features were determined to have sufficient capacity to allow current and expanded use without significant deterioration of the resource or experience.
Criteria:	4)	Accessibility (0 to 18 points)	
Score:	14	Rationale:	For the evaluation criteria of Accessibility, ASRA was rated at 14 of 18 points based upon the presence of high standard roads to the site and generally fair access roads within the site.
Criteria:	5)	Environmental (0 to 20 points)	
Score:	16	Rationale:	For the evaluation criteria of Environmental, ASRA was rated at 16 of 20 points based upon the outstanding scenic and aesthetic qualities of the current deep river canyon wilderness offered in the park. Localized detractors to overall aesthetic quality included the transportation bridges evident at the Confluence Area and some views that include houses and development. Similar aesthetic opportunities are not available within region.
Total Without Project Score Auburn SRA:			**70**

TABLE VII-12: ASRA WITH-PROJECT RATINGS

Criteria:	1)	Recreation experience (0 to 30 points)	
Score:	10	Rationale:	For the evaluation criteria of Recreation Experience under conditions with Auburn Dam in place, the ASRA rating dropped to 10 of 30 points due to the replacement of the numerous "high quality" recreational opportunities with more "general" flatwater recreation and camping activities at the site.
Criteria:	2)	Availability of opportunity (0 to 18 points)	
Score:	3	Rationale:	For the evaluation criteria of Availability of Opportunity under conditions with Auburn Dam in place, the ASRA rating dropped to 3 of 18 points. The reduction is due to the switch to recreational activities which are more regionally abundant and the associated reduction in travel time to get to like recreational opportunities. The new bridge associated with the dam would result in significant reductions in travel time to other sites offering similar flatwater and camping type recreation as offered under with project conditions.
Criteria:	3)	Carrying capacity (0 to 14 points)	
Score:	10	Rationale:	For the evaluation criteria of Carrying Capacity under conditions with Auburn Dam in place, the ASRA rating increased to 10 of 14 points. This score corresponds to the rating guide for optimum facilities to conduct planned recreational activities at site potential. The recreational features identified in the 1978 General Plan for the Auburn Dam recreational area were the basis for the rating (see Table VII-10 and Figure VII-5).
Criteria:	4)	Accessibility (0 to 18 points)	
Score:	15	Rationale:	For the evaluation criteria of Accessibility under conditions with Auburn Dam in place, the ASRA rating increased to 15 of 18 points based upon the assumed addition of good quality access roads within the recreation area to provide access to new recreation sites as identified in the 1978 General Plan for the Auburn Dam recreational area.
Criteria:	5)	Environmental (0 to 20 points)	
Score:	6	Rationale:	For the evaluation criteria of Environmental under conditions with Auburn Dam in place, the ASRA rating dropped to 6 of 20 points. The reduction was based upon a change from the unique deep river-canyon wilderness environment to an average flatwater reservoir environment. The rating accounts for the high variability of the surface elevation of the lake and the resultant aesthetic quality. Additionally, the replaced trails above the pool line would be in the view line of more development along ridgelines and noise from powerboats would be audible along some trails.
Total With-Project Score Auburn SRA:		**44**	

TABLE VII-13: FLSRA WITHOUT-PROJECT RATINGS

Criteria:	1) Recreation experience (0 to 30 points)		
Score:	10	Rationale:	For the evaluation criteria of Recreation Experience, FLSRA was rated at 10 of 30 points due to the availability of several "general" recreation activities at the site. The rating framework defined "high-quality" activities as those that are not common to the region and that and that are usually of high quality. The rating framework defined "general" activities as those that are common to the region and that are usually of normal quality, including picnicking, camping, hiking, riding, and cycling.
Criteria:	2) Availability of opportunity (0 to 18 points)		
Score:	8	Rationale:	For the evaluation criteria of Availability of Opportunity, FLSRA was rated at 8 of 18 points based on the availability of similar recreation activities (such as hiking, motorized boating, sightseeing, biking) within approximately one hour. (Lakes Berryessa, Oroville, Clementine, Sugar Pine, Englebright)
Criteria:	3) Carrying capacity (0 to 14 points)		
Score:	8	Rationale:	For the evaluation criteria of Carrying Capacity, FLSRA was rated at 8 of 14 points based on the provision of adequate facilities for the recreation experiences offered. The recreational features were determined to have sufficient capacity to allow current and expanded use without significant deterioration of the resource or experience.
Criteria:	4) Accessibility (0 to 18 points)		
Score:	12	Rationale:	For the evaluation criteria of Accessibility, FLSRA was rated at 12 of 18 points based upon the presence of high standard roads to the site and generally fair access roads within the site.
Criteria:	5) Environmental (0 to 20 points)		
Score:	4	Rationale:	For the evaluation criteria of Environmental, FLSRA was rated at 4 of 20 points based upon the average aesthetics of the flatwater reservoir environment and several factors that lower aesthetic quality to a minor degree such as the visible development in the viewline of the lake and trails and the existing variability in the surface elevation of the lake.
Total Without Project Score Folsom SRA:	**42**		

TABLE VII-14: FLSRA WITH-PROJECT RATINGS

Criteria:	1)	Recreation experience (0 to 30 points)	
Score:	10	Rationale:	For the evaluation criteria on Recreation Experience under conditions with Auburn Dam in place, the FLSRA rating did not change.
Criteria:	2)	Availability of opportunity (0 to 18 points)	
Score:	6	Rationale:	For the evaluation criteria of Availability of Opportunity under conditions with Auburn Dam in place, the FLSRA rating dropped from a score of 8 to a score of 6 out of a possible 18 points. The reduction is due to the increased availability of similar recreational opportunities in relatively close proximity provided at ASRA with the dam in place.
Criteria:	3)	Carrying capacity (0 to 14 points)	
Score:	8	Rationale:	For the evaluation criteria of Carrying Capacity under conditions with Auburn Dam in place, the FLSRA rating the FLSRA rating did not change.
Criteria:	4)	Accessibility (0 to 18 points)	
Score:	12	Rationale:	For the evaluation criteria of Accessibility under conditions with Auburn Dam in place, the FLSRA rating did not change.
Criteria:	5)	Environmental (0 to 20 points)	
Score:	6	Rationale:	For the evaluation criteria of Environmental under conditions with Auburn Dam in place, the FLSRA rating increased from a score of 4 points to a score of 8 out of a possible 20 points. The increase was based upon the reduction in surface elevation variability during the recreation season at Folsom Lake with Auburn Dam in place.
Total With-Project Score Folsom SRA:		**42**	

TABLE VII-15: SUMMARY OF UNIT DAY POINT RATINGS ASRA AND FLSRA

Recreation Unit	Without Project Point Ratings	With Project Point Ratings	Change
ASRA	70	44	-26
FLSRA	42	42	0
TOTAL	112	86	-26

The point values were then converted to unit day dollar values using the FY2006 table published by the Corps of Engineers as Economic Guidance Memorandum EGM-06, October 2005 (previously presented in Table VII-8). Table VII-16 shows the unit day values associated with the point ratings in Table VII-15. Different values are provided for "general recreation", "hunting and fishing", and "specialized recreation". For this study specialized recreation was defined as those activities of high quality that are not readily available at other sites within the region.

TABLE VII-16: UNIT DAY VALUES CORRESPONDING TO POINT RATINGS

GENERAL RECREATION CONVERSION:	
ASRA Without	
70 points	$7.78 unit day value
ASRA With	
44 points	$6.30 unit day value
FLSRA Without	
42 points	$6.14 unit day value
FLSRA With	
42 points	$6.14 unit day value
HUNTING AND FISHING RECREATION CONVERSION:	
ASRA Without	
70 points	$8.57 unit day value
ASRA With	
44 points	$7.02 unit day value
FLSRA Without	
42 points	$6.90 unit day value
FLSRA With	
42 points	$6.90 unit day value
SPECIALIZED RECREATION CONVERSION:	
ASRA Without	
70 points	$25.52 unit day value
ASRA With	
44 points	$17.83 unit day value
FLSRA Without	
42 points	$17.39 unit day value
FLSRA With	
42.0 points	$17.39 unit day value

With- and Without-Project Recreation Visitation

The unit day values in Table 5 are multiplied by daily visitation estimates at the recreation units to derive an estimate of economic benefits of recreation at each site under each condition. Visitation estimates for the two state recreation areas were provided by the California State Parks Department, Gold Fields District Office and are presented in Table VII-17. The estimates include a breakout of recreation percentages for the "general", "hunting and fishing", and "specialized" recreation categories. Some of the terms used in the table are defined below:

- **Baseline Visitation:** The term "Baseline Visitation" in the table refers to the estimate of current visitation at each SRA. All baseline data shown is considered to be an estimate of 2006 visitation and is the starting point for escalation of visitation based upon the applied visitation growth rates.

- **Optimum Capacity:** The term "Optimum Capacity" refers to the maximum level of visitation that would not result in significant deterioration of the recreation experience and/or resource. The current management practice of DPR is to limit access to recreation areas once optimum capacity is reached.

- **Visitation Participation Rate:** The term "Visitation Participation Rate" in the table refers to the percentage of total visitation at each SRA allocated to different recreation activities. For this analysis, three visitation participation rates were identified: "General", "Hunting and Fishing", and "Specialized"; where specialized recreation is defined as those activities of high quality that are not readily available at other sites within the region and general recreation is the balance of total visitation that is not considered to be specialized or related to hunting and fishing..

The baseline visitation numbers provided were adjusted to the base year (assumed to be 2025 – and for the purposes of the analysis is the first year the project would begin to accrue recreation benefits) based upon 25% of the average annual projected population growth rate in the three counties closest to the project area (Sacramento, Place, and El Dorado counties). This resulted in an annual visitation growth rate of .28% which was determined to be reasonable based upon review of visitation records at the two SRAs; which demonstrated fairly flat visitation over the past five years but still recognizing that the pressures of population growth will result in some annual visitation growth.

TABLE VII-17: DAILY VISITATION ESTIMATES

Item	Value	Notes
Auburn State Recreation Area Without Project		
Auburn SRA Baseline Visitation (2006)	979,297	Value is based upon 5-year average visitation records from fiscal years 2000/2001 - 2004/2005. This 5-year average was judged to be most accurate reflection of current baseline use.
Auburn SRA Optimum Capacity	1,500,000	DPR based this capacity estimate on expert opinion that there is additional use capacity above the baseline level at ASRA for additional trail use (both local and regional users) and additional whitewater use on both forks of the river, as well as the new section of river to be opened up between Highway 49 and Oregon Bar. DPR also considers it reasonable to assume that a new campground could be constructed at Knickerbocker and/or additional picnic areas provided within ASRA as part of future General Plan/Resource Management Plan updates.
ASRA Visitation Participation Rate - General Recreation	84.5%	Based upon DPR visitation records and expert opinion of DPR planners.
ASRA Visitation Participation Rate - Hunting and Fishing	0.5%	Based upon DPR visitation records and expert opinion of DPR planners. Fishing and hunting occur within ASRA, but current numbers are low.
ASRA Visitation Participation Rate - Specialized Recreation	15.0%	Based upon DPR visitation records and expert opinion of DPR planners. Specialized recreation use includes whitewater boating on North and Middle Forks (~25K visitors/yr), Mammoth Bar OHV Track (~20K users/yr) and exceptionally high quality trail use along Western States/Pioneer Express National Recreation Trail (~100K visitors/yr)
Folsom Lake State Recreation Area Without Project		
Folsom Lake SRA Baseline Visitation (2006)	1,355,020	Value is based upon 5-year average from fiscal years 2000/2001 - 2004/2005. This 5-year average was judged to be most accurate reflection of current baseline use.
Folsom Lake SRA Optimum Capacity	2,000,000	Value based upon DPR managers best estimate of optimum capacity. Some of the major water recreation use areas at FLSRA already operate at capacity during peak use season including: Nimbus Flat, Granite Bay, Beals Pt, Browns Ravine and Folsom Point. There is room for growth in visitor use in these areas during shoulder and off-season. There is also room for growth in other areas and uses such as trail use. The GP/RMP for FLSRA is currently being revised. FLSRA is already largely developed; the new plan does not anticipate a large amount of new recreation facility development. Some new trails, a modest expansion of the marina, a few new picnic sites and 25-50% more campsites are anticipated.
FLSRA Visitation Participation Rate - General Recreation	74%	Based upon DPR visitation records and expert opinion of DPR planners.
FLSRA Visitation Participation Rate - Hunting and Fishing	3%	Based upon DPR visitation records and expert opinion of DPR planners. Fishing occurs on Folsom Lake (a little on Lake Natoma). No hunting is allowed within FLSRA.
FLSRA Visitation Participation Rate - Specialized Recreation	23%	Based upon DPR visitation records and expert opinion of DPR planners. The rowing course and flat water paddling on Lake Natoma is a specialized and high quality recreation opportunity (~35K visitors/yr). The 2,000 meter course is considered world class. The take-outs and whitewater use on the South Fork American River contribute to a unique and specialized experience (~75K visitors/yr). The portion of the Jedediah Smith Memorial Bike Path (American River Parkway) within FLSRA is also a specialized experience; this is a nationally recognized trail (~200K visitors/yr). None of these specialized uses would be impacted or enhanced by a dam at Auburn.

Auburn State Recreation Area with Project		
Auburn SRA Baseline Visitation (2006)	650,000	With the dam, all of the specialized without project whitewater use and much of the existing high quality trail use would be eliminated. OHV track would be eliminated. DPR estimates at least 50-70% of existing use would be lost. The Auburn Reservoir would provide a new facility and opportunity, but it was judged reasonable to assume it will take visitors a few years to discover the new opportunity.
Auburn SRA Optimum Capacity	1,600,000	Optimum capacity listed is based on the estimate shown in the 1978 Auburn Reservoir Project Preliminary General Plan. The 1.6 million capacity estimate was selected to remain consistent with the General Plan. It should be noted that DPR currently estimates optimum capacity at a lower level of 1,250,000. The basis of the lower estimate includes: Auburn Reservoir would have fewer points of access and generally less recreation infrastructure than at Folsom; and overall there is greater facility capacity at FLSRA than at the proposed facilities at new Auburn Reservoir. Hence it is expected optimum capacity would be considerably less than FLSRA. The 1.6 million capacity estimate was selected to remain consistent with the general plan.
ASRA Visitation Participation Rate - General Recreation	97%	Based upon expert opinion of DPR planners.
ASRA Visitation Participation Rate - Hunting and Fishing	3%	Based upon expert opinion of DPR planners. With the dam, hunting would be prohibited due to reduced land base and danger of shooting over open water. Increased fishing would be expected to levels similar to % at Folsom.
ASRA Visitation Participation Rate - Specialized Recreation	0%	Based upon expert opinion of DPR planners. No whitewater use would remain, deep canyon portions and rugged/remote unique character of Western States Trail would be eliminated, OHV trails would be rebuilt, but no track, which is a unique resource and accounts for 75% of OHV use.
Folsom Lake State Recreation Area with Project		
Folsom Lake SRA Baseline Visitation (2006)	1,140,250	DPR managers believe that initially, a large new recreation reservoir facility at Auburn would draw visitors away from Folsom (new reservoir is competition for Folsom's opportunities) and result in a reduction of visitation at Folsom in the first year or for several years. This is particularly true for visitors who live closer to Auburn than Folsom. In the analysis this only affects the first two years of the period of analysis. With Auburn Dam it is estimated that there will be an average of 39 additional days per year during the summer season (June-September) when Folsom Reservoir would be held above 430' elevation which DPR estimated to equate to an average of 40,250 more visitors annually at Folsom Lake SRA (based on baseline use levels) than would occur without an Auburn Dam project.
Folsom Lake SRA Optimum Capacity	2,000,000	Same as above under FLSRA without Dam project.
FLSRA Visitation Participation Rate - General Recreation	74%	Same as above under FLSRA without Dam project.
FLSRA Visitation Participation Rate - Hunting and Fishing	3%	Same as above under FLSRA without Dam project.
FLSRA Visitation Participation Rate - Specialized Recreation	23%	Same as above under FLSRA without Dam project.

RESULTS OF PRELIMINARY UPDATE

To calculate the average annual benefits, recreation visitation in each year of the 100-year period of analysis was calculated based upon that year's visitation estimate; the percent participation in general recreation, hunting and fishing, and specialized recreation categories; and the unit day values for each condition. These calculations for each year in the period of analysis were converted to their present value, summed, and converted to their average annual equivalent value. The results of the benefit calculations are presented in Table VII-18.

TABLE VII-18: RECREATION BENEFIT UPDATE (CURRENT CONDITIONS)

Auburn State Recreation Area	
Average Annual Benefits	
Without-Project	$11,402,300
With-Project	$6,378,400
Net Benefits	**-$5,023,900**

Folsom Lake State Recreation Area	
Average Annual Benefits	
Without-Project	$13,216,500
With-Project	$13,437,700
Net Benefits	**$221,200**

Auburn and Folsom Lake State Recreation Areas	
Average Annual Benefits	
Without-Project	$24,618,800
With-Project	$19,816,100
Net Benefits	**-$4,802,700**

Based on the updated analysis described above, the recreation benefits attributed to the project in the 1963 supplemental report do not appear to be reasonable based upon current conditions in the study area. The most significant change in conditions since the previous study is the highly valued recreational use that is currently taking place in the ASRA. Another key finding that caused results to shift from previous analysis was the reduction in visitation that results from the lower capacities at the recreation areas from those levels assumed in the 1963 analysis.

Sensitivity Analysis of Uncertainty in Recreation Use Values and Future Visitation Assumptions

The unit day use values shown in Table VII-16 are based upon updated values provided in the 1983 P&G. A review of other studies on specific day use values indicated that these values may be conservative (lower than in some other published sources). The USDA Forest Service completed a report in 2005 comparing average values per person per day for 30 different recreation activities from over 1,200 study estimates (Forest Service, 2005). Updated for 2006

price levels, the values ranged from a low of $6.43 (for visiting environmental education centers) to a high of $423.15 (for windsurfing) with an average of $51.02 per person per day across all listed activities. This average is higher than the values presented in Table VII-16 and used in the calculation of benefits shown in Table VII-18. Note that the USDA Forest Service values are flat values for types of activities; that is they do not vary for changes in quality as with the point rankings applied in the unit day value method described above.

To examine the sensitivity of the results of the recreation analysis to higher user day values, the unit day values from Table VII-16 were replaced with applicable values from the 2005 USDA Forest Service Study and net benefits were recalculated (using the same visitation estimates). The new use values were based on averages of the listed values for applicable activities found in the Forest Service study and are presented in Table VII-19. The annual recreation benefits using the user day values in Table VII-19 are shown in Table VII-20.

TABLE VII-19: UNIT DAY VALUES BASED ON 2005 FOREST SERVICE STUDY

Activity Listed in Forest Service Study	Value in 2006 Prices[1]
GENERAL RECREATION:	
General Recreation	$37.56
Application: ASRA and FSRA both With and Without	
HUNTING AND FISHING RECREATION:	
Fishing	$50.46
Application: ASRA and FSRA both With and Without	
SPECIALIZED RECREATION:	
Specialized Activities with River Environment	
Floatboating/Rafting and Canoeing	$107.97
Mountain Biking	$78.94
Average River Activities	$93.46
Application: ASRA Without	
Specialized Activities with Lake Environment	
Beach	$42.19
Motorboating	$49.51
Waterskiing	$52.45
Average Lake Activities	$48.05
Application: ASRA With and FSRA With and Without	

[1]*Source: Forest Service, 2005; values were then updated to 2006 values using Consumer Price Index for this table.*

TABLE VII-20: RECREATION BENEFIT UPDATE (USING UNIT VALUES FROM FOREST SERVICE 2005 STUDY)

Auburn State Recreation Area	
Average Annual Benefits	
Without-Project	$50,223,600
With-Project	$27,493,400
Net Benefits	**-$22,730,200**

Folsom Lake State Recreation Area	
Average Annual Benefits	
Without-Project	$60,959,500
With-Project	$61,979,800
Net Benefits	**$1,020,300**

Auburn and Folsom Lake State Recreation Areas	
Average Annual Benefits	
Without-Project	$111,183,100
With-Project	$89,473,200
Net Benefits	**-$21,709,900**

Additional studies based on both Travel Cost Method (TCM) and Contingent Valuation Method (CVM) show that there can be a wide range of published unit day values depending on activities and regions. The Forest Service conducted a 1989 study that showed recreation user day values for Region 5, which would geographically include both ASRA and FSRA, ranging from $6 to $38 depending on activity (Forest Service, 2000). This range is close to the range of unit day values presented in Table VII-16, which had a range of from approximately $6 to $25.

Another recreation study provided aggregated river and reservoir recreation use values along the Snake River (Loomis, 1999). Although in a different region than the study area, this study involved the consideration of recreation conditions with and without dams/reservoirs on a river system. After selecting the types of activities from the Snake River study that were applicable to ASRA and FLSRA and averaging the corresponding day use values, the resultant day use values were similar for both river and reservoir activities at $86.95 and $86.88, respectively (updated for 2006 prices using Consumer Price Index).

Assumptions regarding future projected visitation also have an impact on the benefit estimates. Visitation projections used in the above point ranking/unit day value model were based on past historical visitation, projected population growth and expert judgment. As described in the previous sections, visitation projections were based upon several key assumptions, including:

- Recreation visitation at both SRAs was assumed to grow annually at ¼ of the annual projected population growth rate for the study area

- With project recreation visitation was expected to initially drop at FLSRA with Auburn Dam in place due to initial competition between the sites and the desire for some recreationists to try out the new Auburn Site.
- Initial visitation at ASRA under with project conditions was assumed to drop from existing levels based upon expert opinion of DRP recreation planners since the project would no longer offer the range of unique recreational opportunities and the assumption that it would take a while for people to discover the new site.

For sensitivity analysis, the following changes in the above visitation projection assumptions were incorporated in to the analysis as follows.

- Visitation numbers for the new *with project* Auburn facilities were allowed to grow at a rate equal to the population growth as opposed to the 25% of population growth rate used for *without project conditions*. This change was based upon an assumption that it was possible that the additional opportunity provided with the new Auburn facilities (with more than adequate capacity to meet base year demands) could allow for faster growth than existing without project facilities which have capacity limitations.

- It was assumed that FSRA would not see any of the transfer of use to ASRA (as projected by DPR and included in the methods resulting in the benefits shown Table VII-18) in the first years that Auburn facilities become operational.

- The initial loss of net visitation (new activity visitors minus loss of old activity visitors) from the without project condition to the with project condition at Auburn was assumed reduced to 25%.

Table VII-21 shows the effect on recreation benefits using these adjusted projected visitation assumptions and the Snake River reservoir and river based unit values.

TABLE VII-21: RECREATION BENEFIT UPDATE (USING UPWARD ADJUSTED PROJECTED WITH PROJECT VISITATION AND AGGREGATED UNIT VALUES FROM SNAKE RIVER)

Auburn State Recreation Area	
Average Annual Benefits	
Without-Project	$94,919,400
With-Project	$97,533,100
Net Benefits	**$2,613,700**

Folsom Lake State Recreation Area	
Average Annual Benefits	
Without-Project	$131,231,000
With-Project	$134,575,000
Net Benefits	**$3,344,000**

Auburn and Folsom Lake State Recreation Areas	
Average Annual Benefits	
Without-Project	$226,150,400
With-Project	$232,108,100
Net Benefits	**$5,957,700**

Depending on the source of published day use values and visitation assumptions, the recreation benefit estimates from the construction of Auburn Dam vary significantly. Table VII-22 show a summary of the range of benefits described in this section.

TABLE VII-22: RECREATION BENEFIT SUMMARY VALUES IN 2006 PRICES (IN $ MILLIONS)

	Net Annual Recreation Benefits Based on DPR Estimates and Point Ratings Using Values from Table VII-16	**Net Annual Recreation Benefits Using Substitute Values from Table VII-19 based on Forest Service Study**	**Net Annual Recreation Benefits Based on Adjusted Visitation (Greater Future Use) and Snake River Values**
Auburn – ASRA	-$5.0	-$22.7	$2.6
Folsom – FSRA	$0.2	$1.0	$3.3
Combined Net Benefits	-$4.8	-$21.7	$6.0

LIMITATIONS OF UPDATE APPROACH

The unit day value methodology applied for this preliminary benefit update is appropriate for this reconnaissance level of analysis. If more detailed feasibility level studies are conducted, it may be more appropriate to perform more detailed recreation valuation studies based upon similar or more detailed (contingent valuation or travel cost) methodologies for evaluating the recreation benefits or impacts of the project. Such feasibility level analysis could include more detailed analysis of recreation use valuation and future visitation projections.

As described above, the unit day value method relies on expert opinion to rate recreation quality at the site under without project and under with project conditions. The recreation quality ratings for this study were based upon expert input from DPR planners and recreation specialists with a history of experience at both SRAs. A more detailed feasibility level recreation study could elicit input from a wider base of recreation users as to recreation use and quality/value of recreation experiences in the study area.

With project conditions at ASRA are based upon the features identified in the 1978 General Plan for recreational amenities with construction of Auburn Dam. A more detailed feasibility level analysis could examine if changes in the 1978 General Plan would be required to accommodate current conditions and reflect current recreational development and management policies and priorities.

SECTION VIII
UPDATED FISH AND WILDLIFE BENEFITS

1963 FISH AND WILDLIFE BENEFITS AND EVALUATION METHODOLOGY

As presented in Section II, in 1963 the Secretary of Interior submitted a Supplemental Report on the Auburn-Folsom South Unit, Central Valley Project, California to Congress. This report resulted in Congressional authorization of construction of the Auburn Folsom South Unit. The economic benefits documented in this Supplemental Report for project justification included Fish and Wildlife Benefits. In its summary of project accomplishments, the report stated:

> *"Fish and wildlife. – The operation of Auburn Reservoir in conjunction with the existing Folsom Reservoir will make it possible to maintain a minimum pool of 600,000 acre-feet or more in all except the very critical dry years when Folsom Reservoir might be drawn down to 200,000 acre-feet and Auburn Reservoir storage could be reduced to 369,000 acre-feet, the minimum power pool. Auburn Reservoir would assist in providing control over critical water temperature releases for downstream fish spawning and propagation."*

The Supplemental Report's summary of project benefits stated:

> *"Fish and wildlife benefits. – New benefits, amounting to $459,000 on an annual equivalent basis result from angling at Auburn Reservoir and improved downstream conditions, including those at Folsom Reservoir. Annual equivalent fish and wildlife benefits attributable to the Folsom South Canal are estimated at $19,000 annually for a total of $478,000."*

These cited fish and wildlife benefits were documented in the accompanying U.S. Fish and Wildlife Service report included the following categories:

1. Sport fishing – resident fish and anadromous fish
2. Commercial fishing – anadromous fish
3. Hunting – deer, upland game, and waterfowl

The benefits by category as listed in the 1963 report are included as Table VIII-1.

Sport Fishing

Sport fishing benefits were measured in user days then translated to dollars. Dollars per user day ranged from about $0.89 to $4.50. Sport fishing value for resident fish was generally in the lower portion of the range and the higher part of the range was for sport fishing for anadromous fish. User days were estimated for 1973 (approximately four years after project completion) and then for 50 years in the future. User days for both resident fishing and anadromous fishing were

expected to increase by 100-400% over the period of analysis. It was assumed that fish populations would not limit the potential future fishing use and fishing would generally parallel human population increases in the study area.

Specific benefits to sport fishing cited in the report were a result of: 1) creation of Auburn Reservoir and a large warm-water fishery (non-native species such as bass, brown trout); 2) release of cold water from the reservoir to benefit anadromous fish in the lower American River (below Nimbus Dam) that would increase survival of fall chinook and steelhead; 3) hatchery production of winter and spring chinook that had been extirpated from the watershed; 4) benefits to reservoir fisheries in Folsom and Nimbus Reservoirs; 5) creation of reservoir fisheries in Sugarpine Reservoir and County Line Reservoir (non-native species); and 6) benefits to fishing in the Folsom South Service Area due to increased stream flows. Losses of stream fishing (rainbow trout primarily) in the North and Middle Forks of the American River were generally not quantified in dollar values, although the loss of user days was documented.

Hunting

Hunting benefits were based on user days, with a value of $2.78/user day applied to estimate monetary benefits. Specific dollar benefits were calculated for a likely increase in pheasant hunting in the Folsom South Area as a result of the project. There were expected significant declines in hunter user days for deer hunting and upland game at the Auburn Reservoir site, but these were not translated into dollars.

Commercial Fishing

Commercial fishing benefits were measured in pounds harvested, with a $0.55/pound dollar value for chinook salmon only. The increase in chinook salmon fishing appears to have been based primarily on the hatchery production of winter and spring chinook, with undocumented benefits from increased survival of fall chinook as a result of release of cool water from the dam.

TABLE VIII-1: ANNUAL FISH AND WILDLIFE BENEFITS CITED IN 1963 SUPPLEMENTAL REPORT

Fish & Wildlife Benefits Claimed in 1963 (Econ Appendix)	Annual Benefits
Auburn Reservoir Fishery (non-native bass and trout)	$70,000.00
Folsom Reservoir Fishery (non-native bass and trout)	$156,000.00
Folsom South Stream Fishery (native trout sport)	$20,000.00
Folsom South Upland Game	$19,000.00
Fall Chinook (commercial)	$48,000.00
Spring Chinook (commercial)	$128,000.00
Winter Chinook (commercial)	$32,000.00
Steelhead (commercial)	$5,000.00
Totals	*$478,000.00*

PRIMARY CHANGES AFFECTING BENEFITS

Significant changes have occurred affecting fish and wildlife benefit estimation since the analysis documented in the 1963 Supplemental Report. These include changes in fishing and hunting participation rates from assumed levels, changes to commercial fishing practices and fishery management (including ESA listings) along the Pacific Coast, and changes in the modeling of fish population productivity.

METHODOLOGY AND DATA NEEDS FOR BENEFIT UPDATE

Impacts or benefits associated with sport fishing for resident fish and hunting were captured in the recreational analysis for the preliminary update as documented in Section VII of this TM. Therefore those benefit categories are not addressed further in this Fish and Wildlife Benefits Update Section of the TM.

Potential benefits for commercial fishing and for sport fishing downstream of Nimbus Dam are discussed qualitatively below. In both cases, insufficient data exists to estimate potential benefits in quantitative terms at this time.

Potential Downstream Sport Fishing and Commercial Fishery Benefits

In the 1960 and 1963 economics analyses, a major benefit of the Auburn Reservoir was assumed to be in temperature benefits to the American River downstream from Nimbus Dam. Water stored in Auburn Reservoir would be released throughout the summer and fall and provide cold water flows into Folsom Reservoir, which could then be released downstream of Nimbus Dam. It is likely that a new analysis of potential fishery benefits from Auburn Reservoir would also identify cold water flows as a benefit to the overall American River system. However, the original calculations of benefits would likely be significantly revised.

Current populations of fall chinook and steelhead trout in the American River are significantly reduced from the numbers in the 1950s and 1960s. Based upon available data, it is not possible to determine the extent cold water flows would increase chinook or steelhead trout populations. Hatchery populations have rarely achieved the run sizes projected in the 1963 study.

Similarly, it is unlikely that commercial fishery benefits would reach the projected benefits calculated in 1963. A general decline in anadromous fishery stocks along the Pacific coastline has occurred since the 1963 analysis, resulting in a near closure of the Pacific salmon commercial fishery in California at the time of this report.

Development of reasonable estimates of benefits to sport and commercial fisheries would require more detailed modeling and evaluation of fish stocks and productivity under with- and without-project conditions at Auburn Dam than is currently available. Such analysis would likely be required if a feasibility study were undertaken to address NEPA and ESA requirements.

SECTION IX
SUMMARY OF PRELIMINARY BENEFIT UPDATE

PRELIMINARY RESULTS

As shown in section II, the total benefits attributable to both Auburn Dam and the Folsom South Unit as reported in the 1963 Report were just over $60 million. Assuming that all other existing conditions from the 1960's remained constant, inflationary price factors would raise these values considerably if represented in current 2006 prices. It was determined that such a limited price level update would fail to address the significant changes in the existing and projected future without project conditions that have occurred since that time. Demands for water resources have changed along with changes in infrastructure, historical data, procedures, guidelines and model methodologies that have collectively had a great impact on these benefit estimates. These range from intended users finding alternate sources, such as irrigation for new farmers in the valley to unanticipated without project recreational use at the Auburn State Recreation Area.

With this current analysis, benefits were very sensitive to some basic assumptions regarding operations and variable without project conditions. Therefore, for most benefit categories a range of values were provided based on several scenarios. Table IX-1 shows the results of the current benefit update over a range of possibilities in terms of minimum and maximum benefits.

It is important to note that the benefits shown in the table do not reflect any reformulation or optimization of Auburn Dam. Re-allocation of storage capacity or resizing for optimization would have a significant effect on the benefits. In addition, benefits that could be derived from the completion of the Folsom South Canal are not included in any of the preliminary results. Level of detail of model analysis was also limited, utilizing data from existing studies. In this Special Report, no plan formulation to consider various Auburn Dam alternatives has been completed. These details would require significant effort beyond the scope of the Special Study.

FINDINGS

Based on this update, construction of a 2.326 MAF dam at Auburn would provide greater dollar benefits (unadjusted for price level) than the 2.5 MAF dam described in the 1963 study. Shifts in demands for water resources and changes in without project conditions result in a change in the expected distribution of benefits of the dam. In the 1963 study, about 75% of the total benefits were from expected agricultural uses. Based on this preliminary evaluation there is a significant shift in benefits away from irrigation; while M&I, flood damage reduction, and hydropower are expected to exhibit benefit increases. With existing recreation visitation at Auburn being much greater than forecast in the 1960's, it is possible that the construction of Auburn Dam may lead to a decrease in recreational values in the study area. It is important to note that these findings are based on a preliminary reconnaissance level reevaluation with general broad based assumptions. To derive a more accurate estimate of potential benefits from the construction of Auburn Dam, a detailed feasibility study would be needed.

TABLE IX-1: PRELIMINARY ESTIMATE OF AUBURN DAM BENEFITS UNDER CURRENT (2006) CONDITIONS VALUES IN $ MILLIONS

Category	Annual Equivalent Benefits From Auburn Dam As a Range of Possible Values
IRRIGATION[1]	$25.4 to $42.5
MUNICIPAL & INDUSTRIAL[1]	$3.9 to $10.4
HYDROPOWER	$53.0 to $113.0
FLOOD DAMAGE REDUCTION[2]	$9.6 to $75.0
RECREATION	-$22.7 to $6.0
TOTAL BENEFITS[3]	**$75.7to $240.4**

[1]Simulated water supply allocations have been distributed between irrigation and M&I to provide a range of minimum to maximum benefits. The distribution shown in this table for the minimum is taken from scenario 1 (which would have higher irrigation benefits) described in section III and the maximum from scenario 2 (with higher M&I benefits).

[2]The wide range of flood damage reduction benefits listed in the table reflects the uncertainty of operations. Due to changes in hydrology since the 1963 report, the flood control space would need to be increased or additional costs would have be included in the design to meet current PMF flow requirements. Without reformulation, it is hard to determine the accomplishments of Auburn Dam and account for dam safety.

[3]Due to dependency of Irrigation and M&I benefits as described in note 1, above, minimum total benefits shown are based upon the minimum M&I value and the maximum Irrigation value. The maximum benefits shown are based upon the minimum Irrigation Value and the maximum M&I value.

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