Chapter 5
Plan Evaluation and Comparison

A critically important element of the plan formulation process is the evaluation and comparison of alternative plans. This chapter presents results of this evaluation and comparison of the No-Action Alternative and alternative plans described in Chapter 4. This chapter also (1) presents the rationale for selection of a recommended plan, which will be documented in the Final Feasibility Report; and (2) documents the consistency of the alternative plans with other major water management programs and regulations.

Alternative Plan Evaluation

Four accounts are established to display, and facilitate evaluation of, the effects of alternative plans as required by the P&G (WRC 1983): NED, environmental quality (EQ), regional economic development (RED), and other social effects (OSE). Effects of alternative plans are displayed as the difference in conditions, or differences in metrics under each account, compared to the No-Action Alternative. Economic benefits were quantified for NED and RED accounts. Additional economic benefits of alternative plans that were not quantified are discussed under the EQ, OSE, and other unquantified benefits sections below.

National Economic Development

The objective of NED analysis is to determine the change in net value of the Nation's output of goods and services that would result from implementing each alternative plan. Beneficial and adverse effects are evaluated in monetary terms, and measured in terms of changes in national income among the No-Action and various action alternatives. Beneficial effects in the NED account are (1) increases in the economic value of the national output of goods and services from an alternative plan, (2) the value of output resulting from external economies caused by an alternative plan, and (3) the value associated with the use of otherwise unemployed or underemployed labor resources for the purposes of an alternative plan. Adverse effects in the NED account are the

opportunity costs of resources used in implementing an alternative plan. These adverse effects include (1) implementation outlays, (2) associated costs, and (3) other direct costs. Specific guidelines, standards, and procedures used in NED analysis are contained in the P&G (WRC 1983).

The NED account typically includes net benefits to the following categories: agricultural water supply, M&I water supply, flood damage reduction, power (hydropower), transportation (inland navigation and ocean-going vessel navigation), recreation, commercial fishing, unemployed or underemployed labor resources, and other direct benefits.

For this analysis, the NED account includes agricultural water supply reliability, M&I water supply reliability, hydropower, flood damage reduction, and recreation, as well as the other direct benefits categories for anadromous fish survival, M&I water quality improvements, and emergency water supply.

Environmental benefits, including fisheries and ecosystem resources, are typically included in the EQ account if monetary units cannot be attributed to these benefits. However, for this analysis, ecosystem enhancement benefits for anadromous fish habitat improvements were developed as monetary units, and are included in the NED account. The contribution of the various alternatives to ecosystem enhancement can be included in the NED account under the "other direct benefits" category.

Monetized NED Benefits

Estimating the economic benefits of potential effects is critical to establishing economic feasibility and identifying a corresponding alternative plan that maximizes net benefits, consistent with Federal objectives (also called the NED plan). This section identifies valuation methods and valuation estimates for the benefit categories associated with the primary and secondary planning objectives. Additional detail for each of the benefit categories evaluated is included in the Economics Analysis Appendix.

Water Supply Reliability

The CalSim II model was used to estimate potential increases in water supply reliability to the CVP and SWP for the alternative plans. Table 5-1 shows change in water supply in long-term average and dry year average conditions for the alternative plans.

Agricultural Water Supply

Potential increases in agricultural water supply reliability provided by alternative plans are primarily achieved through storing additional San Joaquin River water during wet periods when excess flows would otherwise become controlled or uncontrolled as flood releases or Section 215 supplies (short-term contracts). Agricultural water supply reliability benefits were estimated through applying the "change in net income," method as estimated by the SWAP model, discussed in further detail in the Economic Analysis Appendix. SWAP is run for each alternative plan for wet, normal, and dry conditions. NED benefits are estimated according to the weighted average benefits across the three year types. As can be seen in Table 5-1, average annual agricultural water supply reliability benefits could range from about $18.6 million per year for Alternative Plan 1 to $20.8 million for Alternative Plans 2 and 3.

Table 5-1. Increases in Agricultural and M&I Water Supply Deliveries and Estimated Benefits for Alternative Plans[1]

Alternative Plan	1	2[2]	3	4
CVP/SWP Agricultural Water Supply Reliability				
Average – Dry/Critical Years (TAF/year)[3]	7	10	22	10
Average – All Years (TAF/year)	30	49	52	41
Average Annual Benefit ($ millions)	**$18.6**	**$20.8**	**$20.8**	**$18.9**
CVP/SWP M&I Water Supply Reliability				
Average – Dry/Critical Years (TAF/year)[3]	12	12	6	12
Average – All Years (TAF/year)	40	22	24	20
Average Annual Benefit ($ millions)	**$43.2**	**$24.0**	**$25.7**	**$22.3**
Total Water Supply Reliability[3]				
Average – Dry/Critical Years[3] (TAF/year)	19	24	30	21
Average – All Years (TAF/year)	70	71	76	61
Total Average Annual Benefit ($ millions)[4 5]	**$61.8**	**$44.8**	**$46.5**	**$41.2**

Notes:

[1] Dollar values are expressed in January 2013 price levels.

[2] Agricultural benefits were not modeled in SWAP for Alternative Plan 2, and are based on Alternative Plan 3 values due to the similar average annual deliveries.

[3] Year-types as defined in the San Joaquin Valley Water Year Hydrologic Classification Index.

[4] All numbers are rounded for display purposes; therefore, line items may not sum to totals.

[5] Total water supply reliability line items may not sum to totals.

Key:
CVP = Central Valley Project
M&I = municipal and industrial
SWP = State Water Project
TAF = thousand acre-feet

Municipal and Industrial Water Supply

The alternative plans increase water supplies to M&I water users in all water year types. Estimates for dry year and long-term average increases in deliveries to SWP SOD M&I water users are shown in Table 5-1. M&I water users have increasingly participated in the water transfer market to augment supplies. M&I water supply reliability benefits were estimated based on the weighted average benefits across all water year types. The analysis relies on values estimated through application of a water transfer pricing model, and through consideration of the costs associated with conveying the water to the M&I service areas. This method is consistent with the "cost of the most likely alternative" method recommended by the P&G. Average annual M&I water supply reliability benefits could range from about $22.3 million per year for Alternative Plan 4 to $43.2 million for Alternative Plan 1.

Emergency Water Supply

An analysis was performed considering the value of potential emergency water supplies provided by alternative plans and available to SOD residential water users during a Delta water supply outage due to a seismic or other catastrophic event. Potential supply disruptions to SOD water users depend upon a variety of factors, including the risk of a seismic or other catastrophic event, vulnerability of non-Delta water supplies, and the timing and duration of the supply disruption. Supply disruptions in an emergency that occur during prolonged periods of drought are likely to result in significantly higher economic costs than those that coincide with wetter conditions. In addition, supply disruptions that are shorter in duration will, in general, result in lower economic costs to residential water users.

Jones Tract Levee Failure, 2004
Source: California Department of Water Resources

Information regarding the risk of Delta levee failures, potential levee failure scenarios, and associated projected SOD shortages was based on information developed for the DRMS (DWR, USACE, and DFG 2007). This analysis is limited to disruptions as characterized by 1, 3, 10, 20, and 30 Delta island inundation scenarios. Economic benefits from emergency water supplies are measured according to residential users' Water Transfer Program to avoid interruptions in water deliveries. Estimated benefits were weighted according to the probability of Delta water supply disruptions due to each Delta island inundation scenario that was considered. Estimated emergency water supply benefits are presented in Table 5-2.

Table 5-2. Summary of Estimated Emergency Water Supply Benefits of Alternative Plans

Probability of Occurrence[1]	Delta Island Breach Scenario	Alternative Plan			
		1	2	3	4
		Temperance Flat RM 274 Emergency Water Supply (TAF)			
0.107	1-island	28	28	28	28
0.082	3-island	47	47	47	47
0.051	10-island	194	195	195	203
0.032	20-island	368	369	365	361
0.019	30-island	442	443	437	534
Benefit ($ millions)[2]		**$25.9**	**$26.0**	**$25.8**	**$27.1**

Notes:
[1] Probabilities of occurrence were developed by the Delta Risk Management Strategy (DWR, USACE, and DFG 2007).
[2] Dollar values are expressed in January 2013 price levels.
Key:
RM = River Mile
TAF = thousand acre feet

Ecosystem Enhancement Benefits

The Temperance Flat RM 274 Reservoir alternative plans provide opportunities for water temperature management and flow flexibility that could enhance San Joaquin River restoration efforts through additional cold-water storage, various operations strategies, and a potential SLIS. Increasing reservoir storage capacity and managing cold-water releases, including the use of an SLIS, would help to preserve a cold-water pool and allow the release of colder water during late summer and fall months that could improve ecosystem habitat conditions, especially for Chinook salmon. Routing water deliveries from Temperance Flat RM 274 Reservoir via the San Joaquin River to Mendota Pool to benefit wildlife refuges, CVP SOD contractors, or SWP M&I contractors also provides increased flow in Reach 1 of the San Joaquin River, which also provides ecosystem benefits. The level of improvement for salmon is determined through the use of the EDT biological habitat model (the EDT model is described in the Modeling Appendix). The economic benefits from habitat improvement related to temperature and flow are estimated based on the application of benefit transfer methods from applicable studies that addressed habitat improvements, combined with efforts to isolate the contribution of the alternative plans to increasing the probability of success of the anadromous fish restoration efforts.

The EDT model was used to simulate the increase in abundance of spring-run Chinook salmon that could be

Chinook salmon

achieved through temperature and flow improvements in the alternative plans. Abundance represents the number of spawning fish that the habitat improvements could sustain. Due to uncertainty and limited data regarding the survival of salmon as they migrate below the Merced River to the ocean and then return to spawn, results were developed to demonstrate a range of potential results for a low and high potential SAR. Limited data exists on SAR for San Joaquin Chinook and no data exist that could be directly related to a potential spring-run Chinook population in the San Joaquin River. SAR is known to vary widely between years largely controlled by ocean conditions or variation in other environmental conditions. These conditions make the SAR especially uncertain. Without fish in the river presently (although they are included in the forecasted future without-project conditions) an accurate SAR cannot be estimated and used in the model. Consequently, the SAR for the Investigation has been based on expert advice from the SJRRP Fisheries Management Work Group and consistency with observed rates for other anadromous fish in the Sacramento-San Joaquin River system (Barnett-Johnson, et al. 2008, Buchanan, et al. 2013). Results are presented for two SAR levels to demonstrate a range of potential benefits for a low and high survival rate. EDT modeling is further described in the Modeling Appendix Attachment A.

Ecosystem benefits are calculated as a willingness-to-pay of households to reduce the risk of extinction of San Joaquin River Chinook salmon assumed to be present in the No-Action Alternative. The calculation of ecosystem benefits is made for three geographic zones. Table 5-3 presents results for the alternative plans by geographic zone. The ecosystem benefit geographic zone (region of analysis) indicates the population that would be affected or place value on the resource. The results indicate that each alternative plan provides positive ecosystem benefits. Benefits in Zone 1 (the six-county area surrounding and adjacent to the upper San Joaquin River) range from $2.2 million to $4.9 million per year. California level ecosystem benefits (sum of Zones 1 and 2) range from $34.1 million to $75.6 million per year. United States level ecosystem benefits (sum of Zones 1, 2, and 3) range from $224.2 million to $496.9 million per year. Benefits for each subsequent larger zone include the benefits from the previous smaller zone. The benefits consider the capacity for an alternative plan to improve habitat conditions for salmon over a long-term average condition as well as the capacity to decrease the risk of extinction in dry year conditions when the species is most vulnerable.

There is considerable difficulty in valuing ecosystem enhancements due to lack of markets and associated information to provide guidance of value. The flow and temperature modifications resulting from the alternative plans may improve biological conditions and lead to increased survival of salmon populations, and an economic benefit, at least in theory, can be attributed to the alternative plans, associated operations, and cold-water volume. A large confidence interval and lack of precision exists around the ecosystem benefit results and values presented should not be interpreted as precise point estimates. Although there is uncertainty about the total value of ecosystem benefits at different regional levels, the results are reasonable and representative of other studies and literature.

Table 5-3. Average Annual Valuation of Willingness-to-Pay for Salmon Habitat Improvements for Alternative Plans [1, 2]

Alternative Plan	1		2		3		4	
Smolt-to-Adult Ratio	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Improvement in Abundance								
Percent Improvement in Long-Term Annual Average Abundance [3, 4]	0.6%	2.8%	0.4%	2.8%	-0.7%	0.6%	2.8%	4.9%
Percent Improvement in Dry Year Abundance [3, 4]	14.0%	15.9%	9.2%	13.2%	13.3%	14.6%	11.1%	13.1%
Ecosystem Benefits								
6-County Level ($ millions)	$3.9	$2.2	$2.5	$2.2	$2.7	$0.5	$4.9	$3.9
CA Level ($ millions)	$59.6	$34.1	$38.8	$33.9	$40.9	$7.6	$75.6	$59.5
U.S. Level ($ millions)	$391.7	$224.2	$255.2	$222.9	$269.2	$49.7	$496.9	$391.3

Notes:
[1] January 2013 price levels.
[2] All numbers are rounded for display purposes; therefore, line items may not sum to totals.
[3] Alternative plans are compared to No-Action Alternative.
[4] Further detail for EDT modeling is presented in the Modeling Appendix Attachment A.

Key:
CA = California

M&I Water Quality

Temperance Flat RM 274 Reservoir alternative plans that route new water supplies to M&I users through the Friant-Kern Canal and cross-valley conveyance (Alternative Plan 3) could improve water quality in the California Aqueduct. The estimate of benefits due to improved M&I water quality reflects the cost savings related to reduction of TDS and other constituents at the receiving water treatment plant. Water quality benefits for Alternative Plan 3 are $2 million annually.

Hydropower

Developing Temperance Flat RM 274 Reservoir would result in the ability to increase hydropower energy generation at Friant Dam generating facilities as well as generate additional hydropower at the Temperance Flat RM 274 Reservoir outlet to mitigate for impacts to the Kerckhoff Hydroelectric Project powerhouses within the inundation area of Temperance Flat RM 274 Reservoir. As can be seen in Table 5-4, construction and operation of Temperance Flat RM 274 Reservoir could result in increased power generation of about 15.7 GWh per year at Friant Dam. Table 5-4, estimated average annual Friant Dam hydropower energy generation benefits of the four plans are $1.6 million. These benefits do not include the energy generation and ancillary services at Temperance Flat RM 274 Reservoir for mitigation of the Kerckhoff Power Project impacts.

Table 5-4. Summary of Friant Dam Hydropower Accomplishment Values for Alternative Plans

Alternative Plan	1	2	3	4
Friant Dam Hydropower Energy Generation				
Change in Hydropower Energy Generation at Friant Dam (Gigawatt-hour/year)	15.8	15.6	15.7	15.7
Average Annual Benefit ($ millions) [1]	**$1.6**	**$1.6**	**$1.6**	**$1.6**

Notes:
[1] Dollar values are expressed in January 2013 price levels.

Recreation

Construction and operation of Temperance Flat RM 274 Reservoir would affect recreation participation by stabilizing the elevation of Millerton Lake water surface throughout the year and specifically during the peak recreational season (April through September). Additionally, creation of a new Temperance Flat RM 274 Reservoir would provide additional water surface acres available for recreational activities in the region. The estimated increase in national recreational value is based on recreational visitor-day values displayed in Table 5-5 below. Table 5-6 compares user days (visitor-days) and estimated recreation values for the No-Action Alternative and each alternative plan. The estimated benefit to recreation ranges from about $6.4 million to $7.4 million per year.

Table 5-5. Recreational Activity Estimated Values per Visitor-Day

Recreational Activity	Value (2013$)
Camping	$45.34
Fishing	$57.49
Hiking	$37.60
Motorboating	$56.41
Picnicking	$50.54
Swimming	$52.03
Waterskiing	$59.76

Source: Loomis 2005

Table 5-6. Average Annual Predicted Visitor-Days and Recreational Values

Alternative Plan	1	2	3	4
Recreation				
Annual Increase in Millerton Lake Visitor Days (1,000) [1]	34.0	34.0	34.0	34.0
Average Annual Benefit ($ millions) [2]	**$1.8**	**$1.8**	**$1.8**	**$1.8**
Annual Increase in Temperance Flat Reservoir Visitor Days (1,000) [1]	82.2	83.0	79.6	96.4
Average Annual Benefit ($ millions) [2]	**$4.8**	**$4.8**	**$4.6**	**$5.6**
Annual Increase in Total Visitor Days (1,000) [1]	116.2	117.0	113.6	130.4
Total Average Annual Benefit ($ millions) [2]	**$6.6**	**$6.6**	**$6.4**	**$7.4**

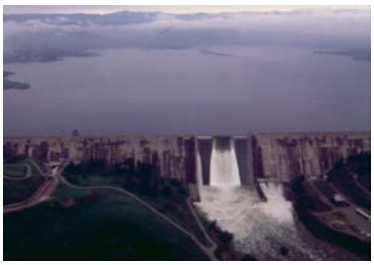
Notes:

[1] Annual increase in visitation represents increases in recreational participation within the Millerton Lake State Recreation Area below River Mile 274 of the San Joaquin River.

[2] Dollar values are expressed in January 2013 price levels.

Flood Damage Reduction

Increasing the overall storage capacity in the upper San Joaquin River Basin consequently increases the likelihood that there would be storage available for use in flood management over and above the dedicated flood storage space in Millerton Lake. This available storage is called incidental flood storage because the amount of storage is not available in a given month every year, unlike dedicated flood storage, which is governed by the reservoir operations rule curve and is available each year for flood management. The existing flood control space for Friant Dam is assumed to be shared between Millerton Lake and Temperance Flat Reservoir in the alternative plans. The flood damage reduction benefits are not based on dedicating additional space in the alternative plans, but on the available incidental storage. Previous flood damage reduction evaluations completed in the IAIR demonstrated that potential flood damage reduction benefits resulting from incidental availability of flood storage space would be similar to those that would result from the dedication of additional flood storage space.



Friant Dam flood releases, January 1997

The annual flood damage reduction for the incidental flood space was estimated using results from the USACE Hydraulic Engineering Center Flood Damage Assessment model (HEC-FDA) estimated annual damage (EAD) values developed for the San Joaquin River, as documented in the Flood Damage Reduction Appendix to the IAIR (Reclamation 2005b) and indexed to January 2013 price levels.

The increase in incidental flood space is the increase in 90 percent exceedence storage above the No-Action Alternative that occurs during the November to January flood season. The EAD for each alternative plan is determined by interpolating between values for given flood storage volumes from the HEC-FDA modeling. Table 5-7 presents the results of the calculations to determine the 90 percent exceedence incidental flood damage reduction for each of the alternative plans evaluated.

Table 5-7. Summary of Estimated Flood Damage Reduction Benefits of Alternative Plans

Alternative Plan	1	2	3	4
Flood Damage Reduction				
Increase in 90% exceedence flood space (TAF) [1]	361	360	343	236
Average Annual Benefit ($ millions) [2]	**$5.0**	**$5.0**	**$4.9**	**$4.0**

Notes:

[1] November – January minimum 90% exceedence storage less 170 TAF for Millerton Lake and Mammoth Pool flood storage. The existing flood control space for Friant Dam is assumed to be shared between Millerton Lake and Temperance Flat Reservoir in the alternative plans.

[2] Dollar values are expressed in January 2013 price levels. The flood damage reduction benefits are not based on dedicating additional space in the alternative plans, but on the available incidental storage.

NED Cost Summary

Table 5-8 summarizes estimated NED construction, investment, and annual costs for each of the alternative plans. Total investment cost is the sum of total construction costs and IDC cost. Construction cost is the sum of the feature field costs plus non-contract costs. Field costs are an estimate of capital costs for a feature or project from award to construction closeout. Non-contract costs are costs of work or service provided in support of the feature construction, and other work that can be attributed to the feature as a whole; and are also known as distributed costs. The IDC cost is based on the construction period for all plans of approximately 8 years, and the Federal discount rate of 3.75 percent. Total investment cost is annualized over the project's assumed 100-year lifespan at

the Federal interest rate of 3.75 percent to compute interest and amortization. Total annual cost is the sum of interest and amortization, estimated annual O&M costs, and additional hydropower mitigation and CVP/SWP pumping costs.

Key differences in costs for alternative plans are attributed to variations in the intake structure and additional hydropower mitigation. Additional detail on the development of investment and annual costs can be found in the Engineering Summary Appendix. The cost estimates have been developed primarily to a feasibility level and the alternatives are projected to be technically feasible, constructible, and can be operated and maintained.

Cost Estimate Terminology:

Construction Cost is the sum of the feature field costs plus non-contract costs.

Investment Cost is the sum of the construction costs and interest during construction.

Annual Cost is the sum of interest and amortization of the investment cost, and other annual costs, such as O&M.

Table 5-8. Estimated NED Investment and Annual Costs of Alternative Plans ($ million)

Alternative Plan	1	2	3	4
Construction Cost				
Field Costs	$1,710	$1,710	$1,710	$1,779
Non-Contract Costs	$430	$430	$430	$437
Total Construction Cost[1]	$2,140	$2,140	$2,140	$2,216
Investment Cost				
Interest During Construction	$349	$349	$349	$361
Total Investment Cost[1]	$2,488	$2,488	$2,488	$2,578
Annual Cost				
Interest and Amortization[2]	$95.7	$95.7	$95.7	$99.2
Operations and Maintenance	$8.4	$8.4	$8.4	$8.4
Additional Hydropower Mitigation[3]	$9.1	$9.1	$9.1	$4.2
CVP/SWP Additional Pumping[4]	$7.6	$4.1	$4.3	$4.1
Total Annual Cost[1]	**$120.8**	**$117.3**	**$117.5**	**$115.9**

Notes:
Costs are reported in January 2013 price levels.
[1] All numbers are rounded for display purposes; therefore, line items may not sum to totals.
[2] 100-year period of analysis, and 3.75 percent interest rate (federal discount rate).
[3] Additional hydropower mitigation is the estimated value of the impacted Kerckhoff Hydroelectric Project energy and ancillary services minus the Temperance Flat Reservoir powerhouse energy and ancillary services value.
[4] The additional CVP/CWP pumping costs do not include water conveyance costs beyond the net power requirement for delivering the new water supply, and additional costs may be incurred to achieve the intended benefits
Key:
CVP = Central Valley Project
NED = National economic development
SWP = State Water Project

Net National Economic Development Benefits

Net NED benefits are calculated by subtracting NED costs from NED benefits. The alternative plan that generates the greatest net NED benefits is Alternative Plan 4 (Table 5-9) with California- and U.S.-level ecosystem benefits.

Though U.S.-level ecosystem benefits may be more appropriate for the NED account, ecosystem benefits are presented for three geographic zones that could be affected by alternative plans and illustrate the range of potential ecosystem benefits. California-level ecosystem benefits represent the middle of the range of estimated ecosystem benefits and, given potential State bond funding and uncertainty in estimating ecosystem benefits, may be most appropriate for discussion and funding purposes.

Alternative Plan 4 would generate net benefits ranging from $24.9 to $41.0 million annually, with California-level ecosystem benefits valuation. Additional benefits of the alternative plans, that have not been monetized, are discussed in the EQ, OSE, and other unquantified benefits sections below. The alternative plans are projected to be economically feasible, since they would provide net benefits in excess of their costs, as summarized in Table 5-9.

Table 5-9. Summary of Estimated NED Annual Costs, Annual Benefits, and Net Benefits for Alternative Plans[1]

Alternative Plan	1		2		3		4	
Potential Annual Benefits[1] ($ million)								
Agricultural Water Supply Reliability	$18.6		$20.8		$20.8		$18.9	
M&I Water Supply Reliability	$43.2		$24.0		$25.7		$22.3	
Emergency Water Supply	$25.9		$26.0		$25.8		$27.1	
M&I Water Quality	$0.0		$0.0		$2.0		$0.0	
Net Hydropower Energy Generation at Friant Dam	$1.6		$1.6		$1.6		$1.6	
Recreation	$6.6		$6.6		$6.4		$7.4	
Flood Damage Reduction	$5.0		$5.0		$4.9		$4.0	
Total Potential Annual Monetary Benefits ($ million) (Without ecosystem benefits)	**$100.9**		**$84.0**		**$87.2**		**$81.3**	
With Ecosystem Benefits[2]	**Low SAR**	**High SAR**	**Low SAR**	**High SAR**	**Low SAR**	**High SAR**	**Low SAR**	**High SAR**
Ecosystem (Six-County[3] Level)	$3.9	$2.2	$2.5	$2.2	$2.7	$0.5	$4.9	$3.9
Total Potential Annual Monetary Benefits ($ million) (Six-County[3] ecosystem benefits)	**$104.8**	**$103.1**	**$86.5**	**$86.2**	**$89.9**	**$87.7**	**$86.2**	**$85.2**
Ecosystem (CA Level)	$59.6	$34.1	$38.8	$33.9	$40.9	$7.6	$75.6	$59.5
Total Potential Annual Monetary Benefits ($ million) (CA-level ecosystem benefits)	**$160.5**	**$135.0**	**$122.8**	**$117.9**	**$128.1**	**$94.8**	**$156.9**	**$140.8**
Ecosystem (U.S. Level)	$391.7	$224.2	$255.2	$222.9	$269.2	$49.7	$496.9	$391.3
Total Potential Annual Monetary Benefits ($ million) (U.S.-level ecosystem benefits)	**$492.6**	**$325.1**	**$339.2**	**$306.9**	**$356.4**	**$136.9**	**$578.2**	**$472.6**
Total Estimated Investment Cost ($ million)	$2,488		$2,488		$2,488		$2,578	
Interest and Ammortization[4] ($ million)	$95.7		$95.7		$95.7		$99.2	
Operations and Maintenance ($ million)	$8.4		$8.4		$8.4		$8.4	
Additional Hydropower Mitigation[5] and CVP/SWP Pumping Costs ($ million)[6]	$16.7		$13.2		$13.4		$8.3	
Total Annual Cost ($ million)	**$120.8**		**$117.3**		**$117.5**		**$115.9**	

Table 5-9. Summary of NED Estimated Annual Costs, Annual Benefits, and Net Benefits for Alternative Plans[1] (contd.)

Alternative Plan	1		2		3		4	
Potential Net Benefits ($million) (Without ecosystem benefits)	-$19.9		-$33.3		-$30.3		-$34.6	
Preliminary Benefit-Cost Ratio (Without ecosystem benefits)	0.83		0.72		0.74		0.70	
With Ecosystem Benefits[2]	**Low SAR**	**High SAR**	**Low SAR**	**High SAR**	**Low SAR**	**High SAR**	**Low SAR**	**High SAR**
Potential Net Benefits ($ million) (Six-County[3] ecosystem benefits)	-$16.0	-$17.7	-$30.8	-$31.1	-$27.6	-$29.8	-$29.7	-$30.7
Preliminary Benefit-Cost Ratio (Six-County[3] ecosystem benefits)	**0.87**	**0.85**	**0.74**	**0.73**	**0.77**	**0.75**	**0.74**	**0.74**
Potential Net Benefits ($ million) (CA-level ecosystem benefits)	$39.7	$14.2	$5.5	$0.6	$10.6	-$22.7	$41.0	$24.9
Preliminary Benefit-Cost Ratio (CA-level ecosystem benefits)	**1.33**	**1.12**	**1.05**	**1.01**	**1.09**	**0.81**	**1.35**	**1.21**
Potential Net Benefits ($ million) (U.S.-level ecosystem benefits)	$371.8	$204.3	$221.9	$189.6	$238.9	$19.4	$462.3	$356.7
Preliminary Benefit-Cost Ratio (U.S.-level ecosystem benefits)	**4.08**	**2.69**	**2.89**	**2.62**	**3.03**	**1.17**	**4.99**	**4.08**

Notes: All benefits and costs are reported in January 2013 dollars. All numbers are rounded for display purposes; therefore, line items may not sum to totals.

[1] All benefits are reported as changes compared to the respective future No-Action Alternative conditions.

[2] The monetary valuation of ecosystem benefits is uncertain, so ranges are presented to capture varying anadromous fish return rates and geographic extent of the ecosystem benefits.

[3] Six-county region encompassing the San Joaquin River and adjacent areas includes Fresno, Kern, Kings, Madera, Merced, and Tulare counties.

[4] 100-year period of analysis, and 3.75 percent interest rate (Federal discount rate).

[5] Additional hydropower mitigation is the estimated value of the impacted Kerckhoff Hydroelectric Project energy and ancillary services minus the Temperance Flat Reservoir powerhouse energy and ancillary services value.

[6] The additional CVP/CWP pumping costs do not include water conveyance costs beyond the net power requirement for delivering the new water supply, and additional costs may be incurred to achieve the intended benefits.

Key:
$ million = million dollars
CA = California
CVP = Central Valley Project
M&I = municipal and industrial
NED = national economic development
SAR = Smolt-to-Adult-Return Rate
SWP = State Water Project

Environmental Quality

The EQ account is used to identify and display the significant non-monetary beneficial and adverse effects each alternative plan has on significant EQ resources when compared to the No-Action Alternative. These include ecological, cultural, and aesthetic properties of natural and cultural resources that sustain and enrich human life. Table 5-10 provides a summary of the effects of alternative plans on EQ resources that occur in the primary and extended study areas. For each EQ resource, one or more indicators were selected to directly or indirectly measure or otherwise describe changes that would be expected to occur with implementation of each alternative plan. A detailed assessment of the potential effects of each alternative plan on the selected resource indicators will be presented in the EIS/EIR and its accompanying appendices and referenced studies.

Millerton Lake/San Joaquin River near Big Bend

All alternative plans are similar in the types of potential environmental effects, although the level of some effects would vary in the primary study area and across different portions of the extended study area depending on water operations for alternative plans. Generally, the adverse effects would be mitigated to less-than-significant levels with prescribed mitigation measures (PRC Section 21002). Some adverse effects for action alternative plans would remain unavoidable despite practicable measures identified to mitigate effects. The EIS/EIR will contain more detailed information and a display of unavoidable impacts, if any are identified. Based on environmental resources studies to date, ecosystem enhancement accomplishments, and information presented in Table 5-10, it is anticipated that the alternative plans would be environmentally feasible.

Table 5-10. Summary of Potential Environmental Effects of Alternative Plans in Environmental Quality Account

Resource Area / Alternative Plan	Primary Study Area	Extended Study Area				Key Considerations
	Temperance Flat RM 274 Reservoir and Vicinity	San Joaquin River, Friant Dam to Merced River	San Joaquin River, Merced River to Delta	Delta	CVP/SWP Facilities and Water Service Areas	
Air Quality						Short-term unavoidable adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation. Long-term beneficial effects for all action alternatives could be realized through reduction in groundwater pumping within CVP service areas, leading to a reduction in emissions from diesel pump use were not quantified.
Biological Resources – Fisheries and Aquatic Ecosystems						Adverse effects to riverine habitat within primary study area similar across all action alternatives and unavoidable due to conversion of riverine habitat to lacustrine habitat within San Joaquin River portion of primary study area. Long-term beneficial effects on anadromous fisheries associated with improved water temperature conditions and changes to flow conditions included in NED account for all action alternatives, and greatest for Alternative 4. Long-term beneficial effects on cold-water fisheries habitat in San Joaquin River between Friant Dam and Mendota Pool for all action alternatives were not quantified, but greatest for Alternative 4.
Biological Resources – Botanical and Wetlands						Short-term adverse effects due to construction and long-term unavoidable adverse effects due to inundation of habitat in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation.
Biological Resources – Wildlife						Short-term adverse effects due to construction and long-term unavoidable adverse effects due to inundation of habitat in Primary Study Area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation. Potential long-term benefits related to improving delivered water quality to CVP refuges were not quantified, but Alternative 2 is likely to have the greatest benefits.
Climate Change and Greenhouse Gas Emissions						Short-term unavoidable adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation. Long-term beneficial effects, similar for all action alternatives, could be realized through reduction in groundwater pumping, leading to a reduction in diesel pump emissions.
Cultural Resources						Potential adverse and unavoidable effects due to construction and inundation of lands in primary study area similar across all action alternatives; adverse effects likely reduced through mitigation.
Environmental Justice						No disproportionately high and adverse effects to minority and low-income populations anticipated for all action alternatives.
Geology and Soils						Short-term adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation.
Hydrology – Flood Management						Beneficial impacts on San Joaquin River realized as a result of decreased flood risk with improved management of flood flows included in NED account for all action alternatives, and greatest for Alternative 1 and Alternative 2. Protection of in-stream channel improvements associated with the SJRRP from flood damages was not quantified.

Table 5-10. Summary of Potential Environmental Effects of Alternative Plans in Environmental Quality Account (contd.)

Resource Area/ Alternatives	Primary Study Area	Extended Study Area				Key Considerations
	Temperance Flat RM 274 Reservoir and Vicinity	San Joaquin River, Friant Dam to Merced River	San Joaquin River, Merced River to Delta	Delta	CVP/SWP Facilities and Water Service Areas	
Hydrology – Groundwater						Beneficial effects to groundwater levels in CVP/SWP water service areas due to increased surface water availability resulting in less groundwater pumping and potential increase in groundwater recharge are anticipated to be similar across all action alternatives; reduced groundwater pumping included in NED account.
Hydrology – Surface Water Supplies and Facilities Operations						Long-term beneficial effects related to water supply reliability included in NED account for all action alternatives, and greatest for Alternative 4; financial debt service benefits from more reliable water supply were not quantified.
Hydrology – Surface Water Quality						Short-term adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation. Long-term beneficial effects on water temperature conditions in San Joaquin River included in NED account for all action alternatives, and greatest for Alternative 4. Long-term beneficial effects on delivered M&I water quality in CVP and SWP water service areas included in NED account for Alternative 3; alternatives 1, 2 and 4 are not anticipated to have M&I water quality benefits. Potential long-term benefits related to meeting San Joaquin River salinity objectives at Vernalis (reduction in Reclamation actions to meet TMDL requirements) were not quantified, but Alternative 2 is likely to have the greatest benefits. Potential long-term water quality improvements for agricultural use and associated improvements in sustainability and agricultural productivity were not quantified, but are anticipated to be similar across all action alternatives.
Indian Trust Assets						Potential adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation.
Land Use Planning and Agricultural Resources						Long-term unavoidable adverse effects to land use in primary study area anticipated to be similar across all action alternatives; adverse effects reduced through mitigation. Long-term beneficial effects on agricultural resources related to agricultural water supply reliability included in NED account for all action alternatives, and greatest for Alternatives 2 and 3. Potential long-term water quality improvements for agricultural use and associated improvements in sustainability and agricultural productivity were not quantified, but are anticipated greatest for CVP Friant Division under Alternative 1, and greatest for CVP South-of-Delta for Alternatives 3 and 4.
Noise and Vibration						Short-term unavoidable adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation.
Paleontological Resources						There are no previously recorded fossil localities within or adjacent to the primary study area.

Table 5-10. Summary of Potential Environmental Effects of Alternative Plans in Environmental Quality Account (contd.)

Resource Area/ Alternatives	Primary Study Area	Extended Study Area				Key Considerations
	Temperance Flat RM 274 Reservoir and Vicinity	San Joaquin River, Friant Dam to Merced River	San Joaquin River, Merced River to Delta	Delta	CVP/SWP Facilities and Water Service Areas	
Power and Energy	■	■	■	■	■	Short-term adverse effects due to construction in primary study area anticipated to be similar across all action alternatives. Long-term adverse effects related to pumping operations and power demands of water conveyance facilities are anticipated for all action alternatives, and greatest for Alternative 1. Long-term adverse effects related to decommissioning of power generation infrastructure anticipated to be similar across all action alternatives. Adverse effects likely reduced through replacement power generation infrastructure and mitigation.
Public Health and Hazardous Materials	■	■	■	■	■	Potential short-term adverse effects due to construction in primary study area and decommissioning of power infrastructure anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation. Potential long-term benefits associated with dam safety were not quantified, but anticipated to be similar across all action alternatives.
Recreation	■■	■	■	■	■	Short-term adverse effects due to construction in primary study area; long-term beneficial effects on recreation in the primary study area included in NED account for all action alternatives, and greatest for Alternative 4. Potential long-term recreation benefits related to increased flow in San Joaquin River were not quantified, but Alternative 2 is likely to have the greatest benefits.
Socioeconomics, Population, and Housing	■	■	■	■	■■	Short-term beneficial effects associated with increased employment during project construction are included in RED Account for all action alternatives, and greatest for Alternative 4. Long-term beneficial effects associated with increased employment through improved water supply reliability are included in RED account for all action alternatives, and greatest for Alternative 1. Long-term beneficial effects associated with increased employment through improved recreation visitation in the study area are included in RED account for all action alternatives, and greatest for Alternative 4. Long-term beneficial effects associated with increased employment from O&M of project features are anticipated to be similar across all action alternatives and included in RED account.
Transportation, Circulation and Infrastructure	■	■	■	■	■	Short-term unavoidable adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation.
Utilities and Service Systems	■	■	■	■	■	Short-term adverse effects due to construction in primary study area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation. Long-term beneficial effects due to replacing and modernizing utilities were not quantified, but anticipated to be similar across all action alternatives.

Table 5-10. Summary of Potential Environmental Effects of Alternative Plans in Environmental Quality Account (contd.)

Resource Area/ Alternatives	Primary Study Area	Extended Study Area				Key Considerations
	Temperance Flat RM 274 Reservoir and Vicinity	San Joaquin River, Friant Dam to Merced River	San Joaquin River, Merced River to Delta	Delta	CVP/SWP Facilities and Water Service Areas	
Visual Resources						Long-term unavoidable adverse effects to aesthetics in reservoir area anticipated to be similar across all action alternatives; adverse effects likely reduced through mitigation.

Key:
No effect, minimal effect, not disproportionately high and adverse (environmental justice), and/or minimal effect after mitigation.
Unavoidable and/or disproportionately high and adverse (environmental justice).
Beneficial effect.
Beneficial effects associated with anadromous fish survival, water supply reliability, flood damage reduction, hydropower, and recreation accounted for in NED. Beneficial effects to regional economics (including jobs and income) included in RED accounts.
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
M&I = municipal and industrial
NED = National Economic Development
O&M = operations and maintenance
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
RED = Regional Economic Development
SJRRP = San Joaquin River Restoration Program
SWP = State Water Project

Regional Economic Development

The RED account displays changes in the distribution of regional economic activity that result from each alternative plan considered in a feasibility study. According to the P&G, two measures of regional effects are considered: regional income and regional employment. A region is generally defined as an area that encounters “significant” income and employment effects. Income and employment effects are further divided into “positive” and “negative” effects. Each of the four categories (positive income, positive employment, negative income, and negative employment) is equal to the sum of the NED effects that accrue in a region, plus transfers between the region and outside the region (i.e., positive income effects equal the NED benefits in the region plus the transfers of income to the region from outside the region). Transfers can come from implementation outlays, transfers of basic economic activity, indirect effects, and induced effects. The positive (and negative) effects on regional employment are directly parallel to effects on income; therefore, typically the analysis of

regional employment effects is organized in the same categories as regional income effects.

The alternative plans are likely to affect the regional economy as a result of the following three factors:

1. Development of Temperance Flat 274 Dam and Reservoir would introduce short-term construction expenditure.

2. Improved long-term water supply reliability would alter, and in some cases increase, agricultural production and output.

3. Improvements to water levels in Millerton Lake and creation of a new Temperance Flat 274 Reservoir would introduce new long-term recreational visitation and spending.

The regional economic impact analysis estimates the economic effects of the three factors described above for the alternative plans. Employment and income effects of the alternative plans were determined through the use of IMPLAN (IMpact analysis for PLANning), an input/output (I/O) model. I/O models are essentially accounting tables that trace the linkages of inter-industry purchases and sales within a given region and year. The IMPLAN model yields "multipliers" that are used to calculate the total direct, indirect, and induced effects on employment and income, among other factors. For further description of the regional economic impact analysis and specific assumptions used, see Chapter 12 of the Economic Analysis Appendix.

Two IMPLAN regional economics models were developed for regional economic impact analyses specific to the Investigation. The first incorporated economic activity in the six-county region (Fresno, Kern, Kings, Madera, Merced, and Tulare counties) surrounding the Friant and West San Joaquin southern CVP Divisions. The six-county regional model estimates the economic impacts to the local economy where the project would be constructed and primary economic effects would be experienced. A second regional economic impact model was developed to address effects at the California statewide level and that may accrue beyond the six-county region. The two models are referred to as the "Southern San Joaquin Valley" and "Statewide" models.

The Southern San Joaquin Valley model estimates the regional economic impact of the project construction expenditure, changes in agricultural production, and increases in recreational visitation to the local six-county region. The Statewide model is intended to capture effects of the alternative plans that transcend beyond the six-county region. The Statewide model estimates regional economic effects of changes in agricultural production that may affect residents and businesses throughout the State. Annual employment and personal income effects of the alternative plans are provided in Tables 5-11 and 5-12, respectively.

Short-term project construction would support 450 direct jobs per year for Alternative Plans 1, 2, and 3, and 460 direct jobs per year for Alternative Plan 4 over the 8 year construction period in the Southern San Joaquin Valley model impact region. Indirect and induced jobs supported by the construction activities would be 1,155 for Alternative Plans 1, 2, and 3, and 1,196 for Alternative Plan 4. The combined total of direct, indirect, and induced impacts would result in 1,605 total annual jobs supported in the Southern San Joaquin Valley model impact region for Alternative Plans 1, 2, and 3, and 1,656 for Alternative Plan 4.

Long-term increases in agricultural production due to alternative plans would support from 177 to 207 direct jobs per year in the Southern San Joaquin Valley model impact region over the project's lifetime (100 years). Indirect and induced jobs supported by increased agricultural production range from 162 to 194. The combined total of direct, indirect, and induced jobs supported in the Southern San Joaquin Valley model impact region by increased agricultural production ranges from 339 to 401 per year.

Long-term increases in recreational visitation due to alternative plans would support direct jobs to the Southern San Joaquin Valley model impact region, from 26 per year to 30 per year over the project's lifetime (100 years). There would be six indirect and induced jobs supported by recreation activities for Alternative Plans 1, 2, and 3, and seven jobs for Alternative Plan 4. The combined total of direct, indirect, and induced jobs supported by recreation activities would range from 33 jobs per year to 37 jobs per year in the Southern San Joaquin Valley model impact region.

Table 5-11. Summary of Annual Employment Benefits for RED Account

Model Impact Region/Duration of Effects/ Activity Type	Employment Effects (Jobs[1] per Year)	Alternative Plan			
		1	2	3	4
Southern San Joaquin Valley ***Short-Term Impacts (average annual over 8-year construction period)***					
Construction Expenditure[3]	**Direct**	450	450	450	460
	Indirect & Induced	1,155	1,155	1,155	1,196
	Total[2]	1,605	1,605	1,605	1,656
Southern San Joaquin Valley ***Long-Term Impacts (average annual over project life)***					
Agricultural Production	**Direct**	207	200	200	177
	Indirect & Induced	194	186	186	162
	Total[2]	401	386	386	339
Recreational Visitation	**Direct**	27	27	26	30
	Indirect & Induced	6	6	6	7
	Total[2]	33	34	33	37
Project Operations and Maintenance[4]	**Direct**	28	28	28	28
	Indirect & Induced	10	10	10	10
	Total[2]	38	38	38	38
TOTAL[2]	**Direct**	262	255	254	235
	Indirect & Induced	210	202	202	179
	Total[2]	472	457	456	415
Statewide ***Long-Term Impacts (average annual over project life)***					
Agricultural Production	**Direct**	169	155	155	145
	Indirect & Induced	134	129	129	111
	Total[2]	303	284	284	256

Notes:

General: The Southern San Joaquin Valley model impact region includes Fresno, Kern, Kings, Madera, Merced, and Tulare counties.

General: The Statewide model impact region includes the entire State of California.

[1] Jobs per year represent full-time, part-time, and temporary positions.

[2] All numbers are rounded for display purposes; therefore, line items may not sum to totals.

[3] Direct jobs were estimated by the study team.

[4] Direct project operations and maintenance jobs were estimated by the study team for powerhouse, dam, and recreational operations.

Key:

RED = Regional Economic Development

Table 5-12. Summary of Annual Personal Income Effects for RED Account

Model Impact Region/Duration of Effects/ Activity Type	Personal Income per Year ($[1] million)	Alternative Plan			
		1	2	3	4
Southern San Joaquin Valley ***Short-Term Impacts (average annual over 8-year construction period)***					
Construction Expenditure	**Direct**	$109.4	$109.4	$109.4	$113.2
	Indirect & Induced	$54.7	$54.7	$54.7	$56.6
	Total[2]	$164.0	$164.0	$164.0	$169.8
Southern San Joaquin Valley ***Long-Term Impacts (average annual over project life)***					
Agricultural Production	**Direct**	$5.4	$5.2	$5.2	$4.6
	Indirect & Induced	$7.5	$7.2	$7.2	$6.2
	Total[2]	$12.9	$12.4	$12.4	$10.8
Recreational Visitation	**Direct**	$0.8	$0.8	$0.8	$0.9
	Indirect & Induced	$0.3	$0.3	$0.3	$0.3
	Total[2]	$1.1	$1.1	$1.1	$1.3
Project Operations and Maintenance	**Direct**	$1.9	$1.9	$1.9	$1.9
	Indirect & Induced	$0.4	$0.4	$0.4	$0.4
	Total[2]	$2.4	$2.4	$2.4	$2.4
TOTAL[2]	**Direct**	$8.1	$7.9	$7.9	$7.4
	Indirect & Induced	$8.2	$7.9	$7.9	$6.9
	Total[2]	$16.3	$15.8	$15.8	$14.5
Statewide ***Long-Term Impacts (average annual over project life)***					
Agricultural Production	**Direct**	$3.3	$3.1	$3.1	$2.9
	Indirect & Induced	$6.5	$6.3	$6.3	$5.4
	Total[2]	$9.9	$9.4	$9.4	$8.3

Notes:
General: The Southern San Joaquin Valley model impact region includes Fresno, Kern, Kings, Madera, Merced, and Tulare counties.
General: The Statewide impact region includes the entire State of California.
[1] Results related to personal income per year are presented at January 2013 price levels.
[2] All numbers are rounded for display purposes; therefore, line items may not sum to totals.
Key:
RED = Regional Economic Development

Long-term project O&M impacts of alternative plans would provide additional direct employment benefits to the Southern San Joaquin Valley model impact region. Direct jobs supported by operations and maintenance activities would be 28 jobs per year for all alternative plans over the project lifetime (100 years). Indirect and induced jobs supported by O&M activities

would be 10 per year for all alternative plans. The combined total of direct, indirect, and induced jobs supported by O&M would be 38 jobs per year for all alternative plans.

Total long-term regional economic impacts to employment for the Southern San Joaquin Valley model impact region would range from 415 to 472 jobs per year for Alternative Plan 1.

Long-term increases in agricultural production of alternative plans would support direct jobs in the Statewide model impact region from 145 to 169 jobs per year over the project lifetime (100 years). Indirect and induced jobs supported by increased agricultural production range from 111 to 134 jobs per year. The combined total of direct, indirect, and induced jobs supported by increased agricultural production to the Statewide model impact region would range from 256 to 303 jobs per year.

Short-term project construction expenditures of Alternative Plans 1, 2, and 3 would lead to direct impacts on personal income of $109.4 million per year, and $113.2 million per year for Alternative Plan 4 in the Southern San Joaquin Valley model impact region over the 8 year construction period. Indirect and induced impacts would be $54.7 million for Alternative Plans 1, 2, and 3, and $56.6 million for Alternative Plan 4. The combined total of direct, indirect, and induced impacts would result in a total annual economic impact on personal income to the Southern San Joaquin Valley model impact region of $164.0 million for Alternative Plans 1, 2, and 3, and $169.8 million for Alternative Plan 4.

Long-term agricultural production impacts of alternative plans would provide a direct personal income benefit to agricultural proprietors and employees in the Southern San Joaquin Valley model impact region that range from $4.6 to $5.4 million per year over the project lifetime (100 years). Indirect and induced impacts on personal income would range from $6.2 to $7.5 million. The combined total of direct, indirect, and induced impacts related to long-term agricultural production would result in a total annual economic impact on personal income in the Southern San Joaquin Valley model impact region between $10.8 to $12.9 million per year.

Long-term recreational visitation impacts of alternative plans would lead to a direct personal income benefit to recreation support industry proprietors and employees in the Southern San Joaquin Valley model impact region that range from $0.8 to

$0.9 million per year over the project's lifetime (100 years). Direct impacts to personal income would lead to indirect and induced impacts of $0.3 million for all alternative plans. The combined total of direct, indirect, and induced impacts related to long-term recreational visitation would result in a total annual economic impact to personal income in the Southern San Joaquin Valley model impact region, ranging from $1.1 to $1.3 million per year.

Long-term project operations and maintenance impacts of alternative plans would provide direct additional personal income to Southern San Joaquin Valley impact region. Direct personal income related to operations and maintenance would be $1.9 million per year for all alternative plans over the project lifetime (100 years). These direct impacts would lead to indirect and induced impacts are $0.4 million per year for all alternative plans. The combined total of direct, indirect, and induced impacts would result in a total annual economic impact of $2.4 million per year for all alternative plans.

The total long-term regional economic impacts to personal income for the Southern San Joaquin Valley impact region would range from $14.5 to $16.3 million per year.

Long-term agricultural production impacts of alternative plans would provide a direct personal income benefit to the Statewide model impact region ranging from $2.9 to $3.3 million per year over the project lifetime (100 years). Direct impacts to personal income would lead to indirect and induced impacts from $5.4 to $6.5 million. The combined total of direct, indirect, and induced impacts would result in a total annual economic impact to personal income from $8.3 to $9.9 million per year.

Other Social Effects

The OSE account is a means of displaying, and integrating information on alternative plan effects from perspectives that are not reflected in the other three accounts into water resources planning. Categories of effects in the OSE account include the following: urban and community impacts; life, health, and safety factors; displacement; long-term productivity; and energy requirements and energy conservation. Both the beneficial and adverse effects in the OSE account are expected to be similar across all alternative plans.

In general, the project action alternatives would result in increased agricultural output (sales), net farm income, and personal income. Alternative plans would also provide limited opportunities for increased employment in agricultural, recreation-affected, and other sectors of the economy. Increases in employment would accrue largely to agricultural workers.

The affected counties in the southern San Joaquin Valley region include several large cities and suburbs, plus many small, agriculturally based towns and unincorporated areas. The prominence of agriculture in the economic base of the region, combined with the direct effect of the alternative plans on agricultural production, is likely to result in demonstrable community benefits.

The extended study area is also a region of considerable ethnic and cultural diversity, high population growth, and an increasing proportion of minority representation. The alternative plans may affect these population groups. Urban areas in the SOD service area could see a reduction in water costs stemming from reduced water treatment costs. The effects are likely to be widespread and positive, while having little, if any, disproportionate effect on a particular population or socioeconomic group.

Finally, there could be some short-term effects associated with all the alternative plans, including:

1. Temporary construction-related benefits flowing to local communities in the areas of the alternative plan features.

2. Potential short-term adverse effects that could occur to those directly affected by construction activities, related to pressures on housing, public services, transportation, and schools.

The alternative plans each result in essentially the same infrastructure requirements, the effects are expected to be nearly uniform across the alternatives.

Other Unquantified Benefits

The alternative plans would provide benefits that would accrue to the general public but that could be difficult to quantify on a monetary scale. For the alternative plans, these "unquantified benefits" not discussed specifically in the EQ or OSE accounts could include water management system operational flexibility and climate change adaptation. These other public benefits are recognized as positive in value and essentially additive to the monetized annual benefits for the alternative plans.

Additional surface storage provided by the alternative plans could provide flexibility to the State's constrained water management system for real-time operational benefits that cannot be provided by other management actions. Surface water storage could also be useful in mitigating lost snowpack storage due to climate change, and in responding to other unforeseen circumstances.

Additional benefits associated with enhancement of the San Joaquin ecosystem are also expected. There could be advancement in research and scientific knowledge that could identify greater benefits to the San Joaquin spring-run chinook and other anadromous fish. There are also likely to be greater opportunities for educational enhancement, as an improved upper San Joaquin River habitat could serve as a field laboratory for students interested in biology and the environment.

Several other potential unquantified benefits of the alternative plans on the SJRRP related to reduction in San Joaquin River flood releases and improved operational flexibility could include:

- Increase in volume of Restoration Flows eligible for recapture at locations downstream of the Restoration Area, pursuant to Paragraph 16(a) of the Settlement.

- Reduction in losses of gravel from Reach 1 of the San Joaquin River during high flood flow, which would reduce maintenance costs for gravel replenishment requirements.

- Reduction in sediment accumulation downstream of Reach 1 due to sand mobilization, which would reduce operation and maintenance costs by the SJRRP to preserve the function of the San Joaquin River Flood Control Project.

- Decrease in the frequency and duration of river connectivity with gravel pits in Reach 1 that causes stranding of salmon and other fish, which could reduce the extent of gravel pit isolation to be implemented as a Phase 2 action of the Settlement.

- Reduction/elimination of late season flood flows damaging newly established riparian habitat.

Alternative Plan Comparison

The Federal planning process in the P&G also includes four specific criteria for consideration in formulating and evaluating alternative plans: completeness, effectiveness, efficiency, and acceptability (WRC 1983). In this section the No-Action Alternative and four alternative plans are ranked for a comparison of their effectiveness, efficiency, acceptability, and completeness.

Effectiveness

Effectiveness is the extent to which an alternative plan alleviates specified problems and achieves planning objectives. For the primary planning objective of increasing water supply reliability and system operational flexibility, ranking was based on the relative amount of long-term annual average water supply and the quantity of emergency water supply that could be derived from each alternative plan. For the primary planning objective of enhancing water temperature and flow conditions in the San Joaquin River, ranking was based on improving habitat conditions for salmon, as demonstrated by increased salmon abundance.

For the secondary planning objectives, four relative ranking factors were considered: (1) reduced frequency and magnitude of flood releases from Friant Dam., (2) maintained value of hydropower attributes, (3) maintained and increased recreation opportunities in the primary study area, and (4) improved quality of water supplies delivered to urban areas.

For increasing water supply reliability and system operational flexibility, Alternative Plan 2 is ranked highest because it has the highest combined ranking for long-term average annual increases in water supply for the CVP/SWP system and emergency water supply.

For enhancing water temperature and flow conditions in the San Joaquin River in support of anadromous fish, Alternative Plan 4 is ranked highest because the combination of high carryover storage and larger cold water pool, reservoir operations and water supply routing, and SLIS operations created the greatest river temperature and flow improvements for salmon out of the four alternative plans.

For potential reduction in flood damage, Alternative Plans 1 achieved the greatest new flood space at 90 percent exceedence and therefore received the highest ranking. For maintaining and increasing energy generation and improve energy management, the Alternative Plan 4, with the greatest amount of carryover storage in Temperance Flat RM 274 Reservoir, achieved the greatest increase in energy generation at Friant Dam, and is ranked the highest. To maintain and increase recreation opportunities in the study area, Alternative Plan 4 ranked highest, achieving about 170,000 new recreation visitor-days. Improving quality of water supplies delivered to urban areas was only achieved by Alternative Plan 3, which therefore ranked highest.

In developing a combined ranking, primary objectives were weighted twice as high as secondary objectives. The effectiveness relative rankings are shown in Table 5-13. A lower level of effectiveness does not mean an alternative plan would be infeasible or incapable of alleviating problems or achieving planning objectives and opportunities; it simply means it would be less preferred.

Table 5-13. Effectiveness Relative Rankings by Alternative Plan

Criterion	Basis for Ranking [1,2]	Alternative Plan				
		No-Action [3]	1	2	3	4
Primary Planning Objective						
Increase Water Supply Reliability and System Operational Flexibility	Long-term average annual increase in water supply; increase in SOD emergency water supply	Lowest	Moderate-Low	Highest	Moderate-High	**Moderate-High**
Enhance water temperature and flow conditions in the San Joaquin River in support of anadromous fish	Long-term average annual improvement in spring-run Chinook salmon abundance due to temperature and flow enhancement in the San Joaquin River between Friant Dam and the Merced River	Moderate-Low	Moderate-High	Moderate	Lowest	**Highest**

Table 5-13. Effectiveness Relative Rankings by Alternative Plan (contd.)

Criterion	Basis for Ranking [1,2]	Alternative Plan				
		No-Action [3]	1	2	3	4
Secondary Planning Objective						
Reduce frequency and magnitude of flood releases from Friant Dam.	Increase in flood space at 90 percent exceedence between Millerton Lake and Temperance Flat Reservoir	Lowest	Highest	Moderate-High	Moderate	**Moderate-Low**
Maintain the value of hydropower attributes.	Increase in local hydropower generation at Friant Dam and ability to mitigate onsite hydropower generation from the Kerckhoff Hydropower Project	Moderate	Moderate	Lowest	Moderate-High	**Highest**
Maintain and increase recreational opportunities in the primary study area	Increase in recreation visitor-days at Millerton Lake and Temperance Flat Reservoir.	Lowest	Moderate	Moderate-High	Moderate-Low	**Highest**
Improve quality of water supplies delivered to urban areas	Decrease in salinity of California Aqueduct water supply to SWP M&I at Edmonston Pumping Plant.	Moderate-High	Moderate-High	Moderate-High	Highest	**Moderate-High**
Combined Ranking	Primary planning objectives worth twice as much as secondary planning objectives	Lowest	Moderate	Moderate-High	Moderate-Low	**Highest**

Notes:

[1] Standard competitive ranking methodology was used to rank alternative plans against each other, including No-Action. An alternative plan was assigned its relative rank. For example, the fifth alternative plan would be ranked lowest, even if the first four alternative plans tie and are each ranked highest.

[2] The rankings do not represent magnitude of accomplishment or impact, or whether they are beneficial or adverse. For example, if all alternative plans, including the No-Action Alternative, have the same value for a criterion, they would all have a rank of highest, even if that value is zero or negative.

[3] The No-Action Alternative typically ranks lowest because it represents baseline conditions and has no accomplishment or impact for a specific criterion. Alternative plans that rank lower than the No-Action Alternative have values lower than the baseline condition.

Key: M&I = municipal and industrial
SOD = South-of-Delta
SWP = State Water Project

Efficiency

Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating specified problems and realizing specified opportunities, consistent with protecting the Nation's environment. The most efficient measures would best address the objectives with the least cost and adverse environmental effects. Factors pertinent to this criterion include (1) cost effectiveness, (2) preliminary monetary and environmental benefits (3) potential biological resource impacts, and (4) potential cultural resources impacts. A lower ranking does not mean that an alternative plan would be infeasible or inefficient; it simply means it would be less preferred. Table 5-14 presents the ranking for efficiency. Potential impacts to biological and cultural resources are currently under development for the EIS/EIR.

Table 5-14. Efficiency Relative Rankings by Alternative Plan[1]

Criterion	Basis for Ranking [2,3]	No-Action Alternative [4]	Alternative Plan 1	Alternative Plan 2	Alternative Plan 3	Alternative Plan 4
Cost effectiveness	Alternative plans ranked by Benefit-Cost ratio	N/A	Moderate-High	Moderate-Low	Moderate	Highest
Preliminary monetary and environmental benefits	Alternative plans ranked by net NED benefits	Lowest	Moderate-High	Moderate-Low	Moderate	Highest
Combined Ranking		**Lowest**	**Moderate-High**	**Moderate-Low**	**Moderate**	**Highest**

Notes:

[1] Efficiency criteria and rankings for potential environmental impacts to biological and cultural resources are under development.

[2] Standard competitive ranking methodology was used to rank alternative plans against each other, including the No-Action Alternative. An alternative plan was assigned its relative rank. For example, the fifth alternative plan would be ranked lowest, even if the first four alternative plans tie and are each ranked highest.

[3] The rankings do not represent magnitude of accomplishment or impact, or whether they are beneficial or adverse. For example, if all alternative plans, including the No-Action Action Alternative, have the same value for a criterion, they would all have a rank of highest, even if that value is zero or negative.

[4] The No-Action Alternative typically ranks lowest because it represents baseline conditions and has no accomplishment or impact for a specific criterion. Alternative plans that rank lower than the No-Action Alternative have values lower than the baseline condition.

Key:

N/A = not applicable

NED = national economic development

Cost-Effectiveness

The alternative plans have the same relative ranking considering either benefit-cost ratio or net NED benefits (Table 5-15). The No-Action Alternative would have no costs and no benefits; therefore, the benefit-cost ratio is not applicable, and the net NED benefits are $0.0.

Table 5-15. Alternative Plans Ranked by Estimated NED Benefit-Cost Ratio and Net Benefits

Ranking	Alternative Plan	Benefit-Cost Ratio[1]	Net Benefits ($million)[1]
Highest	4	1.35	$41.0
Moderate-High	1	1.33	$39.7
Moderate	3	1.09	$10.6
Moderate-Low	2	1.05	$5.5
Lowest	NAA	Not Applicable	$0.0

Notes:
[1] Based on California level and low smolt-to-adult return rate ecosystem benefits valuation.

Key:
NAA = No-Action Alternative
NED = National Economic Development

Least Adverse Environmental Effects (Not Evaluated at This Time)

All alternative plans are anticipated to have similar potential environmental impacts within the primary study area. The level of some potential environmental impacts across the extended study area would vary depending on water operations for alternative plans. Generally, the adverse effects would be mitigated to less-than-significant levels with prescribed mitigation measures (PRC Section 21002). Some adverse effects for action alternative plans would remain unavoidable despite practicable measures identified to mitigate effects. Potential environmental impacts of alternative plans and proposed mitigation measures will be documented in the pending Draft EIS/EIR. The preferred alternative will be identified in the Final EIS/EIR. The environmentally preferred alternative will be identified in the ROD.

Alternative Plan 4 has the greatest ability to provide ecosystem benefits. These benefits would be associated with long term average annual improvement in spring-run Chinook salmon abundance due to temperature and flow enhancement in the San Joaquin River between Friant Dam and the Merced River.

Acceptability

Acceptability is the workability and viability of an alternative plan with respect to acceptance by Federal, State, local entities, public interest groups, and individuals, as well as compatibility

with existing laws, regulations, and public policies. A measure with less support is not infeasible or unacceptable; rather, it is simply less preferred. All alternatives plans are compatible with existing laws, regulations, and public policies. This evaluation criterion will be very important following completion of the Final Feasibility Report and endorsement by a non-Federal partner of the comprehensive plan recommended for implementation. It appears that all of the alternative plans would be similarly ranked for this criterion. Each of the alternative plans need to be coordinated with other agencies and the diverse set of public and stakeholder interests.

Completeness

Completeness is a determination of whether a plan includes all elements necessary to realize planned effects, and the degree that intended benefits of the plan depend on the actions of others. Factors that are important in measuring this criterion include (1) authorization, (2) spectrum of objectives being addressed, (3) reliability (degree of uncertainty in achieving objectives), (4) implementability (includes constructability), and (5) environmental effects and mitigation.

Authorization

The Investigation was authorized by Public Law 108-7 in 2003 and again by Public Law 108-361 in 2004. Following development and selection of a feasible alternative and completion of associated environmental compliance, the recommended alternative will be presented to Congress for authorization.

Spectrum of Objectives Being Addressed

All alternative plans address both primary objectives of water supply reliability and ecosystem enhancement. Alternative plans address opportunities of flood damage reduction, recreation, and urban water quality to varying degrees. None of the alternative plans create opportunities for additional energy generation and management, and improvements to San Joaquin River water quality have not been quantified.

Reliability

All alternative plans currently stand alone and are feasible, but water supply and other benefits would increase in the event of broader operational integration with the CVP and SWP, and/or new Delta conveyance. All alternative plans include implementation of the SJRRP, and although the uncertainty in the magnitude of ecosystem enhancement benefits related to improvements in anadromous fish habitat are recognized, the lower end of the range of ecosystem benefits are defensible and sufficient to demonstrate economic feasibility.

Implementability

All alternative plans generally consist of the same physical implementation; construction of the dam and appurtenant structures was determined to be feasible; however, there is risk in the construction schedule related to cofferdam and diversion structures that could potentially increase project costs. Hydropower mitigation options may be refined based on PG&E interest. Implementation may also require changes to Reclamation's water right on the San Joaquin River, to the place of use, as well as other changes to potentially provide SWP M&I contractors the ability to receive water from Temperance Flat RM 274 Reservoir.

Environmental Effects and Mitigation

Environmental effects and mitigation have not been defined at a feasibility-level for any of the alternative plans. As described above, all alternative plans are anticipated to have similar potential environmental impacts within the primary study area; impacts across the extended study area would vary depending on water operations for alternative plans. The assessment of potential impacts of alternative plans on environmental resources, along with proposed mitigation measures, will be documented in the pending Draft EIS/EIR. Potential mitigation lands containing habitat comparable to habitat that would be affected by constructing Temperance Flat RM 274 Dam and Reservoir have been identified near the study area.

Summary of Comparisons

The evaluation criteria are applied to the alternative plans, as summarized in Table 5-16. The No-Action and four alternative plans were ranked for each of the P&G comparison criteria (none, low, low to moderate, moderate, moderate to high, high). A combined ranking was then developed as the composite of the individual criterion rankings for each alternative plan.

Table 5-16. Summary of Alternative Plan Comparison Related to Planning Criteria

Criterion [1,2]	No-Action Alternative [3]	Alternative Plan 1	Alternative Plan 2	Alternative Plan 3	Alternative Plan 4
Effectiveness	Lowest	Moderate	Moderate-High	Moderate-Low	Highest
Efficiency	Lowest	Moderate-High	Moderate-Low	Moderate	Highest
Acceptability	Moderate-Low	Moderate-Low	Highest	Highest	Highest
Completeness	Lowest	Highest	Highest	Highest	Highest
COMBINED RANKING	**Lowest**	**Moderate-Low**	**Moderate-High**	**Moderate**	**Highest**

Notes:

[1] Standard competitive ranking methodology was used to rank alternative plans against each other, including the No-Action Alternative . An alternative plan was assigned its relative rank. For example, the fifth alternative plan would be ranked lowest, even if the first four alternative plans tie and are each ranked highest.

[2] The rankings do not represent magnitude of accomplishment or impact, or whether they are beneficial or adverse. For example, if all alternative plans, including the No-Action Alternative, have the same value for a criterion, they would all have a rank of highest, even if that value is zero or negative.

[3] The No-Action Alternative typically ranks lowest because it represents baseline conditions and has no accomplishment or impact for a specific criterion. Alternative plans that rank lower than the No-Action Alternative have values lower than the baseline condition.

Rationale for Plan Selection

A plan recommending Federal action is to be the plan that best addresses the targeted water resources problems considering public benefits relative to costs. The basis for selecting the recommended plan is to be fully reported and documented, including the criteria and considerations used in selecting a recommended course of action by the Federal Government. When the Feasibility Report and EIS/EIR are finalized, the Secretary of the Interior will use both documents and supporting information to provide a recommendation to Congress. This recommendation will be documented in a ROD and used by the U.S. Congress, along with the Final Feasibility Report and Final EIS/EIR, to determine interest in, and the form of, project authorization if a plan is recommended for implementation. It is recognized that most of the activities pursued by the Federal Government require assessing trade-offs and that in many cases, the final decision will require judgment regarding the appropriate extent of monetized and non-monetized effects.

The needed rationale to support Federal investment in water resources projects is well described by the P&G (WRC 1983):

> *(a) The alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan) is to be selected unless the Secretary of a department or head of an independent agency grants an exception when there is some overriding reason for selecting another plan, based upon other Federal, State, local, and international concerns. (b) The alternative of taking no action, i.e., selecting none of the alternative plans, should be fully considered. (c) Plan selection is made by the agency - decisionmaker for Federal and Federally-assisted plans. Agency officials and State and local sponsors may recommend selection of a plan other than the NED plan. The agency decisionmaker (the Secretary of a department or the head of an independent agency) will determine whether the reasons for selecting a plan other than the NED plan merit the granting of an exception. (d) The basis for selection of the recommended plan should be fully reported, including considerations used in the selection process. (e) Plans should not be recommended for Federal development if they would physically or economically preclude non-Federal plans that would likely be undertaken in the absence of the Federal plan and that would more effectively contribute to the Federal objective when comparably evaluated.*

In addition, the 2013 P&R (Council on Environmental Quality [CEQ]) states:

> *The rationale supporting Federal investment in water resources at the programmatic or project levels should summarize and explain the decision rationale leading from the identification of need through to the recommendation of a specific action. This should include the steps, basic assumptions, methods and results of analysis, criteria and results of various screenings and selections of alternatives, peer review proceedings and*

> *results, and the supporting reasons for other decisions necessary to execute the planning process. The information should enable the public to understand the decision rationale, confirm the supporting analyses and findings, and develop their own fully-informed opinions and/or decisions regarding the validity of the analysis and any associated recommendations. This information should be presented in a decision document or documents, and made available to the public in draft and final forms. The document(s) must demonstrate compliance with the National Environmental Policy Act (NEPA) and other pertinent Federal statutes and authorities.*

At this stage of the Federal planning and NEPA processes, the potential physical accomplishments and the benefits and costs of the alternative plans have been evaluated and compared based on established criteria. Beneficial and adverse environmental effects analysis has not been completed; therefore, a recommended or preferred alternative plan has not been identified to date. Analyses and evaluations presented in this chapter, and that would be applicable to a recommended or preferred alternative plan, are completed for a representative alternative plan, Alternative Plan 4, because it has the greatest net NED benefits of the alternative plans evaluated in this Draft Feasibility Report.

Operations of the existing CVP and SWP may change as a result of reinitiated CVP and SWP long-term operations consultation. Operations of the representative alternative plan, or other alternative plans, may be refined based on updates to modeling studies, changes in CVP and SWP operations, and input from agencies, stakeholders, and the public.

It is recognized that changes in statewide water operations, other relevant water resources projects and programs, including BDCP efforts, could result in changes to the alternative plans. Ultimately the alternative plan that best meets the Investigation planning objectives, maximizes net public benefits, and is determined to be technically, environmentally, economically, and financially feasible, will be identified in the Final Feasibility Report and Final EIS/EIR with supporting rationale and documentation.

Consistency of Alternative Plans with Other Programs

Alternative plans were evaluated on their consistency with the CVPIA and overall goals and objectives of the CALFED ROD. Potential contributions of the Investigation toward the CVPIA and CALFED goals and objectives are described in this section and summarized in Table 5-17.

Table 5-17. Summary of Contributions of Alternative Plans to CVPIA and CALFED Goals

Program	Potential Contributions of Alternative Plans Toward Program Goals
CVPIA	
Anadromous Fish	• Would increase the ability of Friant Dam to make cold-water releases and regulate water temperature in the San Joaquin River • Could provide for additional flows and increased habitat between Friant Dam and Mendota Pool
Wildlife Habitat	• Could provide diversification of Level 2 water supplies to wildlife refuges with access to Mendota Pool
Water Supply Reliability	• Could increase reliability of firm water supplies by up to 76 TAF per year on an annual average basis, and up to 62 TAF in dry years • Could contribute to replacement of supplies redirected to other purposes in the CVPIA
CALFED	
Water Supply Reliability	• Could increase the reliability of firm water supplies by up to 76 TAF per year on an annual average basis, and up to 62 TAF in dry years
Ecosystem Quality	• Would increase the ability of Friant Dam to make cold-water releases and regulate water temperature in the San Joaquin River • Could provide for additional flows and increased habitat between Friant Dam and Mendota Pool • Could provide diversification of Level 2 water supplies to wildlife refuges with access to Mendota Pool
Delta Levee Integrity	• Could provide greater flexibility in flood control releases and reduce potential flood damage thereby reducing stress on Delta levees

Key:
CALFED = CALFED Bay-Delta Program
CVPIA = Central Valley Project Improvement Act
Delta = Sacramento-San Joaquin Delta
TAF = thousand acre-feet

Central Valley Project Improvement Act

The CVPIA is a Federal statute passed in 1992 with the following purposes:

To protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California; to address impacts of the CVP on fish, wildlife, and associated habitats; to improve the operational flexibility of the CVP; to increase water-related benefits provided by the CVP to the State through expanded use of voluntary water transfers and improved water conservation; to contribute to the State's interim and long-term efforts to protect the Bay-Delta; and to achieve a reasonable balance among competing demands for use of CVP water, including the requirements of fish and wildlife, agricultural, M&I, and power contractors.

Anadromous Fish

As part of the fish and wildlife restoration activities outlined by the CVPIA, a goal was to develop and implement a program that makes reasonable efforts to ensure that natural productions of anadromous fish in Central Valley rivers and streams will be sustainable on a long-term basis. Water temperature is an important factor in increasing the probability of success in achieving the Restoration Goal of the SJRRP. All alternative plans improve the capability, reliability, and flexibility to release water at suitable temperatures for anadromous fish downstream from Friant Dam. All the alternative plans increase the total volume of cold water in Millerton Lake and Temperance Flat RM 274 Reservoir, with larger available cold-water pools in alternative plans with higher carryover storage.

Water Supply Replacement

Since the CVPIA was enacted, 1.2 million acre-feet of CVP yield have been dedicated and managed annually for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized by the CVPIA. All alternative plans would increase water supply reliability through increasing firm water supplies for agricultural and M&I purposes. This action would contribute to the replacement of CVP SOD supplies redirected to other purposes in the CVPIA diversification of CVPIA Level 2 refuge water supplies.

CALFED Bay-Delta Program

CALFED, a coordinated Federal and State program, was established after the Bay-Delta Accord to address water supply reliability, water quality, ecosystem quality, and Delta levee system integrity. CALFED provides a programmatic framework to develop and implement a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The CALFED Bay-Delta Program developed the following program goals:

- **Water Supply Reliability** – Reduce the mismatch between Bay-Delta water supplies and the current and projected beneficial uses dependent on the Bay-Delta system.

- **Water Quality** – Provide good water quality for all beneficial uses.

- **Ecosystem Quality** – Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species.

- **Delta Levee Integrity** – Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees.

Table 5-17 summarizes potential contributions of the alternative plans toward CALFED goals.

Expanding water storage capacity is critical to the successful implementation of all aspects of CALFED. Not only is additional storage needed to meet the needs of a growing population but, if strategically located, such storage would provide much needed flexibility in the system to support fish restoration efforts and improve water quality. Table 5-18 qualitatively compares anticipated contributions of the individual alternative plans relative to CALFED goals and CALFED Storage Program objectives.

Table 5-18. Comparison of Alternative Plans Relative to CALFED Goals and CALFED Storage Program Objectives

Alternative Plan	1	2	3	4
CALFED Bay-Delta Program Goals[1]				
Water Supply Reliability: Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses that depend on the Bay-Delta system	++	++	+++	+
Water Quality: Provide good water quality for all beneficial uses	++	++	++	+++
Ecosystem Quality: Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species	0	0	0	0
Delta Levee Integrity: Reduce the risk to land use and associated economic activities, water supply, infrastructure and the ecosystem from catastrophic breaching of Delta levees	+	+	+	+
CALFED Storage Program Element Objectives[2]				
Pursue specific opportunities for new off-stream storage sites and expansion of existing on-stream storage sites as identified in the Record of Decision	+	+	+	+
Provide financial and technical assistance to implement 1/2 million to 1 million acre-feet of new, locally managed groundwater storage	0[3]	0[3]	0[3]	0[3]

Notes:

[1] Source: CALFED Bay-Delta Program Record of Decision (CALFED 2000a)

[2] Source: CALFED Program Elements (CALFED and DWR 2005)

[3] Although the Investigation alternative plans do not include specific features to fund or assist groundwater storage, Temperance Flat River Mile 274 could allow for additional system flexibility for surface water deliveries, decreasing reliance on groundwater pumping. This could reduce groundwater overdraft conditions in CVP and SWP service areas.

Key:

\+ = net positive effect (benefit)

0 = no anticipated effect

CALFED = CALFED Bay-Delta Program
CVP = Central Valley Project
SWP = State Water Project

Water Supply Reliability

One of the primary goals of CALFED is to improve the reliability of California's water supply within the context of unpredictable hydrology and the competing needs of fish and wildlife and water users. In addition to hydrology, the CALFED ROD assumes that water supply reliability is predicated partially on investment in infrastructure to improve storage and conveyance capacity. Included in the CALFED Storage Program Preferred Program Alternative is development of additional storage in the upper San Joaquin River Basin. Water supply reliability depends on capturing water during peak flows and during wet years, as well as on more efficient water use through conservation and recycling. All alternative plans identified in this Draft Feasibility Report would increase water supply reliability for agricultural and M&I purposes, as well as further implementing demand reduction practices identified by the Common Assumptions for Water Storage Projects Work Group.

Water Quality

Additional storage in the Upper San Joaquin River basin would improve operational flexibility, which could contribute to improved Delta water quality conditions and Delta emergency response. Temperance Flat Reservoir would have the ability to provide increased releases to SOD population centers in the event of a Delta emergency. Water supplies delivered via the San Joaquin River could also improve water quality through reducing salt loading and facilitate exchanges and source diversification for users with access to Mendota Pool.

Ecosystem Quality

Temperance Flat RM 274 Reservoir could contribute to ecosystem enhancement along the San Joaquin River and potentially within the Delta. All alternative plans improve the capability, reliability, and flexibility to release water at suitable temperatures for anadromous fish downstream from Friant Dam. All the alternative plans increase the total volume of cold water in Millerton Lake and Temperance Flat RM 274 Reservoir, with larger available cold-water pools in alternative plans with higher carryover storage.

Temperance Flat RM 274 Reservoir could also contribute to Delta species restoration through increased operational flexibility. Increased storage could allow CVP/SWP pumping operations to be shifted to times when fish are less vulnerable to the effects of these pumping operations.

Delta Levee Integrity

Temperance Flat RM 274 Reservoir could provide greater flexibility in flood control releases because of the potential for additional incidental flood control space. Improved operational flexibility in the timing of flood control releases could reduce stress on San Joaquin River and Delta levees, and could contribute to maintaining their stability.

CALFED "Beneficiary Pays" Principle

Federal cost allocation procedures and applicable cost-sharing laws/regulations govern how the costs of a project are allocated among project purposes, and apportioned to Federal and non-Federal project partners. Federal laws and regulations also determine which Federal costs are reimbursable (paid back to the Federal Government by beneficiaries, typically over time) and nonreimbursable (the burden of the Federal taxpayer). Should the project be authorized by Congress, the Federal authorizing language would likely specify any cost-sharing or financing arrangements that deviate from previously established Federal laws. Non-Federal partners would be responsible for determining how their share of project costs are financed (i.e., how these costs may be passed on to beneficiaries). Federal cost allocation and cost-sharing practices are consistent with the CALFED "beneficiary pays" principle.

This page left blank intentionally.