Merced Integrated Regional Water Management Implementation Grant Proposal

Attachment 8: Benefits and Cost Analysis

Attachment 8 consists of the following items:

- ✓ **Economic Benefits and Costs Analysis by Project**

  This attachment describes and monetizes, when possible, the physical benefits documented in Attachment 7. The descriptions include justification for the monetary values claimed. The benefit analysis for each project was completed using the DWR Method of Analysis.

  The attachment also includes an Annual Costs of Project (Table 19 from the IRWM Grant Program - Proposal Solicitation Package for Round 2, Implementation Grants) for each project in the proposal.

- ✓ **Proposal Cost and Benefits Summary**

  This attachment includes a Proposal Benefits and Costs Summary (Table 20 from the IRWM Grant Program - Proposal Solicitation Package for Round 2, Implementation Grants).

The *Merced Integrated Regional Water Management (IRWM) Implementation Grant Proposal* includes a suite of projects selected based on their ability to address the highest priority objectives of the Merced Region, distribute benefits throughout the region and address critical disadvantaged community (DAC) needs. The following four projects included in this proposal provide a suite of benefits that will benefit not only the Merced Region, but also provide benefits statewide due to the region's vital connection to the Delta and its contribution to the state's agricultural economy.

- Black Rascal Flood Control Project
- Planada Community Services District Water Conservation Project
- El Nido Recharge Basin
- Merced River Education and Enhancement Project

Table 8-1 summarizes the physical benefits that would be achieved through implementation of this Proposal. Additional non-quantified and intangible benefits are discussed in the sections below.

Table 8-1 Summary of Proposal Benefits

Project	Benefit Summary
Water Supply	
Planada Community Service District Water Conservation Project	100 AFY decreased water use through water demand reduction and decreased water distribution conveyance losses
El Nido Area Recharge Project	4,489 AFY of increased water deliveries 3,501 AFY of reduced groundwater pumping

Project	Benefit Summary
Water Quality	
El Nido Area Recharge Project	Reduction in groundwater nitrate concentration, which averages 15.7 mg/L, through recharge of surface water with nitrates <2 mg/L
Flood Damage Reduction	
Black Rascal Flood Control Project	Avoided flood damage to 300 residences and agricultural lands during a 200-year event
El Nido Area Recharge Project	Reduction of flood flows by 100 cfs
Recreational Resources	
Merced River Education and Enhancement Program	137 new recreational visitor days
Environmental Resources	
Merced River Education and Enhancement Program	Removal of invasive species (e.g. water hyacinth, arundo and star thistle) at 2 locations along the Merced River Habitat restoration at 2 demonstration sites covering a total of 5 acres Retirement of 2 acres of agriculture to enhance wildlife habitat
Energy	
El Nido Area Recharge Project	15,773 MT of carbon dioxide (CO_2) emissions avoided
Other Physical Benefits	
Planada Community Service District Water Conservation Project	Increase in minimum distribution system pressure to 20 psi
Merced River Education and Enhancement Program	1 life saved every 10 years due to river recreation safety improvements Reduction of 2 emergency responses per year to rescue people in the river

Economic Benefits and Costs Analysis by Project

This section summarizes the technical work that has been completed to monetize the proposed benefits summarized in Table 8-1.

Black Rascal Flood Control Project

The Black Rascal Flood Control Project will complete the environmental documentation and preliminary design for a detention basin on the Black Rascal Creek Watershed. Implementation of this flood control structure will provide protection to the communities of Merced and Franklin/Beachwood during a 200-year storm event, alleviating recurring inundation of dwellings and agricultural lands, which is a critical water quality issue for the disadvantaged community (DAC) of Merced. In addition to flood control benefits, implementation of the preferred project is anticipated to include habitat enhancements through creation of a deadpool in the reservoir and water supply reliability improvements by allowing the Merced Irrigation District (MID) to regulate flows.

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in Table 8-2.

Table 8-2 Summary of Black Rascal Flood Control Project Benefits and Costs

Category	Summary	Present Value
Benefits		
Flood Damage Reduction	Avoided damage to properties and agricultural crops	$1,045,589
Total Monetized Benefits		$1,045,589
Costs		
Present Value of Capital and O&M Costs	Environmental documentation and preliminary design	$919,570
Total Costs		$919,570

Existing Data and Studies

The Project is supported by a series of studies documenting the potential project benefits, including:

- Feasibility Study and Addendum 1, Black Rascal Creek Flood Control (June 2008, amended February 2009) – included as Appendix 8-1
- Merced County Streams California, General Design Memorandum Phase 1 Plan Formulation, (March 1980) – included as Appendix 8-2
- MIRWMP Flood Management Summary (March 2013) – included as Appendix 8-3
- Hemming & Morse Inc, Expert Report of Daniel W. Ray, Abarca, el al. v. Merced Irrigation District, et. al. United States District Court Case No. 1:07-CV-0388 OWW DLB. – included as Appendix 8-4
- Merced March & April 2006 California County Agricultural Commissioner Disaster Report (2006) – included as Appendix 8-5
- Summary of Legal Costs Incurred as a Result of 2006 Flood Event – included as Appendix 8-6

Without Project Conditions

Without the project, the status quo will continue, meaning properties within the floodplain would be at risk of damage from flooding. These areas include the central part of City of Merced along Bear Creek and the unincorporated area of Franklin/Beachwood in Merced County (downstream of Bear Creek and Black Rascal Creek confluence). Additionally, Merced County, the City of Merced, and MID would continue to be at risk of lawsuits, potentially incurring significant legal costs.

With Project Conditions

With the project, the Merced Region would move one step closer to implementing 200-year flood protection on the Black Rascal Creek Watershed which will protect buildings and crops around the communities of Merced and Franklin/Beachwood from repeated inundation. Significant flooding which resulted in multi-million dollar damages to these communities was experienced as recently as 1998 and 2006.

Description of Benefits and Methods to Estimate Benefits

Section D1 – Cost-Effectiveness Analysis

The cost-effectiveness analysis approach was not used for this project; as such, PSP Table 11 has been omitted.

Section D2 – Non-Monetized Benefits Analysis

A series of non-monetized benefits are expected to accrue from project implementation. The benefits are summarized in Table 8-3, and are described in additional detail below.

Table 8-3 Black Rascal Flood Control Project Non-Monetized Benefits Summary

No.	Question	Enter "Yes", "No" or "Neg"
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	No
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	No
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	Yes

No.	Question	Enter "Yes", "No" or "Neg"
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	Yes
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	Yes
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	Yes/Neg
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits:	

No.	Question	Enter "Yes", "No" or "Neg"
	Will the proposal	
10	**Improve the overall, long-term management of California groundwater resources?**	No
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	No
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	No

Community/Social Benefits

1. Provide Education or Technology Benefits

Not applicable

2. Provide Social Recreation or Access Benefits

Not applicable

3. Help Avoid, Reduce or Resolve Various Public Water Resources Conflicts

In 1970, USACE identified a flood control project known as Haystack Dam to address flooding on Black Rascal Creek (see Appendix 8-2, pp. 1, 5, 72, 74, 76). Later, due to environmental concerns, the USACE placed the Haystack Dam under general re-evaluation, where federal plans for flood control on the Black Rascal watershed remain today. A flood control structure on Black Rascal Creek is the only component of the USACE Merced County Streams Group Project that was not completed (see Appendix 8-3 p. 4). This project would help to resolve the existing conflict between flood management and environmental interests by completing the environmental documentation and design for an alternative flood control structure.

Furthermore, the County of Merced, City of Merced and MID have been subject to multiple lawsuits arising from flood damages to residences (see Appendix 8-4). In 2006, collectively the three agencies spent approximately $21 million in settlements and attorney fees (see Appendix 8-6). Moving forward with the Black Rascal Flood Control Project shows good faith on the part of the agencies and reduces the risk for future lawsuits.

4. Promote Social Health and Safety

The benefit of avoided damage to residences and agricultural lands in terms of personal property loss, structural repair and agricultural damage is accounted for in Section D3. Beyond these quantifiable monetary benefits, the management of flood flows will also reduce public health risk from contact with degraded flood waters.

5. Have Other Social Benefits

The project has disproportionate beneficial effects on the DAC of Merced by addressing flooding that affects residents' personal safety and their property. The project addresses the critical water quality need of the management of flood flows that threaten the habitability of dwellings in a currently unprotected area.

Environmental Stewardship Benefits

6. Benefit Wildlife or Habitat in Ways Not Quantified in Attachment 7

The *Feasibility Study, Black Rascal Flood Control Project* considers four detention basin sites located in the upper Black Rascal Creek watershed. Sensitive habitats (e.g., vernal pools) are located within or in the vicinity of all of these sites. Construction and operation of the detention basin would result in direct loss of habitat at the embankment site and any related permanent structures, and indirect degradation of seasonal wetland habitats due to periodic, seasonal inundation. Special-status species associated with those habitats would also be affected. The level of impacts would be based on the site selected. It is expected that compensation of loss habitat would be required (at a 1:1 or 2:1 ratio). Thus, the Project could result in additional habitat than replacement of the habitat that was lost.

The design of the detention basin is anticipated to include habitat enhancements through creation of a deadpool in the reservoir. Habitat enhancements may introduce refugia for special-status species that may otherwise not occur in the area, potentially resulting in an improved ecosystem for terrestrial and aquatic resources.

In sum, because the Black Rascal Flood Control Project would at least mitigate for biological impacts that are lost, as well as create additional enhancements, the project is expected to benefit habitat and wildlife.

7. Improve Water Quality in Ways Not Quantified in Attachment 7

Implementation of the preferred flood control project will protect domestic water system facilities from flooding and thereby will improve water quality. Additionally, the project will prevent flooding of sewer ponds operated and maintained by Franklin Water District, which is in a sanitary district in the Franklin/Beachwood area.

8. Reduce Net Emissions in Ways Not Quantified in Attachment 7

Not applicable

9. Provide Other Environmental Stewardship Benefits Not Claimed in Sections D1, D3, or D4

Not applicable

Sustainability Benefits

10. Improve the Overall, Long-Term Management of California Groundwater Resources
Not Applicable

11. Reduce Demand for Net Diversions for the Region from the Delta
Not Applicable

12. Provide a Long-Term Solution in Place of a Short-Term One
Not Applicable

13. Promote Energy Savings or Replace Fossil Fuel Based Energy Sources with Renewable Energy
Not Applicable

14. Improve Water Supply Reliability in Ways Not Quantified in Attachment 7
The design of the detention basin is anticipated to include capacity to serve as a regulating reservoir. This will improve waters supply reliability by allowing Merced Irrigations District to regulate flows.

15. Other
Not Applicable

Section D3 – Monetized Benefits Analysis

The following benefits have been monetized for this Project:

- Avoided flood damage

Avoided flood damage

The Black Rascal Flood Control Project will complete the environmental documentation necessary to identify a preferred alternative for a 200-year flood control structure on the Black Rascal Creek Watershed and complete preliminary design of the preferred alternative. Implementation of the preferred alternative will reduce property damage for at least 300 residences and agricultural lands in the communities of Merced and Franklin/Beachwood. Damages to residences which resulted from a 100-year storm in 2006 are detailed in the *Expert Report of Daniel W. Ray* (see Appendix 8-4), and damages to crops are detailed in Merced's *California County Agricultural Commissioner Disaster Report* for March and April 2006 (see Appendix 8-5).

Because the Black Rascal Flood Control Project will be designed to provide 200-year flood protection, at a minimum, the implemented project can be expected to avoid the damages equivalent to those experienced in the 100-year storm of 2006. As shown in PSP 17 in Section D-4, using a conservative assumption in which flood damages from the 200-year storm are equal to the 100-year storm, the expected annual damage equates to $2,420,137.

Only a percent of the full benefits of implementing a flood control structure on Black Rascal Creek are claimed in this proposal. While the Black Rascal Flood Control Project is a step towards avoiding flood damages, the County of Merced recognizes that final design and construction of the detention basin must be completed before the full benefits of the project can be realized, and as such only benefits proportional to the project's percent of total implementation costs are claimed here. Since project costs are approximately 4.7% of total costs required to for the full project, flood reduction benefits are apportioned based on this ratio and have a present value of $1,045,589.

Annual Benefits Table

A modified version of PSP Table 15 shows the present value of the avoided flood damage benefit over the 100-year life of the project. As the measure of benefit was already expressed in dollars, columns (g) and (h) were removed from PSP Table 15 as shown in Table 8-4.

Table 8-4 Black Rascal Flood Control Project Annual Avoided Flood Damage Benefit

Annual Avoided Flood Damage Benefit (All benefits should be in 2012 dollars) Project: Black Rascal Flood Control Project							
(a)	(b)	(c)	(d)	(e)	(f)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Discount Factor (1)	Discounted Benefits (1) (f) x (i)
2012						1.000	$ -
2013					0	0.943	$ -
2014					0	0.890	$ -
2015					0	0.840	$ -
2016					0	0.792	$ -
2017					0	0.747	$ -
2018					0	0.705	$ -
2019					0	0.665	$ -
2020					0	0.627	$ -
2021					0	0.592	$ -
2022					0	0.558	$ -
2023	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.527	$ 1,274,898
2024	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.497	$ 1,202,734
2025	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.469	$ 1,134,655
2026	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.442	$ 1,070,429
2027	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.417	$ 1,009,839
2028	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.394	$ 952,678
2029	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.371	$ 898,753

2030	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.350	$ 847,880
2031	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.331	$ 799,887
2032	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.312	$ 754,610
2033	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.294	$ 711,896
2034	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.278	$ 671,600
2035	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.262	$ 633,585
2036	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.247	$ 597,722
2037	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.233	$ 563,889
2038	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.220	$ 531,970
2039	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.207	$ 501,859
2040	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.196	$ 473,452
2041	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.185	$ 446,653
2042	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.174	$ 421,370
2043	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.164	$ 397,519
2044	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.155	$ 375,018
2045	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.146	$ 353,791
2046	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.138	$ 333,765
2047	Avoided Flood Damage	Dollars from Table	$ -	$ 2,420,137	$ 2,420,137	0.130	$ 314,872

		17					
2048	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.123	$ 297,049
2049	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.116	$ 280,235
2050	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.109	$ 264,373
2051	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.103	$ 249,408
2052	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.097	$ 235,291
2053	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.092	$ 221,973
2054	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.087	$ 209,408
2055	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.082	$ 197,555
2056	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.077	$ 186,373
2057	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.073	$ 175,823
2058	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.069	$ 165,871
2059	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.065	$ 156,482
2060	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.061	$ 147,624
2061	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.058	$ 139,268
2062	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.054	$ 131,385
2063	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.051	$ 123,948
2064	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.048	$ 116,932

2065	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.046	$ 110,314
2066	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.043	$ 104,069
2067	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.041	$ 98,179
2068	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.038	$ 92,621
2069	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.036	$ 87,379
2070	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.034	$ 82,433
2071	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.032	$ 77,767
2072	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.030	$ 73,365
2073	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.029	$ 69,212
2074	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.027	$ 65,294
2075	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.025	$ 61,599
2076	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.024	$ 58,112
2077	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.023	$ 54,822
2078	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.021	$ 51,719
2079	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.020	$ 48,792
2080	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.019	$ 46,030
2081	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.018	$ 43,425
2082	Avoided Flood Damage	Dollars from Table	$ -	$ 2,420,137	$ 2,420,137	0.017	$ 40,967

		17					
2083	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.016	$ 38,648
2084	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.015	$ 36,460
2085	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.014	$ 34,396
2086	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.013	$ 32,449
2087	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.013	$ 30,613
2088	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.012	$ 28,880
2089	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.011	$ 27,245
2090	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.011	$ 25,703
2091	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.010	$ 24,248
2092	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.009	$ 22,876
2093	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.009	$ 21,581
2094	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.008	$ 20,359
2095	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.008	$ 19,207
2096	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.007	$ 18,120
2097	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.007	$ 17,094
2098	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.007	$ 16,126
2099	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.006	$ 15,214

2100	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.006	$ 14,352
2101	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.006	$ 13,540
2102	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.005	$ 12,774
2103	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.005	$ 12,051
2104	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.005	$ 11,368
2105	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.004	$ 10,725
2106	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.004	$ 10,118
2107	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.004	$ 9,545
2108	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.004	$ 9,005
2109	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.004	$ 8,495
2110	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.003	$ 8,014
2111	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.003	$ 7,561
2112	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.003	$ 7,133
2113	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.003	$ 6,729
2114	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.003	$ 6,348
2115	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 5,989
2116	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 5,650
2117	Avoided Flood Damage	Dollars from Table	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 5,330

		17					
2118	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 5,028
2119	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 4,744
2120	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 4,475
2121	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 4,222
2122	Avoided Flood Damage	Dollars from Table 17	$ -	$ 2,420,137	$ 2,420,137	0.002	$ 3,983
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)							$ 22,456,816
Percent of Full Project Benefits Claimed for the Proposed Project, Based on Ratio of Project Cost to Full Project Cost							4.7%
Benefits Claimed for the Project (Total Present Value of the Full Project * Percent of Full Benefits Claimed)							$ 1,045,589
Comments:							

(1) Complete these columns if dollar value is being claimed for the benefit.

Section D4 – Flood Damage Reduction Analysis

Once the preferred flood control alternative is implemented, the risk of flooding for events equal to or with a greater return interval than 200-year will be completely eliminated. Without the project, the probability of failure is 100% for all events because there is no existing flood structure.

To estimate benefits from providing a 100-year level of storm protection, the damages from the 100-year flood in April 2006 documented in *Expert Report of Daniel W. Ray* (see Appendix 8-4), was used. Other significant flooding events have been recorded, as recently as 1998. It is assumed that there are no structural or agricultural damages during a 5-year storm. Also, it is assumed that a 200-year flood will produce roughly the same property and agricultural damage as a 100-year storm.

Property and crop damages resulting from the 2006 100-year flood amounted to $18,250,538 and $3,000,000, respectively, in 2006 dollars (see Appendix 8-4 and 8-5). Property damages included personal property loss of $10,000,510 and estimated future structural repair costs of $18,250,028. To calculate expected annual damages from flooding, the damage totals to 2012 dollars were adjusted using the Consumer Price Index. Based on this adjustment, expected property damages for a 100-year flood are $20,784,792 and expected agricultural damages are $3,416,577

Using the standard DWR Table 17 for calculation for three flooding scenarios, annual property and agricultural damages are expected to be $2,420,137. Over the expected 100-year life of the regulating reservoir, this will yield a present value of $22,456,816 in total flood reduction benefits.

Table 8-5 shows how the expected annual damages were calculated.

Table 8-1: Black Rascal Flood Control Project Expected Annual Damage

Expected Annual Damage Black Rascal Flood Control Project											
Hydrologic Event	Event Exceedance Probability	Event Damage if Flood Structures Fail	Probability Structural Failure		Expected Event Damage		Interval Probability	Average Damage in Interval		Average Damage in Interval times Interval Probability	
			Without Project	With Project	Without Project	With Project		Without Project	With Project	Without Project	With Project
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(i)	(j)	(k)	(l)	(m)
					(c) x (d)	(c) x (e)	from (b)	from (f)	from (g)	(i) x (j)	(i) x (k)
5-year	0.2	$0	1	0	$0	$0					
100-Year	0.01	$24,201,369	1	0	$24,201,369	$0	0.19	$12,100,685	$0	$2,299,130	$0
200-Year	0.005	$24,201,369	1	0	$24,201,369	$0	0.005	$24,201,369	$0	$121,007	$0
Expected Annual Damages, Without and With Project										$2,420,137	$0.00

Section D5 – Project Benefits and Costs Summary

Project costs were developed in accordance with PSP requirements:

- Consistency: The economic analysis is consistent with the grant requirements, and uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in Table **8-** are consistent with the projected schedule for the project, as shown in Attachment 5, which reflect completion of activities for the proposed project in 2015. The flood control project that will be identified through this project and ultimately constructed will have an operational life of 100 years. Assuming construction of the project is completed in 2022, the end of the project life will be 2122.
- Economic Cost. The economic cost of the proposed project as presented in Attachment 4 considers all reasonably foreseeable costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. There are no opportunity costs as there are no resources that have been acquired for this project that could be used for another purpose.
- Discount Rate. In accordance with PSP requirements, a 6% discount rate was applied.
- Dollar Value. In accordance with PSP requirements, all costs are presented in 2012 dollars.

As shown in Table **8-**, the present value of the proposed project costs, discounted at 6%, is estimated to be $919,570 over the life of the project. This estimate includes all costs associated with preparing environmental documentation and preliminary design. The initial costs presented in this table are equivalent to those presented in Attachment 4.

Table 8-6 Black Rascal Flood Control Project Annual Cost of Proposed Project

Annual Costs of Project										
(All costs are in 2012 Dollars)										
Project: Black Rascal Flood Control Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjust-ed Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								-	1.000	-
2013	172,120							172,119.71	0.943	162,309
2014	688,479							688,479	0.890	612,746
2015	172,120							172,120	0.840	144,515
2016								-	0.792	-
2017								-	0.747	-

Annual Costs of Project (All costs are in 2012 Dollars) Project: Black Rascal Flood Control Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjust-ed Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
2018								-	0.705	-
2019								-	0.665	-
.....										
End of Project Life - 2122										
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$ 919,570
Comments: Costs included in this phase of the project include design and environmental documentation.										

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

A second cost table was completed for the Black Rascal Flood Control Project to estimate the present value cost of constructing the preferred alternative; this table is included as Table **8-**. The total implementation cost was used as the basis for assigning benefits to the environmental documentation and preliminary design work, which is the phase of work included in this proposal.

Table 8-7 Black Rascal Flood Control Project Annual Cost of the Fully Implemented Black Rascal Flood Control Structure

Annual Costs of Project (All costs are in 2012 Dollars) Project: Black Rascal Flood Control Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjust-ed Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								0	1.000	-

Annual Costs of Project (All costs are in 2012 Dollars) Project: Black Rascal Flood Control Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjust-ed Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
2013								0	0.943	-
2014								0	0.890	-
2015								0	0.840	-
2016								0	0.792	-
2017								0	0.747	-
2018								0	0.705	-
2019								0	0.665	-
2020	10,592,670							10,592,670	0.627	6,645,972
2021	10,592,670							10,592,670	0.592	6,269,785
2022	10,592,670							10,592,670	0.558	5,914,892
2023								0	0.527	-
2024								0	0.497	-
.....										
End of Project Life - 2122										
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$ 18,830,649
Comments: Project life is assumed to be 100 years from year after construction is finished, which is 2023. No operations or maintenance costs are anticipated for the full project.										

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

Planada Community Services District Water Conservation Project

The Planada Community Services District Water Conservation Project will provide water conservation benefits to one of the most disadvantaged communities in the region. The proposed project would replace a dilapidated and undersized section of pipe in the delivery system, complete water meter installation for approximately a third of the DAC, and replace an existing, out-dated standby generator. By completing water metering for the community, the District will be able to shift from the current flat rate charge to a volumetric charge. This shift, combined with the ability for the District to locate water leaks in real time, is anticipated to save approximately 20% over current water usage.

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in the Table 8-8.

Table 8-8 Summary of Planada Community Services District Water Conservation Project Benefits and Costs

Category	Summary	Present Value
Benefits		
	Demand (water use)	$105,457
Total Monetized Benefits		**$105,457**
Costs		
Present Value of Capital and O&M Costs	Design, pipeline construction, meter installation, replacement of standby generator, annual operation and maintenance	$1,133,342
Total Costs		**$1,133,342**

Existing Data and Studies

The Project is supported by a series of studies documenting the potential project benefits, including:

- Preliminary Engineering Report for the Water System Rehabilitation & Conservation Project (October 2012) – included as Appendix 8-7
- Planada Community Services Minutes January 4, 2011 – included as Appendix 8-8
- Planada 2011 and 2012 Water Use Data – included as Appendix 8-9
- Planada 2012 Water Production/Cost Estimates – included as Appendix 8-10

Without Project Conditions

Without the project, the status quo will continue, meaning reliability of service to customers will continue to suffer with operating pressures below Title 22 standards, which threatens system integrity and public safety through inadequate fire flows. Additionally the community of Planada would not be fully metered and would be unable to implement volumetric water rates.

With Project Conditions

The project will replace a section of the water distribution system which has outlived its useful life and is undersized for current demands. The rehabilitation of the distribution system would improve water supply reliability ensuring continued deliveries to customers and adequate pressure to maintain system integrity and meet required fire flows.

Completion of water metering will facilitate the District's conversion from a flat fee rate to a volumetric water rate, which is a proven method of encouraging water conservation.

Description of Benefits and Methods to Estimate Benefits

Section D1 – Cost-Effectiveness Analysis

The cost-effectiveness analysis approach was not used for this project; as such, PSP Table 11 has been omitted.

Section D2 – Non-Monetized Benefits Analysis

A series of non-monetized benefits are expected to accrue from project implementation. The benefits are summarized in Table 8-9, and are described in additional detail below.

Table 8-9 Planada Community Services District Water Conservation Project Non-Monetized Benefits Summary

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	No
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	No
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	No
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	Yes
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding?	

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	Yes
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	Yes
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	No

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	No

Community/Social Benefits

1. Provide Education or Technology Benefits

Not applicable

2. Provide Social Recreation or Access Benefits

Not applicable

3. Help Avoid, Reduce or Resolve Various Public Water Resources Conflicts

Not applicable

4. Promote Social Health and Safety

The Planada Community Services District Water Conservation Project would promote social health and safety by increasing reliability of the water distribution system for firefighting purposes. Specifically, the Project would improve the water distribution system to allow provide fire suppression flow capacities. In addition, the Project would reduce the potential for potential for backflow contamination (i.e., exposure to water-related hazards) from the under-pressured system conditions, thereby complying with Title 22 standards. The improvement to health and safety would apply under all conditions, not just after seismic or other emergency events.

5. Have Other Social Benefits

The project has disproportionate beneficial effects on the DAC of Planada by addressing critical water supply reliability needs. These needs consist of providing public water supply system infrastructure improvements that assures continued reliability of the minimum quality and quantity of water, and augmentation of inadequate water supply pressure in a public water supply system needed to prevent loss of system integrity and to maintain adequate fire protection flows.

Environmental Stewardship Benefits

6. Benefit Wildlife or Habitat in Ways Not Quantified in Attachment 7

Not applicable

7. Improve Water Quality in Ways Not Quantified in Attachment 7

By reducing groundwater pumping in an overdrafted basin, the project reduces the potential for degradation of the community of Planada's groundwater supply. Groundwater overdraft can create a gradient that draws contaminants from adjacent areas into the pumping sphere of influence, and for Planada this is a real concern as neighboring communities have found traces of tricholorpropane in their groundwater. While this water quality benefit is mentioned in Section D3 to illustrate the community's willingness to pay to pay for other sources of water, the water quality benefit is included here because the benefit was not monetized.

8. Reduce Net Emissions in Ways Not Quantified in Attachment 7

The project includes replacement of an old backup generator with one that is a better quality (more technologically advanced) to reduce criteria pollutant emissions and thus violation of air quality standards.

9. Provide Other Environmental Stewardship Benefits Not Claimed in Sections D1, D3, or D4

Not Applicable

Sustainability Benefits

10. Improve the Overall, Long-Term Management of California Groundwater Resources

The primary source of water in Planada is groundwater. Thus, upgrading the water system to reduce leaks and improve efficiency will reduce overall groundwater extraction to meet the needs of the service area. Thus, the Project would reduce extraction of a non-renewable resource.

11. Reduce Demand for Net Diversions for the Region from the Delta

Not Applicable

12. Provide a Long-Term Solution in Place of a Short-Term One

Not Applicable

13. Promote Energy Savings or Replace Fossil Fuel Based Energy Sources with Renewable Energy

Not Applicable

14. Improve Water Supply Reliability in Ways Not Quantified in Attachment 7

Not Applicable

15. Other

Not Applicable

Section D3 – Monetized Benefits Analysis

The following benefits have been monetized for this Project:

- Reduced water demand from metering and volumetric charges

Reduced water demand from metering and volumetric charges

The Planada Community Services District Water Conservation Project will install 400 meters in the Planada Community Services District service area. This will complete installation of water meters throughout the connections in the Planada Community Services District service area, and allow use of volumetric charges in the Planada Community Services District for the first time instead of current fixed charge per month that does not depend on water usage. When customers are charged according to their water usage, evidence shows that demand will be reduced compared to the level of demand under fixed charges. Percent reductions from volumetric charges with meters compared to unmetered connections range from 15 to 39% (DeOreo, et al. 2011; Koplow and Lownie, 1999), and anecdotal evidence from smaller utilities in Colorado shows that much larger percent reductions in demand are possible. For this analysis, a 20% reduction in demand is assumed, however, this is considered a conservative estimate, and actual demand reduction will likely be higher than this amount, given that Planada Community Services District serves 1,000 connections.

Water conserved as a result of volumetric charges instituted as part of the project will avoid use of the current water source for the Planada Community Services District, which is groundwater pumping. Planada reports that current groundwater pumping costs currently total $82 per AF (see Appendix 8-10)). Avoided pumping costs are assumed to represent the value of water conservation as a result of the project. In reality, this is a likely lower bound on the value (willingness to pay) for additional water sources that will take the pressure off groundwater sources. By reducing the demand on the overdrafted Merced Basin, this water conservation project will also reduce potential for local water quality degradation. Groundwater overdraft can create a gradient that draws contaminants from adjacent areas into the pumping sphere of influence, and for Planada this is a real concern as neighboring communities have found traces of trichloropropane in their groundwater.

The project lifetime of the switch to volumetric charges is considered to be infinite if the District continues to charge customers for the volume of their usage into the future (as is required under State law). However, the assumed lifetime of the overall Planada Community Services District Water Conservation Project is approximately 40 years, and therefore the benefit is calculated based on the 40-year lifetime of the project. Assuming an avoided cost of $82 per acre-foot of groundwater pumping that is constant in real terms over the assumed life of the project, the annual avoided cost of groundwater pumping is $8,348 per AF, and the total present value of this water conservation benefit over the project lifetime is calculated to be $68,071.

Annual Benefits Table

Table 8-10 shows the present value of the water conserved via metering over the 40-year life of the project.

Table 8-10

Annual Benefit (All benefits should be in 2012 dollars) Project: Planada Community Services District Water Conservation Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
2012								1.000	
2013								0.943	
2014								0.890	
2015								0.840	
2016	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.792	6,612
2017	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.747	6,238
2018	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.705	5,885
2019	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.665	5,552
2020	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.627	5,237
2021	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.592	4,941
2022	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.558	4,661
2023	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.527	4,397
2024	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.497	4,149
2025	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.469	3,914
2026	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.442	3,692
2027	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.417	3,483
2028	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.394	3,286
2029	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.371	3,100
2030	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.350	2,925
2031	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.331	2,759
2032	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.312	2,603
2033	Demand	Acre-feet	509	407	102	82	8,348	0.294	2,455

Annual Benefit (All benefits should be in 2012 dollars) Project: Planada Community Services District Water Conservation Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value [1]	Annual $ Value [1] (f) x (g)	Discount Factor [1]	Discounted Benefits [1] (h) x (i)
	(Water Use)								
2034	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.278	2,317
2035	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.262	2,185
2036	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.247	2,062
2037	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.233	1,945
2038	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.220	1,835
2039	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.207	1,731
2040	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.196	1,633
2041	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.185	1,541
2042	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.174	1,453
2043	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.164	1,371
2044	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.155	1,294
2045	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.146	1,220
2046	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.138	1,151
2047	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.130	1,086
2048	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.123	1,025
2049	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.116	967
2050	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.109	912
2051	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.103	860
2052	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.097	812
2053	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.092	766

Annual Benefit (All benefits should be in 2012 dollars) Project: Planada Community Services District Water Conservation Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
2054	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.087	722
2055	Demand (Water Use)	Acre-feet	509	407	102	82	8,348	0.082	681
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									$ 105,457
Comments:									

(1) Complete these columns if dollar value is being claimed for the benefit.

Section D4 – Flood Damage Reduction Analysis

No flood damage reduction benefits are claimed from this Project; as such, PSP Table 17 has been omitted.

Section D5 – Project Benefits and Costs Summary

Project costs were developed in accordance with PSP requirements:

- Consistency: The economic analysis is consistent with the grant requirements and uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in Table 8-11 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect completion of construction activities in 2015. The operational life of the Project is assumed to be 40 years, beginning in 2016, making the end of the project life 2055.
- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. There are no opportunity costs as there are no resources that have been acquired for this project that could be used for another purpose.
- Discount Rate. In accordance with PSP requirements, a 6% discount rate was applied.
- Dollar Value. In accordance with PSP requirements, all costs are presented in 2012 dollars.

As shown in Table 8-11, the present value of project costs, discounted at 6%, is estimated to be $1,133,342 over the 40-year life of the Planada Community Services District Water Conservation Project. This estimate includes all capital costs as well as costs associated with

operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. The initial costs presented in this table are equivalent to those presented in Attachment 4.

Operations and maintenance costs are estimated to be approximately $29,000 per year, beginning in 2015, as presented in Table 8-11. This cost includes operation and maintenance costs for the area that will be served by the rehabilitated pipeline and administration costs and maintenance costs associated with implementation of the volumetric meter rates. A breakdown of this cost is as follows:

- $27,800 per year for operation of the project
- $1,200 per year for routine maintenance.

Table 8-5 Planada Community Services District Project Annual Cost of Proposed Project

Annual Costs of Project										
(All costs are in 2012 Dollars)										
Project: Planada Community Service District Water Conservation Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjust-ed Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								-	1.000	-
2013	2,200							2,200	0.943	2,075
2014	431,410							431,410	0.890	383,955
2015	427,510			27,800	1,200			456,510	0.840	383,295
2016				27,800	1,200			29,000	0.792	22,971
2017				27,800	1,200			29,000	0.747	21,670
2018				27,800	1,200			29,000	0.705	20,445
2019				27,800	1,200			29,000	0.665	19,285
2020				27,800	1,200			29,000	0.627	18,183
2021				27,800	1,200			29,000	0.592	17,168
2022				27,800	1,200			29,000	0.558	16,182
2023				27,800	1,200			29,000	0.527	15,283
2024				27,800	1,200			29,000	0.497	14,413
2025				27,800	1,200			29,000	0.469	13,601
2026				27,800	1,200			29,000	0.442	12,818
2027				27,800	1,200			29,000	0.417	12,093

Annual Costs of Project										
(All costs are in 2012 Dollars)										
Project: Planada Community Service District Water Conservation Project										
2028				27,800	1,200			29,000	0.394	11,426
2029				27,800	1,200			29,000	0.371	10,759
2030				27,800	1,200			29,000	0.350	10,150
2031				27,800	1,200			29,000	0.331	9,599
2032				27,800	1,200			29,000	0.312	9,048
2033				27,800	1,200			29,000	0.294	8,526
2034				27,800	1,200			29,000	0.278	8,062
2035				27,800	1,200			29,000	0.262	7,598
2036				27,800	1,200			29,000	0.247	7,163
2037				27,800	1,200			29,000	0.233	6,757
2038				27,800	1,200			29,000	0.220	6,380
2039				27,800	1,200			29,000	0.207	6,003
2040				27,800	1,200			29,000	0.196	5,684
2041				27,800	1,200			29,000	0.185	5,365
2042				27,800	1,200			29,000	0.174	5,046
2043				27,800	1,200			29,000	0.164	4,756
2044				27,800	1,200			29,000	0.155	4,495
2045				27,800	1,200			29,000	0.146	4,234
2046				27,800	1,200			29,000	0.138	4,002
2047				27,800	1,200			29,000	0.130	3,770
2048				27,800	1,200			29,000	0.123	3,567
2049				27,800	1,200			29,000	0.116	3,364
2050				27,800	1,200			29,000	0.109	3,161
2051				27,800	1,200			29,000	0.103	2,987
2052				27,800	1,200			29,000	0.097	2,813
2053				27,800	1,200			29,000	0.092	2,668
2054				27,800	1,200			29,000	0.087	2,523
									…	
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$ 1,133,342
Comments:										

(1) If any, based on opportunity costs, sunk costs and associated costs

(2) The incremental change in O&M costs attributable to the project

El Nido Area Recharge Project

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in Table 8-12.

Table 8-1 Summary of Proposal Benefits Table 8-62 Summary of El Nido Recharge Basin Benefits and Costs

Category	Summary	Present Value
Benefits		
	Water supply and avoided social costs of GHG emissions	$3,599,218
Total Monetized Benefits		**$3,599,218**
Costs		
Present Value of Capital and O&M Costs	Construction, administration, operation and maintenance	$643,927
Total Costs		**$643,927**

Existing Data and Studies

The Project is supported by a series of studies documenting the potential project benefits, including:

- Merced Irrigation District Water Right Summary for El Nido Irrigation District – included as Appendix 8-11
- Well Level Compilation – included as Appendix 8-12
- El Nido Deliveries Calculations – included as Appendix 8-13
- El Nido Additional Recharge Calculation – included as Appendix 8-14
- Merced County Division of Environmental Health Private Domestic Well Data – included as Appendix 8-15
- El Nido Area Pump Test Data – included as Appendix 8-16

Without Project Conditions

Without the project, the status quo will continue, meaning MID will not fully utilize the two surface water rights it manages for the benefit of the El Nido area. Agricultural users will continue pumping groundwater to supplement surface water deliveries from MID, and the existing levels of groundwater drawdown will continue affecting both agricultural and domestic users.

With Project Conditions

With the project, MID will be able to maximize its use of surface water rights for El Nido. Agricultural users will reduce groundwater pumping through use of surface water that is applied to their lands for in lieu recharge, and additional groundwater will be recharged in the region helping to reverse groundwater overdraft conditions.

Description of Benefits and Methods to Estimate Benefits

Section D1 – Cost-Effectiveness Analysis

The cost-effectiveness analysis approach was not used for this project; as such, PSP Table 11 has been omitted.

Section D2 – Non-Monetized Benefits Analysis

A series of non-monetized benefits are expected to accrue from project implementation. The benefits are summarized in Table8-13, and are described in additional detail below.

Table 8-73: El Nido Area Recharge Project Non-Monetized Benefits Checklist

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	No
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	No
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	Yes
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	No
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	Yes

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	Yes
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	No
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include:	

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	No

Community/Social Benefits

1. Provide Education or Technology Benefits

Not applicable

2. Provide Social Recreation or Access Benefits

Not applicable

3. Help Avoid, Reduce or Resolve Various Public Water Resources Conflicts

The diversion of Mariposa Creek water would provide an opportunity for the growers in El Nido to make a conscious decision to apply Mariposa Creek Water in the fall and winter months to maintain the soil moisture profiles and reduce dependence on other water resources. In this way, it provides opportunities for public involvement in water management, and moreover, it helps to reduce conflict among the various users of the Merced Groundwater Basin.

4. Promote Social Health and Safety

Not applicable

5. Have Other Social Benefits

The project has disproportionate beneficial effects on the DAC of El Nido by addressing critical water supply reliability needs. Because the groundwater basin is currently overdrafted, reduction in groundwater extraction through in-lieu and direct recharge benefits the DAC. The diversification of the water portfolio would provide additional assurance to a community, whose economy is dependent upon agriculture, that water would be available even in some dry years because of the water that the community has banked in previous years. This would empower residents by confirming that they were part of the overall solution in addressing ongoing overdraft issue.

Environmental Stewardship Benefits

6. Benefit Wildlife or Habitat in Ways Not Quantified in Attachment 7

The project enhance management of an existing 2 acre wetland at the El Nido recharge basin, improving habitat for associated species that inhabit the wetland, such as amphibians and other aquatic species, and birds.

7. Improve Water Quality in Ways Not Quantified in Attachment 7

The surface water deliveries from Mariposa Creek will have lower concentrations of nitrates than the existing groundwater. Data from the Merced County Division of Environmental Health Private Domestic Well Data indicates that the average groundwater nitrate concentration around El Nido is 15.7 mg/L (see Appendix 8-15. Water quality monitoring upstream of the El Nido diversion point indicate that the surface water nitrate concentration is generally <2 mg/L. Recharge of the groundwater basin with the surface water will improve drinking water quality for domestic users.

8. Reduce Net Emissions in Ways Not Quantified in Attachment 7

Not Applicable; this benefit is included in Section D3.

9. Provide Other Environmental Stewardship Benefits Not Claimed in Sections D1, D3, or D4

Not Applicable

Sustainability Benefits

10. Improve the Overall, Long-Term Management of California Groundwater Resources

The project would monitor groundwater recharge through the existing recharge basin to better understand the fate of the recharged water. Based on the results, MID may consider expanding its recharge basin program in the area, to capture and store stormwater not only from Mariposa Creek but also Merced River in years where surplus surface water is available. This expansion of such a program would further reduce extraction of the non-renewable groundwater resource, and promote aquifer storage and capture.

11. Reduce Demand for Net Diversions for the Region from the Delta

Not Applicable

12. Provide a Long-Term Solution in Place of a Short-Term One

Not Applicable

13. Promote Energy Savings or Replace Fossil Fuel Based Energy Sources with Renewable Energy

Not Applicable

14. Improve Water Supply Reliability in Ways Not Quantified in Attachment 7

The Project would improve water supply reliability by diversifying the water portfolio. Specifically, the project improves conjunctive management through increased diversions from Mariposa Creek.

15. Other

Not Applicable

Section D3 – Monetized Benefits Analysis

The following benefits have been monetized for this Project:

- Avoided groundwater pumping and delivery costs
- Avoided GHG emissions costs

Avoided groundwater pumping and delivery costs

The El Nido Additional Recharge Calculation also estimates the volume of water that can be recharged directly vs in-lieu. Approximately 22% of the water will be applied directly to the existing recharge basin groundwater with the remaining 78% supplied to agricultural customers in an average year for in-lieu recharge. Water captured by the project will therefore provide agricultural users with 3,501 AFY over the expected 25-year lifetime of benefits, all of which would otherwise have been supplied through extracted groundwater.

The El Nido Recharge Project is expected to capture an average of 4,489 AFY of additional flows from Mariposa Creek (see Appendix 8-14). Approximately 78% of the water stored by the project will be supplied to agricultural customers in an average year, while the remaining 22% will recharge groundwater use for domestic use by individual wells or to address groundwater overdraft conditions. Water stored by the project will therefore provide agricultural users with 3,501 AFY (4,489 * 78%) over the expected 25-year lifetime of benefits, all of which would otherwise have been supplied through extracted groundwater. Assuming agricultural pumping costs of $85 per AF, this will result in the avoided groundwater pumping costs of $297,621 per year (3,501 AF per year * $85 per AF) after the project has been fully implemented. The total present value of avoided groundwater costs is $3,386,073 over the 25-year expected life of the project. PSP Table 8-15 shows the present value of benefits expected from this project.

Avoided GHG emissions costs

Water delivered by this project will avoid approximately 3,501 AFY of groundwater from being extracted for agricultural use. With approximately 509 kWh of energy required to pump one acre-foot of groundwater (which is based on an average of historic pump test data, see Appendix 8-16), this project will additionally avoid use of approximately 1,782 MWh of electricity per year. Over the 25-year expected lifetime of project benefits, total water storage achieved through this project will prevent approximately 44,556 MWh of electricity from being used to extract groundwater for agricultural use.

To calculate the CO_2 emissions rate associated with energy use in California, we relied on 2009 EPA eGRID data. As noted above the California Energy Commission (2011) reports that 70% of electricity used in California is generated in-state, 20% is generated in the WECC Southwest sub-region, and 10% is generated in the WECC Northwest sub-region. EPA publishes average CO_2 emissions rates for these sub-regions based on the various energy sources used to generate electricity within them (i.e., natural gas, hydropower, etc.). Table 8-14 shows the CO_2 emissions rate for the three regions that produce the electricity used in California, and the average weighted rate for electricity used within the state. It is assumed that the mix of energy sources used by the state overall is representative of the energy source used to pump groundwater in Merced County.

Table 8-84 El Nido Area Recharge Project Additional Water Deliveries

WECC region	Emissions rate (MT/MWh)	Percent of California electricity use
California	0.299	70%
Southwest	0.540	20%
Northwest	0.372	10%
Weighted average emissions rate for electricity used in California	**0.354**	

Source: U.S. EPA eGRID data:
http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2012V1_0_year09_GHGOutputrates.pdf

Given the calculated weighted average CO_2 emissions rate of 0.354 MT of CO2 emitted per MWh, 0.18 MT of CO2 are produced for every AF of groundwater pumped for agricultural use (509 kWh/AF multiplied by 0.354 MT/MWh). By eliminating use of approximately 3,681 AFY of imported water (at full implementation), the project will avoid emissions of more than 631 MT of CO_2 per year. Over the 25-year expected lifetime of benefits, this project will avoid emissions of approximately 15,773 MT of CO2.

To monetize this benefit, the dollar value assigned to GHG emissions, measured in carbon dioxide equivalent (CO_2e), was applied. The social cost of carbon is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present. In February 2010, the U.S. Government's Interagency Working Group on Social Cost of Carbon issued guidance on recommend values for the social cost of carbon for use in regulatory benefit-cost analysis. The recommended mean estimate of the social cost of reducing one metric ton (MT) of CO_2 in 2012 is $22.53/MT (updated from 2010 values using CPI), with a range of values from $4.95 to $68.33 per MT. The recommended mean estimate of the social cost of carbon reflects the worldwide net benefits of reducing CO_2 emissions. Estimates of the portions of the net benefits occurring in the United States range from 7% to 23% of the worldwide social cost of carbon. For this analysis, the average value of $22.53/MT was used when calculating social benefits and costs, which produces conservative estimates for the benefits and costs associated with GHG emissions. To determine total costs over the 25-year project period, we escalate the social cost of carbon by 2.4% per year, which is above the general rate of inflation. The social cost of carbon will increase in future years because CO_2 will produce larger incremental damages as physical and economic systems become more stressed in responding to greater climate change.
Over the 25-year project life, total present value benefits associated with avoided social costs of carbon amount to $213,145.

Annual Benefits Table

Table 8-15 shows the present value of the avoided groundwater costs over the 25-year life of the project.

Table 8-95: El Nido Area Recharge Project Annual Benefit

Annual Benefit (All benefits should be in 2012 dollars) Project:El Nido Recharge									
CO2 Social Cost Escalation Rate:	2.4%								
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
2012	Water Supply	Acre-feet of Additional Recharge	0	0	0	$ 85	-	1.000	-
2012	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	0	0	$ 23	-	1.000	-
2013	Water Supply	Acre-feet of Additional Recharge	0	0	0	$ 85	-	0.943	-
2013	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	0	0	$ 23	-	0.943	-
2014	Water Supply	Acre-feet of Additional Recharge	0	0	0	$ 85	-	0.890	-
2014	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	0	0	$ 23	-	0.890	-
2015	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.840	249,888
2015	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 24	14,905	0.840	12,514
2016	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.792	235,743

2016	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 24	15,263	0.792	12,089
2017	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.747	222,400
2017	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 25	15,629	0.747	11,679
2018	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.705	209,811
2018	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 25	16,004	0.705	11,282
2019	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.665	197,935
2019	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 26	16,388	0.665	10,899
2020	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.627	186,731
2020	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 27	16,781	0.627	10,529
2021	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.592	176,161
2021	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 27	17,184	0.592	10,171
2022	Water Supply	Acre-feet of Additional	0	3,501	3501	$ 85	297,621	0.558	166,190

		Recharge							
2022	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 28	17,596	0.558	9,826
2023	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.527	156,783
2023	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 29	18,019	0.527	9,492
2024	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.497	147,908
2024	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 29	18,451	0.497	9,170
2025	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.469	139,536
2025	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 30	18,894	0.469	8,858
2026	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.442	131,638
2026	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 31	19,348	0.442	8,557
2027	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.417	124,187
2027	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 31	19,812	0.417	8,267

2028	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.394	117,157
2028	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 32	20,287	0.394	7,986
2029	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.371	110,526
2029	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 33	20,774	0.371	7,715
2030	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.350	104,270
2030	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 34	21,273	0.350	7,453
2031	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.331	98,368
2031	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 35	21,783	0.331	7,200
2032	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.312	92,800
2032	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 35	22,306	0.312	6,955
2033	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.294	87,547
2033	Avoided Social Cost of CO_2	Metric Tons	0	631	631	$ 36	22,842	0.294	6,719

	Emissions								
2034	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.278	82,591
2034	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 37	23,390	0.278	6,491
2035	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.262	77,916
2035	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 38	23,951	0.262	6,270
2036	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.247	73,506
2036	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 39	24,526	0.247	6,057
2037	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.233	69,345
2037	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 40	25,115	0.233	5,852
2038	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.220	65,420
2038	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 41	25,717	0.220	5,653
2039	Water Supply	Acre-feet of Additional Recharge	0	3,501	3501	$ 85	297,621	0.207	61,717

2039	Avoided Social Cost of CO_2 Emissions	Metric Tons	0	631	631	$ 42	26,335	0.207	5,461
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									$ 3,599,218
Comments:									

(1) Complete these columns if dollar value is being claimed for the benefit.

Section D4 – Flood Damage Reduction Analysis

No flood damage reduction benefits are claimed from this Project; as such, PSP Table 17 has been omitted.

Section D5 – Project Benefits and Costs Summary

Project costs were developed in accordance with PSP requirements:

- Consistency: The economic analysis is consistent with the grant requirements and uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in Table 8-16 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect completion of construction activities in 2015. The operational life of the Project is assumed to be 25 years, beginning in 2015 upon project completion, making the end of the project life 2039.
- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. There are no opportunity costs associated with this project The land that will be used for direct groundwater recharge is already used for recharge, so there is no opportunity cost associated with increasing the frequency of deliveries to this site.
- Discount Rate. In accordance with PSP requirements, a 6% discount rate was applied.
- Dollar Value. In accordance with PSP requirements, all costs are presented in 2012 dollars.

As shown in Table 8-16, the present value of project costs, discounted at 6%, is estimated to be $643,927 over the 25-year life of the El Nido Area Recharge Project. This estimate includes all capital costs as well as costs associated with administration, operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. The initial costs presented in this table are equivalent to those presented in Attachment 4.

Operations and maintenance costs are estimated to be $9,000 per year during normal years with periodic replacement costs of $8,000 every five years and $1,000 in other costs every 8 years. These costs include the following:

- Administration ($1,000 per year): Overhead and salaries associated with field calibration, maintenance on automated gates and maintenance on the basin.

- Operations ($5,000 per year): Operations of the inlet/outlet gates to the basin, observation of the Langeman to confirm correct operations, verification/operation and validation of SCADA information by field operators.
- Maintenance ($3,000 per year): Conditioning the recharge basin (deep ripping), maintenance on the Langemen, maintenance on the basin inlet/outlet gates.
- Periodic Replacement ($8,000 per year): Level transducers, miscellaneous SCADA equipment
- Other ($1,000 per year): SCADA maintenance and upgrades

Table 8-10: El Nido Area Recharge Project Annual Costs of Project

Annual Costs of Project (All costs should be in 2012 Dollars) Project: El Nido Recharge Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								0	1.000	-
2013	92,250							92,250	0.943	86,992
2014	479,712							479,712	0.890	426,944
2015	12300		1,000	5,000	3,000			21,300	0.840	17,884
2016			1,000	5,000	3,000			9,000	0.792	7,129
2017			1,000	5,000	3,000			9,000	0.747	6,725
2018			1,000	5,000	3,000			9,000	0.705	6,345
2019			1,000	5,000	3,000	8000		17,000	0.665	11,306
2020			1,000	5,000	3,000			9,000	0.627	5,647
2021			1,000	5,000	3,000			9,000	0.592	5,327
2022			1,000	5,000	3,000		1,000	10,000	0.558	5,584
2023			1,000	5,000	3,000			9,000	0.527	4,741
2024			1,000	5,000	3,000	8000		17,000	0.497	8,448
2025			1,000	5,000	3,000			9,000	0.469	4,220
2026			1,000	5,000	3,000			9,000	0.442	3,981
2027			1,000	5,000	3,000			9,000	0.417	3,755
2028			1,000	5,000	3,000			9,000	0.394	3,543
2029			1,000	5,000	3,000	8000		17,000	0.371	6,313

2030			1,000	5,000	3,000		1,000	10,000	0.350	3,503
2031			1,000	5,000	3,000			9,000	0.331	2,975
2032			1,000	5,000	3,000			9,000	0.312	2,806
2033			1,000	5,000	3,000			9,000	0.294	2,647
2034			1,000	5,000	3,000	8000		17,000	0.278	4,718
2035			1,000	5,000	3,000			9,000	0.262	2,356
2036			1,000	5,000	3,000			9,000	0.247	2,223
2037			1,000	5,000	3,000			9,000	0.233	2,097
2038			1,000	5,000	3,000		1,000	10,000	0.220	2,200
2039			1,000	5,000	3,000	8000		17,000	0.207	3,519
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$ 643,927
Comments:										

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project

Merced River Education and Enhancement Program

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in Table 8-17.

Table 8-11 Summary Merced River Education and Enhancement Program Benefits and Costs

Category	Summary	Present Value
Benefits		
	Recreation, saved lives, emergencies avoided	$5,203,168
Total Monetized Benefits		**$5,203,168**
Costs		
Present Value of Capital and O&M Costs	Construction/implementation	$1,109,971
Total Costs		**$1,109,971**

Existing Data and Studies

The Project is supported by a series of studies documenting the potential project benefits, including:

- Merced River Corridor Restoration Plan (February 2002) – included as Appendix 8-17
- The Merced River Alliance Project Final Report, Volume I: Education and Outreach (September 2008) – included as Appendix 8-18

- The Merced River Alliance Project Final Report, Volume II: Biological Monitoring and Assessment (September 2008) – included as Appendix 8-19
- Merced Restoration Mapping – included as Appendix 8-20
- News Articles Related to Merced River Fatalities and Rescues – included as Appendix 8-21
- Community Partnering for Student Learning Summary – included as Appendix 8-22
- Merced County Emergency Response Records - included as Appendix 8-23
- AP-GfK Poll on Climate Change (2012) - included as Appendix 8-24
- Our Changing Climate 2012 Vulnerability & Adaptation to the Increasing Risk from Climate Change in California (July 2012) - included as Appendix 8-25

Without Project Conditions

Without the project, the status quo will continue, meaning many watershed residents will remain unengaged and unaware of the impacts of their actions on the watershed. Without a better understanding of the water cycle dynamics of the watershed, local agencies will not be as prepared to take action against climate change, and communities may find themselves unprepared for droughts and groundwater overdraft will persist.

With Project Conditions

With the project, agencies will be able to engage in community capacity building. The project will facilitate public education and outreach, river stewardship, data collection and analysis for the Merced River watershed, and improved recreational opportunities.

Description of Benefits and Methods to Estimate Benefits

Section D1 – Cost-Effectiveness Analysis

The cost-effectiveness analysis approach was not used for this project; as such, PSP Table 11 has been omitted.

Section D2 – Non-Monetized Benefits Analysis

A series of non-monetized benefits are expected to accrue from project implementation. The benefits are summarized in the Table 8-18, and are described in additional detail below.

Table 8-12: Merced River Education and Enhancement Program Non-Monetized Benefits Checklist

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	Yes
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits?	

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	Yes
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	Yes
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	No
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	Yes
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or	

Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	Yes
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	No
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	Yes
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	No

Community/Social Benefits

1. Provide Education or Technology Benefits

The Lower Merced River Stewardship Project would provide education benefits through the provision of school education (in the classroom and on 7 field trips), community outreach (4 public forums, 7 stakeholder/partner coordination workshops and community fairs), and 8 agricultural workshops. The intent of the education is to increase community awareness and build community knowledge and stewardship of primarily the lower Merced River, as well as other creeks in the Merced IRWM Region. The outreach would also extend knowledge of stewardship practices to farmers, ranchers and landowner/managers along the waterways, and will provide technical information and help with access to funding. Education to farmers would also include promoting conservation measures for both agricultural and rural residential residents, including plant choices, efficient irrigation systems and a shift to or improved usage of surface water, to address current groundwater overdraft conditions. Community volunteer efforts are also an integral part of the education to help map at-risk areas along the river and conduct river clean-up. The successful implementation of an existing community partnering program at Snelling-Merced Falls Elementary School serves an example of the success of education through community partnering (see Appendix 8-22).

The Merced Region Climate Change Program would provide both education and technological benefits. Specifically, this subproject would help educators communicate the message to the public about climate change and its effects. The Project provides technological benefit through the use of monitoring equipment to conduct real-time measurements to understand better understand climate change effects on water supplies.

The Lower Merced River Recreational Boating Public Access subproject would consist of a public boat launch for safe access to the River as well as other recreational amenities. These amenities include an interpretative and education display regarding the Merced River.

2. Provide Social Recreation or Access Benefits

Aside from the visitor days already accounted for in Section D3 through the Lower Merced River Recreational Boating Public Access, the Lower Merced River Stewardship Project would provide kayaking opportunities, nature walks, safer water entry through its life vest program, and improved engagement between school children and State Parks in the region.

3. Help Avoid, Reduce or Resolve Various Public Water Resources Conflicts

The Lower Merced River Stewardship Project would provide more opportunities for public involvement in water management through its extensive outreach and meetings with the public, farmers and landowners. Other types of outreach that may be used to inform the public include website, newsletters, articles, blogs, and potentially other multi-media forums. The Project would also involve coordination with San Joaquin Valley Water Quality Coalition, Regional Water Quality Control Board and Central Valley Salinity Alternatives for Long-term Sustainability to extend information and consultation on how to improve water quality of the Merced River, which has direct impacts on the Delta. Collectively, the various information channels will ensure that the public is provided with a message that is consistent.

4. Promote Social Health and Safety

Not applicable; this accounted for in Section D3.

5. Have Other Social Benefits

The project provides benefits to the DACs throughout the Merced River watershed by increasing opportunities to access the Merced River and to learn about and be part of the stewardship of the river. The understanding of this resource as a public good for the benefit of all could promote a further appreciation/respect for the environment and the willingness to participate in solutions to improve the environment in the future.

Environmental Stewardship Benefits

6. Benefit Wildlife or Habitat in Ways Not Quantified in Attachment 7

The removal of invasive species and streambank stabilization proposed by the Lower Merced River Stewardship Project and the provision of an access point for boat launching under the Lower Merced River Recreational Boating Project (which includes a trash receptacle where the public can discard trash) are expected to increase the amount or quality of aquatic, riparian or wetland habitat that are located along the River. It is expected that the education and funding access to help land managers adopt or expand best management practices to protect the River would likely contribute to the amount or quality of existing habitat. With habitat improvements, associated species, including special-status species, are also expected to increase.

7. Improve Water Quality in Ways Not Quantified in Attachment 7

The Merced River is 303(d) listed. Farms, ranches, dairies and rural residential properties along the river, sloughs and creeks are contributors to the degradation of the water quality. The public likely has minimal understanding of how individual actions contribute to degradation of this natural resource. Through education (and access to funding sources for landowners), the public will gain knowledge that can be applied to improve the water quality of the River. In addition, the direct removal of invasive weeds, such as Giant Reed, Star Thistle and water hyacinth, would further improve the quality of the River.

8. Reduce Net Emissions in Ways Not Quantified in Attachment 7

Not Applicable

9. Provide Other Environmental Stewardship Benefits Not Claimed in Sections D1, D3, or D4

Not Applicable

Sustainability Benefits

10. Improve the Overall, Long-Term Management of California Groundwater Resources

The agricultural education component Lower Merced River Stewardship Project will improve long-term management of groundwater by educating farmers, ranchers and rural landowners about their impacts on the groundwater through groundwater pumping and discharges to groundwater.

11. Reduce Demand for Net Diversions for the Region from the Delta

Not Applicable

12. Provide a Long-Term Solution in Place of a Short-Term One

Not Applicable

13. Promote Energy Savings or Replace Fossil Fuel Based Energy Sources with Renewable Energy

The climate change awareness component of the project will develop best practices for communicating climate change information. A recent poll showed that the majority of Americans believe that climate change is happening but not the science behind it (see Appendix 8-24). As stakeholders in the Merced area are educated about the role of climate change on water supply, this project will promote sustainable practices.

14. Improve Water Supply Reliability in Ways Not Quantified in Attachment 7
Not Applicable

15. Other
Not Applicable

Section D3 – Monetized Benefits Analysis

The following benefits have been monetized for this Project:

- Increased boating user days
- Avoided water related deaths
- Avoided emergency response

Increased Boating User Days

Whitewater boating visitation to the river is expected to increase due to the project. The population of the communities that border the Merced River is 13,683. It is expected that 1% of these residents, or 137 individuals, will undertake one new day of boating per year as a result of this project. These trips are valued using a meta-analysis of boating trips in the Pacific Coast Region of the U.S. (Loomis, 2005). The four studies included had average consumer surplus value of $27.84 per visitor day in 2004 dollars, or $33.84 per visitor day when updated to 2012 dollars using the Consumer Price Index. The estimated value of increase whitewater boating visitation is $4,636 per year. The present value of this benefit over the assumed 15-year life of the project is $40,074.

Avoided Water Related Deaths

Review of accidental deaths associated with recreation in the Merced River suggests that one water related death occurs every 10 years. The lifejacket and water safety program is assumed to avoid one death over the 15-year useful life of the project. That avoided death is assumed to occur in the year 2022 (ten years from 2012). US EPA (2013) recently provided an updated Value of a Statistical Life (VSL) estimate to apply to programs that reduce the risk of premature fatality. Based on the Agency's continuing evaluation and interpretation of the empirical literature on the value of mortality risk reduction, US EPA (2013) describes a range of $8.0 million (in 2010 $s, to reflect 1990 income levels) to $9.6 million (in 2010 $s, reflecting projected income for 2020), as the applicable "central estimates" for VSL. Using the midpoint of this range ($8.8 million) and updating to 2012$, this amounts to $9.22 million. This VSL estimate of $9.22 million (in 2012$s) per case of premature fatality avoided is applied in this assessment to the estimated reduction in risk of death. The present value of one saved life over the 15-year project is $5,148,400.

Avoided Emergency Response

The combination of the life jacket loan program, safety programs and improved river access offered by the Lower Merced River Stewardship and Lower Merced River Recreational Boating Public Access components is anticipated to reduce the need for emergency rescues on the river by at least two emergency response calls per year.

Based on an average cost of $850 per search and rescue responses by the Sheriff's Department (see Appendix 8-23), the estimate value of avoided emergency responses is $1,700 per year.

Annual Benefits Table

A modified version, Table 8-19, shows the present value of the avoided water related deaths and increased boating benefit over the 15-year life of the project.

Table 8-13: Merced River Education and Enhancement Program Annual Benefit

Annual Benefit (All benefits should be in 2012 dollars) Project: Merced River Education and Enhancement Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	With-out Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value(1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
2012								1.000	
2013								0.943	
2014								0.890	
2015	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.840	$3,893
2015	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.840	$ -
2015	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.840	$1,427
2016	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.792	$3,672
2016	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.792	$ -
2016	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.792	$ 1,347
2017	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.747	$ 3,464
2017	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.747	$ -
2017	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.747	$1,270
2018	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.705	$3,268
2018	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.705	$ -

2018	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.705	$1,198
2019	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.665	$3,083
2019	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.665	$ -
2019	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.665	$1,131
2020	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.627	$ 2,909
2020	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.627	$ -
2020	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.627	$1,067
2021	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.592	$ 2,744
2021	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.592	$ -
2021	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.592	$1,006
2022	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.558	$2,589
2022	saved lives	avoided water-related deaths	1	1	1	$9,220,000	$ 9,220,000	0.558	$5,148,400
2022	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.558	$949
2023	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.527	$2,442
2023	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.527	$ -
2023	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.527	$896

2024	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.497	$2,304
2024	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.497	$ -
2024	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.497	$ 845
2025	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.469	$2,174
2025	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.469	$ -
2025	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.469	$797
2026	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.442	$2,051
2026	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.442	$ -
2026	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.442	$752
2027	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.417	$1,934
2027	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.417	$-
2027	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.417	$709
2028	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	$ 4,636	$ 4,636
2028	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	$ -	$ -
2028	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	$1,700	$1,700

2029	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	$ 4,636	$ 4,636
2029	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	$ -	$ -
2029	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	$1,700	$1,700
2015	recreation	increased boating user-days	137	137	137	$33.84	$ 4,636	0.840	$3,893
2015	saved lives	avoided water-related deaths	0	0	0	$9,220,000	$ -	0.840	$-
2015	emergencies avoided	avoided emergency response	2	2	2	$850	$1,700	0.840	$1,427
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		$ 5,203,168
Comments: The unit value is the "value of a statistical life" estimate from U.S. EPA, and is the mid-point of the 1990 and 2020 values, updated from 2010 to 2012 dollars. USEPA, 2012. Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division. Publication No. EPA-452/R-12-005. December.									

(1) Complete these columns if dollar value is being claimed for the benefit.

Section D4 – Flood Damage Reduction Analysis

No flood damage reduction benefits are claimed from this Project; as such, PSP Table 17 has been omitted.

Section D5 – Project Benefits and Costs Summary

Project costs were developed in accordance with PSP requirements:

- Consistency: The economic analysis is consistent with the grant requirements, and uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in Table 8-20 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect completion of activities in 2016. The operational life of the Project is assumed to be 15 years, beginning in 2015 when construction components of the project are complete, making the end of the project life 2029.
- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.

- Opportunity Costs. There are no opportunity costs associated with this project.
- Discount Rate. In accordance with PSP requirements, a 6% discount rate was applied.
- Dollar Value. In accordance with PSP requirements, all costs are presented in 2012 dollars.

As shown in Table 8-20, the present value of project costs, discounted at 6%, is estimated to be $1,109,971 over the 15-year life of the Merced River Education and Enhancement Program. This estimate includes all capital costs as well as costs associated with operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. The initial costs presented in this table are equivalent to those presented in Attachment 4.

Operations and maintenance costs are estimated to be $37,200 per year. These costs include the following:

- Operations ($36,000 per year): Daily sit visits to the boat launch to collect trash, clean facilities, etc.
- Maintenance ($1,200 per year): Pumping vault restroom, light bulb replacement and minor plumbing at the boat launch.

Table 8-20: Merced River Education and Enhancement Program Annual Costs of Project

Annual Costs of Project (All costs should be in 2012 Dollars) Project: Merced River Education and Enhancement Program										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								0	1.000	-
2013	89,646							89,646	0.943	84,536
2014	591,799							591,799	0.890	526,701
2015	176,709			36,000	1,200			213,909	0.840	179,602
2016	36,418			36,000	1,200			73,618	0.792	58,312
2017				36,000	1,200			37,200	0.747	27,798
2018				36,000	1,200			37,200	0.705	26,226
2019				36,000	1,200			37,200	0.665	24,738
2020				36,000	1,200			37,200	0.627	23,324

2021				36,000	1,200			37,200	0.592	22,022
2022				36,000	1,200			37,200	0.558	20,758
2023				36,000	1,200			37,200	0.527	19,604
2024				36,000	1,200			37,200	0.497	18,488
2025				36,000	1,200			37,200	0.469	17,447
2026				36,000	1,200			37,200	0.442	16,442
2027				36,000	1,200			37,200	0.417	15,512
2028				36,000	1,200			37,200	0.394	14,657
2029				36,000	1,200			37,200	0.371	13,801
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$1,109,971
Comments:										

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project

Proposal Cost and Benefits Summary

As shown in Table 8-21, the present value of total proposal costs is $3,806,810, compared to the present value of proposal benefits of $9,953,432.

Table 8-21: Proposal Benefits and Costs Summary

Proposal: Merced IRWM Implementation Grant Proposal Agency: Merced Irrigation District							
Project	Project Proponent	Total Present Value Project Costs (1)	Total Present Value Project Benefits			Cost Effective Analysis	From Section D2 – Briefly describe the main non-monetized benefits
			From Section D3 – Monetized (2)	From Section D4 – Flood Damage Reduction (3)	Total		
(a)	(b)	(c)	(d)	(e)	(f) = (d) + (e)	(g)	(h)
Black Rascal Flood Control Project	Merced County	$919,570	$1,045,589		$1,045,589		Address DAC water quality need, reduce water related conflicts and avoid future litigation
Planada Community Services District Water Conservation Project	Planada Community Services District	$1,133,342	$105,457		$105,457		Address DAC water supply reliability, protect groundwater quantity and quality, avoid air quality violations
El Nido Area Recharge Project	Merced Irrigation District	$643,927	$3,599,218		$3,599,218		Address DAC water supply reliability, improve water quality, enhance existing wetland
Merced River Education and Enhancement Project	Merced Irrigation District, East Merced Resource Conservation District, UC Merced	$1,109,971	$5,203,168		$5,203,168		Provide education, enhance habitat through invasive species removal, improve water quality, encourage sustainable practices

(1) From Table 19, or RWMG method

(2) From Table 15 or RWMG method

(3) From Table 18 or RWMG method

Merced Integrated Regional Water Management Implementation Grant Proposal

Appendices 8-1 to 8-25 provided on CD

App. #	Document Title	File Name
App. 8-1	Feasibility Study and Addendum 1, Black Rascal Creek Flood Control	Att8_IG2_BenCost_2of26
App. 8-2	Merced County Streams California, General Design Memorandum Phase 1 Plan Formulation	Att8_IG2_BenCost_3of26
App. 8-3	MIRWMP Flood Management Summary	Att8_IG2_BenCost_4of26
App. 8-4	Hemming & Morse Inc, Expert Report of Daniel W. Ray, Abarca, el al. v. Merced Irrigation District, et. al. United States District Court Case No. 1:07-CV-0388 OWW DLB.	Att8_IG2_BenCost_5of26
App. 8-5	Merced March & April 2006 California County Agricultural Commissioner Disaster Report	Att8_IG2_BenCost_6of26
App. 8-6	Summary of Legal Costs Incurred as a Result of 2006 Flood Event	Att8_IG2_BenCost_7of26
App. 8-7	Preliminary Engineering Report for the Water System Rehabilitation & Conservation Project (October 2012)	Att8_IG2_BenCost_8of26
App. 8-8	Planada Community Services Minutes January 4, 2011	Att8_IG2_BenCost_9of26
App. 8-9	Planada 2011 and 2012 Water Use Data	Att8_IG2_BenCost_10of26
App. 8-10	Planada 2012 Water Production/Cost Estimates	Att8_IG2_BenCost_11of26
App. 8-11	Merced Irrigation District Water Right Summary for El Nido Irrigation District	Att8_IG2_BenCost_12of26
App. 8-12	Well Level Compilation	Att8_IG2_BenCost_13of26
App. 8-13	El Nido Deliveries Calculations	Att8_IG2_BenCost_14of26
App. 8-14	El Nido Additional Recharge Calculation	Att8_IG2_BenCost_15of26
App. 8-15	Merced County Division of Environmental Health Private Domestic Well Data	Att8_IG2_BenCost_16of26
App. 8-16	El Nido Area Pump Test Data	Att8_IG2_BenCost_17of26
App. 8-17	Merced River Corridor Restoration Plan	Att8_IG2_BenCost_18of26
App. 8-18	The Merced River Alliance Project Final Report, Volume I: Education and Outreach	Att8_IG2_BenCost_19of26
App. 8-19	The Merced River Alliance Project Final Report, Volume II: Biological Monitoring and Assessment	Att8_IG2_BenCost_20of26
App. 8-20	Merced Restoration Mapping	Att8_IG2_BenCost_21of26
App. 8-21	News Articles Related to Merced River Fatalities and Rescues	Att8_IG2_BenCost_22of26
App. 8-22	Community Partnering for Student Learning Summary	Att8_IG2_BenCost_23of26
App. 8-23	Merced County Emergency Response Records	Att8_IG2_BenCost_24of26
App. 8-24	AP-GfK Poll on Climate Change	Att8_IG2_BenCost_25of26
App. 8-25	Our Changing Climate 2012 Vulnerability & Adaptation to the Increasing Risk from Climate Change in California	Att8_IG2_BenCost_26of26