East Contra Costa County Region
Proposition 84 Round 2 Grant Proposal

ATTACHMENT 8 –
BENEFITS AND COST ANALYSIS

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Proposal Description and Summary of Benefits

The East County Round 2 Proposition 84 implementation grant proposal includes a series of projects selected based on their ability to address the region's critical issues. The following five projects included in this Proposal provide a suite of benefits that will benefit not only the Region, but – due to the Region's location within and dependence upon the statutory Delta – significant benefits statewide.

- **Project 1:** Beacon West Arsenic Well & Tank Replacement Project
- **Project 2:** Rossmoor Well Replacement / Groundwater Monitoring Well System Expansion
- **Project 3:** Integrated Regional Flood Protection and Water Quality Improvement Borrow Area Project
- **Project 4:** Knightsen Wetland Restoration and Flood Protection Project
- **Project 5:** Recycled Water Salinity Reduction and Distribution System Expansion Project

Table 8-1 summarizes the benefits that would be achieved through implementation of this Proposal.

Table 8-1: Summary of Proposal Physical Benefits

Project	Benefit Summary
Water Supply	
Beacon West Arsenic Well & Tank Replacement	9 million gallons per year of groundwater supply meeting the arsenic MCL
Rossmoor Well Replacement / Monitoring Well System Expansion	500 acre-feet per year (AFY) of groundwater supply
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area	19 AFY increase in emergency supply 359 AFY supply conserved due to reduced salinity-driven CVP/SWP releases 120 AFY conserved from reduced CVP/SWP releases due to (Old and Middle Rivers) OMR restrictions
Recycled Water Salinity Reduction and Distribution System Expansion	75.6 AFY of Delta supply offset with recycled water
Water Quality	
Beacon West Arsenic Well & Tank Replacement	Reduction in arsenic concentration to less than the arsenic MCL of 10 ug/L
Rossmoor Well Replacement / Monitoring Well System Expansion	500 AFY supply remaining in Delta
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area	Reduction in average bromate concentration from 5.6 to 4.99 ug/L 0.002 reduction in excess cancer cases per year due to bromate 12.6 acre reduction in agricultural runoff area 0.02% reduction in annual solids handling requirements
Knightsen Wetland Restoration and Flood Protection	Approximately 17 acre feet of stormwater treated per storm event
Flood Damage Reduction	
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area	3 residential structures protected from flooding per year, on average 0.3 acre reduction in average annual acres inundated from flooding 14 Mcf/d reduction in average annual energy interruptions from flooding 1 acre reduction in average annual acres of Dutch Slough Property inundated from flooding 0.014-mile reduction in average annual road inundation from flooding 0.01-day per year reduction in average annual response time to address a 50’ levee breach due to flooding 2 AFY reduction in average annual supply interruption due to flooding 5 year reduction in time to realize flood damage reduction benefits of the USCB flood control project, including 100-year protection to more than 3,000 parcels
Knightsen Wetland Restoration and Flood Protection	Approximately 17 acre-feet managed to reduce flooding per storm event

Environmental Resources	
Rossmoor Well Replacement / Monitoring Well System Expansion	500 AFY supply remaining in Delta
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area	10 year reduction in time to realize environmental benefits of Dutch Slough Tidal Marsh Restoration Project
Knightsen Wetland Restoration and Flood Protection	30 acre wetlands created
Recycled Water Salinity Reduction and Distribution System Expansion	471 acres of Dow Wetlands supported with 1 AFY of recycled water
Energy	
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area	10 MWH/year reduction in energy required for pumping 9,670 pound per year reduction in CO_2 emissions per year due to reduced pumping 448,000 pound reduction in CO_2 emissions in 2018 associated with reduced fill hauling distance
Recycled Water Salinity Reduction and Distribution System Expansion	336 MT carbon dioxide (CO_2) emissions avoided
Recreation / Public Access	
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area	10 year reduction in time to realize recreation benefits of Dutch Slough Tidal Marsh Restoration Project, including a 55-acre community park 5 year reduction in time to realize recreation benefits of USCB Flood Control Project, including 6.25-acre park in Antioch
Other Physical Benefits	
Recycled Water Salinity Reduction and Distribution System Expansion	Reduction in nutrient application requirements as follows: 359,100 lbs of nitrogen 756 lbs of phosphorus 64,260 lbs of potassium

Economic Benefits and Costs Analysis

This section summarizes the extensive technical work that has been completed to monetize the proposed benefits summarized above.

Project 1: Beacon West Arsenic Well & Tank Replacement Project

This Project will benefit the residents of Beacon West, a community within census tract 3010 (and also the Census Designated Place, Bethel Island), which is considered a disadvantaged community (DAC) based on the definition contained in PRC §75005 (g). The Project will replace a well that has high arsenic levels (in excess of the Maximum Contaminant Level, or MCL) with a well in a shallower aquifer zone with water shown to have arsenic levels below Primary Drinking Water Standards. The Project will also replace two 1,500 gallon hydropneumatic pressure tanks that have corroded and jeopardize the community's water supply. The location of the new well has already been determined and the District has received a Variance Permit from the Contra Costa Health Services Department given its location within the existing road right-of-way.

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in the following table.

Category	Summary	Present Value
Benefits		
Water quality improvements	Avoided cost of wellhead treatment	$696,258
Total Monetized Benefits		**$696,258**
Costs		
Present Value of Capital and O&M Costs	Well installation, annual administration and maintenance	$429,889
Total Costs		**$429,889**

Existing Data and Studies

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

- 1999 Investigation of Groundwater Resources – Appendix 1-1
- Diablo Water District (DWD) 2013 Feasibility Study - Beacon West Arsenic Well and Tank Replacement Project – Appendix 1-2
    - Well Drillers log for target aquifer – included in Feasibility Study (Appendix 1-2) as attachment 3
    - Geologic Cross Section of target aquifer – included in Feasibility Study (Appendix 1-2) as attachment 3
    - Lab results of water sample from target aquifer showing non-detect arsenic levels – included in Feasibility Study (Appendix 1-2) as attachment 4
    - Approved Variance request from Health Department for location of well – included in Feasibility Study (Appendix 1-2) as attachment 5
    - Construction cost quotes for the new well system and replacement of the two 1,500 gallon pressure tanks – included in Feasibility Study (Appendix 1-2) as Attachment 6
- DWD 2010 Urban Water Management Plan - Appendix 1-3

- Preliminary Design and Site Planning, 2013 - Appendix 1-4

Without Project Conditions

As discussed in the Feasibility Study provided as Appendix 1-2, without the Project, the County Health Department may force the water system to install treatment or shut down the well which would leave the community without water. Requiring treatment would cause current water charges to quadruple, going from approximately $1,000 per year to $4,000 per year per household which would be cost-prohibitive for this community. Alternatively, the County Health Department could require that water be trucked in for the community on a daily basis, which would also be cost-prohibitive and impractical.

Additionally, the corrosion, pin holes, and crumbling footings observed on the two 1,500 gallon hydro-pneumatic pressure tanks that provide storage and pressure for the water system will not be corrected; as such, one or both tanks are likely to fail.

With Project Conditions

With the Project, the well would be replaced with a new well in compliance with the Maximum Contaminant Level (MCL) for arsenic, and the corroding tanks would be replaced prior to failure.

Description of Benefits and Methods to Estimate Benefits

The DWR method was used to assess 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 PSP Table 12, and are described in additional detail below.

Table 12 – 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? - 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**

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	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?**	**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?**	**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?**	**No**
	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:	

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- 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?**	**Yes**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
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

Mailers will be sent to residents of the community in the DAC area educating them about the improvement in their water supply, the fact that the funding for the project came from DWR, the cost of the project, and the project schedule. In this way, the project educates the community regarding how water quality is being improved by reducing arsenic in the water supply.

2. Provide Social Recreation or Access Benefits

Not applicable

3. Help Avoid, Reduce or Resolve Various Public Water Resources Conflicts
The water system is currently in violation of State and Federal standards for Arsenic as stated in the attached Contra Costa County Environmental Health Compliance Order No. 002-09. Based on data from another well, the Project is expected to provide water from an aquifer with arsenic levels below the MCL.

4. Promote Social Health and Safety
The Project will reduce the public health risk associated with exposure to water with high levels of arsenic.

5. Have Other Social Benefits
Project will benefit residents in a DAC area.

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
Not applicable

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 Project will allow continued use of groundwater resources in the region. By performing sampling, the Project will contribute to long-term understanding and management of California's groundwater resources.

11. Reduce Demand for Net Diversions for the Region from the Delta
If water needs to be trucked in to the water system, it will come from Diablo water District's water supply which is a surface water supply from the Delta.

12. Provide a Long-Term Solution in Place of a Short-Term One
Rather than trucking in water to meet demands, which is not a sustainable solution, the Project will implement a new well, providing a long-term solution in place of a short-term one. In addition, rather than continuing to spot-repair the failing tanks, the Project will provide a long-term solution.

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:

- Avoided cost of implementing wellhead treatment

Monetized benefits, and the process for monetizing benefits, are discussed in the following paragraphs. Benefits are based on avoided cost to implement the next least cost alternative, as shown in PSP Table16.

Avoided Cost of Implementing Wellhead Treatment

As discussed on page 3 of the Feasibility Study (Appendix 1-2), the District identified the least-cost alternative to the proposed Project as utilizing an Isolux FX0030 treatment module system. The capital cost of the system would be $73,200 plus the cost of installation. The capital cost of the system would be $73,200 plus the cost of installation. The O&M costs were calculated to be $45,000 per year.

Annual Benefits Table

Implementation of the proposed Project would avoid the need to install a treatment system.

The present value of the avoided cost of treatment is presented in Table 16, below. This amounts to approximately $696,258 over the 50-year project life, as shown in Table 16. Because the avoided cost approach is being taken, PSP Table 15 has been omitted to avoid double-counting of benefits.

Table 16 – Annual Costs of Avoided Projects
(All avoided costs should be in 2012 dollars)
Project: Beacon West Arsenic Well & Tank Replacement Project

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Isolux FX0030 Avoided Project Description: Wellhead arsenic treatment system				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2012					1.000	
2013					0.943	**$0**
2014	$72,300			$72,300	0.899	**$64,998**
2015			$45,000	$45,000	0.840	**$37,783**
2016			$45,000	$45,000	0.792	**$35,644**
2017			$45,000	$45,000	0.747	**$33,627**
2018			$45,000	$45,000	0.705	**$31,723**
2019			$45,000	$45,000	0.665	**$29,928**
2020			$45,000	$45,000	0.627	**$28,234**

Table 16 – Annual Costs of Avoided Projects (All avoided costs should be in 2012 dollars) Project: Beacon West Arsenic Well & Tank Replacement Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Isolux FX0030 Avoided Project Description: Wellhead arsenic treatment system				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2021			$45,000	$45,000	0.592	**$26,635**
2022			$45,000	$45,000	0.558	**$25,128**
2023			$45,000	$45,000	0.527	**$23,705**
2024			$45,000	$45,000	0.497	**$22,364**
2025			$45,000	$45,000	0.469	**$21,098**
2026			$45,000	$45,000	0.442	**$19,904**
2027			$45,000	$45,000	0.417	**$18,777**
2028			$45,000	$45,000	0.394	**$17,714**
2029			$45,000	$45,000	0.371	**$16,711**
2030			$45,000	$45,000	0.350	**$15,765**
2031			$45,000	$45,000	0.331	**$14,873**
2032			$45,000	$45,000	0.312	**$14,031**
2033			$45,000	$45,000	0.294	**$13,237**
2034			$45,000	$45,000	0.278	**$12,488**
2035			$45,000	$45,000	0.262	**$11,781**
2036			$45,000	$45,000	0.247	**$11,114**
2037			$45,000	$45,000	0.233	**$10,485**
2038			$45,000	$45,000	0.220	**$9,891**
2039			$45,000	$45,000	0.207	**$9,332**
2040			$45,000	$45,000	0.196	**$8,803**
2041			$45,000	$45,000	0.185	**$8,305**
2042			$45,000	$45,000	0.174	**$7,835**
2043			$45,000	$45,000	0.164	**$7,391**
2044			$45,000	$45,000	0.155	**$6,973**
2045			$45,000	$45,000	0.146	**$6,578**
2046			$45,000	$45,000	0.138	**$6,206**
2047			$45,000	$45,000	0.130	**$5,855**
2048			$45,000	$45,000	0.123	**$5,523**
2049			$45,000	$45,000	0.116	**$5,211**
2050			$45,000	$45,000	0.109	**$4,916**

Table 16 – Annual Costs of Avoided Projects (All avoided costs should be in 2012 dollars) Project: Beacon West Arsenic Well & Tank Replacement Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Isolux FX0030 Avoided Project Description: Wellhead arsenic treatment system				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2051			$45,000	$45,000	0.103	**$4,637**
2052			$45,000	$45,000	0.097	**$4,375**
2053			$45,000	$45,000	0.092	**$4,127**
2054			$45,000	$45,000	0.087	**$3,894**
2055			$45,000	$45,000	0.082	**$3,673**
2056			$45,000	$45,000	0.077	**$3,465**
2057			$45,000	$45,000	0.073	**$3,269**
2058			$45,000	$45,000	0.069	**$3,084**
2059			$45,000	$45,000	0.065	**$2,910**
2060			$45,000	$45,000	0.061	**$2,745**
2061			$45,000	$45,000	0.058	**$2,590**
2062			$45,000	$45,000	0.054	**$2,443**
2063			$45,000	$45,000	0.051	**$2,305**
2064			$45,000	$45,000	0.048	**$2,174**
Total Present Value of Discounted Costs (Sum of Column (g))						**$696,258**
(%) Avoided Cost Claimed by Project						**100%**
Total Present Value of Discounted Avoided Project Costs Claimed by Alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)						**$696,258**
Comments:						

Section D4 – Flood Damage Reduction Analysis

No flood damage reduction benefits are claimed from this Project.

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, uses the total Project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in PSP Table 19 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect start and

completion of construction activities in 2013. The operational life of the Project is assumed to be 50 years, which is consistent with most well construction projects.

- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs including opportunity costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. All opportunity costs are accounted for including previous construction costs incurred since October 2008.
- 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 PSP Table 19 below, the present value of project costs, discounted at 6%, is estimated to be $429,889 over the 50-year life of the Project. This estimate includes all capital costs as well as costs associated with construction, administration, operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. Costs funded by local, State, federal agencies and non-profits are included. The initial costs presented in this table are equivalent to those presented in Attachment 4, with the exceptions identified above.

Capital costs are estimated to be $136,262, and will be implemented in 2014. Operations and maintenance costs are estimated to be $22,000 per year, as presented in PSP Table 19. These costs include the following:

- Administration ($2,000 per year): Annual water quality report, management of employees, ordering chemicals and supplies
- Operations ($13,000 per year): Pumping, chlorination, water sampling, PG&E power
- Maintenance ($5,000 per year): Piping repairs, chlorine pump repair, pressure tank repair, repair of system leaks, electrical repairs, site cleanup
- Periodic Replacement ($2,000 per year): Chlorine pump, piping

Table 19 – Annual Costs of Project
(All costs are in 2012 Dollars)
Project: Beacon West DAC Arsenic Well & Tank Replacement 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									1.000	
2013									0.943	
2014	$136,262							$136,262	0.890	**$121,273**
2015			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.840	**$18,472**
2016			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.792	**$17,426**
2017			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.747	**$16,440**

Table 19 – Annual Costs of Project (All costs are in 2012 Dollars) Project: Beacon West DAC Arsenic Well & Tank Replacement 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)
2018			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.705	**$15,509**
2019			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.665	**$14,631**
2020			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.627	**$13,803**
2021			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.592	**$13,022**
2022			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.558	**$12,285**
2023			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.527	**$11,589**
2024			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.497	**$10,933**
2025			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.469	**$10,314**
2026			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.442	**$9,731**
2027			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.417	**$9,180**
2028			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.394	**$8,660**
2029			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.371	**$8,170**
2030			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.350	**$7,708**
2031			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.331	**$7,271**
2032			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.312	**$6,860**
2033			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.294	**$6,471**
2034			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.278	**$6,105**
2035			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.262	**$5,760**
2036			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.247	**$5,434**
2037			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.233	**$5,126**
2038			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.220	**$4,836**
2039			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.207	**$4,562**
2040			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.196	**$4,304**
2041			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.185	**$4,060**
2042			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.174	**$3,830**
2043			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.164	**$3,614**
2044			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.155	**$3,409**
2045			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.146	**$3,216**
2046			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.138	**$3,034**
2047			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.130	**$2,862**
2048			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.123	**$2,700**

Table 19 – Annual Costs of Project (All costs are in 2012 Dollars) Project: Beacon West DAC Arsenic Well & Tank Replacement 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)
2049			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.116	**$2,547**
2050			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.109	**$2,403**
2051			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.103	**$2,267**
2052			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.097	**$2,139**
2053			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.092	**$2,018**
2054			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.087	**$1,904**
2055			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.082	**$1,796**
2056			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.077	**$1,694**
2057			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.073	**$1,598**
2058			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.069	**$1,508**
2059			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.065	**$1,422**
2060			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.061	**$1,342**
2061			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.058	**$1,266**
2062			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.054	**$1,194**
2063			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.051	**$1,127**
2064			$2,000	$13,000	$5,000	$2,000	$0	$22,000	0.048	**$1,063**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$429,889**
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

Project Benefits

PSP Table 20, below, summarizes benefits and costs for the proposed Project.

Table 20 – Project Benefits and Costs Summary Proposal: East Contra Costa County Region – Proposition 84 Round 2 Grant Proposal Agency: Contra Costa Water District							
Project	Project Proponent	Total Present Value Project Costs (1)	Total Present Value Project Benefits			From Section D1 – Cost-Effectiveness Analysis, Cost Savings	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)
DWD Beacon West Arsenic Well & Tank Replacement Project	DWD	$429,889	$696,258	N/A	$696,258	N/A	Education, reduced reliance on Delta supplies

(1) From Table 19, or RWMG method

(2) From Table 15 or RWMG method

(3) From Table 18 or RWMG method

Project 2: Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion Project

The Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion Project will allow the City of Pittsburg to meet current and future water demands in a disadvantaged community (DAC) while reducing current and future reliance on Delta supplies by replacing the current 600 gallon per minute (gpm) Rossmoor Well with a 1400 gpm well fitted with a variable frequency drive (VFD), installing 1,200 feet of larger supply line, and implementing a multiport monitoring well to expand the groundwater monitoring system.

The City currently relies mostly on purchased raw surface water from the Delta from CCWD, and meets remaining water demands with groundwater. Surface and groundwater supplies are treated at the City's water treatment plant prior to delivery to its residents. The City produces groundwater from two wells, one of which, the Rossmoor Well, has experienced biofouling, which has caused a noticeable decline in groundwater production. By replacing the existing well, the City will obtain a more reliable groundwater supply and will be able to meet customer demands now and in the future, while reducing dependence on the Delta.

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in the following table.

Category	Summary	Present Value
Benefits		
Water supply benefits	Avoided Delta supply purchases	$3,172,222
Total Benefits		**$3,172,222**
Costs		
Present Value of Capital and O&M Costs		$2,269,320
Total Costs		**$2,269,320**

Existing Data and Studies

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

- Reports on Groundwater Monitoring Program (September 2009, February 2012) – Appendix 2-1
- Pittsburg Plain Groundwater Basin (2-4) CASGEM Monitoring Plan (December 2011) – Appendix 2-2
- Pittsburg Plain Groundwater Basin (2-4) Groundwater Management Plan (October 2012) – Appendix 2-3
- City of Pittsburg 2010 Urban Water Management Plan Update – Appendix 2-4
- California Environmental Quality Act (CEQA) Notice of Exemption – Appendix 2-5
- Cost comparison – Bodega and Rossmoor Wells – Appendix 2-6

In addition, the City implemented a similar project, replacing the Bodega Well, in 2009. The previous replacement of the Bodega Well provides additional assurance that this project is technically feasible, will be implemented as effectively as possible, and will provide the benefits claimed.

Without Project Conditions

The City is expected to continue to depend on groundwater to meet a portion of demands. As shown in Tables 4-3 and 4-4 on page 20 of the City's 2010 Urban Water Management Plan Update (Appendix 2-4), the City's current and projected groundwater demand is 1,500 AFY. Without replacement of the Rossmoor Well to restore capacity, the remaining demand would need to be met with up to 500 AFY of additional Delta supplies. As such, the project provides water supply benefits by reducing the need to purchase up to an additional 500 AFY of Delta supplies and maintaining supply reliability for this DAC.

With Project Conditions

The proposed Project will replace the current 600 gpm Rossmoor Well with a 1400 gpm well to allow continued use of groundwater to meet a portion of the City's demands. Without the project, the City would be forced to increase reliance on Delta supplies to meet existing and future demands.

The project will provide statewide water quality improvements by avoiding the need to purchase up to an additional 500 AFY of Delta supplies.

Description of Benefits and Methods to Estimate Benefits

The DWR method was used to assess 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 PSP Table 12, and are described in additional detail below.

Table 12 – 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? - 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?	

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- 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?**	**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**
	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?	

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
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?**	**Yes**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
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

Mailers will be sent to residents of the DAC educating them about the well installation program. In addition, the project includes construction of a sampling well, which will provide ongoing information related to groundwater conditions in the region.

2. Provide Social Recreation or Access Benefits

Not applicable

3. Help Avoid, Reduce or Resolve Various Public Water Resources Conflicts
Demand for Delta supplies exceeds available supply; as such, the Delta is a frequent source of public water resources conflicts. By reducing reliance on Delta supplies, this project will assist in resolving these issues.

4. Promote Social Health and Safety
The Project will improve water supply reliability for this DAC, thereby improving public health and safety.

5. Have Other Social Benefits
The Project will benefit a DAC.

Environmental Stewardship Benefits

6. Benefit Wildlife or Habitat in Ways Not Quantified in Attachment 7
The Project will reduce reliance on Delta supplies, potentially leaving 500 AFY in the Delta that would otherwise be required to meet demands. This increased supply would provide benefits to wildlife and habitat in the Delta.

7. Improve Water Quality in Ways Not Quantified in Attachment 7
The Project will reduce reliance on Delta supplies, potentially leaving 500 AFY in the Delta that would otherwise be required to meet demands. This increased supply would provide water quality benefits to the Delta by improving water temperature and providing dilution for contaminants.

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 Project includes a groundwater monitoring well, which would provide valuable data and information to assist in the long-term management of California's groundwater resources.

11. Reduce Demand for Net Diversions for the Region from the Delta
The Project will reduce reliance on Delta supplies by as much as 500 AFY.

12. Provide a Long-Term Solution in Place of a Short-Term One
The City has performed numerous short-term fixes to maintain well function. The Project would replace the well, providing a long-term solution in place of short-term fixes.

13. Promote Energy Savings or Replace Fossil Fuel Based Energy Sources with Renewable Energy
The Project will reduce energy consumption and associated greenhouse gas emissions as quantified in Attachment 7.

14. Improve Water Supply Reliability in Ways Not Quantified in Attachment 7
Groundwater supplies are typically more resilient to hydrologic changes than Delta surface water supplies. In addition, the City's groundwater supply is not subject to interruption in the event of seismic

or other catastrophic events. As such, by reducing the City's dependence on Delta supplies in lieu of local groundwater supplies, the project provides an additional water supply reliability benefit to this DAC.

15. Other
Not applicable

Section D3 – Monetized Benefits Analysis

The following benefits have been monetized for this Project:

- Avoided cost of purchasing Delta supplies

Monetized benefits, and the process for monetizing benefits, are discussed in the following paragraphs and summarized in PSP Table 15 below. Because no avoided projects have been identified and monetized, PSP Table16 has been omitted.

Avoided Cost of Purchasing Delta Supplies

The City is expected to continue to depend on groundwater to meet a portion of demands. As shown in Tables 4-3 and 4-4 on page 20 of the City's 2010 Urban Water Management Plan Update (Appendix 2-4), the City's current and projected groundwater demand is 1,500 AFY. Without replacement of the Rossmoor Well to restore capacity, the remaining demand would need to be met with up to 500 AFY of additional Delta supplies. As such, the project provides water supply benefits by reducing the need to purchase up to an additional 500 AFY of Delta supplies and maintaining supply reliability for this DAC.

Based on information provided by the City of Pittsburg, the current cost to purchase, treat, and distribute Delta supplies is $592 / AF. The life of the project is assumed to be 22 years, which is the age of the existing Rossmoor Well requiring replacement. Over the 22-year project life, the present value of the avoided cost of purchasing 500 AFY of Delta supply is $3,172,222, as shown in PSP Table 15 below.

Annual Benefits Table

PSP table 15, which summarizes present value of annual monetized benefits, is provided below.

Table 15 – Annual Benefit
(All benefits should be in 2012 dollars)
Project: Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion 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	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.840	**$248,527**
2016	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.792	**$234,460**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion 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)
2017	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.747	**$221,188**
2018	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.705	**$208,668**
2019	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.665	**$196,857**
2020	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.627	**$185,714**
2021	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.592	**$175,202**
2022	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.558	**$165,285**
2023	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.527	**$155,929**
2024	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.497	**$147,103**
2025	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.469	**$138,776**
2026	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.442	**$130,921**
2027	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.417	**$123,510**
2028	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.394	**$116,519**
2029	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.371	**$109,924**
2030	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.350	**$103,702**
2031	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.331	**$97,832**
2032	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.312	**$92,294**
2033	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.294	**$87,070**
2034	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.278	**$82,142**
2035	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.262	**$77,492**
2036	Avoided Delta supply	AFY	0	500	500	$592	$296,000	0.247	**$73,106**
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$3,172,222**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion 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)
Comments:									

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

Section D4 – Flood Damage Reduction Analysis

No flood damage reduction is claimed from project implementation.

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, uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in Table 19 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect start and completion of construction activities in 2015. The operational life of the Project is assumed to be 22 years, which is the age of the well being replaced.
- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs including opportunity costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. All opportunity costs are accounted for including previous construction costs incurred since October 2008.
- 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 PSP Table 19 below, the present value of project costs, discounted at 6%, is estimated to be $2,008,899. This estimate includes all capital costs as well as costs associated with construction, administration, operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. Costs funded by local, State, federal agencies and non-profits are included. The initial costs presented in this table are equivalent to those presented in Attachment 4, with the exceptions identified above.

Capital costs are estimated to be $1,322,200, and will phased based as follows.

- $173,200 completed in 2014 (planning /design/environmental documentation costs and project administration costs)
- $1,174,000 completed in 2015 (construction and construction administration costs)

Operations and maintenance costs are estimated to be approximately $81,090 per year, beginning in 2015, as presented in Table 19. These costs include the following:

- $61,090 per year for operations. This cost assumes $61.09 per AF for energy associated with groundwater pumping and distribution and an average production of 1000 AFY.
- $20,000 per year for routine maintenance.

Table 19 – Annual Costs of Project
(All costs are in 2012 Dollars)
Project: Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion Project

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Ops	Maintenance	Replace.	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									0.943	**$0**
2014	$173,200							$173,200	0.890	**$154,147**
2015	$1,174,000			$61,090	$20,000		$0	$1,255,090	0.840	**$1,053,798**
2016				$61,090	$20,000		$0	$81,090	0.792	**$64,231**
2017				$61,090	$20,000		$0	$81,090	0.747	**$60,595**
2018				$61,090	$20,000		$0	$81,090	0.705	**$57,165**
2019				$61,090	$20,000		$0	$81,090	0.665	**$53,929**
2020				$61,090	$20,000		$0	$81,090	0.627	**$50,877**
2021				$61,090	$20,000		$0	$81,090	0.592	**$47,997**
2022				$61,090	$20,000		$0	$81,090	0.558	**$45,280**
2023				$61,090	$20,000		$0	$81,090	0.527	**$42,717**
2024				$61,090	$20,000		$0	$81,090	0.497	**$40,299**
2025				$61,090	$20,000		$0	$81,090	0.469	**$38,018**
2026				$61,090	$20,000		$0	$81,090	0.442	**$35,866**
2027				$61,090	$20,000		$0	$81,090	0.417	**$33,836**
2028				$61,090	$20,000		$0	$81,090	0.394	**$31,921**
2029				$61,090	$20,000		$0	$81,090	0.371	**$30,114**
2030				$61,090	$20,000		$0	$81,090	0.350	**$28,409**
2031				$61,090	$20,000		$0	$81,090	0.331	**$26,801**
2032				$61,090	$20,000		$0	$81,090	0.312	**$25,284**
2033				$61,090	$20,000		$0	$81,090	0.294	**$23,853**
2034				$61,090	$20,000		$0	$81,090	0.278	**$22,503**
2035				$61,090	$20,000		$0	$81,090	0.262	**$21,229**
2036				$61,090	$20,000		$0	$81,090	0.247	**$20,027**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$2,008,899**

Table 19 – Annual Costs of Project (All costs are in 2012 Dollars) Project: Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost(1)	Annual Costs (2)						Discounting Calculations	
			Admin	Ops	Maintenance	Replace.	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
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

Project Benefits

PSP Table 20, below, summarizes benefits and costs for the proposed project.

Table 20 – Project Benefits and Costs Summary Proposal: East Contra Costa County Region – Proposition 84 Round 2 Grant Proposal Agency: Contra Costa Water District							
			Total Present Value Project Benefits				
Project	Project Proponent	Total Present Value Project Costs (1)	From Section D3 – Monetized (2)	From Section D4 – Flood Damage Reduction (3)	Total	From Section D1 – Cost-Effectiveness Analysis, Cost Savings	From Section D2 – Briefly describe the main Non-monetized benefits
(a)	(b)	(c)	(d)	(e)	(f) = (d) + (e)	(g)	(h)
Rossmoor Well Replacement/Groundwater Monitoring Well System Expansion Project	City of Pittsburg	$2,008,899	$3,172,222	N/A	$3,172,222	N/A	Education, reduced reliance on Delta supplies, DAC benefit

(1) From Table 19, or RWMG method
(2) From Table 15 or RWMG method
(3) From Table 18 or RWMG method

Project 3: Integrated Regional Flood Protection and Water Quality Improvement Borrow Area Project

The Contra Costa Water District (CCWD) and the Contra Costa County Flood Control & Water Conservation District (FCD) jointly propose the Integrated Regional Flood Protection and Water Quality Improvement Project (Project), in eastern Contra Costa County, for funding under the California Department of Water Resources' (DWR) Integrated Regional Water Management (IRWM) Grant Program. The project will reuse surplus materials (fill) in a sustainable manner to improve water supply and quality by supporting the Canal Levee Elimination and Flood Protection Pipeline Construction and by expanding the Contra Costa County Upper Sand Creek Detention Basin Flood Control Project.

The Upper Sand Creek Basin Project (USCB) is currently being implemented, using funding from Proposition 1E, to prevent flooding along the lower reach of Marsh Creek between Sand Creek and the Marsh Creek outfall into the Sacramento-San Joaquin River at Big Break in Oakley (refer to Appendix 3-1.6 for the USCB Prop 1E work plan). The construction of USCB will expand an existing interim flood control basin from 41 acres in area to a final constructed area of approximately 62 acres, increasing the flood storage capacity of the basin from 123 acre feet to 900 acre feet with a 35-foot maximum depth. The expansion is being constructed by excavating the existing interim basin floor to create a deeper basin where water will be held and slowly released downstream during major storm events. Soil removed from the excavation is being used to construct an earthen dam on the northeast side of the basin to impound flood waters from major storm events. Remaining soil is being stockpiled for future use by interested parties. Currently, approximately 500,000 cubic yards of fill remains in the basin, reducing flood control capacity from 900 AF to 750 AF. FCD is actively pursuing alternatives to eliminate the 500,000 cubic yards of fill.

The proposed Project will consist of removing 75,000 cubic yards (cy) of stockpiled, surplus earthen material from the USCB site, and reusing this material at the CCWD's Contra Costa Canal Levee Elimination and Flood Protection Project. The full, five-phased Contra Costa Canal Levee Elimination and Flood Protection Project will replace 21,000 feet of the unlined Contra Costa Canal (the Canal) with a pipeline and install a Canal flood isolation structure that will allow CCWD to remotely isolate the Canal following a major flood or earthquake. Completion of the Project will reduce regional flood risk and to improve water supply reliability and delivered water quality for CCWD's customers. Secondary benefits include increasing water supply and water supply reliability for the State Water Project and Central Valley Project and improving public safety by limiting access to the open Canal. Segment 1 of the Project, encasement of the Canal from Pump Plant #1 to Marsh Creek, was completed in 2009. Construction of the flood isolation structure and Segment 2 pipeline is scheduled to begin in the fall of 2013 (refer to Appendix 3-3.11 for executed Prop 1E contract).

In addition, by removing 75,000 cy of fill, capacity of the USCB will be increased by approximately 45 AF. By assisting in removing fill, it is estimated that this project will allow USCB to realize the benefits associated with the 45 AF increase in capacity approximately 5 years sooner than previously estimated (full benefits expected in 2018 rather than 2023). As such, the proposed project will accelerate the projected flood damage reduction benefits of the Proposition 1E-funded USCB project by approximately five years.

The Contra Costa Canal Levee Elimination and Flood Protection Project received $10 M in State funding from Round 1 of the Proposition 1E Stormwater Management and Flood Protection grant program to install approximately 4,000 linear feet of pipeline, replace the Canal embankments along the portion of

the unlined Canal in Oakley, CA, reduce regional flood risk and improve water supply reliability and delivered water quality for CCWD's customers. As such, the portion of the Contra Costa Canal Flood Protection and Levee Elimination Project that was funded through Proposition 1E is expected to generate approximately 19 percent (4,000 feet / 21,000 feet) of the benefits of the full, five-phased project. The Integrated Regional Flood Protection and Water Quality Improvement Project currently proposed would provide fill for the Contra Costa Canal Levee Elimination and Flood Protection Project, reducing the cost to procure fill and enabling CCWD to complete an additional 450 feet of pipeline installation for the existing Proposition 1E funded budget. Because the Project will allow an additional 450 feet of canal to be encased in a buried pipeline, the benefits of the portion of the full, five-phased project expected to be realized with the existing Proposition 1E funding would be expected to increase from 19 percent of the total project benefit to 21.1 percent of the total project benefits through implementation of this Project.

Many of the benefits of the proposed Project, as described below, are intrinsically linked to the construction of an additional 450 feet of pipeline for the Contra Costa Canal Flood Protection and Levee Elimination Project. An added 2.1 percent (450 feet/21,000 feet) of the total project benefits would be realized through implementation of the proposed Integrated Regional Flood Protection and Water Quality Improvement Project.

Similarly, the Upper Sand Creek Basin Flood Control Project is currently being implemented using $2 million in funding from Proposition 1E. Implementation of the proposed project would increase basin capacity by 45 AF. By moving the fill, the project will reduce the dependence of the USCB project on economic conditions and accelerate achievement of the full flood control benefits of the Upper Sand Creek Basin Flood Control Project by approximately five years (with full benefits realized in 2018 instead of 2023).

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in the following table.

Category	Summary	Present Value
Benefits		
Water supply benefits	Emergency Supply	**$436,878**
	Avoided SWP and CVP salinity releases	**$3,776,723**
	Avoided SWP and CVP OMR releases	**$1,243,997**
Water quality improvements	Bromate cancer reduction	**$270,147**
Environmental benefits	Accelerated Dutch Slough Project Implementation	**$3,756,078**
Flood Damage Reduction	Flood Damage Reduction	**$1,814,768**
	Accelerated USCB flood protection benefits	**$5,120,548**
Energy	Energy savings	**$28,732**
	Avoided social cost of GHGs	**$5,609**
Other Physical Benefits	Reduced drowning s	**$1,674,909**
	Canal Maintenance Savings	**$105,480**

Category	Summary	Present Value
	Avoided Patrolling	$37,797
	Reduced Solids Handling	$1,406
Total Benefits		$18,273,072
Costs		
Present Value of Capital and O&M Costs		$1,243,604
Total Costs		$1,243,604

Existing Data and Studies

CCWD and FCD have completed numerous studies and reports evaluating and quantifying the benefits of the Contra Costa Canal Levee Elimination and Flood Protection Project and Upper Sand Creek Basin Flood Control Project, both of which would be extended through implementation of the proposed Project. As such, a wealth of information is available for both the with and without project conditions to substantiate the physical benefits claimed. Phase 1 of the Contra Costa Canal Levee Elimination and Flood Protection Project has been constructed, and design of the remaining phases is nearing completion. The Upper Sand Creek Basin Flood Control Project is currently being implemented.

Technical documents that support the feasibility of the Upper Sand Creek Basin portion of the project are included in Appendix 3-1 as follows:

- Upper Sand Creek Basin Preliminary Soil Characterization Study, 2000 – Appendix 3-1.1
- Upper San Creek Detention Basin Design Report, August 2010 – Appendix 3-1.2
- CEQA analysis regarding hauling of fill from the Sand Creek Bain site by the Contra Costa County Flood Control & Water Conservation District, Approved by Contra Costa County Board of Supervisors on November 2010 – Appendix 3-1.3
- Upper Sand Creek Basin Geotechnical Report, 2012 – Appendix 3-1.4
- Upper Sand Creek Basin Project Plans and Specifications, 2012 – Appendix 3-1.5
- Contra Costa Flood Control District Proposition 1E Round 1 Funding Application Work Plan and Economic Analysis – Upper Sand Creek Basin – Appendix 3-1.6

In addition, CCWD has completed numerous studies and reports evaluating and quantifying the benefits of the Contra Costa Canal Levee Elimination and Flood Protection Project, which would be extended through implementation of the proposed project. Phase 1 of the Project has been constructed, and design of the remaining phases is nearing completion. Specific studies and actions completed to-date supporting feasibility of the Contra Costa Canal Levee Elimination and Flood Protection Project include the following.

Environmental & Permitting Documentation – Appendix 3-2

- Environmental documentation has been completed in accordance with the California Environmental Quality Act (CEQA) and National Environmental Protection Act (NEPA). A Negative Declaration was approved on November 2006; it was determined that the Project will not have significant effects on the environment. Reclamation approved a NEPA Finding of No Significant Impact (FONSI) in July, 2007. CEQA Addendum and NEPA modifications will be conducted as required for new phases of construction. (Appendix 3-2.1)
- Mitigation Monitoring and Reporting Program for the Contra Costa Canal Replacement Project. State Clearinghouse # 2006042082. November 2006. (Appendix 3-2.2)

- Final Mitigated Negative Declaration for the Contra Costa Canal Replacement Project. November 2006. (Appendix 3-2.3)
- Final Environmental Assessment Contra Costa Canal Replacement Project, contra Costa County, California. June 2007. (Appendix 3-2.4)
- Several permits and agreements were secured in 2007, including: Central Valley Regional Water Quality Control Board 401 Permit, CA Department of Fish and Game 1600 and 2081 Permits, State Historic Preservation Officer MOU, US Army Corps of Engineers 404 Permit, National Marine Fisheries Service Letters of Concurrence, US Fish and Wildlife Coordination Act Letter, and Bureau of Reclamation/Western Area Power Administration (WAPA) NEPA EA/FONSI. These permits may require modification to reflect current field conditions consistent with CEQA Addendum and NEPA updates. (Appendix 3-2.5)
- Conservation Easement Deed Holland Tract Preserve. Completed environmental mitigation included a total of 145 acres of mitigation land including 98 acres of upland habitat and 47 acres of wetland habitat in Holland Tract. (Appendix 3-2.6)

Engineering & Design Documentation – Appendix 3-3

- Geotechnical Engineering Investigation Contra Costa Water District Canal Replacement Project Oakley, CA. DCM Engineering/Carollo Engineers, November 2007. (Appendix 3-3.1)
- Recommended Pipeline Alignment. Technical Memorandum. Brown & Caldwell. June 2011. (Appendix 3-3.2)
- Canal Crossings. Technical Memorandum. Brown & Caldwell. June 2011. (Appendix 3-3.3)
- Canal Levee Elimination and Flood Mitigation Project Phase 2 – Pipeline. Access Structure Structural Calculations. Brown and Caldwell. June 2011. (Appendix 3-3.4)
- Cypress Grove Levee Protection. Technical Memorandum. Brown & Caldwell. June 2011 (Appendix 3-3.5)
- Pumping Plant 1 Test Report. Technical Memorandum. Brown & Caldwell, June 2011. (Appendix 3-3.6)
- Final Grade Elevations and Imported Backfill. Technical Memorandum. Brown & Caldwell, June 2011. (Appendix 3-3.7)
- 100% Design Drawings Segments 2 – 4 (Appendix 3-3.8)
- Volume-1-DIV-00-17-FULL (Appendix 3-3.9)
- Volume-2-Appendices (Appendix 3-3.10)
- Executed Prop 1E Agreement for Contra Costa Canal Levee Elimination and Flood Protection Project (Appendix 3-3.11)

Flood Benefits Documentation – Appendix 3-4

- Photos and narrative description of historical flood damage: RD 1237, Contra Costa Water District Operations and Maintenance Staff (Appendix 3-4.1)
- Flood frequency curves for Old River at Rock Slough and San Joaquin River at Antioch. Developed by Corps of Engineers, Sacramento California. February 1992. (Appendix 3-4.2)
- FEMA inundation maps. (Appendix 3-4.3)
- Water surface elevations measured at Rock Slough. http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=RSL (Appendix 3-4.4)
- Application for Individual Permit Supplemental Attachment. Dutch Slough Tidal Marsh Restoration (SPK-2004000043). Prepared for U.S. Army Corps of Engineers Sacramento District, Regulatory Division. Prepared by California Department of Water Resources. March 2012 (Appendix 3-4.5).

- Dutch Slough Tidal Marsh Restoration Project Final Environmental Impact Report. SCH # 2006042009. State of California Department of Water Resources. March 2010. (Appendix 3-4.6)
- City of Oakley 2020 General Plan. Updated January 2010. http://www.ci.oakley.ca.us/UserFiles/file/GeneralPlan/General%20Plan%202020_Updated%20January%2026,%202010.pdf (Appendix 3-4.7)
- City of Oakley East Cypress Corridor Specific Plan Final Supplemental Environmental Impact Report. January 2009. http://www.ci.oakley.ca.us/UserFiles/file/planning/East%20Cypress/ECC%20SP%20Draft%20EIR.pdf (Appendix 3-4.8)

Water Supply Benefits Documentation – Appendix 3-5

- Spreadsheet of CCWD daily operations model output (Appendix 3-5.1)
- Contra Costa Water District Daily Operations Model (WRSEL based linear program). Los Vaqueros Expansion Model Documentation. Technical Memorandum. MBK Engineers. November 3, 2010. (Appendix 3-5.2)
- G-model used to estimate water savings to CVP/SWP associated with compliance with water quality standards. Accounting for Antecedent Conditions in Seawater Intrusion Modeling – Applications for the San Francisco Bay-Delta. Richard Denton, 1993. Hydraulic Engineering, Volume 1, ASCE, pp. 448-453. (Appendix 3-5.3)
- Calculation of water savings based on Rock Slough salinity requirements, Contra Costa Water District, 2013. (Appendix 3-5.4)
- CCWD Rates without Subsidy, CCWD 2012 (Appendix 3-5.5)

Water Quality Benefits Documentation – Appendix 3-6

- Water Quality at Contra Costa Water District's Contra Costa Canal Intake: A Review of Rock Slough Water Quality Analyses. Contra Costa Water District Interoffice Memorandum. August 14, 2001. (Appendix 3-6.1)
- Rock Slough Technical Memorandum Evaluating Veale Tract Discharge. FlowScience. December 19, 2003. (Appendix 3-6.2)
- Identification of Water Quality Degradation Sources in Rock Slough and Unlined Portion of Contra Costa Canal. Contra Costa Water District Interoffice Memorandum. October 23, 2003. (Appendix 3-6.3)
- Bay Area Water Quality & Supply Reliability Program. CALFED Bay Delta Program. May 2005. (Appendix 3-6.4)
- Amy, G.L., M. Siddiqui, K. Ozekin, H.W. Zhu, and C. Wang, (1998). Empirically Based Models for Predicting Chlorination and Ozonation By-Product: Haloacetic Acids, Chloral Hydrate, and Bromate. EPA Report CX 819579. USEPA Office of Groundwater and Drinking Water: Cincinnati, OH. 1998. (Appendix 3-6.5)
- Field data collected by Contra Costa Water District and the Department of Water Resources. (Appendix 3-6.6)
- Beneficial Use Impact Study, Final Report Ironhouse Sanitary District, Oakley, California. Prepared by HydroFocus. December 2003. (Appendix 3-6.7)
- US EPA. 2013. Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter. EPA-452/R-12-005. Washington, DC. February 28. Table 5-9, p 5-50. http://www.epa.gov/ttnecas1/regdata/RIAs/finalria.pdf (Appendix 3-6.8)

Environmental Benefits Documentation – Appendix 3-7

- Dutch Slough Tidal Marsh Restoration Project Final Environmental Impact Report. SCH # 2006042009. State of California Department of Water Resources. March 2010. (Appendix 3-7.1)
- East Contra Costa County HCP/NCCP Mitigation Fee Audit. East Contra Costa County Habitat Conservancy, December 2012. (Appendix 3-7.2)
- East Contra Costa County Habitat Conservancy Governing Board Memorandum: Review and Adjustment of the HCP/NCCP Mitigation Fees, July 2011. (Appendix 3-7.3)

Energy Related Benefits Documentation - Appendix 3-8

- Spreadsheet of CCWD daily operations model output, Contra Costa Water District Daily Operations Model (WRSEL based linear program). Los Vaqueros Expansion Model Documentation. Technical Memorandum. MBK Engineers. November 3, 2010. Greenhouse gas (GHG) emissions for the Contra Costa Water District (CCWD) is based on the Climate Registry's (Registry) General Reporting Protocol v3.1 (Protocol) released in January 2009. (Appendix 3-8.1)

Because the Project has been fully evaluated and designed, the projected physical benefits are well-defined and justifiable. The following sections provide the technical justification to support these claimed benefits.

Without Project Conditions

Without the fill material, no additional pipeline would be constructed beyond what is currently planned. In addition, the canal area will have a depression in the right of way, and it is likely that over time portions of the Canal may revert to wetland areas. This could increase Canal maintenance costs and create a need to mitigate in the future to fill in the new wetlands. In addition, the USCB Flood Control Project would continue to depend upon favorable economic conditions to find users for the remaining fill currently reducing basin capacity.

With Project Conditions

With the Project, an additional 450 feet of Canal could be encased within a buried pipeline within the existing funding constraints. This would result in achievement of 2.1 percent of the full range of benefits from the 21,000, five-phased Contra Costa Canal Flood Protection and Levee Elimination Project. In addition, the USCB flood control basin capacity would be increased due to fill removal. The fill removal would accelerate the projected completion date on which the USCB Flood Control project achieves full projected benefits by approximately five years (from 2023 to 2018).

Description of Benefits and Methods to Estimate Benefits

The DWR method was used to assess 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 PSP Table 12, and are described in additional detail below.

Table 12 – 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? - 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?**	**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?**	**No**
	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?	

Table 12 – Non-monetized Benefits Checklist		
No.	Question	Enter "Yes", "No" or "Neg"
	- 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?**	**No**
	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?**	**Yes**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
	Examples are not limited to, but may include: - Replace a temporary water supply with a more permanent supply? - Replace a temporary water quality solution with a more permanent solution? - Replace temporary flood control management with a more permanent solution? - Replace temporary habitat with a more permanent solution?	
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:	

Table 12 – Non-monetized Benefits Checklist		
No.	Question	Enter "Yes", "No" or "Neg"
	- 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

As discussed in Attachment 6, the Contra Costa Canal Flood Protection and Levee Elimination Project will involve a long-term water quality monitoring program, which will be designed to evaluate and assess the salinity benefits provided by the full Project. This information will be made available to applicable statewide databases, providing additional information to be used in evaluating future, similar projects. In addition, the Project will enable DWR's Dutch Slough Tidal Marsh Restoration Project to proceed. DWR's Dutch Slough Project is a critical early action to improve the ecosystem health of the Sacramento-San Joaquin Delta. Completion of DWR's Dutch Slough Tidal Marsh Restoration Project is legislatively mandated (SBX7-1 Section 85085) and dependent on the construction of 11,000 ft of the pipeline adjacent to DWR's Dutch Slough project site. According to the 2008 Dutch Slough Adaptive Management Plan, there is considerable uncertainty regarding how best to restore tidal marsh and the extent to which restored marshes may benefit or impact native fish and water quality in the Delta. Restoring some types of tidal habitat could simply provide habitat for exotic species or could degrade water quality conditions in the Delta. And restoring the Delta's subsided lands to tidal marsh could be prohibitively expensive unless we identify strategies for reducing costs.

DWR's Dutch Slough restoration project is an opportunity to both restore tidal marsh and learn more about the function of tidal marsh in the Bay-Delta ecosystem. The site is one of the only locations in the Western Delta with suitable elevations for tidal marsh restoration and is configured in three separate tracts which will allow scientists to compare and contrast the efficacy of different approaches on the different parcels. A key goal of DWR's Dutch Slough Adaptive Management Plan is:

Contribute to scientific understanding of ecological restoration by implementing the project under an adaptive management framework.

By enabling a portion of the Contra Costa Canal Flood Protection and Levee Elimination Project to proceed, the proposed Project will provide significant educational benefits.

2. Provide Social Recreation or Access Benefits

As discussed previously, DWR's Dutch Slough Tidal Marsh Restoration Project cannot proceed without implementation of the proposed Project. A key goal of DWR's Dutch Slough Tidal Marsh Restoration is: *Provide shoreline access, educational and recreational opportunities*

Proposed recreational elements described in the Adaptive Management Plan include:

- Open trail around Emerson levee
- Create a 55-acre community park
- Provide public access to the Delta shoreline
- Create signage to educate public about restoration project
- Build wildlife viewing platforms
- Involve schools and community groups
- Build non-motorized boat launch
- Create swimming opportunities for the public
- Create opportunities to canoe and kayak

By assisting in enabling DWR's Dutch Slough Tidal Marsh Restoration Project to proceed, the proposed Project enables these recreation benefits to be realized.

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

Currently, DWR's Dutch Slough Tidal Marsh Restoration Project is proposed to be implemented adjacent to the unlined Contra Costa Canal (Canal). Implementation of DWR's Dutch Slough Tidal Marsh Restoration Project without first encasing the Canal in a pipeline would result in significant water quality impacts to the Canal, impacting the water supply of nearly 550,000 Californians. By implementing the proposed Project, this conflict between ecological and drinking water needs could be alleviated.

4. Promote Social Health and Safety

As discussed later in this attachment, the Contra Costa Canal Flood Protection and Levee Elimination Project will provide significant health and safety benefits by eliminating the risk of drowning in the Canal. By enabling additional 450 feet of canal to be encased in a buried pipeline, the proposed Project will contribute to achieving these benefits.

In addition, the Contra Costa Canal Flood Protection and Levee Elimination Project will eliminate the potential for flooding related to hydrologic events. By enabling a portion of the Canal to be encased in a buried pipeline, the proposed Project will assist in reducing concerns with regard to system security and public safety. Fences will be maintained along the 300-foot right of way boundary, maintenance roads will be maintained, and security personnel will patrol the area.

5. Have Other Social Benefits

The social benefits provided by the proposed Project are discussed in other sections of this Proposal.

Environmental Stewardship Benefits

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

The Contra Costa Canal Flood Protection and Levee Elimination Project will provide significant wildlife and habitat benefits. The proposed Project, by enabling an additional 450 feet of Canal to be encased in a buried pipeline, will contribute to these benefits.

Ecosystem restoration and habitat protection are linked to protecting the water quality and water supply reliability in East County. Protecting Delta water quality protects source water for the region and improves ecosystem habitat for the Delta's aquatic species while also protecting them from the harmful impacts of degraded water quality. Promoting the recovery of the Delta's endangered fish species improves water supply reliability by reducing regulatory conflicts between the legal requirements to protect endangered species and project operations to divert water from the Delta and. Tidal wetland and riparian restoration projects can sometimes create habitat for endangered species while at the

same time reducing the amount of polluted runoff flowing into the Delta – a win for water quality, endangered species, and water supply reliability.

The Contra Costa Canal Flood Protection and Levee Elimination Project will protect natural resources of the Delta and promote habitat restoration for sensitive species. Although construction of the full Project is not complete, the mitigation for the full Project is complete. CCWD purchased 47 acres of wetland and 98 acres of upland habitat as mitigation for the full Project. These lands provide habitat for species of concern such as Delta smelt, longfin smelt and the giant garter snake. Completion of the full Project will also promote the completion of DWR's Dutch Slough Tidal Marsh Restoration Project. DWR's Dutch Slough Tidal Marsh Restoration Project will restore a tidal wetland just to the north of the Project. The Project is a critical early action to improve the ecosystem health of the Sacramento-San Joaquin Delta. Completion of DWR's Dutch Slough Tidal Marsh Restoration Project is legislatively mandated (SBX7-1 Section 85085) and dependent on the construction of 11,000 ft of the pipeline adjacent to DWR's Dutch Slough project site.

7. Improve Water Quality in Ways Not Quantified in Attachment 7
As discussed in Attachment 7 and later in this Attachment, the Contra Costa Canal Flood Protection and Levee Elimination Project will provide water quality benefits through reduced salinity and turbidity and reduced risk of pathogen contamination from nearby grazing activities; a portion of these benefits can be attributed to the proposed Project.

No other unquantified water quality improvements have been identified.

8. Reduce Net Emissions in Ways Not Quantified in Attachment 7
As discussed in Attachment 7, project implementation will result in reduced energy usage and GHG emission reductions. No other unquantified emissions reductions have been identified.

9. Provide Other Environmental Stewardship Benefits Not Claimed in Sections D1, D3, or D4
All environmental stewardships benefits are discussed previously in this section.

Sustainability Benefits

10. Improve the Overall, Long-Term Management of California Groundwater Resources
As discussed in Attachment 7 and previously in this Attachment, the Contra Costa Canal Flood Protection and Levee Elimination Project will provide significant water supply benefits and will reduce water quality impacts associated with saline groundwater intrusion, a portion of which can be attributed to the proposed Project.

Delta supplies, groundwater, and reclaimed water in East Contra Costa County are operated as an interconnected system. If water quality impacts were to limit Delta supplies available to the Region, groundwater dependence would increase. As such, water quality in the Canal by implementing the proposed Project will reduce reliance on local groundwater supplies, improving the long-term management of Groundwater Resources.

11. Reduce Demand for Net Diversions for the Region from the Delta
As discussed in Attachment 7 and previously in this Attachment, the Contra Costa Canal Flood Protection and Levee Elimination Project and the proposed Project will provide significant water supply benefits.

By eliminating local degradation from groundwater seepage and runoff, the Contra Costa Canal Flood Protection and Levee Elimination Project will increase overall water supply for the Federal Central Valley Project by reducing the need for upstream releases into the Delta to offset this local degradation.

12. Provide a Long-Term Solution in Place of a Short-Term One
The full Project will eliminate up to eight miles of aging Canal embankments (unconsolidated dredging spoils from the original construction) that were not designed to provide flood protection and are not seismically sound. Encasing the Canal in a pipeline provides a long-term solution to the flood protection challenges currently being caused by the improper use of the existing embankments for flood protection purposes.

13. Promote Energy Savings or Replace Fossil Fuel Based Energy Sources with Renewable Energy
As discussed in Attachment 7, the proposed Project will reduce energy usage and associated GHG emissions. It will not replace fossil fuel based energy sources with renewable energy and resources.

14. Improve Water Supply Reliability in Ways Not Quantified in Attachment 7
As discussed in Attachment 7, the proposed Project will provide significant water supply benefits and improved water supply reliability.

15. Other
All other benefits are summarized in Attachments 7 and 8.

Section D3 – Monetized Benefits Analysis

This section describes other benefits (not including the flood reduction benefits described above) that can be quantified for the proposed Project based on its ability to enable an additional 450 feet of the Contra Costa Canal Levee Elimination and Flood Protection Project to be constructed within the existing budget. These benefits include:

WS1: Increase in emergency water supply available for CCWD customers and partners

WS2: CVP/SWP water savings from upstream reservoirs that would otherwise be released to meet state water quality regulations as measured at the downstream end of the Canal

WS3: CVP/SWP operational flexibility when regulations limit Old and Middle River flows

WQ1: Reduced Bromide Concentration and Associated Reduction in Excess Lifetime Cancer Risk

WQ2: Decreased Agricultural Runoff from Adjacent Fields (not monetized)

WQ3: Decreased Risk in Fecal Borne Pathogens Transported into the Canal (not monetized)

WQ4: Decreased Turbidity and Associated Solids Handling Requirements

ENV1: Enabled Completion of Dutch Slough Tidal Marsh Restoration Project

ENV2: Reduction in Herbicide Treatment of Unlined Canal

ERG1: Energy Reduction

ERG2: Greenhouse Gas Emission Reduction (not monetized)

OTH1: Reduced Security Risk

Monetization of these benefits is discussed in additional detail below.

WS1: Water for Emergency Supplies

Replacing the unlined Canal with a pipeline will lead to improved water quality at the Rock Slough intake, which will decrease the amount of water released from Los Vaqueros Reservoir in order to meet

CCWD's customer water quality delivery goals. On average, this effectively adds 340 AFY on average to water available in storage but increases available storage up to 860 AFY during dry times, assumed to occur 2 out of every 5 years for an average emergency water supply savings of 340 AFY. In addition, reduced evaporation losses from the open Canal amount to an estimated 60 AFY saved per year. Combined, there is a savings of 400 AFY for CCWD. The portion attributable to the proposed Project is 8.4 AFY. CCWD's daily operations model output is provided in Appendix 3-5.1 and technical documentation for the model is provided in Appendix 3-5.2.

Table 8-4 Increased Storage Benefit

	Minimum Storage in Los Vaqueros Reservoir [AF]
Without Project	148,570
With Project	147,710
Emergency Supply Benefit of Contra Costa Canal Flood Protection and Levee Elimination Project	860
Benefits Attributable to Implementation of the Proposed Integrated Regional Flood Protection and Water Quality Improvement(2.1 percent)	19

The increase in water saved to storage becomes most important during an extended drought or other emergency (multiple levee failures in the Delta limiting) when water supply is limited statewide. Storage levels in Los Vaqueros Reservoir have been maintained above minimum 'emergency levels' since the completion of the reservoir in 1998.

The benefits of enhanced emergency supply may be monetized using the estimated price of emergency water. The normal cost of water available for partners use in Los Vaqueros Reservoir is approximately $400 per AF. During 2009, when CCWD declared water conservation requirements in response to the ongoing drought, emergency water rates over allocated levels increased by a factor of 4, to approximately $1,600 per AF in 2009 dollars; this equates to approximately $1,648 in 2012 dollars. Utilizing this figure as an estimate of the value of enhanced emergency storage yields an annual benefit value of $13,440 (8.4 AFY at $1,600 per AF). As calculated from PSP Table 15 at the end of this section, the present value of this benefit attributable to the proposed Project (2.1 percent), assuming benefits begin to accrue in 2018 and a 100-year project life and 6 percent discount rate, is $436,878.

WS2: Avoided Releases from SWP and CVP reservoirs to Meet Water Quality Standards

Water quality in the Contra Costa Canal affects both CCWD operations and statewide CVP/SWP operations. The federal water and state water projects are required to meet state water quality objective defined by the State Water Resource Control Board Decision 1641; compliance with two state water quality objectives are measured at Pumping Plant 1. One of the D-1641 objectives specifies that salinity in the Contra Costa Canal as measured at Pumping Plant 1 (PP1) must be below 150 mg/L chlorides for a minimum of 155 days per year and up to 240 days per year depending on water year type. The second objective specifies that water quality at Pumping Plant 1 must be below 250 mg/L chlorides to comply with secondary MCL health standards. Although compliance with these standards does not often dictate statewide water operations, there are times when CVP/SWP reservoirs must make releases specifically to meet these water quality objectives.

There are three sources of salinity and contamination in the Canal: 1) seawater intrusion from the ocean into the Delta, groundwater intrusion from an elevation water table adjacent to the Canal, and

agricultural return flow from adjacent farms and ranches. Salinity in the Canal from seawater is naturally variable due to the variation in hydrologic conditions and tidal forcing. When there is high freshwater outflow from the Delta, water in the Canal is relatively fresh because the river flow is sufficient to keep seawater downstream of the Delta, conversely, when there is low freshwater outflow from the Delta, water in the Canal is relatively salty because seawater is able to mix upstream into the Delta. Salinity from the other two sources, groundwater and agricultural return flow, are largely due to human activities and will be eliminated by implementing the Project. Eliminating the two "human derived" sources of salt will improve water quality in the Canal and in turn can change SWP/CVP operations such that there are water supply benefits.

Because compliance with the regulatory standards is measured at PP1, at the downstream end of the unlined Canal, degradation incurred along the unlined portion of the Canal from groundwater intrusion and agricultural runoff can result in increased releases from CVP/SWP reservoirs. Historical land use practices adjacent to the unlined Canal, such as land disposal of sewage, agricultural drainage, and cattle grazing, have resulted in significant water quality degradation in the unlined Canal. Implementing the full five-phased Project will eliminate salinity intrusion from groundwater and direct agricultural runoff thereby decreasing the salinity at Pumping Plant 1 and decreasing the amount of water CVP/SWP need to release from upstream reservoirs to meet the water quality standards.

Table 8-5: SWP / CVP Supply Benefits Associated with Reduced Salinity at PP1

	150 standard			**250 standard**			
Water Year	Amount of Water Saved to Meet Standard by Implementing Project [AF/d]	Maximum Number of Days Per Year Where Water Quality Savings Could be Realized	Amount of Water That Could be Saved [AF/yr]	Amount of Water Saved to Meet Standard by Implementing Project [AF/d]	Maximum Number of Days Per Year Where Water Quality Savings Could be Realized	Amount of Water That Could be Saved [AF/yr]	Maximum Total Water Saved [AF/yr]
1999	936	20	18,720	244	16	3,904	22,624
2000	936	14	13,104	244	13	3,172	16,276
2001	936	20	18,720	244	23	5,612	24,332
2002	936	13	12,168	244	33	8,052	20,220
2003	936	28	26,208	244	0	0	26,208
2004	936	20	18,720	244	0	0	18,720
2005	936	7	6,552	244	0	0	6,552
2006	936	2	1,872	244	0	0	1,872
Average (Full Project)		**16**	**14,508**		**11**	**2,593**	**17,101**
Portion Attributable to proposed Project (2.1 percent)			**305**			**54**	**359**

According to the historical water quality record from 1999 through 2007, implementing the full Project could have improved the water quality at Rock Slough such that the 150 mg/L chloride standard could

have been achieved by reducing releases for 16 days per year on average for a total water savings of 14,000 AFY. Similarly, releases could have been reduced on average for 11 days per year to meet the 250 mg/L chloride standard for an average water savings of 2,593 AFY. Combined, implementing the Project could save between 24,000 AFY and 2,000 AFY depending on the water year type. Over the eight year period, the average potential water savings that could have been realized was 17,000 AFY. Methods to estimate water savings due to reduced SWP/CVP releases are summarized in Appendix 3-5.3. Calculations of water savings based on Rock Slough salinity requirements are provided in Appendix 3-5.4.

The value of the water that would have otherwise been released from upstream reservoirs to meet western Delta water quality standards is difficult to determine but based on the settlement agreement between the City of Antioch and the Department of Water Resources, CCWD's untreated water rate that the City of Antioch pays was deemed a reasonable value. The City of Antioch has been diverting fresh water from its intake since the 1860s. The City has an adjudicated pre-1914 appropriative right. When salinity at the City's intake exceeds the 250 mg/L chloride standard it precludes use of water at the intake and the City purchases water from CCWD. The City is partially reimbursed for these purchases according to the terms of an agreement between the City and the California Department of Water Resources (DWR). The City of Antioch currently pays approximately $575 /AF to CCWD for untreated water as described in CCWD's Code of Regulations Chapter 5.20.[1] However, this rate is subsidized and the true cost of delivering the water is approximately $754 per acre-foot, as shown in Appendix 3-5.5 to this Attachment.

Using the $754 per AF value, the 359 AFY released, on average, amounts to an average annual avoided cost of $270,686 (see PSP Table 15). Over the expected Project lifetime, the present value benefits attributable to the proposed Project (2.1 percent) amount to approximately $3,776,723.

WS3: Statewide Water Supply Benefits during 'OMR' Regulations

Conflicts between the need to divert water from the Delta and the legal requirements to protect endangered species can result in pumping restrictions that severely limit the quantity of Delta water allowed to be withdrawn in a given year. The Central Valley Project and State Water Project are subject to flow restrictions from January through June each year to protect endangered species such as Delta smelt. One of these restrictions limits the amount of exporting by regulating flow in Old and Middle Rivers (a.k.a. OMR). CCWD maintains four intakes in the Delta; Mallard Slough Intake, Rock Slough Intake (Pumping Plant 1), Old River Intake and Middle River Intake. Implementation of the Project will improve water quality at Pumping Plant 1 which in turn will enable CCWD to use Pumping Plant 1 more often to meet a greater portion of customer demand that was previously met by using other intakes and releases from the Los Vaqueros Reservoir. CCWD would be able to shift diversions from our Old and Middle River Intakes to Pumping Plant 1, thereby providing CVP/SWP more operational flexibility during that critical regulatory window and possibly increasing the amount of water available for export while complying with OMR regulations.

Water made available for export during the OMR regulation window from January through June would likely be split between urban and agricultural users. The Metropolitan Water District of Southern California's Tier 2 untreated water service rate[2] of $743 per AF was used to calculate the economic value

[1] http://www.ccwater.com/files/COR5.pdf
[2] http://www.mwdh2o.com/mwdh2o/pages/finance/finance_03.html

of enabling greater operational flexibility and possibly increased exports during the OMR regulatory window. Assuming $743 per AF, the total value of the full Project could be up to $4.2M per year. Over the 100-year Project life, assuming a 6 percent discount rate, this amounts to approximately $1,243,997 attributable to this Project, as calculated from PSP Table 15.

Table 8-6: SWP / CVP Supply Benefits Associated with OMR Regulation

	CCWD Old River Pumping Jan – Jun [AF/yr]	CCWD Middle River Pumping Jan – Jun [AF/yr]	Total CCWD Pumping Jan – Jun [AF/yr]
Without Project	17,578	7,605	25,183
With Project	14,044	5,431	19,475
CVP/SWP Supply Benefit During OMR Restrictions (Full Canal Project)	**3,534**	**2,174**	**5,708**
Benefit Attributable to Proposed Project (2.1 percent)	**74**	**46**	**120**

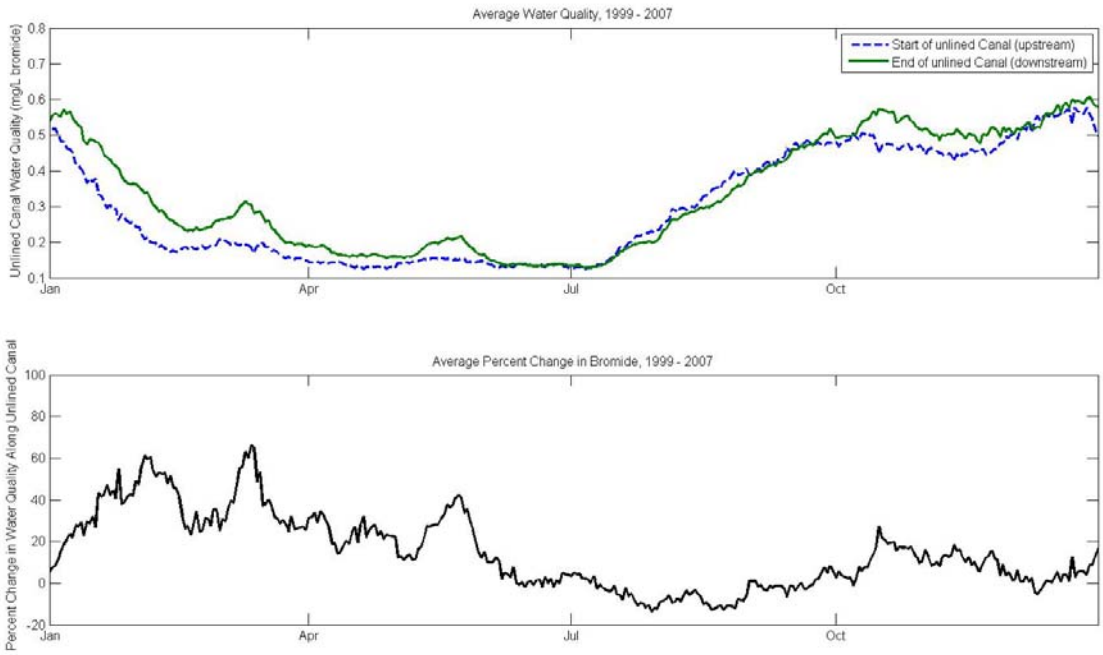
WQ1: Reduced Levels of DBPs in Drinking Water

Improved water quality expected from this Project will result in a reduction in disinfection byproduct formation, and associated public health protection. Implementing the full Project will reduce bromide concentrations at PP1 by 15% on average. Figure 8-1 below shows the increase in bromide concentration that occurs as water travels down the unlined canal; this increase in bromide concentration is due to groundwater intrusion. Groundwater beneath the Ironhouse Sanitary District (ISD) properties immediately adjacent to Segment 1 of the Canal has bromide concentrations regularly exceeding 5 mg/L[3]; over ten times the concentration measured in surface water. Similarly, the bromide concentration on the Dutch Slough Properties adjacent to Segments 2 through 4 of the Canal can be greater than 3 mg/L.[4] The lower panel of Figure 8-2 below shows that by implementing the Project, bromide concentrations could be reduced between 0% and 60%, with an annual average reduction of 15%.

[3] Beneficial Use Impact Study, Final Report Ironhouse Sanitary District, Oakley, California. Prepared by HydroFocus. December 2003 (Appendix 3-6.7)

[4] Dutch Slough Restoration Area First and Second Quarters 2012. Semi Annual Groundwater Monitoring Report. Prepared by HydroFocus October 2012. (Appendix 3-6.6)

Figure 8-2: Influence of Groundwater on Canal Bromide Concentrations



Bromide in the source water is transformed into bromate during ozonation at CCWD's Randall Bold Treatment Plant. Bromate is suspected of contributing to kidney and thyroid cancer in humans. The state and federal MCL for bromate is 10 µg/L. Bromate concentration in CCWD service area has exceeded 10 µg/L in the past, with a maximum of 12 µg/L recorded in 2005. Since 2008, Segment 1 of the Project was implemented limiting the groundwater flux of bromide from ISD's property and the treatment process at Randall Bold Water Treatment Plant was modified to limit bromate concentrations in the service area to less than 5 µg/L.

As bromate is presumed to have a linear no-threshold dose-response relationship, the only risk-free level of exposure to bromate is zero. Thus, any Project that reduces the potential level of bromate in drinking water provides a positive reduction in risk of cancer to those who drink that water (US EPA, 2003).

The bromate model of Ozekin and Amy2 determines bromate formation based on ozone dose, bromide, DOC, and pH as follows:[5]

$$BrO^3 = 1.63 \times 10\text{-}6 * TOC^{-1.26} * pH^{5.82} * (O_3 \text{ dose})^{1.57} * Br^{0.73} * time^{0.28}$$

with BrO3 in ug/L, TOC in mg/L, O_3 in mg/L, Br in ug/L, and contact time in minutes. The 2005 CALFED Bay Area Water Quality and Supply Reliability Program (BAWQ&SRP) assessed bromate formation at CCWD's water treatment plants.[6] Page C-29 of the BAWQ&SRP report presents long-term average water

[5] Amy, G.L., M. Siddiqui, K. Ozekin, H.W. Zhu, and C. Wang, (1998). Empirically Based Models for Predicting Chlorination and Ozonation By-Product: Haloacetic Acids, Chloral Hydrate, and Bromate. EPA Report CX 819579. USEPA Office of Groundwater and Drinking Water: Cincinnati, OH, 1998 (Appendix 3-6.5).

[6] Bay Area Water Quality & Supply Reliability Program. CALFED Bay Delta Program. May 2005 (Appendix 3-6.4)

quality concentrations for CCWD source water at Rock Slough. Long-term average TOC and bromide concentrations presented in this report are approximately 3.0 mg/L and 0.35 mg/L, respectively. Based on conversations with CCWD staff, long-term average pH in water treatment plant influent is approximately 7.2. The BAWQ&SRP also estimated water treatment conditions at Randall Bold water treatment plant. Based on this report (page D-13), ozone dose is approximately 1 mg/L and contact time is approximately 11 min. Bromate production would therefore be calculated as 5.6 ug/L as follows:

$$BrO^3 = 1.63 \times 10\text{-}6 * (3.0 \text{ mg/L TOC})^{-1.26} * (\text{pH of } 7.2)^{5.82} * (O_3 \text{ dose of } 1 \text{ mg/L})^{1.57} * (\text{Br of } 350 \text{ ug/L})^{0.73} * (11 \text{ min})^{0.28}$$

Reducing bromide by 15% would reduce bromate formation to 4.99 ug/L, or a 11.2% percent reduction, as follows:

$$BrO^3 = 1.63 \times 10\text{-}6 * (3.0 \text{ mg/L TOC})^{-1.26} * (\text{pH of } 7.2)^{5.82} * (O_3 \text{ dose of } 1 \text{ mg/L})^{1.57} * (\text{Br of } 350 * 0.85 \text{ ug/L})^{0.73} * (11 \text{ min})^{0.28}$$

The drinking water unit cancer risk for bromate is equal to $2 * 10^{-5}$ per µg/L; for water at the MCL concentration of 10 µg/L, this corresponds to 2 in 10,000, or 2 x 10-4 per ug/L.[7] The relationship between bromate risk and concentration is linear, so risk at 5.6 ug/L (as calculated above) equals 56% of the risk at the MCL, or 1.1×10^{-4} per ug/L. Multiplying this risk level by the number of households served (178,571) and the average number of people per household in the area (3.1) provides the estimate of the excess lifetime cancer cases expected under baseline: 61. This Project will reduce bromide levels by approximately 11.2% on average to 4.99 ug/L. This corresponds to an excess lifetime cancer cases expected under the with-Project condition of 54 ($0.98 * 10^{-4} * 178{,}571 * 3.1$). This translates to a reduction in excess lifetime cancer cases of 7 fewer cancer cases per 70-year lifetime compared to baseline, or an average of 0.1 cases avoided each year.

The proposed Project will enable an additional 450 feet of pipeline to be constructed, and therefore will result in 2.1 percent of the benefits of the full Contra Costa Canal Flood Protection and Levee Elimination Project. This translates to a reduction in excess lifetime cancer cases attributable to the proposed Project of 0.15 fewer cancer cases per 70-year lifetime compared to baseline, or an average of 0.002 cases avoided each year.

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 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 dollars, this amounts to $9.22 million. This VSL estimate of $9.22 million (in 2012 dollars) per case of premature fatality avoided is applied in this assessment to the estimated reduction in risk of death (refer to Appendix 3.6-8, p 5-50, Table 5-9).

Based on the excess cancer cases avoided for this Project and the U.S. EPA-sanctioned estimate of the value of a statistical life, this Project would provide approximately $19,362 in benefits from avoided cancer cases annually (0.002 cancer cases avoided per year, times $9.22 million per avoided cancer

[7] US EPA Integrated Risk Management System, toxicological review for bromate. http://www.epa.gov/iris/subst/1002.htm

case). As calculated from PSP Table 15, the present value of this benefit attributable to the proposed project amounts to $270,147.

WQ2: Decreased Agricultural Runoff from Adjacent Fields

This benefit has not been monetized.

WQ3: Decreased Risk in Fecal Borne Pathogens Transported into the Canal

This benefit has not been monetized.

WQ4: Decreased Turbidity and Associated Solids Handling Requirements

As discussed in Attachment 7, implementing the full Project would result in an approximately four-fold reduction in turbidity during the beginning of rain events and the beginning of irrigation return flow, approximately 14 days per year. Turbidity accounts for roughly 25% of the solid waste that must disposed. Assuming that turbidity during those 14 days accounts for approximately 4 percent of the total solids attributable to turbidity (14/365), turbidity during those 14 days would account for approximately one percent of CCWD's total solids handling (0.04*0.25). A four-fold reduction in turbidity during those 14 days would therefore result in an overall 0.8 percent reduction in total solids handling requirements for CCWD (0.01*0.8). The portion attributable to the proposed Project (2.1 percent) would generate a 0.0168 percent reduction in CCWD's annual solids management requirements. CCWD's annual solids management requirements budget is approximately $600,000. This would equate to an annual solids handling savings of $101/year.

ENV1: Enabled Completion of Dutch Slough Tidal Marsh Restoration Project

Encasing the unlined Canal is a critical step for the completion of DWR's Dutch Slough Tidal Marsh Restoration Project, a tidal wetland restoration site just north of the Canal. DWR's Dutch Slough Tidal Marsh Restoration Project cannot move forward as planned until the Canal is replaced by a pipeline through this area. As specified in Mitigation term 3.1.1-5 of the Dutch Slough EIR Mitigation Monitoring and Reporting Program, "To avoid potential negative impacts to water quality within the Canal from groundwater intrusion, breaching of the Dutch Slough project site will not commence until encasement of the Canal south of the site is complete."

DWR's Dutch Slough Tidal Marsh Restoration Project, in the City of Oakley, is situated at a location and elevation which offer the only opportunity for an immediate and major tidal marsh restoration and research program in the western Delta. The 1,200 acre site is currently is the process of restoring over six miles of shoreline and a mosaic of tidal, riparian, and upland habitats. The resulting restored habitats will provide enhanced western Delta habitat for fish and wildlife. The unique site topography which is relatively unsubsided provides for immediate restoration of intertidal dendritic channels favored by native fish including threatened spring run Chinook salmon, endangered winter run Chinook salmon, and Sacramento splittail. The habitat restoration in the upland sites will allow for the development of riparian forest and shaded riverine habitats.

DWR's Dutch Slough Tidal Marsh Restoration Project is expected to provide important benefits to the larger Delta ecosystem. Numerous planning processes, including the Delta Vision Strategic Plan, the CALFED Ecosystem Restoration Plan, and the Bay Delta Conservation Plan, have identified restoring tidal marsh as integral to restoring the health of the Bay-Delta Ecosystem.

It has been assumed that the full value of the Dutch Slough Project will be realized approximately five years following completion of the pipeline, or in 2023. Wetland establishment/creation has a very high value given the difficulties of gaining regulatory approval for wetland development and the shortage of available wetlands on the open market. The market value of wetland establishment/creation is

increasing over time. CCWD has evidence to support a trend towards higher values for any wetlands that can be established and created based its own experience with purchasing wetlands to mitigate for project impacts.

The proposed Project would enable 450 feet of the 10,000 feet of Canal adjacent to the Dutch Slough Tidal Marsh Restoration Project to be encased in a buried Canal. This means that approximately 4.5 percent (450/10,000) of the benefits associated with preventing the delayed implementation of the Dutch Slough Tidal Marsh Restoration Project could be attributed to the proposed Project.

Approximately 4.5 percent of the benefits associated with preventing delays to implementation of the Dutch Slough Tidal Marsh Restoration Project could be attributed to the proposed Project, which would enable 450 of the 10,000 feet adjacent to the Dutch Slough Tidal Marsh Restoration Project to be encased in a buried pipeline.

In 2007, CCWD entered into an agreement with Wildlands Inc. to pay $60,000 per acre for seasonal wetland establishment/creation at the Holland Tract Preserve. CCWD obtained 48.6 wetland acres at the Holland Tract Preserve to mitigate for impacts from filling in the open Canal and replacing it with a pipeline as well as impacts from constructing a new intake along Victoria Canal. In 2010, CCWD entered an agreement with Wildlands Inc to pay $74,500 per acre for establishment of tidal wetlands at Liberty Island.

The East Contra Costa County Habitat Conservancy (Conservancy), implementing entity for the East Contra Costa County Habitat Conservation Plan / Natural Community Conservation Plan (ECCCHCP), 2013 fee is about $257,000 per acre of impact of seasonal wetlands. This fee amount builds in a 2:1 mitigation ratio and is based on an estimate of the Conservancy's past and future costs of seasonal wetland restoration. Therefore, the Conservancy's fee of $257,000 per acre of seasonal wetland impact translates to an estimated cost for seasonal wetland restoration of about $128,000 per acre restored or created. This figure represents an anticipated average cost, not a maximum cost. During a periodic evaluation of fee amounts, economists advising the Conservancy found that some seasonal wetland restoration projects in the greater East Bay area were costing as much as $750,000 per acre (Appendix 3-7.2 provides a Conservancy mitigation fee audit, and Appendix 3-7.3 summarizes mitigation fee adjustments).

CCWD has subsequently been seeking to obtain wetlands that can be applied to its SCPL Improvement Project. CCWD has been quoted prices varying from $800,000 (San Francisco District Wetland Mitigation Bank) to $500,000 (Newark Slough Wetland Mitigation Bank, not yet constructed). The $500,000 per acre price quoted by the Newark Slough Wetland Mitigation Bank is discounted from the expected asking price of $650,000 per acre. CCWD is currently working a turnkey mitigation site near Rheem Creek within the City of Richmond. The estimated cost of wetland developed at this location is approximately $363,000 per acre, assuming that 4.82 acre site of wetlands are developed on the ten acre property at one time. Price quotes from other wetland providers that could not be used by the District varied from $100,000 (Wildlands, Rivers Ranch in Yolo County, limited acreage available) to $200,000 (Elsie Gridely, Solano County and Grizzly Bay, Solano County) per acre.

Tidal wetland mitigation lands are in very limited supply and can cost up to $800,000 per acre. As explained above, CCWD will incur approximately $363,000 per acre for seasonal wetlands to mitigate its SCPL Improvement Project. The District was willing to compensate the East Contra Costa County HCP at $299,000 per acre; however, the East Contra Costa County HCP was not able to provide wetlands to

CCWD for a variety of reasons. Assuming a conservative estimate for the Dutch Slough Tidal Wetlands of $299,000 per acre, then by allowing the Canal to move forward this supports DWR creating 1,200 acres of wetlands with a market value of approximately $358.8 million.

Based on estimated costs of seasonal wetland restoration in the area, we have assumed the value of the completed Dutch Slough Project will be on the order of $358.8 M (1200 acres * $299,000 per acre), and that this benefit would be realized in 2023 (five years after the Canal is placed within a pipeline). The portion attributable to the Proposed Project is 4.5 percent of the total 1,200 acre benefit, or 54 acres. The value attributable to the proposed Project is therefore $16,146,000.

Without available funding to support replacement of the unlined Canal, the Dutch Slough Project would face substantial delays. It is assumed that, without expeditious completion of the proposed Project, the Dutch Slough project would not be implemented until 2033[8], which represents a ten-year delay. Preventing a ten-year delay in implementation of the Dutch Slough Project would translate to a net present value of $3,756,078 ($8,505,511 - $4,749,433). This represents the portion of the full benefit that can be attributed to completion of the proposed Project (4.5 percent).

ENV2: Reduction in Herbicide Treatment of Unlined Canal

An additional annual operating cost that would be avoided with the Contra Costa Canal Flood Protection and Levee Elimination Project is the elimination of the need to use aquatic pesticides. Further, with the Project, CCWD will avoid the need for future consultation with the Bureau of Reclamation, US Fish and Wildlife Service, National Marine Fisheries Service, and the Department of Fish and Game to obtain approval to use aquatic pesticides. These costs would be eliminated with Project implementation.

The reduction in maintenance costs is estimated to be $360,000 / year, and includes the following activities.

CCWD labor and contractor costs involved in the herbicide treatment include:

- Contractor to apply Sonar
- CCWD Maintenance staff to facilitate contractor field work (provide access, install stoplogs)
- CCWD Operations divert water from more expensive sources for the 2 months required for treatment (Canal is not used during treatment).
- CCWD Water Quality staff to regularly sample and analyze water quality
- CCWD Planning staff to report on permitted activity

This benefit has a present value of approximately $4.5 million over the life of the Contra Costa Canal Flood Protection and Levee Elimination Project. The portion attributable to the proposed Project (2.1%) is approximately $93,877.

ERG1: Energy Reduction

CCWD estimates that the energy savings derived from pipeline-related improvements to water quality will amount to over 490 MWH per year. This reduction in power usage translates to an annual cost savings of $98,000 per year for the full Project (Appendix 3-8.1 provides CCWD daily operations model outputs and energy usage calculations). This equates to a present value of approximately $1.2 million.

[8] CCWD assumes that the Canal must be replaced before DWR implements the Tidal Restoration Project. Proposition 1E Round 2 is the last known grant funding opportunity that CCWD is aware of that is of sufficient size to allow the District to fully pipe the area adjacent to the Dutch Slough Tidal Restoration Project. It is assumed that if CCWD does not obtain Proposition 1E Round 2 grant funding to support work adjacent to the Dutch Slough Tidal Restoration Project, the Dutch Slough Tidal Marsh Restoration would be delayed from 2018 to 2028 (ten years) and the new Dutch Slough wetlands would not be successfully completed until 2033.

The portion of benefits attributable to the proposed Project is approximately $28,732, as shown in PSP Table 15.

Table 8-7: Annual Energy Savings with Project

	Total Power Use [MWh/yr]	Annual Power Cost [$/yr]
Without Encasement	37,796	$4,551,014
With Encasement	37,306	$4,452,952
Energy and Cost Savings (Full Project)	**490**	**$98,062**
Portion Attributable to Proposed project (2.1 percent)	**10**	**$2,059**

ERG2: Greenhouse Gas Emission Reduction

As discussed in Attachment 7, the energy savings described above will generate a 460,000 pound-per-year reduction in CO_2 emissions through implementation of the full Contra Costa Canal Flood Protection and Levee Elimination Project, 9,670 of which can be attributed to the proposed project. Table 8-8 below shows the reduction in emissions of CO_2 as well as other GHGs.

Table 8-8: GHG Emissions With- and Without-Project

	Average Power Use CVP All Intakes [MWh/yr]	Average Power Use MID All Intakes [MWh/yr]	Average Power Use PG&E All Intake [MWh/yr]	Total CO2 Emissions [lbs/yr]	Total SO2 Emissions [lbs/yr]	Total NOx Emissions [lbs/yr]	Total CH4 Emissions [lbs/yr]	Total N2O Emissions [lbs/yr]
Without Encasement	19,325	10,093	8,377	13,241,573	422	1,948	189	20
With Encasement	19,324	9,605	8,376	12,781,105	403	1,886	180	19
Reduction in Energy & Greenhouse Gas Emissions (Full project)	**1**	**488**	**1**	**460,468**	**19**	**62**	**9**	**1**
Benefit Attributable to Proposed Project (2.1 percent)		**10**		**9,670**				

To monetize this benefit, we applied the dollar value assigned to greenhouse gas (GHG) emissions, measured in carbon dioxide equivalent (CO2e). 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 (IPCC, 2007). In February 2010, the U.S. Government's Interagency Working Group on Social Cost of Carbon issued guidance (Interagency Working Group, 2010) 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 CO2 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 CO2 emissions. Estimated percents of the net benefits occurring in the United States to the worldwide social cost of carbon[9] range from 7% to 23%.

For this analysis, the average value of $22.53/MT for 2012 was used when calculating social benefits and costs, which produces conservative estimates for the benefits and costs associated with GHG emissions. The United Kingdom has established an official estimate of the social cost of carbon for use in many of its project evaluations and models the growth rate of the cost at 2.4% per year in real terms. To determine total costs over the project period, we escalate the real 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 CO2 will produce larger incremental damages as physical and economic systems become more stressed in responding to greater climate change.

With an average annual GHG savings of 9,670 lb per year (4.4 MT per year), and assuming a 2012 benefit of $22.53, increasing at a rate of 2.4% per year, this equates to avoided social costs of GHG emissions of $2,229 over the 100-year project life.

This Project will also enable CCWD to secure fill material from the Upper Sand Creek Basin site. Without the project, CCWD would secure fill from an alternate location in Tracy. Assuming the standard capacity of 15 cy per truck, 5,000 truckloads (75,000 cy / 15 cy / truck) would be required to haul the fill. This equates to a 32 mile reduction, round-trip (distance from Canal site to Antioch is 10 miles one way, compared to 26 miles one way to Tracy).

As discussed in Attachment 7, reducing the hauling distance reduces GHG emissions by approximately 448,000 pounds (5,000 truckloads * 32 miles / truckload * 2.8 pounds / mile), or 203 MT, in 2018. Applying the same methodology described above, this equates to an avoided social impact of GHG emissions of $3,380 in 2018.

Together, the combined GHG reduction benefit over the 100-year project life is estimated to be $5,609.

OTH1: Reduced Security Risk

Currently, the open Canal presents a risk for drowning or other accidents. This is of particular concern because the area is being developed rapidly for residential use, with up to 8,000 homes planned for the area and 25,000 residents. Enclosing the Canal will completely eliminate this risk.

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[9] Interagency Working Group. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. Interagency Working Group on Social Cost of Carbon, United States Government. February. Available: www.epa.gov/oms/climate/regulations/scc-tsd.pdf. Accessed 7/13/2011.

IPCC. 2007. Summary for policymakers. In Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.). Cambridge University Press, Cambridge, UK. pp. 7–22.

According to CCWD's records, there have been a total of 70 drownings in the Canal since 1942 (70 drownings over 69 years). The accuracy of older records is uncertain, but records kept since 1972 indicate a total of at least 24 drownings have occurred in recent history (24 drownings over 39 years). This past history indicates a risk of at least 24 fatalities in 39 years, and possibly as many as 70 fatalities in 69 years. To be conservative, we have applied an average risk of 62 percent (24 / 39) that a drowning will occur in any given year. Enclosing the Canal in a pipeline will eliminate this risk. Applying the USEPA estimate of $9.22 million per VSL[10] as the value of reducing risks of premature death and the percentage of total benefit attributable to the proposed project (2.1 percent), the annual risk reduction benefit of the proposed Project amounts to $120,044 per year (0.62 times $9.22 million times 2.1 percent).
As shown in PSP Table 15, the present value of this benefit amounts to $$1,674,909 for the proposed Project.

In addition, the open Canal is highly vulnerable to intentional and unintentional contamination, and poses a security risk to the utility, its customers, and adjacent residents. This vulnerability is likely to increase as development increases in the area. Enclosing the Canal will eliminate this security risk. No monetary value has been assigned to the reduced security risk.

In addition, the open Canal presents a security risk. To offset this risk, CCWD currently patrols the Canal. Replacing the open Canal with a pipeline will greatly reduce the need to patrol the Canal. CCWD estimates an annual benefit of $129,000 in reduced costs to patrol the open Canal. Over the life of the Project, this amounts to $1.8 million (2.1%, or $ $37,797, attributed to the proposed Project).

Annual Benefits Table

PSP table 15, which summarizes present value of annual monetized benefits, is provided below.

Table 15 – Annual Benefit

(All benefits should be in 2012 dollars)

Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
2016	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.792	**$24,802**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.792	**$214,409**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.792	**$70,623**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.792	**$95,086**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.792	**$1,631**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.792	**$15,337**

[10] US EPA. 2013. Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter. EPA-452/R-12-005. Washington, DC. February 28. Table 5-9, p 5-50. http://www.epa.gov/ttnecas1/regdata/RIAs/finalria.pdf (Appendix 3-6.8)

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.792	**$5,988**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.792	**$2,146**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.792	**$80**
	GHG Emissions Reduction	MT CO2	4	0	4	$22.50	$99	0.792	**$78**
2017	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.747	**$23,398**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.747	**$202,272**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.747	**$66,626**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.747	**$89,704**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.747	**$1,539**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.747	**$14,468**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.747	**$5,649**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.747	**$2,024**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.747	**$75**
	GHG Emissions Reduction	MT CO2	4	0	4	$23.04	$101	0.747	**$76**
2018	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.705	**$22,074**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.705	**$190,823**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.705	**$62,854**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.705	**$84,627**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.705	**$1,452**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.705	**$13,649**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.705	**$5,330**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.705	**$1,910**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.705	**$71**
	Accelerated USCB Flood Protection	Dollars	0	28,739,187	28,739,187	$1	$28,739,187	0.705	**$20,259,993**
	GHG Emissions Reduction	MT CO2	208	0	208	$23.59	$4,898	0.705	**$3,453**
2019	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.665	**$20,824**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.665	**$180,022**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.665	**$59,296**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.665	**$79,836**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.665	**$1,370**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.665	**$12,877**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.665	**$5,028**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.665	**$1,802**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.665	**$67**
	GHG Emissions Reduction	MT CO2	4	0	4	$24.16	$106	0.665	**$70**
2020	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.627	**$19,646**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.627	**$169,832**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.627	**$55,940**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.627	**$75,317**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.627	**$1,292**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.627	**$12,148**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.627	**$4,743**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.627	**$1,700**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.627	**$63**
	GHG Emissions Reduction	MT CO2	4	0	4	$24.74	$109	0.627	**$68**
2021	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.592	**$18,534**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.592	**$160,219**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.592	**$52,774**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.592	**$71,054**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.592	**$1,219**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.592	**$11,460**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.592	**$4,475**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.592	**$1,603**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.592	**$60**
	GHG Emissions Reduction	MT CO2	4	0	4	$25.33	$111	0.592	**$66**
2022	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.558	**$17,484**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.558	**$151,150**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.558	**$49,786**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.558	**$67,032**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.558	**$1,150**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.558	**$10,812**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.558	**$4,221**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.558	**$1,513**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.558	**$56**
	GHG Emissions Reduction	MT CO2	4	0	4	$25.94	$114	0.558	**$64**
2023	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.527	**$16,495**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.527	**$142,594**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.527	**$46,968**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.527	**$63,238**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.527	**$1,085**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.527	**$10,200**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.527	**$3,983**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.527	**$1,427**
	Accelerated Dutch Slough Project Implementation	Wetland Acres	0	54	54	$299,000	$16,146,000	0.527	**$8,505,511**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.527	**$53**
	Accelerated USCB Flood Protection	Dollars	28,739,187	0	(28,739,187)	$1	-$28,739,187	0.527	**-$15,139,445**
	GHG Emissions Reduction	MT CO2	4	0	4	$26.56	$117	0.527	**$61**
2024	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.497	**$15,561**
	Avoided SWP	AFY	0	359	359	$754	$270,686	0.497	**$134,523**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	and CVP salinity releases								
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.497	**$44,310**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.497	**$59,658**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.497	**$1,023**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.497	**$9,622**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.497	**$3,757**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.497	**$1,346**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.497	**$50**
	GHG Emissions Reduction	MT CO2	4	0	4	$27.20	$119	0.497	**$59**
2025	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.469	**$14,680**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.469	**$126,908**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.469	**$41,802**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.469	**$56,281**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.469	**$965**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.469	**$9,078**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.469	**$3,544**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.469	**$1,270**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.469	**$47**
	GHG Emissions Reduction	MT CO2	4	0	4	$27.85	$122	0.469	**$57**
2026	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.442	**$13,849**
	Avoided SWP	AFY	0	359	359	$754	$270,686	0.442	**$119,725**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	and CVP salinity releases								
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.442	**$39,436**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.442	**$53,096**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.442	**$911**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.442	**$8,564**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.442	**$3,344**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.442	**$1,198**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.442	**$45**
	GHG Emissions Reduction	MT CO2	4	0	4	$28.52	$125	0.442	**$55**
2027	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.417	**$13,065**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.417	**$112,948**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.417	**$37,203**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.417	**$50,090**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.417	**$859**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.417	**$8,079**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.417	**$3,155**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.417	**$1,130**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.417	**$42**
	GHG Emissions Reduction	MT CO2	4	0	4	$29.21	$128	0.417	**$53**
2028	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.394	**$12,326**
	Avoided SWP	AFY	0	359	359	$754	$270,686	0.394	**$106,555**

Table 15 – Annual Benefit
(All benefits should be in 2012 dollars)
Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	and CVP salinity releases								
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.394	**$35,098**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.394	**$47,255**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.394	**$811**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.394	**$7,622**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.394	**$2,976**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.394	**$1,066**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.394	**$40**
	GHG Emissions Reduction	MT CO2	4	0	4	$29.91	$131	0.394	**$52**
2029	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.371	**$11,628**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.371	**$100,523**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.371	**$33,111**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.371	**$44,580**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.371	**$765**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.371	**$7,190**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.371	**$2,808**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.371	**$1,006**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.371	**$37**
	GHG Emissions Reduction	MT CO2	4	0	4	$30.63	$134	0.371	**$50**
2030	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.350	**$10,970**
	Avoided SWP	AFY	0	359	359	$754	$270,686	0.350	**$94,833**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	and CVP salinity releases								
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.350	**$31,237**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.350	**$42,057**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.350	**$721**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.350	**$6,783**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.350	**$2,649**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.350	**$949**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.350	**$35**
	GHG Emissions Reduction	MT CO2	4	0	4	$31.36	$138	0.350	**$48**
2031	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.331	**$10,349**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.331	**$89,465**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.331	**$29,469**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.331	**$39,676**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.331	**$681**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.331	**$6,399**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.331	**$2,499**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.331	**$895**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.331	**$33**
	GHG Emissions Reduction	MT CO2	4	0	4	$32.11	$141	0.331	**$47**
2032	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.312	**$9,763**
	Avoided SWP	AFY	0	359	359	$754	$270,686	0.312	**$84,401**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	and CVP salinity releases								
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.312	**$27,801**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.312	**$37,430**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.312	**$642**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.312	**$6,037**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.312	**$2,357**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.312	**$845**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.312	**$31**
	GHG Emissions Reduction	MT CO2	4	0	4	$32.88	$144	0.312	**$45**
2033	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.294	**$9,211**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.294	**$79,624**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.294	**$26,227**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.294	**$35,312**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.294	**$606**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.294	**$5,695**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.294	**$2,224**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.294	**$797**
	Accelerated Dutch Slough Project Implementation	Wetland Acres	54	0	(54)	$299,000	($16,146,000)	0.294	**($4,749,433)**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.294	**$30**
	GHG Emissions	MT CO2	4	0	4	$33.67	$148	0.294	**$43**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	Reduction								
2034	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.278	**$8,689**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.278	**$75,117**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.278	**$24,742**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.278	**$33,313**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.278	**$571**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.278	**$5,373**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.278	**$2,098**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.278	**$752**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.278	**$28**
	GHG Emissions Reduction	MT CO2	4	0	4	$34.48	$151	0.278	**$42**
2035	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.262	**$8,197**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.262	**$70,865**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.262	**$23,342**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.262	**$31,427**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.262	**$539**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.262	**$5,069**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.262	**$1,979**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.262	**$709**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.262	**$26**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$35.31	$155	0.262	**$41**
2036	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.247	**$7,733**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.247	**$66,854**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.247	**$22,021**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.247	**$29,648**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.247	**$509**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.247	**$4,782**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.247	**$1,867**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.247	**$669**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.247	**$25**
	GHG Emissions Reduction	MT CO2	4	0	4	$36.16	$159	0.247	**$39**
2037	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.233	**$7,296**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.233	**$63,069**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.233	**$20,774**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.233	**$27,970**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.233	**$480**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.233	**$4,511**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.233	**$1,761**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.233	**$631**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.233	**$23**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$37.02	$162	0.233	**$38**
2038	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.220	**$6,883**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.220	**$59,499**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.220	**$19,598**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.220	**$26,387**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.220	**$453**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.220	**$4,256**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.220	**$1,662**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.220	**$595**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.220	**$22**
	GHG Emissions Reduction	MT CO2	4	0	4	$37.91	$166	0.220	**$37**
2039	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.207	**$6,493**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.207	**$56,132**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.207	**$18,489**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.207	**$24,893**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.207	**$427**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.207	**$4,015**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.207	**$1,568**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.207	**$562**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.207	**$21**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$38.82	$170	0.207	**$35**
2040	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.196	**$6,126**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.196	**$52,954**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.196	**$17,442**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.196	**$23,484**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.196	**$403**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.196	**$3,788**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.196	**$1,479**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.196	**$530**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.196	**$20**
	GHG Emissions Reduction	MT CO2	4	0	4	$39.75	$174	0.196	**$34**
2041	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.185	**$5,779**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.185	**$49,957**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.185	**$16,455**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.185	**$22,155**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.185	**$380**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.185	**$3,573**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.185	**$1,395**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.185	**$500**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.185	**$19**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$40.71	$179	0.185	**$33**
2042	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.174	**$5,452**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.174	**$47,129**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.174	**$15,524**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.174	**$20,901**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.174	**$359**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.174	**$3,371**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.174	**$1,316**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.174	**$472**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.174	**$18**
	GHG Emissions Reduction	MT CO2	4	0	4	$41.69	$183	0.174	**$32**
2043	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.164	**$5,143**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.164	**$44,461**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.164	**$14,645**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.164	**$19,718**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.164	**$338**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.164	**$3,180**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.164	**$1,242**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.164	**$445**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.164	**$17**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$42.69	$187	0.164	**$31**
2044	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.155	**$4,852**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.155	**$41,945**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.155	**$13,816**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.155	**$18,602**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.155	**$319**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.155	**$3,000**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.155	**$1,171**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.155	**$420**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.155	**$16**
	GHG Emissions Reduction	MT CO2	4	0	4	$43.71	$192	0.155	**$30**
2045	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.146	**$4,577**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.146	**$39,571**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.146	**$13,034**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.146	**$17,549**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.146	**$301**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.146	**$2,830**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.146	**$1,105**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.146	**$396**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.146	**$15**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$44.76	$196	0.146	**$29**
2046	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.138	**$4,318**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.138	**$37,331**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.138	**$12,296**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.138	**$16,556**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.138	**$284**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.138	**$2,670**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.138	**$1,043**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.138	**$374**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.138	**$14**
	GHG Emissions Reduction	MT CO2	4	0	4	$45.83	$201	0.138	**$28**
2047	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.130	**$4,074**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.130	**$35,218**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.130	**$11,600**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.130	**$15,618**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.130	**$268**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.130	**$2,519**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.130	**$984**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.130	**$352**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.130	**$13**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$46.93	$206	0.130	**$27**
2048	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.123	**$3,843**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.123	**$33,224**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.123	**$10,944**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.123	**$14,734**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.123	**$253**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.123	**$2,377**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.123	**$928**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.123	**$333**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.123	**$12**
	GHG Emissions Reduction	MT CO2	4	0	4	$48.06	$211	0.123	**$26**
2049	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.116	**$3,626**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.116	**$31,344**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.116	**$10,324**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.116	**$13,900**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.116	**$238**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.116	**$2,242**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.116	**$875**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.116	**$314**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.116	**$12**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$49.21	$216	0.116	**$25**
2050	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.109	**$3,420**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.109	**$29,569**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.109	**$9,740**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.109	**$13,114**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.109	**$225**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.109	**$2,115**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.109	**$826**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.109	**$296**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.109	**$11**
	GHG Emissions Reduction	MT CO2	4	0	4	$50.39	$221	0.109	**$24**
2051	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.103	**$3,227**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.103	**$27,896**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.103	**$9,188**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.103	**$12,371**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.103	**$212**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.103	**$1,995**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.103	**$779**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.103	**$279**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.103	**$10**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$51.60	$226	0.103	**$23**
2052	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.097	**$3,044**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.097	**$26,317**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.097	**$8,668**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.097	**$11,671**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.097	**$200**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.097	**$1,882**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.097	**$735**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.097	**$263**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.097	**$10**
	GHG Emissions Reduction	MT CO2	4	0	4	$52.84	$232	0.097	**$23**
2053	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.092	**$2,872**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.092	**$24,827**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.092	**$8,178**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.092	**$11,010**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.092	**$189**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.092	**$1,776**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.092	**$693**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.092	**$248**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.092	**$9**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$54.11	$237	0.092	**$22**
2054	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.087	**$2,709**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.087	**$23,422**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.087	**$7,715**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.087	**$10,387**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.087	**$178**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.087	**$1,675**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.087	**$654**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.087	**$234**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.087	**$9**
	GHG Emissions Reduction	MT CO2	4	0	4	$55.41	$243	0.087	**$21**
2055	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.082	**$2,556**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.082	**$22,096**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.082	**$7,278**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.082	**$9,799**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.082	**$168**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.082	**$1,581**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.082	**$617**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.082	**$221**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.082	**$8**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$56.74	$249	0.082	**$20**
2056	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.077	**$2,411**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.077	**$20,845**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.077	**$6,866**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.077	**$9,245**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.077	**$159**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.077	**$1,491**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.077	**$582**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.077	**$209**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.077	**$8**
	GHG Emissions Reduction	MT CO2	4	0	4	$58.10	$255	0.077	**$20**
2057	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.073	**$2,275**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.073	**$19,665**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.073	**$6,477**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.073	**$8,721**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.073	**$150**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.073	**$1,407**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.073	**$549**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.073	**$197**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.073	**$7**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$59.50	$261	0.073	**$19**
2058	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.069	**$2,146**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.069	**$18,552**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.069	**$6,111**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.069	**$8,228**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.069	**$141**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.069	**$1,327**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.069	**$518**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.069	**$186**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.069	**$7**
	GHG Emissions Reduction	MT CO2	4	0	4	$60.92	$267	0.069	**$18**
2059	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.065	**$2,025**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.065	**$17,502**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.065	**$5,765**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.065	**$7,762**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.065	**$133**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.065	**$1,252**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.065	**$489**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.065	**$175**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.065	**$7**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$62.39	$274	0.065	**$18**
2060	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.061	**$1,910**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.061	**$16,511**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.061	**$5,439**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.061	**$7,323**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.061	**$126**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.061	**$1,181**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.061	**$461**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.061	**$165**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.061	**$6**
	GHG Emissions Reduction	MT CO2	4	0	4	$63.88	$280	0.061	**$17**
2061	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.058	**$1,802**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.058	**$15,577**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.058	**$5,131**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.058	**$6,908**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.058	**$119**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.058	**$1,114**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.058	**$435**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.058	**$156**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.058	**$6**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$65.42	$287	0.058	**$17**
2062	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.054	**$1,700**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.054	**$14,695**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.054	**$4,840**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.054	**$6,517**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.054	**$112**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.054	**$1,051**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.054	**$410**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.054	**$147**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.054	**$5**
	GHG Emissions Reduction	MT CO2	4	0	4	$66.99	$294	0.054	**$16**
2063	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.051	**$1,604**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.051	**$13,863**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.051	**$4,566**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.051	**$6,148**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.051	**$105**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.051	**$992**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.051	**$387**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.051	**$139**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.051	**$5**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$68.59	$301	0.051	**$15**
2064	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.048	**$1,513**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.048	**$13,079**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.048	**$4,308**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.048	**$5,800**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.048	**$99**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.048	**$936**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.048	**$365**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.048	**$131**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.048	**$5**
	GHG Emissions Reduction	MT CO2	4	0	4	$70.24	$308	0.048	**$15**
2065	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.046	**$1,427**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.046	**$12,338**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.046	**$4,064**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.046	**$5,472**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.046	**$94**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.046	**$883**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.046	**$345**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.046	**$123**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.046	**$5**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$71.93	$315	0.046	**$14**
2066	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.043	**$1,346**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.043	**$11,640**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.043	**$3,834**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.043	**$5,162**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.043	**$89**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.043	**$833**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.043	**$325**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.043	**$116**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.043	**$4**
	GHG Emissions Reduction	MT CO2	4	0	4	$73.65	$323	0.043	**$14**
2067	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.041	**$1,270**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.041	**$10,981**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.041	**$3,617**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.041	**$4,870**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.041	**$84**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.041	**$785**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.041	**$307**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.041	**$110**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.041	**$4**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$75.42	$331	0.041	**$13**
2068	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.038	**$1,198**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.038	**$10,359**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.038	**$3,412**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.038	**$4,594**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.038	**$79**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.038	**$741**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.038	**$289**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.038	**$104**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.038	**$4**
	GHG Emissions Reduction	MT CO2	4	0	4	$77.23	$339	0.038	**$13**
2069	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.036	**$1,131**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.036	**$9,773**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.036	**$3,219**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.036	**$4,334**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.036	**$74**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.036	**$699**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.036	**$273**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.036	**$98**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.036	**$4**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$79.08	$347	0.036	**$13**
2070	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.034	**$1,067**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.034	**$9,220**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.034	**$3,037**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.034	**$4,089**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.034	**$70**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.034	**$659**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.034	**$258**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.034	**$92**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.034	**$3**
	GHG Emissions Reduction	MT CO2	4	0	4	$80.98	$355	0.034	**$12**
2071	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.032	**$1,006**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.032	**$8,698**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.032	**$2,865**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.032	**$3,857**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.032	**$66**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.032	**$622**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.032	**$243**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.032	**$87**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.032	**$3**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$82.92	$364	0.032	**$12**
2072	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.030	**$949**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.030	**$8,206**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.030	**$2,703**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.030	**$3,639**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.030	**$62**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.030	**$587**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.030	**$229**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.030	**$82**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.030	**$3**
	GHG Emissions Reduction	MT CO2	4	0	4	$84.91	$372	0.030	**$11**
2073	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.029	**$895**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.029	**$7,741**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.029	**$2,550**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.029	**$3,433**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.029	**$59**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.029	**$554**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.029	**$216**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.029	**$77**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.029	**$3**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$86.95	$381	0.029	**$11**
2074	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.027	**$845**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.027	**$7,303**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.027	**$2,406**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.027	**$3,239**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.027	**$56**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.027	**$522**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.027	**$204**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.027	**$73**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.027	**$3**
	GHG Emissions Reduction	MT CO2	4	0	4	$89.04	$391	0.027	**$11**
2075	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.025	**$797**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.025	**$6,890**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.025	**$2,269**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.025	**$3,055**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.025	**$52**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.025	**$493**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.025	**$192**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.025	**$69**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.025	**$3**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$91.18	$400	0.025	**$10**
2076	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.024	**$752**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.024	**$6,500**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.024	**$2,141**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.024	**$2,882**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.024	**$49**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.024	**$465**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.024	**$182**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.024	**$65**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.024	**$2**
	GHG Emissions Reduction	MT CO2	4	0	4	$93.36	$410	0.024	**$10**
2077	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.023	**$709**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.023	**$6,132**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.023	**$2,020**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.023	**$2,719**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.023	**$47**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.023	**$439**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.023	**$171**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.023	**$61**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.023	**$2**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$95.60	$419	0.023	**$9**
2078	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.021	**$669**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.021	**$5,785**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.021	**$1,905**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.021	**$2,565**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.021	**$44**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.021	**$414**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.021	**$162**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.021	**$58**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.021	**$2**
	GHG Emissions Reduction	MT CO2	4	0	4	$97.90	$429	0.021	**$9**
2079	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.020	**$631**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.020	**$5,457**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.020	**$1,798**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.020	**$2,420**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.020	**$42**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.020	**$390**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.020	**$152**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.020	**$55**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.020	**$2**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$100.25	$440	0.020	**$9**
2080	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.019	**$596**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.019	**$5,148**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.019	**$1,696**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.019	**$2,283**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.019	**$39**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.019	**$368**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.019	**$144**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.019	**$52**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.019	**$2**
	GHG Emissions Reduction	MT CO2	4	0	4	$102.65	$450	0.019	**$9**
2081	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.018	**$562**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.018	**$4,857**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.018	**$1,600**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.018	**$2,154**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.018	**$37**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.018	**$347**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.018	**$136**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.018	**$49**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.018	**$2**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$105.12	$461	0.018	**$8**
2082	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.017	**$530**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.017	**$4,582**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.017	**$1,509**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.017	**$2,032**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.017	**$35**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.017	**$328**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.017	**$128**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.017	**$46**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.017	**$2**
	GHG Emissions Reduction	MT CO2	4	0	4	$107.64	$472	0.017	**$8**
2083	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.016	**$500**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.016	**$4,323**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.016	**$1,424**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.016	**$1,917**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.016	**$33**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.016	**$309**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.016	**$121**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.016	**$43**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.016	**$2**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$110.22	$483	0.016	**$8**
2084	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.015	**$472**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.015	**$4,078**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.015	**$1,343**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.015	**$1,809**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.015	**$31**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.015	**$292**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.015	**$114**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.015	**$41**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.015	**$2**
	GHG Emissions Reduction	MT CO2	4	0	4	$112.87	$495	0.015	**$7**
2085	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.014	**$445**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.014	**$3,847**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.014	**$1,267**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.014	**$1,706**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.014	**$29**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.014	**$275**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.014	**$107**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.014	**$39**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.014	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$115.58	$507	0.014	**$7**
2086	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.013	**$420**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.013	**$3,629**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.013	**$1,195**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.013	**$1,610**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.013	**$28**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.013	**$260**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.013	**$101**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.013	**$36**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.013	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$118.35	$519	0.013	**$7**
2087	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.013	**$396**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.013	**$3,424**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.013	**$1,128**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.013	**$1,518**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.013	**$26**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.013	**$245**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.013	**$96**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.013	**$34**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.013	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$121.19	$532	0.013	**$7**
2088	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.012	**$374**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.012	**$3,230**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.012	**$1,064**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.012	**$1,433**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.012	**$25**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.012	**$231**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.012	**$90**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.012	**$32**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.012	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$124.10	$544	0.012	**$6**
2089	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.011	**$353**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.011	**$3,047**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.011	**$1,004**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.011	**$1,351**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.011	**$23**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.011	**$218**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.011	**$85**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.011	**$30**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.011	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$127.08	$557	0.011	**$6**
2090	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.011	**$333**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.011	**$2,875**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.011	**$947**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.011	**$1,275**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.011	**$22**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.011	**$206**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.011	**$80**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.011	**$29**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.011	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$130.13	$571	0.011	**$6**
2091	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.010	**$314**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.010	**$2,712**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.010	**$893**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.010	**$1,203**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.010	**$21**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.010	**$194**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.010	**$76**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.010	**$27**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.010	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$133.25	$584	0.010	**$6**
2092	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.009	**$296**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.009	**$2,559**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.009	**$843**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.009	**$1,135**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.009	**$19**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.009	**$183**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.009	**$71**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.009	**$26**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.009	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$136.45	$599	0.009	**$6**
2093	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.009	**$279**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.009	**$2,414**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.009	**$795**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.009	**$1,070**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.009	**$18**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.009	**$173**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.009	**$67**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.009	**$24**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.009	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$139.73	$613	0.009	**$5**
2094	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.008	**$263**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.008	**$2,277**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.008	**$750**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.008	**$1,010**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.008	**$17**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.008	**$163**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.008	**$64**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.008	**$23**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.008	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$143.08	$628	0.008	**$5**
2095	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.008	**$248**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.008	**$2,148**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.008	**$708**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.008	**$953**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.008	**$16**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.008	**$154**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.008	**$60**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.008	**$21**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.008	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$146.51	$643	0.008	**$5**
2096	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.007	**$234**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.007	**$2,027**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.007	**$668**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.007	**$899**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.007	**$15**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.007	**$145**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.007	**$57**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.007	**$20**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.007	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$150.03	$658	0.007	**$5**
2097	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.007	**$221**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.007	**$1,912**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.007	**$630**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.007	**$848**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.007	**$15**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.007	**$137**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.007	**$53**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.007	**$19**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.007	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$153.63	$674	0.007	**$5**
2098	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.007	**$209**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.007	**$1,804**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.007	**$594**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.007	**$800**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.007	**$14**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.007	**$129**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.007	**$50**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.007	**$18**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.007	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$157.32	$690	0.007	**$5**
2099	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.006	**$197**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.006	**$1,702**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.006	**$560**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.006	**$755**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.006	**$13**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.006	**$122**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.006	**$48**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.006	**$17**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.006	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$161.09	$707	0.006	**$4**
2100	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.006	**$186**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.006	**$1,605**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.006	**$529**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.006	**$712**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.006	**$12**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.006	**$115**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.006	**$45**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.006	**$16**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.006	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$164.96	$724	0.006	**$4**
2101	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.006	**$175**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.006	**$1,514**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.006	**$499**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.006	**$672**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.006	**$12**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.006	**$108**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.006	**$42**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.006	**$15**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.006	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$168.92	$741	0.006	**$4**
2102	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.005	**$165**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.005	**$1,429**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.005	**$471**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.005	**$634**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.005	**$11**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.005	**$102**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.005	**$40**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.005	**$14**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.005	**$1**
	GHG Emissions Reduction	MT CO2	4	0	4	$172.97	$759	0.005	**$4**
2103	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.005	**$156**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.005	**$1,348**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.005	**$444**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.005	**$598**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.005	**$10**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.005	**$96**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.005	**$38**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.005	**$13**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.005	**$1**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$177.12	$777	0.005	**$4**
2104	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.005	**$147**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.005	**$1,272**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.005	**$419**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.005	**$564**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.005	**$10**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.005	**$91**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.005	**$36**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.005	**$13**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.005	**$0**
	GHG Emissions Reduction	MT CO2	4	0	4	$181.38	$796	0.005	**$4**
2105	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.004	**$139**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.004	**$1,200**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.004	**$395**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.004	**$532**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.004	**$9**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.004	**$86**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.004	**$34**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.004	**$12**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.004	**$0**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$185.73	$815	0.004	**$4**
2106	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.004	**$131**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.004	**$1,132**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.004	**$373**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.004	**$502**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.004	**$9**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.004	**$81**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.004	**$32**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.004	**$11**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.004	**$0**
	GHG Emissions Reduction	MT CO2	4	0	4	$190.19	$834	0.004	**$3**
2107	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.004	**$123**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.004	**$1,068**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.004	**$352**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.004	**$473**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.004	**$8**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.004	**$76**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.004	**$30**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.004	**$11**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.004	**$0**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$194.75	$854	0.004	**$3**
2108	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.004	**$117**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.004	**$1,007**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.004	**$332**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.004	**$447**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.004	**$8**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.004	**$72**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.004	**$28**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.004	**$10**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.004	**$0**
	GHG Emissions Reduction	MT CO2	4	0	4	$199.42	$875	0.004	**$3**
2109	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.004	**$110**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.004	**$950**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.004	**$313**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.004	**$421**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.004	**$7**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.004	**$68**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.004	**$27**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.004	**$10**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.004	**$0**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$204.21	$896	0.004	**$3**
2110	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.003	**$104**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.003	**$896**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.003	**$295**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.003	**$398**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.003	**$7**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.003	**$64**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.003	**$25**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.003	**$9**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.003	**$0**
	GHG Emissions Reduction	MT CO2	4	0	4	$209.11	$917	0.003	**$3**
2111	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.003	**$98**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.003	**$846**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.003	**$279**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.003	**$375**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.003	**$6**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.003	**$60**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.003	**$24**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.003	**$8**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.003	**$0**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$214.13	$939	0.003	**$3**
2112	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.003	**$92**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.003	**$798**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.003	**$263**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.003	**$354**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.003	**$6**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.003	**$57**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.003	**$22**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.003	**$8**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.003	**$0**
	GHG Emissions Reduction	MT CO2	4	0	4	$219.27	$962	0.003	**$3**
2113	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.003	**$87**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.003	**$753**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.003	**$248**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.003	**$334**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.003	**$6**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.003	**$54**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.003	**$21**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.003	**$8**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.003	**$0**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$224.53	$985	0.003	**$3**
2114	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.003	**$82**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.003	**$710**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.003	**$234**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.003	**$315**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.003	**$5**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.003	**$51**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.003	**$20**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.003	**$7**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.003	**$0**
	GHG Emissions Reduction	MT CO2	4	0	4	$229.92	$1,008	0.003	**$3**
2115	Emergency Supply	AFY	0	19	19	$1,648	$31,312	0.002	**$77**
	Avoided SWP and CVP salinity releases	AFY	0	359	359	$754	$270,686	0.002	**$670**
	Avoided SWP and CVP OMR releases	AFY	0	120	120	$743	$89,160	0.002	**$221**
	Reduced drownings	Drownings	0.62	0.60698	0.01302	$9,220,000	$120,044	0.002	**$297**
	Energy savings	Dollars	98,062	96,003	2,059	1	$2,059	0.002	**$5**
	Bromate cancer reduction	Excess cancer / yr	0.02	0.02	0.002	$9,220,000	$19,362	0.002	**$48**
	Canal Maintenance Savings	Dollars	$360,000	$352,440	$7,560	$1	$7,560	0.002	**$19**
	Avoided Patrolling	Dollars	$129,000	$126,291	$2,709	$1	$2,709	0.002	**$7**
	Reduced Solids Handling	Percent	1.000	0.9998	0.0002	$600,000	$101	0.002	**$0**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Disc. Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	4	0	4	$235.44	$1,033	0.002	**$3**
								…	
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$16,458,304**
Comments:									

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

Section D4 – Flood Damage Reduction Analysis

The full, five-phased Contra Costa Canal Levee Elimination and Flood Protection Project will replace 21,000 feet of the unlined Contra Costa Canal with a pipeline and install a Canal flood isolation structure that will allow CCWD to remotely isolate the Canal following a major flood or earthquake. Completion of the Project will reduce regional flood risk, improve water supply reliability, and improve delivered water quality for CCWD's customers. Secondary benefits include increasing water supply and water supply reliability for the State Water Project (SWP) and Central Valley Project (CVP) and improving public safety by limiting access to the open Canal. Segment 1 of the Project, encasement of the Canal from Pump Plant #1 to Marsh Creek, was completed in 2009. Construction of the flood isolation structure and Segment 2 pipeline is scheduled to begin in the summer of 2014.

The proposed Project will enable an additional 450 feet of pipeline to be constructed with existing Proposition 1E funding. The Contra Costa Canal Levee Elimination and Flood Protection Project is intricately linked with the Dutch Slough Tidal Marsh Restoration Project, which will construct 3.4 miles of new flood protection levees surrounding the Emerson, Gilbert and Burroughs Parcels adjacent to the Canal. Together, these projects will improve regional flood protection four-fold. Based on historical water levels, flood frequency curves in the area, and previous damage to the Canal, there is a 2% chance of major failure in the Canal embankments any given year. By eliminating the Canal embankments and upgrading the Dutch Slough levees, the risk of major flood damage in the region decreases from 2% in a given year to 0.5% or less.

Because the proposed Project will enable an additional 450 feet of pipeline to be constructed with the existing budget, 2.1 percent (450 / 21,000) of the flood protection benefits of the full, five-phased Contra Costa Canal Levee Elimination and Flood Protection Project may be attributed to the proposed project.

The region surrounding the unlined Canal has been historically used for agricultural purposes, but land use has changed dramatically since 2003. The region at greatest risk of flooding due to Canal levee failure is bounded by Dutch Slough to the north, Sandmound Slough to the east and the open, unlined

Canal to the south. Without the Project, approximately 555 residential units are at risk of flooding, and an additional 628 housing units in the Summer Lakes development would be isolated if the Canal failed. At least 32 miles of road are at risk of flooding, including the sole arterial access road for the majority of the regions' residents. At least 8 active gas wells are at risk of flooding in the region. In addition, there are overhead power transmission lines for Pacific Gas and Electric and Western Alliance Power Association that transect the region. An additional 3,000 acres are planned for urban development, and 1,200 acres will be restored to tidal wetlands as part of the Dutch Slough Tidal Marsh Restoration Project – all of which are at risk, should the Canal fail without the Project.

The Upper Sand Creek Basin project (USCB) is currently being implemented, using funding from Proposition 1E, to prevent flooding along the lower reach of Marsh Creek between Sand Creek and the Marsh Creek outfall into the Sacramento-San Joaquin River at Big Break in Oakley. The construction of USCB will expand an existing interim flood control basin from 41 acres in area to a final constructed area of approximately 62 acres, increasing the flood storage capacity of the basin from 123 acre feet to 900 acre feet with a 35-foot maximum depth. The expansion is being constructed by excavating the existing interim basin floor to create a deeper basin where water will be held and slowly released downstream during major storm events. Soil removed from the excavation is being used to construct an earthen dam on the northeast side of the basin to impound flood waters from major storm events. Remaining soil is being stockpiled for future use by interested parties. Currently, approximately 500,000 cubic yards of fill remains in the basin, reducing flood control capacity from 900 AF to 750 AF. FCD is actively pursuing alternatives to eliminate the 500,000 cubic yards of fill.

In addition, the proposed Project will consist of removing 75,000 cy of stockpiled, surplus earthen material from the USCB site, and reusing this material at the CCWD's Contra Costa Canal Levee Elimination and Flood Protection Project. By removing 75,000 cy of fill, capacity of the USCB will be increased by approximately 45 AF. The USCB project is dependent on favorable economic conditions to find users for the fill that is currently reducing basin capacity. By assisting in removing fill, it is estimated that this project will allow USCB to realize full flood protection approximately five years sooner than previously estimated (full benefits expected in 2018 rather than 2023). As such, the proposed project will accelerate the projected flood damage reduction benefits of the Proposition 1E-funded USCB project by approximately five years.

Benefits of accelerating the flood protection benefits of the USCB project are presented in PSP Table 15.

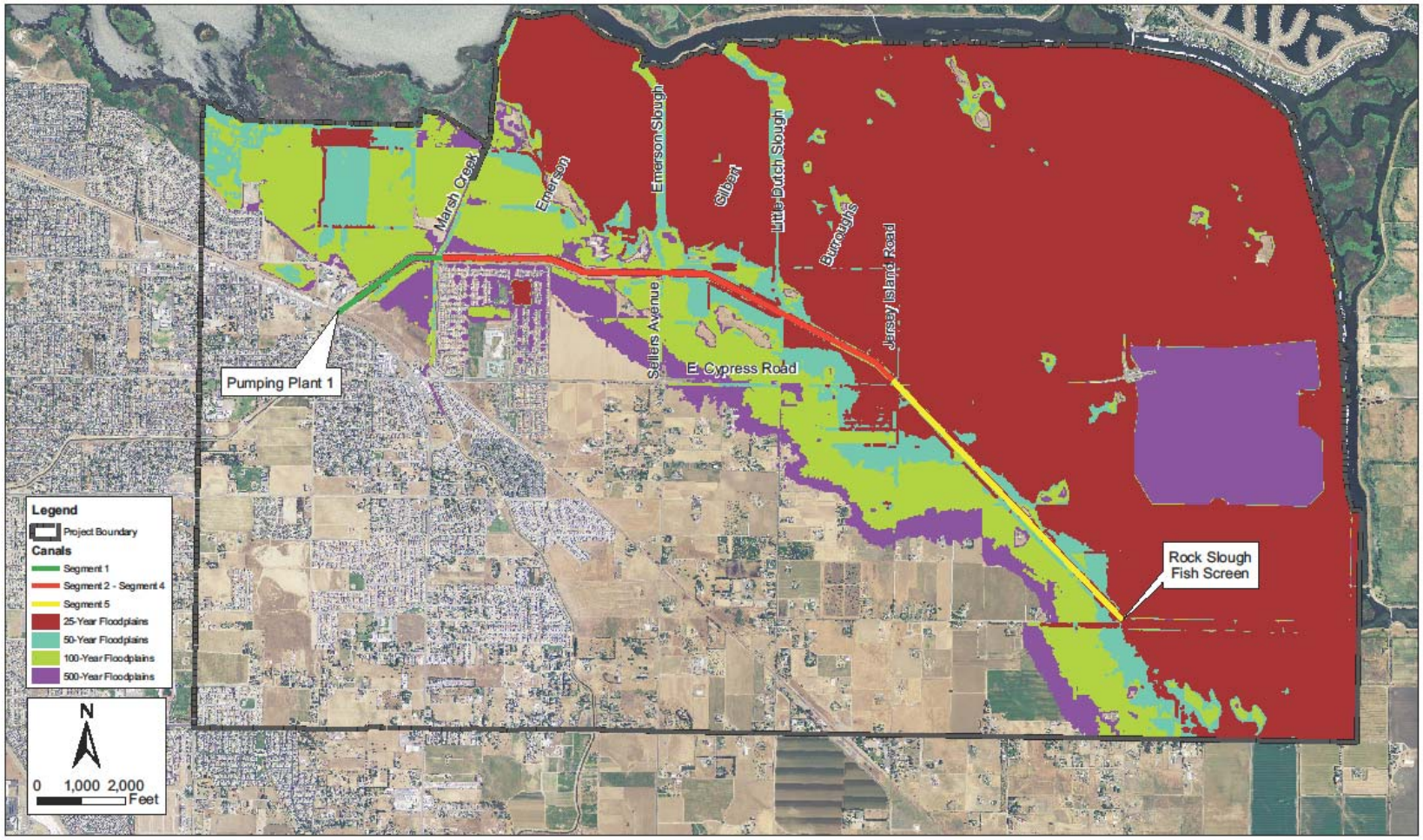
Without-Project Conditions

Figure 8-3 shows the areas that are currently at risk of flooding without the Contra Costa Canal Levee Elimination and Flood Protection Project. Table 8-9 presents various "Without Project" conditions for the selected hydrologic events (refer to Appendix 3-4.1).

Table 8-9: Structures At Risk of Flooding Without the Contra Costa Canal Levee Elimination and Flood Protection Project (Without East Cypress Corridor Development)

	25 year Event	50 year Event	100 year Event	500 year Event
Total Acreage	3,215	3,562	4,482	5,512
Number of Homes	560	580	650	2,362
Miles of Road	23	28	37	43
Number of Schools	2	2	2	4
Number of Gas Wells	6	8	8	8
Acres of Farmland	257	561	872	1,030
Acres of Commercial & Industrial Property	226	229	240	290
Acres of Easement for Overhead Power lines	123	123	123	123
Acres of Dutch Slough Tidal Marsh Restoration Project	1200	1200	1200	1200

Figure 8-3: Potential Inundation Areas for Various Levels of Flooding – Without the Contra Costa Canal Levee Elimination and Flood Protection Project



Aerial Source: NAIP 2012
FEMA Source: http://www.fema.gov/index.shtm
FEMA3.mxd

Similarly, implementation of the Upper San Creek Basin Flood Control Project would provide flood protection benefits, preventing property damage in the 100-year event. The area below the planned detention basin consists of Sand Creek (which provides little to no flood protection from relatively minor storms). Sand Creek enters into Marsh Creek, which has engineered banks intended to protect adjacent areas from flooding up to a 50-year event.

According to page 3 of the Economic Analysis – Flood Damage Reduction section of the successful Proposition 1E Round 1 application (Appendix 3-1.6), the area at risk covers over 10,000 acres, and includes residential developments (nearly 2000 homes), as well as over 250 commercial, industrial and institutional buildings. Figure 8-4 presents the 100-year floodplain for the Upper San Creek Basin flood control project.

The following damages would be prevented by the USCB project (refer to the economic analysis presented in Appendix 3-1.6):

- A 10-year event would conservatively be associated with a 2% probability of flooding in this area, with an associated damage loss of at least 2% of the property values at risk.
- A 50-year event would be associated with a 100% probability of flooding in this area, with an associated damage loss of at least 5% of the property values at risk.
- A 100-year flood event would conservatively be associated with a 100% probability of flooding in this area, with an associated damage loss of at least 10% of the property values at risk.

These damages would be avoided by implementation of the USCB project. The proposed project will accelerate the flood protection benefits of the full USCB project by approximately five years (shown in PSP Table 15).

A portion of the region at risk of flooding surrounding the unlined portion of the Canal is known as the East Cypress Corridor. The East Cypress Corridor Specific Plan included development of mixed-uses for the 2,546-acre site. The project planned up to 5,609 residential units, 92.6 acres of commercial use, 52.6 acres of public schools, 152.3 acres of man-made lake, 190 acres of open space/easements, 20.5 acres of existing and proposed gas well sites, 122.1 acres of wetlands/dunes, 46,100 feet of flood-control levees, 101.7 acres of parks (neighborhood and community), 5.7 acres of light industrial use, 37.3 acres of commercial recreation and a 6-acre beach club (refer to Appendix 3-4.8 for the East Cypress Corridor Specific Plan). Some of the planned development has been constructed but some of the proposed development has been delayed due to the poor economy. 23 acres of parks have been developed and the beach club house has been developed. Development is projected to resume in 2016. As such, the development is expected to be complete by the time the Project is completed and benefits begin to accrue in 2018. Existing and planned development in the without-Project project inundation areas is presented in the following table.

Figure 8-4: Parcels in 100-Year Floodplain Protected by USCB Project

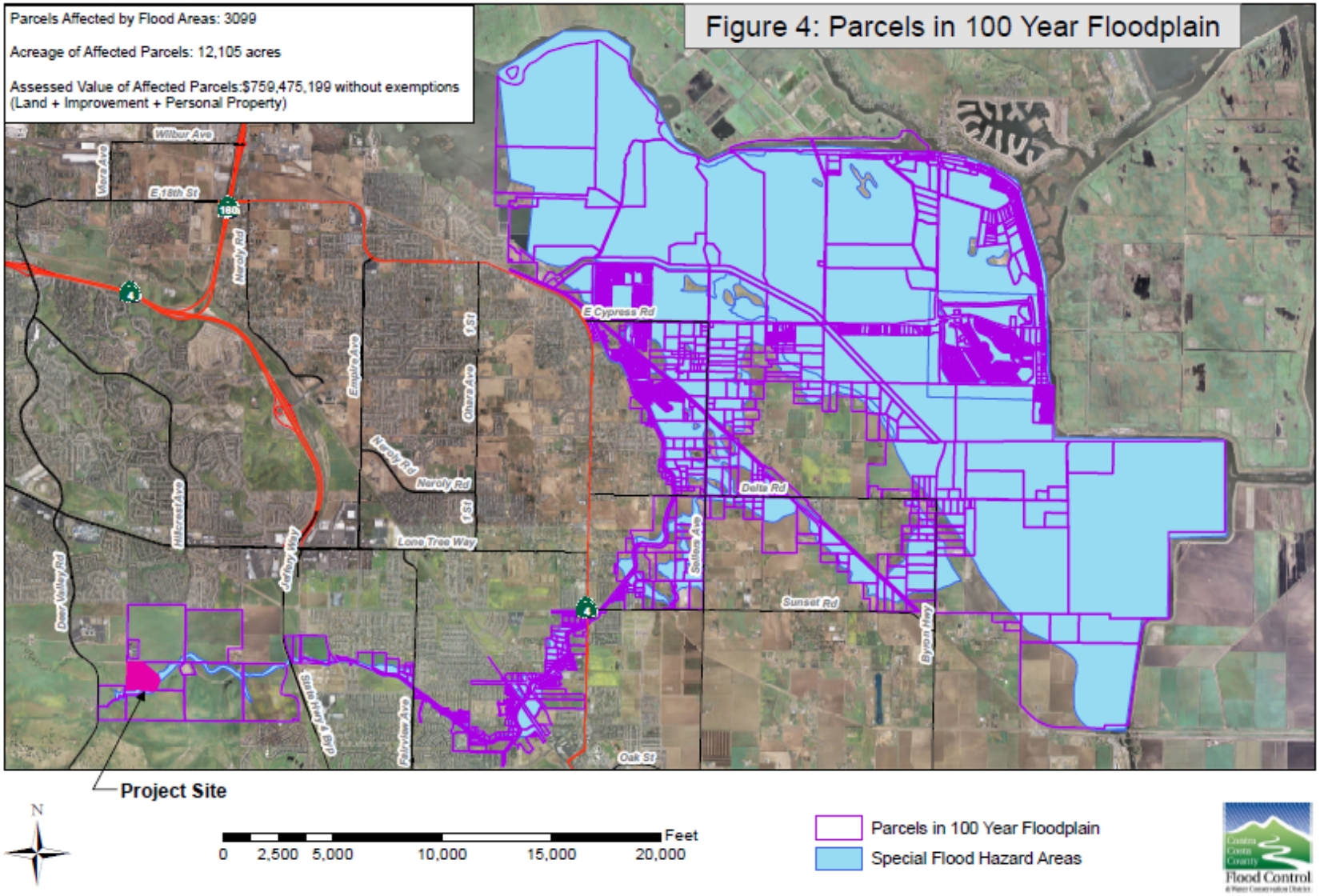


Table 8-10: Structures At Risk of Flooding Without the Contra Costa Canal Levee Elimination and Flood Protection Project (With East Cypress Corridor Development)

	25 year Event	50 year Event	100 year Event	500 year Event
Total Acreage	3,215	3,562	4,482	5,512
Number of Homes	6,169	6,189	6,259	7,971
Miles of Road	23	28	37	43
Number of Schools	3	3	3	5
Number of Gas Wells	6	8	8	8
Acres of Farmland	257	561	872	1,030
Acres of Commercial & Industrial Property	319	322	333	383
Acres of Easement for Overhead Power lines	123	123	123	123
Acres of Dutch Slough Tidal Marsh Restoration Project	1200	1200	1200	1200

The following flood damages would occur without the Contra Costa Canal Levee Elimination and Flood Protection Project. These damages are discussed in Attachment 7 and monetized in the following sections.

FD1: Residential and Commercial Structure and Content Damage

FD2: Loss of Agricultural Land Production

FD3: Loss of Gas Production

FD4: Damage to Dutch Slough Property

FD5: Road Inundation

FD6: Emergency Response Requirements

FD7: Supply Replacement Needs

FD1: Residential and Commercial Structure and Content Damage

Residential Damages

Median home values for the local area affected by the Canal project are presented in Table 8-8.

Table 8-11: Median Home Values in Project Vicinity

Community	Median Home Value[1]
Oakley	$221,200
Brentwood	$322,000
Antioch	$201,200
Rio Vista	$189,400
Discovery Bay	$384,800
Walnut Grove	$233,700
Average	**$258,717**

1. Values from www.zillow.com, accessed January 28, 2013

As shown in Table 8-11, a review of median home values in the Contra Costa Canal Levee Elimination and Flood Protection Project area revealed an average value of approximately $259,000 per home. To be conservative in reflecting likely sale prices and depreciation, this value was reduced by 15 percent, for an average structure value of approximately $220,150 ($259,000 * 0.85).

The Lincoln Institute of Land Policy maintains estimates of the average value of housing, land, and structures, and price indexes for land and housing, for the average single-family detached owner-occupied housing unit in each of 46 large metropolitan areas in the United States. The data set is quarterly spanning the 1984:4 – 2012:3 period.[11] The percent of total value attributable to the structure alone in quarter 3 of 2012 was found to be 83 percent for Sacramento, 30 percent for San Jose, and 40 percent for Oakland. We have conservatively assumed a value of 30 percent for this analysis, which translates to an average structure replacement value of $66,045 ($220,150 * 0.30).

Assuming the replacement value of each at-risk residential structure equals approximately $66,045, we calculate the total replacement value of at-risk residential property to be $407,431,605, $408,752,505, $413,375,655, $526,444,695 for the 25-year, 50-year, 100-year, and 500-year floods, respectively.

To estimate the percentage of structure value lost in each event, Structure Dept-Damage tables were applied, based on tables presented in the Army Corps of Engineers December 4, 2000 Economic Guidance Memorandum (EGM) 01-03, Generic Depth-Damage Relationships. The residential structures affected in the area were estimated to be primarily one-story structures without basements (approximately 80 percent), with some two-story structures, also without basements (approximately 20 percent). Based on the information presented previously, water depth in the inundated areas varies with return interval and location, but is generally expected to range from 1-12 ft in the residential areas inundated. For the purposes of this analysis, we have conservatively assumed an average depth of 1 foot above the first floor. The Army Corps Guidance Memorandum provides Structure Depth-Damage values of 23.3 percent and 15.2 percent for one- and two-story structures without basements, respectively. Assuming 80 percent of structures are one story and the remaining 20 percent of structures are two stories, this corresponds to an approximate value of 21.68 percent of structure value lost in a flooding

[11] Institute of Land Policy statistics can be accessed at: http://www.lincolninst.edu/subcenters/land-values/metro-area-land-prices.asp.

event with flood waters one foot above the first floor elevation (23.3 * 0.8 + 15.2 * 0.2). Applying this percentage to our total at-risk property values, we estimate structural damages in the 25-year, 50-year, 100-year, and 500-year flood events to be $88,331,172, $88,617,543, $89,619,842, and $114,133,210 ($407,431,605 * 0.2168, $408,752,505 * 0.2168, $413,375,655 * 0.2168, and $526,444,695 * 0.2168).

To estimate the value of contents damaged in each event, we refer to guidance provided in the Army Corps of Engineers document entitled Guidelines to Estimating Existing and Future Residential Content Values, dated June, 1993. This document recommends that, in the absence of site-specific content to structure value data, a value of 55 percent should be used (refer to recommendation #2). Following this guidance, we estimate the total value of residential contents at risk to be $224,087,383, $224,813,878, $227,356,610, and $289,544,582 for the 25-year, 50-year, 100- and 500-year flood event, respectively ($407,431,605 * 0.55, $408,752,505 * 0.55, $413,375,655 * 0.55, and $526,444,695 * 0.55). We then reviewed the Content Depth-Damage curves presented in the Army Corps of Engineers Economic Guidance Memorandum (EGM) 01-03, Generic Depth-Damage Relationships to find generic content damage values of 13.3 percent for a one-story home with no basement and 8.7 percent for a two-story home with no basement with flood waters reaching one foot above the first floor elevation. Assuming 80 percent of homes are one-story and 20 percent of homes are two-story, this gives us a content damage value of 12.38 percent (13.3 * 0.8 + 8.7 * 0.2). Applying this percentage to the total structural value at risk, we estimate residential structure content damages to be $27,742,018, $27,831,958, $28,146,748, and $35,845,619 for the 25-year, 50-year, 100-year, and 500-year events, respectively ($224,087,383 * 0.1238, $224,813,878 * 0.1238, $227,356,610 * 0.1238, and $289,544,582 * 0.1238).

In summary, the total residential damages, including damages to structures and content, is estimated to be $116,073,190, $116,449,501, $117,766,590, $149,978,829 for the 25-, 50-, 100- and 500-year flood events, respectively, for the full Contra Costa Canal Levee Elimination and Flood Protection Project.

As discussed in the successful Round 1 Proposition 1E funding application for the Upper Sand Creek Basin project (Appendix 3-1.6), the area at risk covers 12,000 acres, and includes residential developments (nearly 2000 homes), as well as over 250 commercial, industrial and institutional buildings, agricultural lands, and numerous arterial roads (including Highway 4) and bridges.

Property tax assessment records indicate the value of existing properties in the 100-year floodplain of these creeks amounts to $759 million. These tax assessment figures are likely to understate the true market value of these properties, and do not include the value of contents and other personal property that may also be at risk in these neighborhoods.

Approximately 15% of the properties at risk are located along the area at risk from flooding from Sand Creek ($112.4 million at risk = 15% of $749 million), and the remaining 85% of the at risk property values ($636.7 million = 85% of $749 million) are located in the areas subject to flooding from March Creek.

Sand Creek Area Damage Risks

Without the project, the properties along the Sand Creek portion of the watershed will continue to flood regularly from a wide range of storm events. Specific flood event frequency and associated damage estimates are not available, but regional experts indicate that it is reasonable to assume the following as baseline conditions (refer to economic analysis provided in Appendix 3-1.6).

- A 10-year event would conservatively be associated with a 2% probability of flooding in this area, with an associated damage loss of at least 2% of the property values at risk. Thus, the

expected loss in a 10-year event is conservatively estimated as $45,568 ($112.4 million*0.02*0.02).

- A 50-year event would be associated with a 100% probability of flooding in this area, with an associated damage loss of at least 5% of the property values at risk. Thus, the expected loss in a 50-year event is conservatively estimated as $5.7 M ($112.4 million*0.05).
- A 100-year flood event would conservatively be associated with a 100% probability of flooding in this area, with an associated damage loss of at least 10% of the property values at risk. Thus, the expected loss in a 100-year event is conservatively estimated as $11.2 million ($112.4 million*0.1).

Marsh Creek Area Damage Risks
At baseline, Marsh Creek properties are generally protected from all events up to and including 50-year storms. However, without the project, the $636.7 million in property value does remain at risk to storms of severity greater than the 1-in-50 year event. For example, in a 100 year event with a 100% of failure (flooding over the banks) and assuming damages amounting to 10% of assessed values, a loss would be incurred of over $63.7 million ($636.7 million *0.1).

Accelerated flood protection benefits of the USCB project are provided in PSP Table 15.

Commercial Damages
Commercial damages were estimated in the same manner as residential damages. The number of commercial facilities included in the inundation area was estimated based on acres of commercial and industrial land inundated, assuming an average of two structures per acre. Based on this analysis, it was estimated that approximately 638, 644, 666, and 766 structures would be at risk in a 25-year, 50-year, 100-year, and 500-year event, respectively. Property value data was not available for the at-risk commercial structures; as such, structure values have been conservatively estimated at $1 million each. The total at-risk value of commercial structures was therefore estimated to be approximately $638,000,000, $644,000,000, $666,000,000 and $766,000,000 for the 25-year, 50-year, 100-year and 500-year flood events, respectively.

To estimate the percentage of structure value lost in each event, Army Corps of Engineers commercial depth damage factors were applied (NRCS flood tools). Although there are multiple types of businesses located within the inundation area, the bulk of the commercial properties affected can be characterized as office buildings. As such, we conservatively applied the depth-damage factor for the category office buildings – general of 12 percent. This yielded estimated damages to commercial structures of $76,560,000, $77,280,000, $79,920,000, $91,920,000 for the 25-year, 50-year, 100-year and 500-year events, respectively ($638,000,000 * 0.12, $644,000,000 * 0.12, $666,000,000 * 0.12 and $766,000,000 * 0.12).

Ratios of content to structure value were not available for commercial properties. For the purposes of this analysis, we have conservatively assumed that the ratio of content value to structure value for the nonresidential properties affected is approximately 20 percent, less than half of the assumption used for residential properties. Based on this assumption, the value of at-risk contents in the inundation areas is approximately $127,600,000, $128,800,000, $133,200,000, and $153,200,000 for the 25-year, 50-year, 100-year and 500-year flood event, respectively ($638,000,00 * 0.2, $644,000,000 * 0.2, $666,000,000 * 0.2 and $766,000,000 * 0.2). The Army Corps of Engineers commercial depth damage factor for the category office building – general is 16 percent. Applying this factor to the at-risk content values calculated previously, we estimate commercial content damages to be $20,416,000, $20,608,000,

$21,312,000, and $24,512,000 for the 25-year, 50-year, 100-year, and 500-year floods, respectively ($127,600,000 * 0.16, $128,800,000 * 0.16, $133,200,000 * 0.16, and $153,200,000 * 0.16).

In summary, the total commercial damages, including damages to structures and content, is estimated to be $96,976,000, $97,888,000, $101,232,000, and $116,432,000 for the 25-, 50-, 100- and 500-year flood events, respectively. Data related to cleanup and debris removal costs are not available, and have therefore been excluded from this analysis.

FD2: Loss of Agricultural Land Production

Adjacent to the Canal is 1,030 acres of prime farmland, the annual revenue of which is estimated to be up to $600 per acre per year. The total estimated annual revenues associated with agricultural lands at risk from flooding are approximately $154,200, $336,600, $523,200, and $618,000 for the 25-year, 50-year, 100-year, and 500-year event, respectively. Assuming damages equal to 90 percent of the annual revenues, this corresponds to a loss of $138,780, $302,940, $470,880, $556,200 per year in the 25-year, 50-year, 100-year, and 500-year floods, respectively.

FD3: Loss of Gas Production

Adjacent to the Canal is a gas well field, which would be inundated in a 25-, 50-, 100- or 500-year flood event (6 wells inundated in the 25-year event and 8 wells inundated in all other events). Venoco owns the mineral rights on the Dutch Slough properties.[12] Per Venoco, the field produces natural gas from the Hamilton, Anderson, Martinez and McCormick formations at depths ranging from 6,500 to 8,300 feet. Average net production from the field was 1,344 per thousand cubic feet per day (Mcf/d) in December 2005. As of December 31, 2005, there were five producing wells in the field. Two new wells were drilled in the first quarter of 2006.

Assuming that current average well production is equal to one fifth of the 2005 average production for five wells, production is estimated at 269 Mcf/d per well. Assuming inundation would cause a loss of inundated wells for at least a two-week period (14 days), and considering current natural gas prices of approximately $3.03 / Mcf/d, this equates to a loss of $68,465 in the 25-year event (14 * $3.03 *269 * 6) and $91,288 in the 50-year, 100-year, and 500-year event (14 * $3.03 *269 * 8).[13]

FD4: Damage to Dutch Slough Property

DWR's Dutch Slough Tidal Marsh Restoration Project will restore a tidal wetland just to the north of the Project. This Project is a critical early action to improve the ecosystem health of the Sacramento-San Joaquin Delta, a point highlighted by Governor Schwarzenegger in a July 2007 statement and its inclusion in the Interim Delta Plan. The Dutch Slough property, purchased for approximately $23 M in 2003 ($2003), is located entirely within the inundation area. This translates to a 2012 value of $27.6 M. Assuming 50 percent of the land value would be lost in the event of an inundation, $13.8 M ($2012) of Dutch Slough property value would be at risk under the 25-, 50-, 100-, and 500-year flood event.

FD5: Road Inundation

Road inundation was estimated by comparing aerial imagery of roads within the project area with the inundation maps for each flood event. The following table summarizes the length of each road type expected to be inundated in the 25-, 50-, 100- and 500-year flood events. As shown in Table 8-12, major

[12] Summary provided at:http://www.wikinvest.com/stock/Venoco_(VQ)/Sacramento%20Basin>

[13] Gas prices estimated based on information accessed on January 28, 2013 from: http://www.eia.gov/dnav/ng/hist/n9190us3m.htm.

roads, including E. Cypress Road, Sellers Ave, Bethel Island Rd and Sandmound Rd, would experience significant inundation in all flood events analyzed.

Costs associated with road inundation were estimated using the default values within DWR's Flood Rapid Assessment Model (F-RAM). These default values assume the cost per mile of highway / arterial, major, minor, and unsealed roads to be $250,000, $100,000, $30,000, and $10,000, respectively. These assumptions are based on estimates developed for the San Francisco Bay Area. The inundation areas identified in the project area are also located within the San Francisco Bay Area. As such, it was determined that these values reasonably reflect the costs associated with road inundation in the project area. In total, these costs sum to $1,517,754, $1,847,701, $2,441,604, and $2,837,540 for the 25-year, 50-year, 100- and 500-year floods, respectively.

Table 8-12: Miles of Roads Inundated Without Project

Road	Category	Unit Cost ($/Mile Inundated)[1]	Miles Inundated				Inundation Cost				
			25-Year Event	50-Year Event	100-Year Event	500-Year Event	25-Year Event	50-Year Event	100-Year Event	500-Year Event	Total Cost
BETHEL ISLAND RD	Major	$100,000	2.3	2.8	3.71	4.31	$230,615	$280,749	$370,989	$431,150	$1,313,503
BROADWAY	Unsealed	$10,000	0.31	0.37	0.50	0.57	$3,075	$3,743	$4,947	$5,749	$17,513
DUTCH SLOUGH RD	Minor	$30,000	0.61	0.75	1.00	1.15	$18,449	$22,460	$29,679	$34,492	$105,080
CYPRESS AND EAST CYPRESS RD	Major	$100,000	4.61	5.61	7.41	8.62	$461,230	$561,497	$741,979	$862,299	$2,627,005
JERSEY ISLAND RD	Major	$30,000	4.61	5.61	7.41	8.62	$138,369	$168,449	$222,594	$258,690	$788,102
KNIGHTSEN AVE	Minor	$30,000	0.31	0.37	0.50	0.57	$9,225	$11,230	$14,840	$17,246	$52,540
TULE LN	Minor	$30,000	0.05	0.06	0.07	0.09	$1,384	$1,684	$2,226	$2,587	$7,881
COW POKE LN	Unsealed	$10,000	0.46	0.56	0.74	0.86	$4,612	$5,615	$7,420	$8,623	$26,270
FRANKLIN RD	Unsealed	$10,000	0.15	0.19	0.25	0.29	$1,537	$1,872	$2,473	$2,874	$8,757
WELLS RD	Minor	$10,000	2.00	2.43	3.22	3.74	$19,987	$24,332	$32,152	$37,366	$113,837
CACTUS LN	Minor	$10,000	0.05	0.06	0.07	0.09	$461	$561	$742	$862	$2,627
DELTA RD	Minor	$10,000	0.46	0.56	0.74	0.86	$4,612	$5,615	$7,420	$8,623	$26,270
MARINER RD	Minor	$10,000	0.15	0.19	0.25	0.29	$1,537	$1,872	$2,473	$2,874	$8,757
SANDMOUND BLVD	Major	$100,000	6.15	7.49	9.90	11.50	$614,973	$748,663	$989,305	$1,149,733	$3,502,674
SELLERS AVE	Minor	$10,000	0.77	0.94	1.24	1.44	$7,687	$9,358	$12,366	$14,372	$43,783
TOTAL			23	28	37	43	$1,517,754	$1,847,701	$2,441,604	$2,837,540	$8,644,599

In addition, the Upper Sand Creek Basin will provide protection from road inundation in the 100-year event. As discussed on page 3 of the Economic Analysis – Flood Damage Reduction section of the successful Proposition 1E Round 1 funding application (Appendix 3-1.6), while the 10- and 50-year events would not cause road inundation, the 100-year event would result in extensive road inundation. Road inundation was calculated utilizing GIS mapping of 100-year flood zone and measurement of the roads flooded. Based on this analysis, the following road distances would be inundated in a 100 year event: 17.3 miles of arterial roads, 3.0 miles of major roads, 36.0 miles of minor roads, and 11.4 miles of unsealed roads, for a total of 67.7 miles. The proposed project would accelerate protection of those roads by five years.

Table 8-13: Miles of Roads Inundated Without the Upper San Creek Basin Flood Control Project

Road Category	Miles Inundated		
	25-Year Event	50-Year Event	100-Year Event
Arterial	0.0	0.0	17.3
Major	0.0	0.0	3.0
Minor	0.0	0.0	36.0
Unsealed	0.0	0.0	11.4
Total	0.0	0.0	67.7

Accelerated flood protection benefits of the USCB project are provided in PSP Table 15.

FD6: Emergency Response Requirements

A conceptual cost estimate of levee repair was developed by CCWD for a 50 foot stretch of Canal failure. Table 8-14 below provides an estimate of the steps CCWD would take to repair the Canal and the associated cost. All values are approximate and in present day costs. To repair a 50 foot section of levee failure, it would cost approximately $576,000. This is a level of failure similar to the failures experienced in the past (see Attachment 7). This does not include the cost of any flood damages to other structures or the cost of potential service interruption for some customers.

Table 8-14: Structures At Risk of Flooding Without the Project

Conceptual Cost Estimate		
Repair 50' Breech Section of the Contra Costa Canal, Oakley, CA		
Initial Response and Condition Assessment		$10,000
	Mobilize; Perform emergency response and assessment of canal; Verify canal berm repair criteria. Duration: 3 days.	
Canal Isolation (Cofferdam)		$100,000
	Material procurement; Installation of cofferdam. Duration: 5 days.	
	Assumptions: - Hydrosack/sandbag cofferdam system	
Canal Berm Repair		$200,000
	Material hauling from borrow source; stockpile at site; material handling and placement for canal repair. Duration: 7 days.	
	Assumptions: - Typical Canal Berm Section (above adjacent ground): 600 square feet - Volume 50' Breech Section: 1,110 cubic yards (say 1,200 cubic yards)	
Return to Service		$50,000
	Site restoration; Removal of Cofferdam. Duration: 5 days.	
Miscellaneous		$40,000
	Contract Administration; Permits; Field Testing Services.	
Subtotal		***$400,000***
Contingency: 20%		$80,000
Subtotal		***$480,000***
Contractor Overhead, Insurance, Profit: 20%		$96,000
	Includes Emergency Response Premium (24/7 Work)	
Total		**$576,000**

FD7: Supply Replacement Needs

If the Canal failed in a similar fashion to the historical failures in the late 1990s, CCWD estimates that it would take approximately 20 days to repair the Canal and return the Canal to service. 20 days is roughly 5 percent of the year and that percent of CCWD's demand would need to be met by other water sources. The Rock Slough Intake/PP1 is the least expensive facility in CCWD's raw water system to operate. The cost of supplying water to the city of Brentwood is approximately $390 per AF because they only utilize water diverted at Rock Slough. CCWD's normal untreated water rate is approximately $575 per AF. However, this rate is subsidized and the true cost of delivering the water is approximately $754 per acre-foot, as shown in Appendix 3-5.5 to this Attachment. Assuming that during a Canal failure, CCWD's Canal supplies could be replaced with other CCWD water supplies, the cost to treat and deliver that supply would be $754 per AF, an increase of $364/AF. If CCWD could not supply the replacement water for some reason (catastrophic levee failures around the Delta), the replacement cost would be much greater. The cost of replacing Canal supply for a 20 day outage would be $1,659,512.

Table 8-15: Supply Replacement Costs in the Event of Canal Failure

	Amount of Demand Met by PP1 Diversions [AF/yr]	Percent of Annual Service Would be Interrupted by 20 day outage	Amount of Water that would need to be replaced [AF/yr]	Increase in Cost of Replacing Canal Supplies with Other Supplies $/AF	Replacement Cost of Water During 20 day Canal Outage
Brentwood [14]	19,500	5.5%	1,069	$364	$389,116
Complete CCWD Service Area	65,250	5.5%	3,589	$364	$1,306,396
Total					**$1,695,512**

Probability of Flood Structure Failure

Once the Project is implemented, risk of flooding due to Canal berm failure will be completely eliminated. Further, when the related Dutch Slough Tidal Marsh Restoration Project & East Cypress Corridor Projects move forward, the level of protection for the area will exceed the 200 year urban levee design criteria. As such, the probability of failure without the Project is estimated to be approximately 33% per year for the 25-year, 75% per year for the 50-year, 85% for the 100-year, and 100% for the 500-year event.

Estimate of Total Flood Damages

Table 8-16 below summarizes total monetized flood damages without the full, five-phased Project.

[14] http://www.brentwoodca.gov/pdf/newsletters/2010UWMP.pdf

Table 8-16: Total Estimated Flood Damages Without Project

Category	Estimated Damages Without Project			
	25-Year Event	**50-Year Event**	**100-Year Event**	**500-Year Event**
FD1: Residential Damages	$116,073,190	$116,449,501	$117,766,590	$149,978,829
FD1: Commercial / Industrial Damages	$96,976,000	$97,888,000	$101,232,000	$116,432,000
FD2: Agricultural Land Damage	$68,466	$91,288	$91,288	$91,288
FD3: Loss of Gas Production	$138,780	$302,940	$470,880	$556,200
FD4: Dutch Slough Property Damage	$13,800,000	$13,800,000	$13,800,000	$13,800,000
FD5: Road Inundation	$1,517,754	$1,847,701	$2,441,604	$2,837,540
FD6: Emergency Response	$576,000	$576,000	$576,000	$576,000
FD7: Supply Replacement Costs	$1,695,512	$1,695,512	$1,695,512	$1,695,512
Total Estimated Flood Damages	**$230,845,702**	**$232,650,942**	**$238,073,874**	**$285,967,369**

Accelerated flood protection benefits of the USCB project are provided in PSP Table 15.

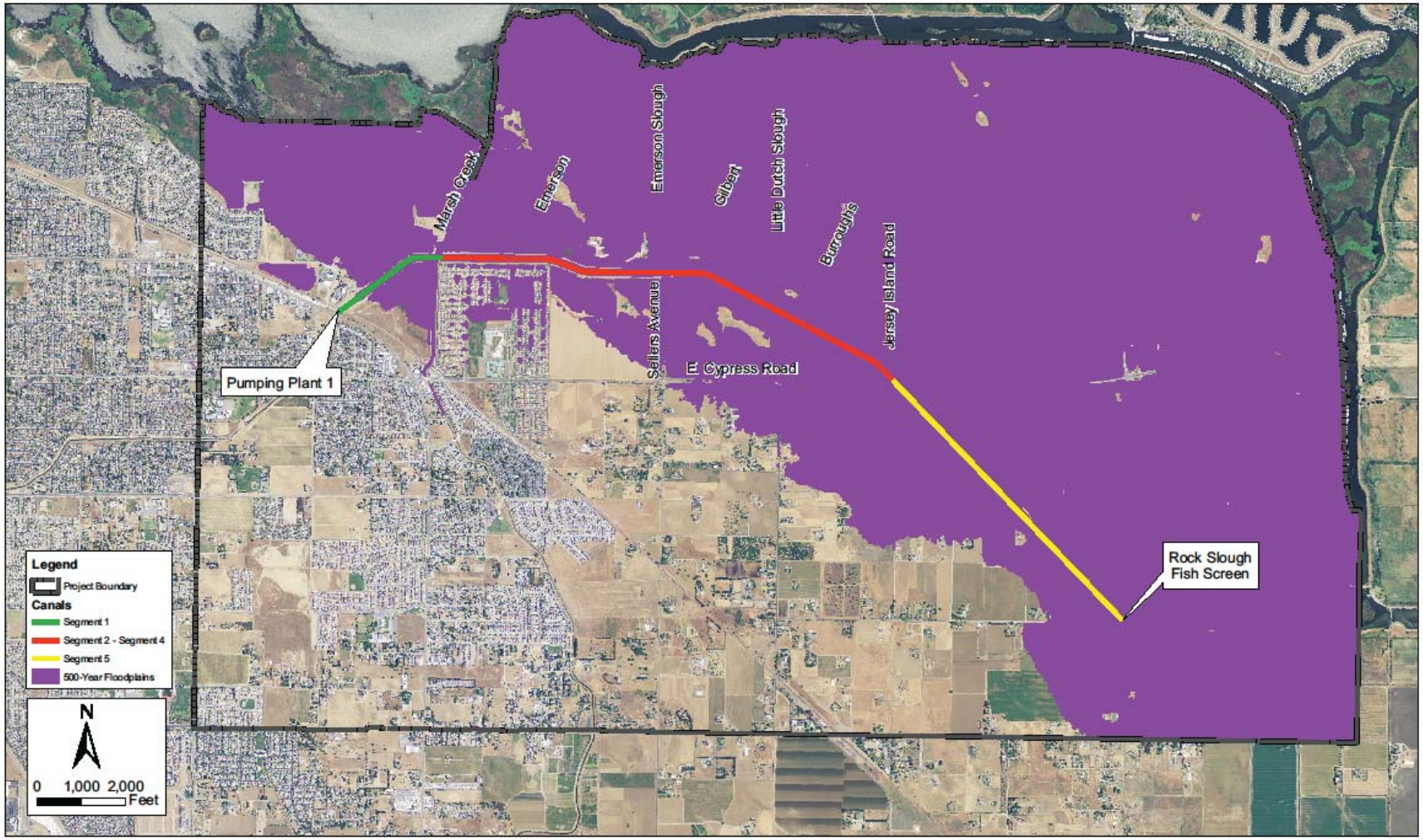
With-Project Conditions

Table 8-17 presents various "With-Project" conditions for the selected hydrologic events with implementation of the full, five-phased Contra Costa Canal Flood Protection and Levee Elimination Project. Once the full Project is implemented and levee improvements in the region have been made, the risk from the Canal failing will be eliminated; however, there will still be some level of flooding risk remaining from other levee failures or other sources of water such as Sandmound Slough and Marsh Creek. The levees in the region for the planned developments and the levees surrounding the Dutch Slough Tidal Marsh Restoration Project will be designed to withstand at least a 200 year flood. Therefore, the flooding risk currently present for an event with a return interval greater than 200 years will continue in the future once the Project is implemented. Figure 8-5 shows the inundation area for the 500-Year event with the Contra Costa Canal Flood Protection and Levee Elimination project. Appendix 3-4.3 provides FEMA inundation maps.

Table 8-17: Structures At Risk of Flooding With the Full Contra Costa Canal Flood Protection and Levee Elimination Project

	25 year Event	**50 year Event**	**100 year Event**	**500 year Event**
Number of Homes	0	0	0	5,512
Miles of Road	0	0	0	7,971
Number of Schools	0	0	0	43
Number of Gas Wells	0	0	0	5
Acres of Farmland	0	0	0	8
Acres of Commercial & Industrial Property	0	0	0	1,030
Acres of Easement for Overhead Power lines	0	0	0	383
Acres of Dutch Slough Tidal Marsh Restoration Project	0	0	0	1,200

Figure 8-5: Inundation Areas for 500-Year Event With the Contra Costa Canal Flood Protection and Levee Elimination Project



Aerial Source: NAIP 2012
FEMA Source: http://www.fema.gov/index.shtm
FEMA3.mxd

Estimate of Total Flood Damages

Implementation of the Contra Costa Canal Flood Protection and Levee Elimination Project was expected to eliminate expected damages for events smaller than the 200-year event. Table 8-18 summarizes the expected damages with the Contra Costa Canal Flood Protection and Levee Elimination Project. The portion attributable to the proposed Project, 2.1 percent, is also shown.

Table 8-18: Total Estimated Flood Damages With Project

Category	Estimated Damages Without Project			
	25-Year Event	50-Year Event	100-Year Event	500-Year Event[1]
FD1: Residential Damages	$0	$0	$0	$149,978,829
FD1: Commercial / Industrial Damages	$0	$0	$0	$116,432,000
FD2: Agricultural Land Damage	$0	$0	$0	$91,288
FD3: Loss of Gas Production	$0	$0	$0	$556,200
FD4: Dutch Slough Property Damage	$0	$0	$0	$13,800,000
FD5: Road Inundation	$0	$0	$0	$2,837,540
FD6: Emergency Response	$0	$0	$0	$576,000
FD7: Supply Replacement Costs	$0	$0	$0	$1,695,512
Total Estimated Flood Damages Avoided by Contra Costa Canal Flood Protection and Levee Elimination Project	**$0**	**$0**	**$0**	**$285,967,369**
Estimated Flood Damages Avoided by Proposed Project (2.1 Percent)	**$0**	**$0**	**$0**	**$6,005,314**

1. Assumed to equal the without-Project condition.

As shown on page 8 of the Economic Analysis attachment of the successful Proposition 1E application for the USCB Project (Appendix 3-1.6), the total projected flood benefits of project implementation are $27,902,123 in 2009 dollars. Escalating this to 2012 dollars yields a current estimate of projected benefits of $28,739,187 ($27,902,123*1.03). By removing 75,000 cy of fill from the flood control basin, this project reduces the USCB's dependence on economic conditions to find users for the fill currently taking up detention basin space. It is estimated that this project reduces the time required to realize full flood control benefits by approximately five years (from 2023 to 2018). The present value benefit of completing the USCB flood control benefits in 2018 instead of 2023 is $5,120,548 ($20,259,993 - $15,139,445). Accelerated flood protection benefits of the USCB project are provided in PSP Table 15.

With- and Without-Project Comparison

The economic analysis provides the cost and benefits for the with- and without-project conditions for the 100-year Project life. PSP Table 17 summarizes Expected Annual Damages under with- and without-project conditions. PSP Table 18 presents the present value of avoided flood damage benefits over a 100-year Project life, and using a 6 percent discount rate. The present value of avoided flood damages totals approximately $86.4 million. Because this Project represents approximately 2.1 percent of the full $96 million Project, the portion of benefits attributable to this project is approximately $1.8 million as shown in PSP Table 18.

In addition, the present value of accelerating benefits from the USCB project is $5,120,548, shown in PSP Table 15.

Annual Cost of Avoided Projects

Implementation of this project would not cause an alternate project or projects to be avoided. As such, Table 15 has not been included.

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, uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in Table 8-19 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect start and completed of construction activities in 2015. The operational life of the Project is assumed to be 100 years.
- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs including opportunity costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. All opportunity costs are accounted for including previous construction costs incurred since October 2008.
- 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 PSP Table 19, the present value of project costs, discounted at 6%, is estimated to be $1,243,604. This estimate includes all capital costs as well as costs associated with construction, administration, operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. Costs funded by local, State, federal agencies and non-profits are included. The initial costs presented in this table are equivalent to those presented in Attachment 4, with the exceptions identified above.

Capital costs are estimated to be $1,478,587, and will phased based as follows.

- $13,971 of project administration and planning/design/environmental work completed in 2013
- $13,971 of project administration and planning/design/environmental work completed in 2014
- $1,450,644 of project administration, construction contracting, construction / implementation, construction management , and environmental compliance / mitigation completed in 2015

No operations and maintenance costs are expected for this Project.

Table 17 – Example Calculation of Expected Annual Damage											
Event	Event Exceed. Prob.	Event Damage if Flood Structures Fail	Prob. Struct. Failure		Expected Event Damage		Interval Prob.	Average Damage in Interval		Average Damage in Interval times Interval Probability	
			W/o	W/	W/o	W/		W/o	W/	W/o	W/
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(i)	(j)	(k)	(l)	(m)
25-Year	0.04	$76,179,082	0.33	0	$76,179,082	$0					
50-Year	0.02	$174,488,206	0.75	0	$174,488,206	$0	0.02	$125,333,644	$0	$2,506,673	$0
100-Year	0.01	$202,362,793	0.85	0	$202,362,793	$0	0.01	$188,425,500	$0	$1,884,255	$0
500-Year	0.002	$285,967,369	1	1	$285,967,369	$285,967,369	0.008	$244,165,081	$142,983,685	$1,953,321	$1,143,869
Expected Annual Damages, Without and With the Full Contra Costa Flood Protection and Levee Elimination Project										$6,344,249	$1,143,869
Portion Attributable to Proposed Project (2.1 percent)										$133,229	$24,021
NOTE: Total damages presented are for the full $96 M project. Annual damages attributable to the proposed Project are approximately $133,229 without- and $24,021 with-Project (2.1% of total damages).											

Table 18 – Present Value of Expected Annual Damage Benefits Project: Integrated Regional Flood Protection and Water Quality Improvement Borrow Area Project			
(a)	Expected Annual Damage Without Project (1)		**$133,229**
(b)	Expected Annual Damage With Project (1)		**$24,021**
(c)	Expected Annual Benefit	(a) – (b)	**$109,208**
(d)	Present Value Coefficient (2)		**16.62**
(e)	**Present Value of Future Benefits of Contra Costa Canal Flood Protection and Levee Elimination project**	**(c) x (d)**	**$1,814,768**

(1) This program assumes no land use changes in the floodplain. So, EAD will be constant over analysis period.
(2) 6% discount rate; 50-year analysis period (could vary depending upon lifecycle of project).
(3) Present value of future benefits reflects present value of benefits for the proposed Project only.

Table 19 – Annual Costs of Project (All costs are in 2012 Dollars) Project: Integrated Regional Flood Protection and Water Quality Improvement Borrow Area 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									1.000	
2013	$13,971							$13,971	0.943	**$13,181**
2014	$13,971							$13,971	0.890	**$12,434**
2015	$1,450,644							$1,450,644	0.840	**$1,217,989**
….										
2114									0.003	**$0**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$1,243,604**
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

Project Benefits

PSP Table 20, below, summarizes benefits and costs for the proposed project.

Table 20 – Project Benefits and Costs Summary Proposal: East Contra Costa County Region – Proposition 84 Round 2 Grant Proposal Agency: Contra Costa Water District							
Project	Project Proponent	Total Present Value Project Costs (1)	Total Present Value Project Benefits			Cost-Eff.	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)
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area Project	CCWD	$1,243,604	$16,458,304	$1,814,768	$18,273,072	N/A	Education, reduced reliance on Delta supplies, environmental / habitat benefits

(1) From Table 19, or RWMG method

(2) From Table 15 or RWMG method

(3) From Table 18 or RWMG method

Project 4: Knightsen Wetland Restoration and Flood Protection

The Knightsen Wetland Restoration and Flood Protection Project includes the following elements:

1. Acquisition of an existing 645-acre parcel to treat and manage stormwater from the area,
2. Completion of the design of a 30-acre stormwater treatment wetland; and
3. Completion of construction of a 30-acre stormwater treatment wetland.

The proposed project, which is a phase of a larger, multi-objective project, will create 30-acres of new wetlands and treat contaminated flood/storm water near the unincorporated town of Knightsen. The proposed project will provide environmental (habitat and species) benefits as well as substantial water quality by removing contaminants from urban and agricultural run-off as well as flood control benefits.

This project is needed to and safely discharge (if needed) treated water into No Name Slough while also restoring a mosaic of habitats on site including but not limited to: Delta freshwater marsh, freshwater wetland, alkali wetland and tidally influenced sloughs.

In addition to creating 30 acres of stormwater detention and treatment wetlands on property currently used for irrigated agriculture, the Project provide substantial water quality benefits. Feasibility studies have been completed that examine flood control and water quality as well as habitat creation. The full Project, when completed, has the potential to provide:

- 320 acres of Freshwater Tidal Marsh
- 140 acres of (Alkali) Seasonal Wetland Complex
- 22 acres of Stabilized Interior Dune
- 157 acres of Oak Savanna
- Retain up to 160 acres of flood water from the great Knightsen area.

In addition to the immediate and local impacts to the area around Knightsen, improving the water quality of runoff in this area is particularly critical because contaminated storm water drains to Rock Slough and adjacent Delta waterways. Rock slough is the location for the intake to the Contra Costa Canal, a primary source of drinking water for central and eastern Contra Costa County.

This grant proposal outlines a comprehensive program to develop construction/ restoration plans that will then be implemented through this and future grants and/or the utilization of interagency partnerships. The 645-acre parcel proposed for the project was recently put up for sale and several potential partners have indicated a strong interest in acquiring the land for environmental protection purposes. Purchasing the property, completing the design and construction plans for this restoration, and initiating construction are the next critical steps in addressing flooding, water quality and habitat in the Knightsen area.

Existing Data and Studies

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

- Knightsen Water Quality Wetland Feasibility Assessment (2002) – Appendix 4-1
- Knightsen Habitat Restoration Feasibility Study (2013) – Appendix 4-2
- Property appraisal (confidential)

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in the following table.

Category	Summary	Present Value
Benefits		
	Wetlands creation	$2,869,471
Total Benefits		**$2,869,471**
Costs		
Present Value of Capital and O&M Costs		$4,813,624
Total Costs		**$4,813,624**

Without Project Conditions

Without the proposed project, conditions will remain as is.

The stormwater from the greater Knightsen area will regularly flood the town of Knightsen and agricultural areas (see Figure 8-6). The water will be drained to properties adjacent to the delta and pumped into sloughs (directly upstream from CCWD's water intake). The stormwater has historically caused property damage, contamination of groundwater/drinking water well sources and directs pollutants into the delta sloughs.

Figure 8-6: Photo Illustrating Ponded Agricultural Tailwater Flooding the Community of Knightsen and Draining to No Name Slough and Rock Slough (1997)

The opportunity to create and restore a mosaic of habitat that benefit water quality and listed species would be missed. Large parcels do not become available for sale frequently - often only once a generation. This parcel was identified in the 2002 feasibility study as a preferred location to store and treat stormwater. In 2012, Knightsen and the East Contra Costa County Habitat Conservancy funded a follow up feasibility study to examine the restoration potential on the site. Without the project there will be no habitat restoration and the parcel may remain in irrigated agriculture.

Description of Benefits and Methods to Estimate Benefits

The DWR method was used to assess 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 PSP Table 12, and are described in additional detail below.

Table 12 – 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? - 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?**	**Yes**

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	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?**	**No**
	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?**	**No**
	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**

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
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

The Project will test technologies and methods for using wetlands to treat stormwater.

2. Provide Social Recreation or Access Benefits

The completed Project (all phases) will provide a trail system for hikers and equestrians in the proposed uplands and along berms in the wetlands is proposed. Access to Delta water ways for person, non-motorized watercraft is also proposed.

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

The Project will avoid or reduce conflicts related to the Delta as a source of municipal water and as a place to drain storm water.

4. Promote Social Health and Safety

The Project will reduce flood risks.

5. Have Other Social Benefits

Not applicable

Environmental Stewardship Benefits

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

The Project will contribute to the recovery of habitat for special status species (not mitigation) required under the East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan.

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

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 Project will reduce groundwater pollution by preventing discharge of contaminated stormwater into wells.

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
The Project will develop a long term, sustainable means for treating and managing stormwater. The current situation is not effective, and stormwater regularly floods the local community and drains directly to Delta waterways.

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:

- Value of wetlands created

Monetized benefits, and the process for monetizing benefits, are discussed in the following paragraphs and summarized in PSP Table 15 below. Because no avoided projects have been identified and monetized, PSP Table16 has been omitted.

Value of Wetlands Created

This Project will create a 30-acre wetland on lands currently used for irrigated agriculture to treat contaminated storm water near the unincorporated town of Knightsen. It is assumed that the wetlands will be seasonal alkali wetlands.

The Conservancy, implementing entity for the ECCCHCP, currently charges a fee of about $257,000 per acre of impact of seasonal wetlands. This fee amount builds in a 2:1 mitigation ratio and is based on an estimate of the Conservancy's past and future costs of seasonal wetland restoration. Therefore, the Conservancy's fee of $257,000 per acre of seasonal wetland impact translates to an estimated cost for seasonal wetland restoration of about $128,000 per acre restored or created. This figure represents an anticipated average cost, not a maximum cost. During a periodic evaluation of fee amounts, economists advising the Conservancy found that some seasonal wetland restoration projects in the greater East Bay area were costing as much as $750,000 per acre.

Based on the Conservancy's estimated costs of seasonal wetland restoration in the area, we have assumed the value of the completed 30-acre seasonal wetland as approximately $3,840,000 (30 acres * $128,000 per acre). This value is realized on completion of the project in 2017. As such, this benefit has a present value of $2,869,471, shown in PSP Table 15.

Annual Benefits Table

PSP table 15, which summarizes present value of annual monetized benefits, is provided below.

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Knightsen Wetland Restoration and Flood Protection									
(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	0.840	**$0**
2016							$0	0.792	**$0**
2017	Wetlands Created	Acres	0	30	30	$128,000	$3,840,000	0.747	**$2,869,471**
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$2,869,471**
Comments:									

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

Section D4 – Flood Damage Reduction Analysis

Flood damage reduction has not been monetized for this Project. As such, PSP Tables 17 and 18 have 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, uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in Table 19 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect start and completion of construction activities in 2016. The operational life of the Project is assumed to be 100 years.
- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs including opportunity costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. All opportunity costs are accounted for.
- 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 PSP Table 19, the present value of project costs, discounted at 6%, is estimated to be $4,813,624. This estimate includes all capital costs as well as costs associated with construction, administration, operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. Costs funded by local, State, federal agencies and non-profits are included. The initial costs presented in this table are equivalent to those presented in Attachment 4, with the exceptions identified above.

Capital costs are estimated to be $5,458,750, and will phased based as follows.

- $4,865,000 in land acquisition and project administration in 2013
- $283,750 in project administration and design in 2014
- $310,000 in construction, construction administration, project administration, and other expenses completed in 2016

No operations and maintenance costs are expected for this Project.

Table 19 – Annual Costs of Project (All costs are in 2012 Dollars) Project: Knightsen Wetland Restoration and Flood Protection Project										
	Initial Costs Grand Total Cost	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									1.000	
2013								$0	0.943	**$0**
2014	$4,865,000							$4,865,000	0.890	**$4,329,833**
2015	$283,750							$283,750	0.840	**$238,242**
2016	$310,000							$310,000	0.792	**$245,549**
2115								$0	0.002	**$0**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$4,813,624**
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

Project Benefits

PSP Table 20, below, summarizes benefits and costs for the proposed project.

Table 20 – Project Benefits and Costs Summary Proposal: East Contra Costa County Region – Proposition 84 Round 2 Grant Proposal Agency: Contra Costa Water District							
Project	Project Proponent	Total Present Value Project Costs (1)	Total Present Value Project Benefits			Cost-Effectiveness Analysis, Cost Savings	Briefly describe the main Non-monetized benefits
			From Section D3 – Monetized (2)	Flood Damage Reduction (3)	Total		
(a)	(b)	(c)	(d)	(e)	(f) = (d) + (e)	(g)	(h)
Knightsen Wetland Restoration and Flood Protection Project	Contra Costa County	$4,813,624	$2,869,471	N/A	$2,869,471	N/A	Environmental restoration, water quality protection, stormwater management

(1) From Table 19, or RWMG method

(2) From Table 15 or RWMG method

(3) From Table 18 or RWMG method

Project 5: Recycled Water Salinity Reduction and Distribution System Expansion Project

The Recycled Water Salinity Reduction and Distribution System Expansion Project will improve recycled water quality and provide operational benefits, cost savings, and expand recycled water capacity by reducing total dissolved solids (TDS) concentration in recycled water produced at Delta Diablo Sanitation District (DDSD). This project involves the installation of approximately 9,200 lineal feet of 6" high density polyethylene (HDPE) pipe and appurtenances to redirect a high TDS brine line from Dow to the DDSD wastewater treatment plant downstream of the recycled water facility. This will reduce recycled water TDS concentrations by 15% to 20%. Reduced TDS concentration will allow increased cycling ratios for cooling purposes, thus freeing up an additional 170 AFY of recycled water capacity and allowing DDSD to reliably meet peak demands. In addition, the project will reduce TDS throughout DDSD's recycled water system, improving water quality for all of DDSD's industrial and irrigation customers. New recycled water service will also be established for several use sites for landscape irrigation and for industrial purposes located in disadvantaged communities in the Cities of Antioch and Pittsburg.

Existing Data and Studies

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

- Recycled Water Master Plan (Jan. 2013) – Appendix 5-1
- TDS Reduction Advanced Treatment Feasibility Study (Feb. 2012) – Appendix 5-2
- Technical Memorandum, Final Effluent Quality Analysis with Dow Industrial Waste Relocation, (November 2012) Appendix 5-3
- Regional Water Quality Control Board approval letter, February 28, 2013 – Appendix 5-4
- Final Biological Assessment and the Cultural Resources Inventory Report, March 2013 (prepared in support of the Recycled Water Master Plan/Title XVI Feasibility Study Report) – Appendix 5-5
- Draft Diablo Water District Well Utilization Project Phase 2 and Future Phase 3 Environmental Impact Report, Jones and Stokes (August 2008) – Appendix 5-6

Summary of Monetized Benefits and Costs

The projected monetized project benefits and costs are summarized in the following table.

Category	Summary	Present Value
Benefits		
Water supply benefits	Avoided Delta supply	$592,289
Energy	Avoided energy costs	$51,957
	Avoided Social Costs of GHGs	$2,373
Other Physical Benefits	Avoided fertilizer costs	$55,717
Avoided Project Costs	Avoided side-stream reverse osmosis treatment	$6,909,841
Total Benefits		**$7,612,177**
Costs		
Present value of Capital and O&M Costs		$3,077,498
Total Costs		**$3,077,498**

Without Project Conditions

There are two main components to the Project: the TDS reduction component and the new user connections component. Without-Project conditions for each are discussed below.

TDS reduction component: Without the Project, sidestream reverse osmosis (RO) treatment would be implemented to reduce TDS in the brine line from Dow to the DDSD wastewater treatment plant. As such, without the Project, TDS would continue to be reduced by approximately 200 mg/L, however at a much higher cost.

New user connections: Without the Project, new recycled water service would not be established for landscape irrigation and / or industrial purposes located in disadvantaged communities in the Cities of Antioch and Pittsburg. No new users would be connected, and no additional recycled water would be served over current quantities. DDSD would discharge the same quantity of treated effluent, on average, and the same mass of constituents to the environment, as is currently discharged. Because the use of Delta water requires more energy than the use of recycled water, CO_2 emissions would continue to be greater than they would be with project implementation. In addition, when potable water is used for irrigation, irrigators must apply additional fertilizer because the potable water does not contain common fertilizing constituents common in recycled water (e.g., nitrogen, phosphorus, & potassium). This would result in increased fertilizer costs to the schools and other city use sites. Recycled water is a drought-resistant supply, increasing reliability and availability during potable water shortages.

With Project Conditions

With the Project, recycled water would be expanded to new users, offsetting 75.6 AFY of Delta supplies in the Cities of Pittsburg and Antioch with recycled water supplies.

In addition, high TDS in recycled water requires more frequent blowdown discharge, increasing the overall water demand for cooling tower operations. With the Project, TDS in the entire recycled water stream would be reduced by approximately 200 mg/L. Reducing the recycled water TDS will allow LMEC and DEC to concentrate the water within the cooling tower more before blowdown discharge, reducing the amount of water they purchase and reducing the amount of chemicals needed for conditioning within the cooling towers for both the with-Project and without-Project (sidestream RO) conditions by approximately 170 AFY.

The Project will also connect the Dow Wetlands project as a new recycled water user, with recycled water used to maintain 471 acres of wetland habitat through augmentation of water supply. The Dow Wetlands are home to endangered species (salt marsh harvest mouse, Mason's lileaopsis, Suisun aster) and threatened species (black shouldered kites, northern harrier).

With the Project, energy usage will be reduced, as recycled water production and distribution requires less energy than Delta supplies. By offsetting Delta supplies with recycled water supplies, energy consumption and associated greenhouse gas emissions are reduced.

Finally, because recycled water is higher in nutrients than Delta supplies and the Project will enable use of recycled water for irrigation in lieu of Delta supplies, the need for fertilizer application will be reduced.

Description of Benefits and Methods to Estimate Benefits

The DWR method was used to assess 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 PSP Table 12, and are described in additional detail below.

Table 12 – 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?**	**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?**	**No**
	Examples are not limited to, but may include:	

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- 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?**	**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?**	**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?**	Yes
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?	

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- 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

The Project will provide recycled water to parks and schools for irrigation. During dry years, supplies to golf courses, parks, and schools can be restricted, limiting recreation. Use of recycled water in lieu of Delta water will improve reliability and ensure suitable fields for recreation even during dry years.

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

Not applicable

4. Promote Social Health and Safety

Not applicable

5. Have Other Social Benefits

Not applicable

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

DDSD routinely meets wastewater discharge regulations for its wastewater effluent, but any reduction in discharge in mass of pollutants helps the overall water quality of the Delta ecosystem.

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
Less water will be purchased from CCWD due to this project, therefore CCWD will divert less water from the Delta.

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
Recycled water is a drought-resistant supply and is less variable due to year-to-year variations in rainfall or snowmelt. Switching customers from potable water supply to recycled water will avoid the need for demand cut backs during droughts, ensuring that their full demand will be met each year.

15. Other
Not applicable

Section D3 – Monetized Benefits Analysis

The following benefits have been monetized for this Project:

- Delta supply offset with recycled water
- Avoided cost of sidestream reverse osmosis for TDS reduction
- Reduction in energy usage
- Reduction in nutrient application requirements:
    - Nitrogen
    - Phosphorus
    - Potassium

Monetized benefits, and the process for monetizing benefits, are discussed in the following paragraphs and summarized in PSP Table 15 below. Because no avoided projects have been identified and monetized, PSP Table16 has been omitted.

Delta Supply Offset with Recycled Water

As discussed on pages 3-6 and 3-10 of the DDSD RW Master Plan/Feasibility Study Report (provided as Appendix 5-1 to this Attachment), the Project would offset 75.6 AFY of Delta supplies in the Cities of Pittsburg and Antioch with recycled water supplies. Over the 50 year project life, this equates to 3,780 AF of Delta supplies offset.

The current cost of CCWD supply is $592 / AF. This translates to an avoided cost of $44,755 per year, as shown in PSP Table 15. Over the 50-year project life, this equates to an avoided cost of $592,289.

Avoided Cost of Sidestream Reverse Osmosis Treatment

If the TDS reduction component of this project is not implemented, sidestream reverse osmosis will be implemented to achieve a 200 mg/L TDS reduction and free up an additional 170 AFY of recycled water capacity. The cost of implementing a 1-mgd sidestream process is detailed in Table 4-3 on page 4-9 of the TDS Reduction Advanced Treatment Feasibility Study (provided as Appendix 5-2). The total capital cost is estimated to be $3,550,000. Operations and maintenance costs are presented on the same page, in Table 4-10. For a 1-mgd facility, O&M costs are estimated to be $197,000 per year. In order to achieve a 200-mg/L TDS reduction, a 1.1-mgd facility would be required. Scaling these values accordingly, we find a capital cost of $4,970,000 and an annual O&M cost of $220,640 per year. Over the 50-year project life, these avoided costs amount to $6,909,841, as shown in PSP Table 16.

Energy-Related Benefits

By offsetting Delta water demands with recycled water, the project will reduce energy usage by replacing Delta supplies with less energy-intensive recycled water supplies.

DDSD does not have specific data on the amount of energy (and associated carbon emissions) required to import water from the Delta (via CCWD) to the City of Pittsburg. However, this information is available for DWD. For this analysis, it is assumed that the energy required to transport water to DWD customers is approximately equal to that required to deliver Delta water to customers within the Cities of Pittsburg and Antioch.

In Table 5-7 (page 5-25) of its Draft Environmental Impact Report for the Well Utilization Project (provided as Appendix 5-6), DWD estimates that it requires 0.728 MWh to treat and deliver one AF of water from the Delta. Further, for every MWh of electricity used to import water, 0.222 MT of CO_2 are emitted. Thus, every acre-foot of Delta water generates approximately 0.162 metric tons (MT) of CO_2 (0.728 MWh/AF multiplied by 0.222 MT/MWh). By avoiding the use of 75.6 AFY of Delta water per year, the project will avoid use of 55 MWh of energy and 12 MT of emissions per year. Over the 50-year project life, by avoiding use of 3,780 AF of Delta supply, the project will avoid 2,752 MWh of energy use and emission of 612 MT of CO_2.

Avoided carbon emissions will be offset to some extent by the energy required to pump and treat recycled water. Based on data provided by DDSD, 0.328 MWh are required to produce and distribute one AF of recycled water within the District. Using the same CO_2 emissions rate of 0.222 MT/MWh, for every AF of recycled water delivered within the District, 0.073 MT of CO_2 are emitted (0.328 MWh/AF multiplied by 0.222 MT/MWh). This translates to annual energy use and emissions of 24.8 MWh and 5.5 MT CO2 per year, respectively. Over the 50-year lifetime of the project, total energy use and CO_2 emissions associated with recycled water production and distribution will amount to 1,240 MWh and 276 MT, respectively. Thus, with the project, net avoided energy use and carbon emissions will be 1,512 MWh and 336 MT, respectively.

Based on the Recycled Water Master Plan, DDSD's current energy costs are $0.13 / kWh, or $130/MWh. Over the 50-year life of the Project, this translates to an avoided energy cost of $51,957 (as calculated from PSP Table 15).

To monetize the benefit of reduced GHG emissions, we applied the dollar value assigned to GHG emissions, measured in CO_2e. 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 (IPCC, 2007). In February 2010, the U.S. Government's

Interagency Working Group on Social Cost of Carbon issued guidance (Interagency Working Group, 2010) 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 CO2 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 CO2 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.[15]

For this analysis, the average value of $22.53/MT for 2012 was used when calculating social benefits and costs, which produces conservative estimates for the benefits and costs associated with GHG emissions. The United Kingdom has established an official estimate of the social cost of carbon for use in many of its project evaluations and models the growth rate of the cost at 2.4% per year in real terms. To determine total costs over the project period, we escalate the real 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 CO2 will produce larger incremental damages as physical and economic systems become more stressed in responding to greater climate change.

With an average annual GHG savings of 5.5 MT per year, and assuming a 2012 benefit of $22.53, increasing at a rate of 2.4% per year, this equates to avoided social costs of GHG emissions of $2,373 over the 50-year project life.

Reduction in Nutrient Application Requirements

In absence of the project, potable water will continue to be used for the 75.6 AFY of irrigation that would be met through recycled water with following project implementation. Because recycled water contains higher concentrations of fertilizing compounds (e.g., nitrogen, phosphorous, potassium) than commonly contained in Delta supplies, offsetting Delta supplies with recycled water for irrigation will result in a decrease in fertilizer required.

DDSD's recycled water contains 95 lbs of nitrogen per AF, 0.2 lbs of phosphorous per AF, and 17 lbs of potassium per AF. Each year following project implementation, the project will avoid 7,182 lbs of nitrogen application, 15 lbs phosphorus application, and 1,285 lbs potassium application.

The commercial value of these concentrations of fertilizing compounds amounts to $41.32, $0.36, and $14.01 per AF of recycled water. Thus, for every AF of the recycled water used in lieu of potable water, a total of $55.69 in fertilizer costs will be avoided. For the 75.6 AF of recycled water applied each year in-lieu of Delta water (beginning in 2016), avoided fertilizer costs will be about $4,210 (2012 USD). Over the lifetime of the project, total present value avoided fertilizer costs will amount to $55,717.

Annual Benefits Table

PSP table 15, which summarizes present value of annual monetized benefits, is provided on the following page. Table 15 presents benefits associated with connection of new users.

[15] Interagency Working Group. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. Interagency Working Group on Social Cost of Carbon, United States Government. February. Available: www.epa.gov/oms/climate/regulations/scc-tsd.pdf. Accessed 7/13/2011.

IPCC. 2007. Summary for policymakers. In Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.). Cambridge University Press, Cambridge, UK. pp. 7–22.

PSP Table 16 summarizes avoided costs associated with implementing side stream reverse osmosis for TDS reduction, which would be implemented if the salt reduction portion of the proposed project were not implemented. Because the benefits in PSP Table 15 pertain to a different project component than the benefit provided in PSP Table 16, no double-counting has occurred.

Table 15 – Annual Benefit
(All benefits should be in 2012 dollars)
Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	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	**$0**
2016	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.792	**$35,450**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.792	**$3,110**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.792	**$3,335**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$22.50	$124	0.792	**$98**
2017	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.747	**$33,444**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.747	**$2,934**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.747	**$3,146**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$23.04	$127	0.747	**$95**
2018	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.705	**$31,551**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.705	**$2,768**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.705	**$2,968**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$23.59	$130	0.705	**$91**
2019	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.665	**$29,765**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.665	**$2,611**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.665	**$2,800**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$24.16	$133	0.665	**$88**
2020	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.627	**$28,080**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.627	**$2,463**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.627	**$2,642**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$24.74	$136	0.627	**$85**
2021	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.592	**$26,491**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.592	**$2,324**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.592	**$2,492**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$25.33	$139	0.592	**$82**
2022	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.558	**$24,991**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.558	**$2,192**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.558	**$2,351**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$25.94	$143	0.558	**$80**
2023	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.527	**$23,576**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.527	**$2,068**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.527	**$2,218**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$26.56	$146	0.527	**$77**
2024	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.497	**$22,242**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.497	**$1,951**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.497	**$2,092**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$27.20	$150	0.497	**$74**
2025	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.469	**$20,983**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.469	**$1,841**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.469	**$1,974**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	5.5	0	6	$27.85	$153	0.469	**$72**
2026	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.442	**$19,795**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.442	**$1,736**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.442	**$1,862**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$28.52	$157	0.442	**$69**
2027	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.417	**$18,675**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.417	**$1,638**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.417	**$1,757**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$29.21	$161	0.417	**$67**
2028	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.394	**$17,618**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.394	**$1,545**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.394	**$1,657**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$29.91	$164	0.394	**$65**
2029	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.371	**$16,620**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.371	**$1,458**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.371	**$1,564**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$30.63	$168	0.371	**$63**
2030	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.350	**$15,680**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.350	**$1,375**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.350	**$1,475**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$31.36	$172	0.350	**$60**
2031	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.331	**$14,792**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.331	**$1,298**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.331	**$1,392**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$32.11	$177	0.331	**$58**
2032	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.312	**$13,955**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.312	**$1,224**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.312	**$1,313**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$32.88	$181	0.312	**$56**
2033	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.294	**$13,165**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.294	**$1,155**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.294	**$1,238**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$33.67	$185	0.294	**$54**
2034	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.278	**$12,420**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.278	**$1,089**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.278	**$1,168**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$34.48	$190	0.278	**$53**
2035	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.262	**$11,717**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.262	**$1,028**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.262	**$1,102**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$35.31	$194	0.262	**$51**
2036	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.247	**$11,054**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.247	**$970**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.247	**$1,040**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	5.5	0	6	$36.16	$199	0.247	**$49**
2037	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.233	**$10,428**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.233	**$915**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.233	**$981**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$37.02	$204	0.233	**$47**
2038	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.220	**$9,838**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.220	**$863**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.220	**$925**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$37.91	$209	0.220	**$46**
2039	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.207	**$9,281**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.207	**$814**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.207	**$873**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$38.82	$214	0.207	**$44**
2040	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.196	**$8,755**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.196	**$768**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.196	**$824**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$39.75	$219	0.196	**$43**
2041	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.185	**$8,260**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.185	**$725**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.185	**$777**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$40.71	$224	0.185	**$41**
2042	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.174	**$7,792**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.174	**$684**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.174	**$733**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$41.69	$229	0.174	**$40**
2043	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.164	**$7,351**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.164	**$645**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.164	**$692**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$42.69	$235	0.164	**$39**
2044	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.155	**$6,935**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.155	**$608**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.155	**$652**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$43.71	$240	0.155	**$37**
2045	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.146	**$6,543**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.146	**$574**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.146	**$615**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$44.76	$246	0.146	**$36**
2046	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.138	**$6,172**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.138	**$541**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.138	**$581**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$45.83	$252	0.138	**$35**
2047	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.130	**$5,823**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.130	**$511**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.130	**$548**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	5.5	0	6	$46.93	$258	0.130	**$34**
2048	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.123	**$5,493**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.123	**$482**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.123	**$517**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$48.06	$264	0.123	**$32**
2049	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.116	**$5,182**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.116	**$455**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.116	**$488**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$49.21	$271	0.116	**$31**
2050	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.109	**$4,889**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.109	**$429**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.109	**$460**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$50.39	$277	0.109	**$30**
2051	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.103	**$4,612**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.103	**$405**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.103	**$434**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$51.60	$284	0.103	**$29**
2052	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.097	**$4,351**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.097	**$382**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.097	**$409**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$52.84	$291	0.097	**$28**
2053	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.092	**$4,105**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.092	**$360**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.092	**$386**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$54.11	$298	0.092	**$27**
2054	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.087	**$3,873**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.087	**$340**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.087	**$364**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$55.41	$305	0.087	**$26**
2055	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.082	**$3,653**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.082	**$320**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.082	**$344**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$56.74	$312	0.082	**$25**
2056	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.077	**$3,447**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.077	**$302**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.077	**$324**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$58.10	$320	0.077	**$25**
2057	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.073	**$3,251**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.073	**$285**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.073	**$306**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$59.50	$327	0.073	**$24**
2058	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.069	**$3,067**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.069	**$269**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.069	**$289**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	GHG Emissions Reduction	MT CO2	5.5	0	6	$60.92	$335	0.069	**$23**
2059	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.065	**$2,894**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.065	**$254**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.065	**$272**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$62.39	$343	0.065	**$22**
2060	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.061	**$2,730**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.061	**$239**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.061	**$257**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$63.88	$351	0.061	**$21**
2061	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.058	**$2,575**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.058	**$226**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.058	**$242**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$65.42	$360	0.058	**$21**
2062	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.054	**$2,430**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.054	**$213**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.054	**$229**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$66.99	$368	0.054	**$20**
2063	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.051	**$2,292**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.051	**$201**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.051	**$216**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$68.59	$377	0.051	**$19**
2064	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.048	**$2,162**

Table 15 – Annual Benefit (All benefits should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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	Unit $ Value (1)	Annual $ Value (1) (f) x (g)	Discount Factor (1)	Discounted Benefits (1) (h) x (i)
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.048	**$190**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.048	**$203**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$70.24	$386	0.048	**$19**
2065	Avoided Delta supply	AFY	0	75.6	75.6	$592	$44,755	0.046	**$2,040**
	Avoided energy costs	MWh	55	25	30	$130	$3,926	0.046	**$179**
	Avoided fertilizer costs	AFY	0	75.6	75.6	$56	$4,210	0.046	**$192**
	GHG Emissions Reduction	MT CO2	5.5	0	6	$71.93	$396	0.046	**$18**
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$702,336**
Comments:									

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

Table 16 – Annual Costs of Avoided Projects (All avoided costs should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Sidestream RO Treatment Avoided Project Description: Sidestream RO Treatment to reduce TDS by 200 mg/L				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2012					1.000	
2013					0.943	**$0**
2014	$497,000			$497,000	0.899	**$446,803**
2015	$3,479,000			$3,479,000	0.840	**$2,921,035**
2016	$994,000			$994,000	0.792	**$787,341**

Table 16 – Annual Costs of Avoided Projects (All avoided costs should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Sidestream RO Treatment				Discount	Discounted Costs
2017			$220,640	$220,640	0.747	**$164,875**
2018			$220,640	$220,640	0.705	**$155,542**
2019			$220,640	$220,640	0.665	**$146,738**
2020			$220,640	$220,640	0.627	**$138,432**
2021			$220,640	$220,640	0.592	**$130,596**
2022			$220,640	$220,640	0.558	**$123,204**
2023			$220,640	$220,640	0.527	**$116,230**
2024			$220,640	$220,640	0.497	**$109,651**
2025			$220,640	$220,640	0.469	**$103,445**
2026			$220,640	$220,640	0.442	**$97,589**
2027			$220,640	$220,640	0.417	**$92,065**
2028			$220,640	$220,640	0.394	**$86,854**
2029			$220,640	$220,640	0.371	**$81,938**
2030			$220,640	$220,640	0.350	**$77,300**
2031			$220,640	$220,640	0.331	**$72,924**
2032			$220,640	$220,640	0.312	**$68,797**
2033			$220,640	$220,640	0.294	**$64,902**
2034			$220,640	$220,640	0.278	**$61,229**
2035			$220,640	$220,640	0.262	**$57,763**
2036			$220,640	$220,640	0.247	**$54,493**
2037			$220,640	$220,640	0.233	**$51,409**
2038			$220,640	$220,640	0.220	**$48,499**
2039			$220,640	$220,640	0.207	**$45,754**
2040			$220,640	$220,640	0.196	**$43,164**
2041			$220,640	$220,640	0.185	**$40,721**
2042			$220,640	$220,640	0.174	**$38,416**
2043			$220,640	$220,640	0.164	**$36,241**
2044			$220,640	$220,640	0.155	**$34,190**
2045			$220,640	$220,640	0.146	**$32,255**
2046			$220,640	$220,640	0.138	**$30,429**
2047			$220,640	$220,640	0.130	**$28,706**
2048			$220,640	$220,640	0.123	**$27,082**
2049			$220,640	$220,640	0.116	**$25,549**
2050			$220,640	$220,640	0.109	**$24,102**
2051			$220,640	$220,640	0.103	**$22,738**

Table 16 – Annual Costs of Avoided Projects (All avoided costs should be in 2012 dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Sidestream RO Treatment				Discount	Discounted Costs
2052			$220,640	$220,640	0.097	**$21,451**
2053			$220,640	$220,640	0.092	**$20,237**
2054			$220,640	$220,640	0.087	**$19,091**
2055			$220,640	$220,640	0.082	**$18,011**
2056			$220,640	$220,640	0.077	**$16,991**
2057			$220,640	$220,640	0.073	**$16,030**
2058			$220,640	$220,640	0.069	**$15,122**
2059			$220,640	$220,640	0.065	**$14,266**
2060			$220,640	$220,640	0.061	**$13,459**
2061			$220,640	$220,640	0.058	**$12,697**
2062			$220,640	$220,640	0.054	**$11,978**
2063			$220,640	$220,640	0.051	**$11,300**
2064			$220,640	$220,640	0.048	**$10,661**
2065			$220,640	$220,640	0.046	**$10,057**
2066			$220,640	$220,640	0.043	**$9,488**
Total Present Value of Discounted Costs (Sum of Column (g))						**$6,909,841**
(%) Avoided Cost Claimed by Project						**100%**
Total Present Value of Discounted Avoided Project Costs Claimed by Alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)						**$6,909,841**
Comments:						

Section D4 – Flood Damage Reduction Analysis

Flood damage reduction benefits are not expected from this Project. As such PSP tables 17 and 18 have 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, uses the total project costs as provided in Attachment 4.
- Period of Analysis. The initial costs presented in PSP Table 19 are consistent with the projected construction schedule for the project, as shown in Attachment 5, and reflect start and completion of construction activities in 2015. The operational life of the Project is assumed to be 50 years, which is consistent with most recycled water projects.

- Economic Cost. The economic cost of the total Project as presented in Attachment 4 considers all reasonably foreseeable costs including opportunity costs.
- Sunk Costs. No sunk costs have been eliminated from the initial costs.
- Opportunity Costs. All opportunity costs are accounted for including previous construction costs incurred since October 2008.
- 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 PSP Table 19 below, the present value of project costs, discounted at 6%, is estimated to be $3,077,498. This estimate includes all capital costs as well as costs associated with construction, administration, operation and maintenance of the project, and includes all costs required for the project to achieve its stated benefits. Costs funded by local, State, federal agencies and non-profits are included. The initial costs presented in this table are equivalent to those presented in Attachment 4, with the exceptions identified above.

Capital costs are estimated to be $3,000,000, and will phased based as follows.

- $263,200 of project administration, planning / design / environmental work, and other expenses incurred in 2013
- $301,750 of project administration, land purchase / easement, and other expenses incurred in 2014
- $2,435,050 of project administration, construction, construction administration, and other expenses incurred in 2015

Operations and maintenance costs are estimated to be $39,000 / year, as presented in PSP Table 19. These costs include the following:

- Administration ($12,000 per year): Coordination with recycled water users, inspections of facilities, review of required paperwork, customer billing.
- Operations ($11,000 per year): Pumping energy cost, chemical costs
- Maintenance ($10,000 per year): Repair of facilities, inspections, regular maintenance activities
- Periodic Replacement ($6,000 per year): Replacement of piping, valves, and other appurtenances at the end of their useful life

Table 19 – Annual Costs of Project
(All costs are in 2012 Dollars)
Project: Recycled Water Salinity Reduction and Distribution System Expansion 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									1.000	
2013	$263,200							$263,200	0.943	**$248,302**
2014	$301,750							$301,750	0.890	**$268,556**
2015	$2,435,050							$2,435,050	0.840	**$2,044,515**
2016			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.792	**$30,892**

Table 19 – Annual Costs of Project (All costs are in 2012 Dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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)
2017			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.747	**$29,143**
2018			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.705	**$27,493**
2019			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.665	**$25,937**
2020			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.627	**$24,469**
2021			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.592	**$23,084**
2022			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.558	**$21,777**
2023			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.527	**$20,545**
2024			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.497	**$19,382**
2025			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.469	**$18,285**
2026			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.442	**$17,250**
2027			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.417	**$16,273**
2028			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.394	**$15,352**
2029			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.371	**$14,483**
2030			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.350	**$13,663**
2031			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.331	**$12,890**
2032			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.312	**$12,160**
2033			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.294	**$11,472**
2034			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.278	**$10,823**
2035			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.262	**$10,210**
2036			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.247	**$9,632**
2037			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.233	**$9,087**
2038			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.220	**$8,573**
2039			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.207	**$8,087**
2040			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.196	**$7,630**
2041			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.185	**$7,198**
2042			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.174	**$6,790**
2043			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.164	**$6,406**
2044			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.155	**$6,043**
2045			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.146	**$5,701**
2046			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.138	**$5,379**
2047			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.130	**$5,074**
2048			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.123	**$4,787**

Table 19 – Annual Costs of Project (All costs are in 2012 Dollars) Project: Recycled Water Salinity Reduction and Distribution System Expansion 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)
2049			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.116	**$4,516**
2050			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.109	**$4,260**
2051			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.103	**$4,019**
2052			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.097	**$3,792**
2053			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.092	**$3,577**
2054			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.087	**$3,375**
2055			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.082	**$3,184**
2056			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.077	**$3,003**
2057			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.073	**$2,833**
2058			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.069	**$2,673**
2059			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.065	**$2,522**
2060			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.061	**$2,379**
2061			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.058	**$2,244**
2062			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.054	**$2,117**
2063			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.051	**$1,997**
2064			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.048	**$1,884**
			$12,000	$11,000	$10,000	$6,000	$0	$39,000	0.046	**$1,778**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$3,077,498**
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

Project Benefits

PSP Table 20, below, summarizes benefits and costs for the proposed project.

Table 20 – Project Benefits and Costs Summary

Proposal: East Contra Costa County Region – Proposition 84 Round 2 Grant Proposal

Agency: Contra Costa Water District

Project	Project Proponent	Total Present Value Project Costs (1)	Total Present Value Project Benefits			From Section D1 – Cost-Effectiveness Analysis, Cost Savings	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)
Recycled Water Salinity Reduction and Distribution System Expansion Project	DDSD	$3,077,498	$7,612,177	N/A	$7,612,177	N/A	Water quality improvements, reduced reliance on Delta supplies, DAC benefits

(1) From Table 19, or RWMG method

(2) From Table 15 or RWMG method

(3) From Table 18 or RWMG method

Proposal Benefits and Costs Summary

As shown in PSP Table 20 below, the present value of total proposal costs is $14,387,962, compared to the present value of proposal benefits of $17,694,879.

Table 20 – Proposal Benefits and Costs Summary

Proposal: East Contra Costa County Region – Proposition 84 Round 2 Grant Proposal

Agency: Contra Costa Water District

Project	Project Proponent	Total Present Value Project Costs (1)	Total Present Value Project Benefits			Cost -Eff. Analysis	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)
DWD Beacon West Arsenic Well and Tank Replacement Project	DWD	$429,889	$696,258	N/A	$696,258	N/A	Education, reduced reliance on Delta supplies, DAC benefit
Rossmoor Well Replacement/ Groundwater Monitoring Well System Expansion	City of Pittsburg	$2,008,899	$3,172,222	N/A	$3,172,222	N/A	Education, reduced reliance on Delta supplies, DAC benefit
Integrated Regional Flood Protection and Water Quality Improvement Borrow Area	CCWD	$1,243,604	$16,458,304	$1,814,768	$18,273,072	N/A	Education, reduced reliance on Delta supplies, environmental / habitat benefits
Knightsen Wetland Restoration and Flood Protection	Contra Costa County	$4,813,624	$2,869,471	N/A	$2,869,471	N/A	Environmental restoration, water quality protection, stormwater management
Recycled Water Salinity Reduction and Distribution System Expansion	DDSD	$3,077,498	$7,612,177	N/A	$7,612,177	N/A	Water quality improvements, reduced reliance on Delta supplies, DAC benefits
TOTAL		$11,573,513	$30,808,431	$1,814,768	$32,623,200	$0	

(1) From Table 19, or RWMG method

(2) From Table 15 or RWMG method

(3) From Table 18 or RWMG method

Appendices

The following Appendices have been provided on the CD included at the end of this proposal.

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Appendix 2-2: Pittsburg Plain Groundwater Basin (2-4) CASGEM Monitoring Plan (December 2011)	Att8_IG2_BenCost_3of20
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Appendix 2-4: City of Pittsburg 2010 Urban Water Management Plan Update	Att8_IG2_BenCost_3of20
Appendix 2-5: CEQA Notice of Exemption	Att8_IG2_BenCost_3of20
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Appendix 3 - Studies Supporting Project 3: Integrated Regional Flood Protection and Water Quality Improvement Borrow Area Project	
Appendix 3-1: Studies Supporting Upper Sand Creek Basin Portion of Project	
Appendix 3-1.1: Upper Sand Creek Basin Preliminary Soil Characterization Study, 2000	Att8_IG2_BenCost_3of20
Appendix 3-1.2: Upper San Creek Detention Basin Design Report, August 2010	Att8_IG2_BenCost_4of20
Appendix 3-1.3: CEQA analysis regarding hauling of fill from the Sand Creek Bain site by the Contra Costa County Flood Control & Water Conservation District, Approved by Contra Costa County Board of Supervisors on November 2010	Att8_IG2_BenCost_5of20
Appendix 3-1.4: Upper Sand Creek Basin Geotechnical Report, 2012	Att8_IG2_BenCost_5of20
Appendix 3-1.5: Upper Sand Creek Basin Project Plans and Specifications, 2012	Att8_IG2_BenCost_4of20
Appendix 3-1.6: Contra Costa Flood Control District Proposition 1E Round 1 Funding Application Work Plan and Economic Analysis – Upper Sand Creek Basin	Att8_IG2_BenCost_6of20
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Appendix 3-2.1: Negative Declaration (November 2006)	Att8_IG2_BenCost_6of20
Appendix 3-2.2: Mitigation Monitoring and Reporting Program for the Contra Costa Canal Replacement Project. State Clearinghouse # 2006042082. November 2006.	Att8_IG2_BenCost_6of20
Appendix 3-2.3: Final Mitigated Negative Declaration for the Contra	Att8_IG2_BenCost_6of20

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Costa Canal Replacement Project. November 2006.	
Appendix 3-2.4: Final Environmental Assessment Contra Costa Canal Replacement Project, contra Costa Cou8nty, California. June 2007.	Att8_IG2_BenCost_6of20
Appendix 3-2.5: Permits and agreements secured in 2007, including: Central Valley Regional Water Quality Control Board 401 Permit, CA Department of Fish and Game 1600 and 2081 Permits, State Historic Preservation Officer MOU, US Army Corps of Engineers 404 Permit, National Marine Fisheries Service Letters of Concurrence, US Fish and Wildlife Coordination Act Letter, and Bureau of Reclamation/Western Area Power Administration (WAPA) NEPA EA/FONSI	Att8_IG2_BenCost_6of20
Appendix 3-2.6: Conservation Easement Deed Holland Tract Preserve	Att8_IG2_BenCost_6of20
Appendix 3-3: Engineering & Design Documentation (Canal Portion of Project)	
Appendix 3-3.1: Geotechnical Engineering Investigation Contra Costa Water District Canal Replacement Project Oakley, CA. DCM Engineering/Carollo Engineers, November 2007.	Att8_IG2_BenCost_7of20
Appendix 3-3.2: Recommended Pipeline Alignment. Technical Memorandum. Brown & Caldwell. June 2011.	Att8_IG2_BenCost_7of20
Appendix 3-3.3: Canal Crossings. Technical Memorandum. Brown & Caldwell. June 2011.	Att8_IG2_BenCost_7of20
Appendix 3-3.4: Canal Levee Elimination and Flood Mitigation Project Phase 2 - Pipeline. Access Structure Structural Calculations. Brown and Caldwell. June 2011.	Att8_IG2_BenCost_7of20
Appendix 3-3.5: Cypress Grove Levee Protection. Technical Memorandum. Brown & Caldwell. June 2011	Att8_IG2_BenCost_8of20
Appendix 3-3.6: Pumping Plant 1 Test Report. Technical Memorandum. Brown & Caldwell, June 2011.	Att8_IG2_BenCost_8of20
Appendix 3-3.7: Final Grade Elevations and Imported Backfill. Technical Memorandum. Brown & Caldwell, June 2011.	Att8_IG2_BenCost_8of20
Appendix 3-3.8: 100% Design Drawings Segments 2 - 4	Att8_IG2_BenCost_8of20 *through* Att8_IG2_BenCost_11of20
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Appendix 3-4.2: Flood frequency curves for Old River at Rock Slough and San Joaquin River at Antioch. Developed by Corps of Engineers, Sacramento California. February 1992.	Att8_IG2_BenCost_14of20
Appendix 3-4.3: FEMA inundation maps.	Att8_IG2_BenCost_14of20
Appendix 3-4.4: Water surface elevations measured at Rock Slough. http://cdec.water.ca.gov/cgi-progs/staMeta?station_id=RSL	Att8_IG2_BenCost_14of20
Appendix 3-4.5: Application for Individual Permit Supplemental	Att8_IG2_BenCost_14of20

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Attachment. Dutch Slough Tidal Marsh Restoration (SPK-2004000043). Prepared for U.S. Army Corps of Engineers Sacramento District, Regulatory Division. Prepared by California Department of Water Resources. March 2012.	
Appendix 3-4.6: Dutch Slough Tidal Marsh Restoration Project Final Environmental Impact Report. SCH # 2006042009. State of California Department of Water Resources. March 2010.	Att8_IG2_BenCost_14of20
Appendix 3-4.7: City of Oakley 2020 General Plan. Updated January 2010. http://www.ci.oakley.ca.us/UserFiles/file/GeneralPlan/General%20Plan%202020_Updated%20January%2026,%202010.pdf	Att8_IG2_BenCost_14of20
Appendix 3-4.8: City of Oakley East Cypress Corridor Specific Plan Final Supplemental Environmental Impact Report. January 2009. http://www.ci.oakley.ca.us/UserFiles/file/planning/East%20Cypress/ECC%20SP%20Draft%20EIR.pdf	Att8_IG2_BenCost_14of20
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Appendix 3-5.2: Contra Costa Water District Daily Operations Model (WRSEL based linear program). Los Vaqueros Expansion Model Documentation. Technical Memorandum. MBK Engineers. November 3, 2010.	Att8_IG2_BenCost_15of20
Appendix 3-5.3: G-model used to estimate water savings to CVP/SWP associated with compliance with water quality standards. Accounting for Antecedent Conditions in Seawater Intrusion Modeling - Applications for the San Francisco Bay-Delta. Richard Denton, 1993. Hydraulic Engineering, Volume 1, ASCE, pp. 448-453.	Att8_IG2_BenCost_15of20
Appendix 3-5.4: Calculation of water savings based on Rock Slough salinity requirements, Contra Costa Water District, 2013	Att8_IG2_BenCost_15of20
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Appendix 3-6.2: Rock Slough Technical Memorandum Evaluating Veale Tract Discharge. FlowScience. December 19, 2003.	Att8_IG2_BenCost_16of20
Appendix 3-6.3: Identification of Water Quality Degradation Sources in Rock Slough and Unlined Portion of Contra Costa Canal. Contra Costa Water District Interoffice Memorandum. October 23, 2003.	Att8_IG2_BenCost_16of20
Appendix 3-6.4: Bay Area Water Quality & Supply Reliability Program. CALFED Bay Delta Program. May 2005.	Att8_IG2_BenCost_16of20
Appendix 3-6.5: Amy, G.L., M. Siddiqui, K. Ozekin, H.W. Zhu, and C. Wang, (1998). Empirically Based Models for Predicting Chlorination and Ozonation By-Product: Haloacetic Acids, Chloral Hydrate, and Bromate. EPA Report CX 819579. USEPA Office of Groundwater and Drinking Water: Cincinnati, OH, 1998.	Att8_IG2_BenCost_16of20

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Appendix 3-6.6: Field data collected by Contra Costa Water District and the Department of Water Resources	Att8_IG2_BenCost_17of20
Appendix 3-6.7: Beneficial Use Impact Study, Final Report Ironhouse Sanitary District, Oakley, California. Prepared by HydroFocus. December 2003	Att8_IG2_BenCost_17of20
Appendix 3-6.8: US EPA. 2013. Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter. EPA-452/R-12-005. Washington, DC. February 28. http://www.epa.gov/ttnecas1/regdata/RIAs/finalria.pdf	Att8_IG2_BenCost_17of20
Appendix 3-7: Environmental Benefits Documentation (Canal Portion of Project)	
Appendix 3-7.1: Dutch Slough Tidal Marsh Restoration Project Final Environmental Impact Report. SCH # 2006042009. State of California Department of Water Resources. March 2010.	Att8_IG2_BenCost_18of20
Appendix 3-7.2: East Contra Costa County HCP/NCCP Mitigation Fee Audit. East Contra Costa County Habitat Conservancy, December 2012	Att8_IG2_BenCost_18of20
Appendix 3-7.3: East Contra Costa County Habitat Conservancy Governing Board Memorandum: Review and Adjustment of the HCP/NCCP Mitigation Fees, July 2011	Att8_IG2_BenCost_18of20
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Appendix 5-5: Final Biological Assessment and the Cultural Resources Inventory Report, March 2013 (prepared in support of the Recycled Water Master Plan/Title XVI Feasibility Study Report)	Att8_IG2_BenCost_20of20
Appendix 5-6: Draft Diablo Water District Well Utilization Project Phase 2 and Future Phase 3 Environmental Impact Report, Jones and Stokes (August 2008)	Att8_IG2_BenCost_20of20