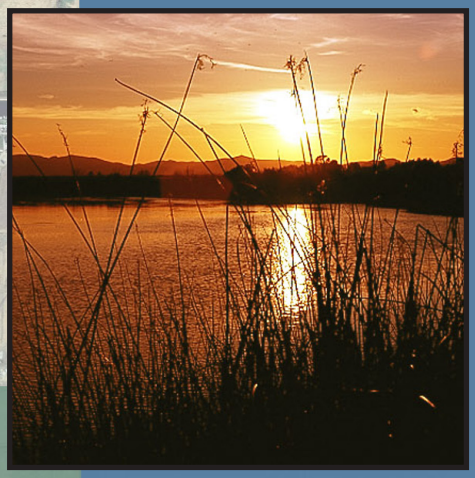

Contra Costa Water District
Proposition 1E Grant Proposal
Attachment 9

Water Quality and Other Expected Benefits

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East Contra Costa County Region
Contra Costa Water District
Stormwater Flood Management Grant Proposal

ATTACHMENT 9 –
WATER QUALITY AND OTHER EXPECTED BENEFITS

Proposal	Page
Contra Costa Canal Levee Elimination and Flood Protection Project	9-1

This attachment describes the water quality and other expected benefits provided by the Contra Costa Canal Levee Elimination and Flood Protection Project. In accordance with the PSP, the following details are provided for the proposed Project:

- ✓ Narrative discussion of the estimates of without-project physical conditions
- ✓ Narrative discussion of the estimates of with-project physical conditions
- ✓ Description of methods used to estimate without- and with-project conditions
- ✓ Description of potential other benefits
- ✓ Description of the distribution of local, regional, and statewide benefits
- ✓ Identification of beneficiaries
- ✓ When benefits will be received
- ✓ Uncertainty of benefits
- ✓ Description of any adverse effects

The following sections present a quantitative and qualitative analysis of project costs and water supply benefits. Table 19 has been completed, and is included at the end of this section.

Overview

Contra Costa Water District's (CCWD) Canal Levee Elimination and Flood Protection Project (Project) is needed to reduce the flood risk currently posed by the Contra Costa Canal (the Canal). At least seven square miles are currently at risk of flooding if the Canal levees fail, including housing developments, roads, working farms and a tidal marsh restoration project. The full Project will replace four miles of the unlined portion of the Canal with a pipeline and eliminate eight miles of aging embankments. Phase 5 of the Project is the portion of the full Project evaluated in this grant; Phase 5 includes installing a flood isolation structure near the mouth of the Canal (Rock Slough Intake), installing 4,000 feet pipeline and eliminating approximately 8,000 feet of levees. Phase 5 will enable CCWD to remotely isolate the Canal from the San Joaquin-Sacramento River Delta in the event of a levee breach. Other benefits of the Project include improving source water quality by preventing intrusion of saline groundwater, improving public safety by eliminating the drowning risk of the open water Canal, and improving CCWD's water supply reliability.

It is important to note that Phase 5, which is submitted in this proposal and evaluated in this Attachment, reflects a key portion of the full Project (including the installation of a flow isolation structure), but not the entire 21,000 feet of anticipated pipeline installation to replace all of the existing Canal. To evaluate benefits, we estimated (as feasible) the value of the benefits for the full Project (because the benefits accrue from the full Project being completed), and then attributed a portion of those aggregate benefits to the specific portion of the Project that would be developed under Phase 5. At $20 M, Phase 5 reflects 20.8 percent of the full $96 M Project budget; therefore we assigned 20.8 percent of the overall water supply, water quality, and other Project benefits to this specific portion of the Project. Because Phase 5 includes installation of the flow isolation structure, all avoided flood damages from the full Project will be achieved through implementation of this component.

A summary of all benefits and costs of the Project are provided in Table 9-1. Project costs and water quality and other benefits are discussed in the remainder of this attachment. Flood damage reduction benefits are described in Attachment 7, and water supply benefits are described in Attachment 8. In several instances, the water supply and water quality benefits are highly inter-woven, and could have been placed in either of the Attachments; however we have been careful to avoid double counting. Several of the most important benefits could not be reliably quantified or monetized.

Table 9-1. Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	$16,847,000
Monetizable Benefits	
Flood Damage Reduction (Attachment 7)	$44,576,131
Water Supply Benefits (Attachment 8)	$11,624,000
Water Quality and Other Benefits	
Public safety – reduced drowning risk	$11,794,000
Reduced energy use (water pumping/blending)	$764,000
Reduced levels of DBPs in drinking water	$594,000
Avoided patrolling costs	$353,000
Enabled completion of DWR's Dutch Slough Tidal Marsh Restoration Project	$5,319,000
Total Monetized Benefits	$75,024,113
Qualitative Benefit or Cost	**Qualitative indicator***
Water Supply Benefits (Attachment 8)	++
Water Quality and Other Benefits	

Table 9-1. Benefit-Cost Analysis Overview

	Present Value
Improved Water Quality for CCWD customers (beyond DBPs)	+
Reduced energy demands and CO2 Emissions (less pumping)	+
Reduced fish loss (including special status species)	+
Increased security (intentional or accidental contamination/disruption) of CCWD water supply	+

O&M = Operations and Maintenance

* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

Description of Without-Project Conditions

Without the Project, CCWD will continue to rely on a long stretch of open, unlined Canal in order to convey water. Water quality at the intake would continue to be degraded due to seepage into the Canal from groundwater. Higher salinity groundwater seepage has been identified as the primary source of water quality degradation in the Canal. The State Water Project and Central Valley Project would continue to release water to meet the water quality objective at Rock Slough. Residential area runoff from the increasingly developed adjacent areas could also pose new challenges to water quality in the Canal.

Additionally, the Department of Water Resources' (DWR's) Dutch Slough Tidal Marsh Restoration Project will exacerbate the existing seepage problem. Consequently, this very important ecologic restoration project cannot be implemented until the open Canal is replaced with a pipeline.

In addition, without the Project, the Canal would continue to pose a flooding and public safety threat to the adjacent land area which has become increasingly residential. The levees that contain the Canal were not designed for flood protection, yet they are currently used for this purpose.

Overall, this Project will provide significant benefits at the local, regional, and state level through improved water supply reliability, and regional improvements in water quality. By reducing seepage into the Canal, this Project will improve both water supply and water quality for CCWD, the State Water Project (SWP), and the Central Valley Project (CVP). It also will enable a significant Delta restoration Project to proceed.

Description of With-Project Conditions (Expected Water Quality and Other Benefits)

With the full Project, four miles of unlined Canal will be replaced with a buried pipeline, and the levees on either side of the Canal will be eliminated. This will improve water quality, eliminate flooding hazards, eliminate predation and entrainment of fish in the Canal, eliminate the public safety hazard of an open Canal in a residential area, and ensure compatibility with adjacent land use, including habitat restoration. The Project must be completed prior to the completion of DWR's Dutch Slough Tidal Marsh Restoration Project to avoid further degradation of water quality. Replacing the unlined Canal will also

reduce upstream reservoir releases needed to meet water quality objectives at Rock Slough, increasing water supply available for CCWD, SWP and CVP contractors.

This Project is expected to create a variety of water quality and other benefits, including the following.

Water Quality Benefits

The primary water quality benefit expected from this Project is a reduction in disinfection byproduct formation, and associated public health protection. With completion of the Project, water at PP1 will have lower bromide levels. 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 federal maximum contaminant level (MCL) for bromate is 10 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 is providing positive reduction in risk of cancer to those who drink that water (US EPA, 2003).

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 (US EPA, 2011). The relationship between bromate risk and concentration is linear, so risk at 6.5 ug/L will equal 65% of the risk at the MCL, or 1.3 x 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: 72.0. This Project will reduce bromate levels by an average of 3 percent; therefore, this Project would result in 2.16 fewer cancer cases per 70-year lifetime, or an average of 0.031 cases avoided each year.

In its Stage 2 Disinfectant and Disinfectant By-Products Rule, the U.S. EPA estimates the value of a statistical life (VSL) at approximately $7.1 million, adjusted to 2005 dollars. More recently, EPA has updated its best estimate for VSL to $7.0 million (in 2006 dollars, but based on projected 2010 income levels) (US EPA 2008). Here we use the $7.0 million VSL figure as a reasonable approximation for 2009 dollars. The VSL estimates are based on meta-analyses of the "wage-risk" literature, which involves estimating the tradeoff individuals are willing to pay between risk and higher income based on salary differentials between occupations with differing risk levels.

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 $217,000 in benefits from avoided cancer cases annually (0.031 cancer cases avoided per year, times $7 million per avoided cancer case). As shown in Table 19, the present value of this benefit amounts to $2,856,000 for the entire Project. Assigning the 20.8 percent share of the total benefit attributable to the portion of the pipeline project covered by this specific component of the overall Project, the present value benefits amount to roughly $594,000.

Other Benefits

Other benefits expected from Project implementation include completion of DWR's Dutch Slough Tidal Marsh Restoration Project, reduced energy usage, reduced carbon footprint, improved public safety and reduced fish loss. These benefits are discussed below.

Enabling Completion of DWR's 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 5 years following completion of the pipeline, or in 2018. The value of wetland habitat can be difficult to monetize. CCWD has recently paid between $60,000 to $74,500 per acre for mitigation wetlands. Tidal wetland mitigation lands are in very limited supply and can cost more than $100,000 per acre. Assuming an investment of $10,000 to $20,000 per acre would be required to cultivate special status species and habitats, this would translate to a net benefit of approximately $30,000 to $70,000 per acre. To be conservative, we have assumed the value of the completed Dutch Slough Project will be on the order of $43.2 M ($1200 acres * $30,000 per acre), and that this benefit would be realized in 2018. This translates to a net present value of $25,570,000, of which 20.8 percent ($5,319,000) can be attributed to this Project.

Reduced Operating Costs to Meet Water Quality Targets for CCWD Finished Waters

Improved water quality at the intake will enable CCWD to meet its finished water quality goals with less pumping and blending of its supplies. This is anticipated to result in a savings of $200,000 per year in energy costs.

An additional annual operating cost that would be avoided with this Project is the elimination of the need to use aquatic pesticides. Absent the Project, these pesticides would continue to be used as needed to control algae and other aquatic plants in the Canal, at a cost of $60,000 per year. 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. The cost of this consultation is approximately $100,000 every six years. These costs would be eliminated with Project implementation.

Combining these avoided expenses, the energy and pesticide cost savings associated with this Project amount to $260,000 in most years, and $360,000 every sixth year. As shown in Table 19, the present value of this benefit amounts to $3,675,000 for the entire Project. Assigning the 20.8 percent share of these total benefits that are attributable to this specific component of the overall Project, the present value benefits amount to about $764,000.

Reduced Carbon Footprint

CCWD estimates that the energy savings derived from pipeline-related improvements to water quality will amount to over 1700 MWH per year. This energy savings is associated with a reduction in CO_2 emissions of 497.5 metric tons per year. Over the 100-year life of the pipeline, this amounts to a reduction in the CCWD carbon footprint of nearly 50,000 metric tons. Over 10,300 of these metric tons of reduced carbon emissions (20.8 percent) can be attributed to the portion of the pipeline addressed by this specific Project. No monetized values are associated with this reduction in CCWD's carbon footprint.

Security and Public Safety

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.

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 generally accepted USEPA estimate of $7 million per VSL as the value of reducing risks of premature death, the annual risk reduction benefit of the Project amounts to $4.3 M per year (0.62 times $7 million).

As shown in Table 19, the present value of this benefit amounts to $56.7 M for the entire Project. Assigning the 20.8 percent share of these total benefits that are attributable to the portion of the full Project covered by this specific component, the present value benefits amount to about $11,794,000.

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.

Reduced Costs to Patrol the Open Canal

As described previously, the currently 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 $1,698,000 ($353,000 attributed to the proposed Project).

Reduced Fish Loss

Fish entrainment and predation are recognized issues in the unlined Canal. Under existing conditions, intake pumping and tidal action have the potential to draw fish into the Canal. A study of predation conducted by DFG in the mid-1990s estimated the predation rate of fish in the unlined Canal to be as high as 80 percent. The Rock Slough Fish screen meets approach velocity criteria for smelt and salmon, providing protection from impingement and entrainment. The Canal replacement combined with the Rock Slough Fish screen should largely eliminate predation of sensitive fish in the Canal and entrainment at PP1.

The potentially high value of reduced take of special status fish in the near-Delta waters are not assigned monetary values in this analysis. However, these non-monetized benefits could nonetheless be of considerable value.

Project Beneficiaries and Distribution of Benefits

In terms of water quality and other benefits, the Project will benefit stakeholders at the local, regional, and state level, as shown in Table 9-2. At the local level, CCWD will benefit from improved operational flexibility.

This Project not only benefits CCWD, but also many state and federal interests. As discussed previously, completion of DWR's legislatively mandated (SBX7-1 Section 85085) Dutch Slough Tidal Marsh Restoration Project is dependent on the encasement of the Canal adjacent to the Dutch Slough project site. This will provide appreciable ecological benefits to the Delta and all state-wide stakeholders with an interest in the Delta's health.

Table 9-2. Project Beneficiaries Summary

Local	Regional	*Statewide*
CCWD and its retail customers Residents living in lands adjacent to the existing Canal.	Contra Costa Water District's wholesale customers, especially those relying on raw water (all of which relies on the Canal)	Department of Water Resources State Water Project, Central Valley Project, fisheries, and general ecologic well-being

Timing of Benefits

Construction of the new pipeline will be completed and will come online in 2014. For this analysis, a 100-year useful project life is assumed, thus benefits and costs are calculated through 2113 (100 years after the Project comes online).

Summary of Qualitative Benefits

Qualitative benefits from the proposed Project include: (1) improved water quality for CCWD customers; (2) reduced energy demands and CO_2 emissions; (3) reduced sensitive fish loss; and (4) increased security. These benefits are summarized in Table 3.

Table 3. Qualitative Benefits Summary – Water Quality and Other Benefits

Benefit	Qualitative Indicator
Water Quality and Other Benefits	
Improved Water Quality for CCWD customers (beyond DBPs)	+
Reduced energy demands and CO2 Emissions (less pumping)	+
Reduced fish loss (including special status species)	+
Increased security (intentional or accidental contamination/disruption) of CCWD water supply	+

Uncertainty of Benefits

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In most cases, omissions lead to a downward bias in benefits: the Project is expected to be much more beneficial than the subset of benefits that can be monetized would indicate. Several of these issues are listed in Table 9-4.

Table 9-4. Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	*Comment*
Value of enabling completion of DWR's Dutch Slough Tidal Marsh Restoration Project	++	The Dutch Slough restoration Project is expected to generate considerable ecologic and other benefits to the Delta system. The project cannot move forward without completion of the pipeline. The value of this project was conservatively estimated based on typical wetlands purchase costs and assumptions related to investment needed to establish and maintain habitat. It is likely that the actual value of the completed project will exceed the lower-bound estimate described herein. Therefore, the total benefits are likely to be understated.
Reduced cancer risk from reduced bromate concentrations	U	The amount by which bromide in source waters will be reduced, and the amount of bromate reduction realized in tap waters, is uncertain. There also are uncertainties regarding the quantified cancer risk assessment and valuation of the avoided cases using VSL. In addition, there may be other DBP reductions associated with the improved source water quality that are omitted from the benefits analysis.
Project costs	U	The calculation of the present value of costs is a function of the timing of capital outlays and a number of other factors and conditions. Changes in these variables will change the estimate of costs.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.

U = Uncertain, could be + or –.

Potential Adverse Effects

Potential adverse impacts from this Project are expected to be limited to temporary construction impacts.

Documents Supporting Benefits Analysis

The following documents were used to develop the cost and benefit analyses described in this section:

- CCWD Board Meeting minutes - accounts of Canal drownings.
- US EPA, 2008. BenMAP, the Environmental Benefits Mapping and Analysis Program. Office of Air Planning and Standards. Available: http://www.epa.gov/air/benmap/download.html.
- US EPA, 2003. National Primary Drinking Water Regulations: Stage 2 Disinfectants and Disinfection Byproducts Rule; Proposed Rule. 40 CFR Parts 141,142, and 143, August 18.
- Personal communication with Marie Valmores and Maureen Martin, Contra Costa Water District (3/16/2011, 3/24/2011, 3/29/2011)
- Personal communication with Mark Seedall, Contra Costa Water District (3/29/2011)

Economic Benefit Tables

The quantifiable water quality and other benefits generated by this Project are summarized in Table 19. As shown in this table, the full Project provides present value water quality and other expected benefits totaling $90,500,000. The portion attributable to this Project is approximately 20.8 percent of the total Project benefit, or $18,824,000.

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2009								1.00	$0
2010								0.94	$0
2011								0.89	$0
2012								0.84	$0
2013								0.79	$0
2014	Avoided drownings	Risk (%)	61.54%	0%	62%	$7,000,000	$4,307,692	0.75	$3,218,958
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.75	$269,013
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.75	$162,155
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.75	$96,396
2015	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.70	$3,036,753
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.70	$183,290
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.70	$152,976
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.70	$90,940
2016	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.67	$2,864,861
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.67	$172,915
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.67	$144,317
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.67	$85,792

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2017	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.63	$2,702,699
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.63	$163,127
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.63	$136,148
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.63	$80,936
2018	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.59	$2,549,716
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.59	$153,894
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.59	$128,442
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.59	$76,355
	Value of Completed Dutch Slough Project	Dollars	0	43,200,000	43,200,000	$1	$43,200,000	0.59	$25,570,014
2019	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.56	$2,405,393
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.56	$145,183
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.56	$121,172
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.56	$72,033
2020	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.53	$2,269,239

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.53	$189,644
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.53	$114,313
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.53	$67,956
2021	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.50	$2,140,791
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.50	$129,212
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.50	$107,842
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.50	$64,109
2022	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.47	$2,019,614
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.47	$121,898
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.47	$101,738
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.47	$60,480
2023	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.44	$1,905,296
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.44	$114,998
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.44	$95,979

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.44	$57,057
2024	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.42	$1,797,449
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.42	$108,489
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.42	$90,547
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.42	$53,827
2025	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.39	$1,695,707
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.39	$102,348
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.39	$85,421
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.39	$50,780
2026	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.37	$1,599,724
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.37	$133,691
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.37	$80,586
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.37	$47,906
2027	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.35	$1,509,173
	Treatment Energy and	Risk (%)	100%	0%	100%	$260,000	$260,000	0.35	$91,089

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Herbicide Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.35	$76,025
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.35	$45,194
2028	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.33	$1,423,748
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.33	$85,933
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.33	$71,721
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.33	$42,636
2029	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.31	$1,343,159
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.31	$81,069
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.31	$67,662
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.31	$40,223
2030	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.29	$1,267,131
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.29	$76,480
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.29	$63,832
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.29	$37,946

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2031	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.28	$1,195,407
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.28	$72,151
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.28	$60,219
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.28	$35,798
2032	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.26	$1,127,742
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.26	$94,247
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.26	$56,810
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.26	$33,772
2033	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.25	$1,063,908
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.25	$64,214
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.25	$53,594
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.25	$31,860
2034	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.23	$1,003,686
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.23	$60,580

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.23	$50,561
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.23	$30,057
2035	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.22	$946,874
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.22	$57,151
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.22	$47,699
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.22	$28,355
2036	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.21	$893,277
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.21	$53,916
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.21	$44,999
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.21	$26,750
2037	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.20	$842,714
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.20	$50,864
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.20	$42,452
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.20	$25,236

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2038	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.18	$795,014
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.18	$66,440
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.18	$40,049
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.18	$23,808
2039	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.17	$750,013
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.17	$45,269
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.17	$37,782
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.17	$22,460
2040	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.16	$707,559
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.16	$42,706
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.16	$35,643
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.16	$21,189
2041	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.15	$667,509
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.15	$40,289

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.15	$33,626
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.15	$19,990
2042	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.15	$629,725
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.15	$38,008
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.15	$31,722
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.15	$18,858
2043	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.14	$594,080
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.14	$35,857
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.14	$29,927
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.14	$17,791
2044	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.13	$560,453
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.13	$46,838
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.13	$28,233
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.13	$16,784

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2045	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.12	$528,729
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.12	$31,913
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.12	$26,635
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.12	$15,834
2046	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.12	$498,801
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.12	$30,106
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.12	$25,127
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.12	$14,937
2047	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.11	$470,567
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.11	$28,402
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.11	$23,705
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.11	$14,092
2048	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.10	$443,931
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.10	$26,794

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.10	$22,363
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.10	$13,294
2049	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.10	$418,803
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.10	$25,278
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.10	$21,097
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.10	$12,542
2050	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.09	$395,097
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.09	$33,019
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.09	$19,903
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.09	$11,832
2051	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.09	$372,733
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.09	$22,497
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.09	$18,776
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.09	$11,162

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2052	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.08	$351,635
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.08	$21,224
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.08	$17,714
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.08	$10,530
2053	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.08	$331,731
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.08	$20,022
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.08	$16,711
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.08	$9,934
2054	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.07	$312,954
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.07	$18,889
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.07	$15,765
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.07	$9,372
2055	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.07	$295,240
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.07	$17,820

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.07	$14,873
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.07	$8,841
2056	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.06	$278,528
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.06	$23,277
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.06	$14,031
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.06	$8,341
2057	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.06	$262,762
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.06	$15,860
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.06	$13,237
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.06	$7,869
2058	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.06	$247,889
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.06	$14,962
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.06	$12,487
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.06	$7,423

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2059	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.05	$233,858
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.05	$14,115
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.05	$11,781
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.05	$7,003
2060	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.05	$220,620
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.05	$13,316
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.05	$11,114
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.05	$6,607
2061	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.05	$208,132
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.05	$12,562
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.05	$10,485
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.05	$6,233
2062	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.05	$196,351
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$360,000	$360,000	0.05	$16,409

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.05	$9,891
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.05	$5,880
2063	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.04	$185,237
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.04	$11,180
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.04	$9,331
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.04	$5,547
2064	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.04	$174,752
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.04	$10,548
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.04	$8,803
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.04	$5,233
2065	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.04	$164,860
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.04	$9,950
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.04	$8,305
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.04	$4,937

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2066	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.04	$155,529
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.04	$9,387
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.04	$7,835
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.04	$4,658
2067	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.03	$146,725
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.03	$8,856
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.03	$7,391
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.03	$4,394
2068	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.03	$138,420
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.03	$11,568
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.03	$6,973
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.03	$4,145
2069	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.03	$130,585
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.03	$7,882

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.03	$6,578
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.03	$3,911
2070	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.03	$123,193
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.03	$7,436
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.03	$6,206
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.03	$3,689
2071	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.03	$116,220
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.03	$7,015
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.03	$5,855
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.03	$3,480
2072	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.03	$109,642
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.03	$6,618
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.03	$5,523
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.03	$3,283

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2073	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$103,435
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.02	$6,243
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$5,211
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$3,098
2074	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$97,581
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.02	$8,155
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$4,916
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$2,922
2075	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$92,057
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.02	$5,556
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$4,637
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$2,757
2076	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$86,846
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.02	$5,242

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$4,375
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$2,601
2077	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$81,931
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.02	$4,945
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$4,127
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$2,454
2078	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$77,293
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.02	$4,665
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$3,894
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$2,315
2079	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$72,918
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.02	$4,401
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$3,673
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$2,184

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2080	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$68,790
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.02	$5,749
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$3,465
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$2,060
2081	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.02	$64,897
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.02	$3,917
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.02	$3,269
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.02	$1,943
2082	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$61,223
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$3,695
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$3,084
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,833
2083	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$57,758
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$3,486

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$2,910
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,730
2084	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$54,488
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$3,289
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$2,745
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,632
2085	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$51,404
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$3,103
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$2,589
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,539
2086	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$48,495
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.01	$4,053
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$2,443
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,452

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2087	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$45,750
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$2,761
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$2,305
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,370
2088	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$43,160
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$2,605
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$2,174
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,292
2089	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$40,717
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$2,458
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$2,051
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,219
2090	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$38,412
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$2,318

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,935
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,150
2091	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$36,238
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$2,187
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,825
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,085
2092	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$34,187
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.01	$2,857
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,722
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$1,024
2093	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$32,252
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$1,947
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,625
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$966

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2094	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$30,426
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$1,836
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,533
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$911
2095	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$28,704
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$1,732
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,446
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$860
2096	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$27,079
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$1,634
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,364
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$811
2097	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$25,546
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$1,542

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,287
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$765
2098	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$24,100
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.01	$2,014
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,214
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$722
2099	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.01	$22,736
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.01	$1,372
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.01	$1,145
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.01	$681
2100	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$21,449
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$1,295
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$1,081
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$642

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2101	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$20,235
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$1,221
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$1,019
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$606
2102	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$19,090
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$1,152
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$962
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$572
2103	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$18,009
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$1,087
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$907
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$539
2104	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$16,990
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$360,000	$360,000	0.00	$1,420

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$856
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$509
2105	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$16,028
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$967
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$807
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$480
2106	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$15,121
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$913
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$762
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$453
2107	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$14,265
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$861
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$719
	Avoided patrolling	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$427

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change from Project (e) – (d)	Unit $ Value	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	cost								
2108	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$13,457
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$812
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$678
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$403
2109	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$12,696
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$766
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$640
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$380
2110	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$11,977
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$360,000	$360,000	0.00	$1,001
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$603
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$359
2111	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$11,299
	Treatment Energy and Herbicide	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$682

Table 19: Water Quality and Other Expected Benefits
Contra Costa Canal Levee Elimination and Flood Protection Project

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	**Type of Benefit**	**Measure of Benefit (Units)**	**Without Project**	**With Project**	**Change from Project (e) – (d)**	**Unit $ Value**	**Annual $ Value (f) x (g)**	**Discount Factor**	**Discounted Benefits (h) x (i)**
	Cost Savings								
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$569
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$338
2112	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$10,660
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$643
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$537
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$319
2113	Avoided drownings	Risk (%)	62%	0%	62%	$7,000,000	$4,307,692	0.00	$10,056
	Treatment Energy and Herbicide Cost Savings	Risk (%)	100%	0%	100%	$260,000	$260,000	0.00	$607
	Avoided bromate production	Risk (%)	3%	0%	3%	$7,000,000	$217,000	0.00	$507
	Avoided patrolling cost	Dollars per year	129,000	$0	$129,000	$1	$129,000	0.00	$301
Proj. Life	100 Years							…	
Total Present Value of Discounted Costs (Sum of Column (i))									**$90,499,850**
Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries									

Comments:
Present value is for the full Project. This Project is responsible for approximately 20/96 = 20.8 percent of full Project benefits, or $18,823,969.
All costs are in 2009 dollars.

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