Introduction

This attachment presents the benefits and cost analysis for the projects included in this Proposal. Below is the table of contents for this attachment.

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Acronyms Used in this Attachment

AF	acre-feet
AFY	Acre-feet per year
ASTM	American Society for Testing and Materials
Calleguas	Calleguas Municipal Water District
CCC	California Coastal Conservancy
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CO_2	carbon dioxide
CPI	Consumer Price Index
CSD	Camarillo Sanitary District
DBPs	disinfection byproducts
EPA	Environmental Protection Agency
GHG	greenhouse gases
GIS	Geographic Information System
GMA	Groundwater Management Agency
HOA	Homeowners Association
IRWM	Integrated Regional Water Management
LARWQCB	Los Angeles Regional Water Quality Control Board
Metropolitan	Metropolitan Water District of Southern California
mg/L	Milligrams per liter
MGD	million gallons per day
MT	metric tons
MWh	Megawatt hours
MWWTP	Moorpark Wastewater Treatment Plant
NPV	North Pleasant Valley
ppb	parts per billion
ppm	parts per million
PV	Pleasant Valley
RO	Reverse Osmosis
RWQCB	Regional Water Quality Control Board
SBx7-7	Senate Bill 7 of Extraordinary Session 7
SMP	Salinity Management Pipeline
SMCLs	Secondary Maximum Contaminant Levels
SWP	State Water Project
TDS	total dissolved solids
THM	Trihalomethanes
TMDLs	Total Maximum Daily Loads
TOC	Total organic carbon
United	United Water Conservation District
VCWWD	Ventura County Waterworks District
WCVC	Watersheds Coalition of Ventura County
WPD	Watershed Protection District
WQCP	Water Quality Control Plant
WWD1	Waterworks District 1
WWD8	Waterworks District 8

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Introduction

This attachment describes the monetized and non-monetized benefits of the overall suite of projects and the six individual projects included in this Proposal and complements the physical benefit descriptions documented in Attachment 7. This attachment uses the DWR Method as described in the PSP.

As shown in Table 1 below, the total present value cost for all six projects is $101,565,698 while the total present value benefits are $156,759,827 for a benefit/cost ratio of 1.54 for the Proposal. The overall benefit/cost ratio is greater than one and therefore favorable, which illustrates the overall benefits of the projects. The benefit/cost ratio for the individual projects ranges from 0.4 to 3.4 with four of the six projects having ratios significantly greater than one. Additionally, the projects in this Proposal have numerous non-monetizable benefits in terms of water supply, water quality, public safety, environmental justice, recreation, and habitat.

TABLE 1 – PROPOSAL BENEFITS AND COSTS SUMMARY (Table 20 of PSP) Proposal: Watersheds Coalition of Ventura County Proposition 84 IRWMP Implementation Grant Agency: County of Ventura							
Project	Project Proponent	Total Present Value Costs [1]	Total Present Value Benefits [2]			From D1 Cost Effect. Analysis, Cost Savings	From Section D2 - Briefly describe the main Non-monetized benefits
			From Section D3 Monetized [2]	From D4 Flood Damage Reduction	Total		
(a)	(b)	(c)	(d)	(e)	(f) = (d) + (e)	(g)	(h)
NPV Groundwater Desalter	City of Camarillo	$73,280,300	$103,413,024	$0	$103,413,024	NA	Improved water quality including salt removal from watershed, avoided salt import to watershed, assistance with TMDL compliance, prevention of groundwater plume migration, reduced impact of chlorides on agriculture. Reduced dependence on Delta. Reduced CO2 emissions.
Simi RW Project	City of Simi Valley	$10,380,848	$34,959,093	$0	$34,959,093	NA	Improved water quality including avoided salt import to watershed. Improved water supply reliability. Reduced dependence on Delta. Reduced CO2 emissions. Assistance with compliance with State mandates on water recycling.
Moorpark Recycled Water Phase IV	Ventura County Waterworks District 1	$7,496,391	$8,445,920	$0	$8,445,920	NA	Improved water quality including avoided salt import to watershed. Improved water supply reliability. Reduced dependence on Delta. Reduced CO2 emissions. Assistance with compliance with State mandates on water recycling and water conservation (SBx7-7).
South Oxnard Stormwater Flood Management and Community Enhancement Project Phase 2B	Ventura County Watershed Protection District	$6,034,296	$3,587,881	$0	$3,587,881	NA	Reduced impact of flood control facilities on neighborhood. Improved public safety. Unification of a DAC environmental justice neighborhood. Improved habitat for threatened and endangered species. Improved water quality in Ormond Beach Lagoon. Preservation of high value wetlands habitat. Reduced channel maintenance emissions. Prerequisite for future park.
Santa Clara River Restoration	University of California Santa Barbara	$2,625,287	$5,649,650	$0	$5,649,650	NA	Improved habitat and water quality. Reduced streambank erosion. Reduced flood and fire risk. Scientific information transfer. Increased recreational benefits.
Ventura River Restoration	Ventura County Watershed Protection District	$1,748,576	$704,259	$0	$704,259		Improved habitat and water quality. Reduced streambank erosion. Reduced flood and fire risk. Scientific information transfer. Increased recreational benefits.
Total Present Value Costs		**$101,595,294**	**Total Present Value Benefits**		**$156,759,827**		**Total Benefit Cost Ratio 1.54**
1 - From Tables A4, B5, C4, D5, E4, F4						2 - From Tables A3, B3, B4, C3, D3, D4, E3, F3	

North Pleasant Valley Groundwater Desalter (NPV Groundwater Desalter)

Summary

To help meet the challenges of increasing salt concentrations in groundwater and rising groundwater levels, the City of Camarillo, in conjunction with its project partners the City of Thousand Oaks and Camrosa Water District, is constructing the NPV Groundwater Desalter. Reverse osmosis (RO) treatment technology will be used to remove salts from the groundwater. The desalter will allow Camarillo to pump groundwater that is brackish and unusable without blending or treatment. The water produced by the desalter will then be delivered to Camarillo's customers as well as to the Calleguas Municipal Water District (Calleguas) potable water system during periods of low demand. Salts removed by the facility will be discharged to the Pacific Ocean via the Salinity Management Pipeline (SMP), which is operated by Calleguas.

The main benefits of undertaking this project include avoiding the use of imported water from the State Water Project (SWP) and reducing the accumulation of salts in the Calleguas Creek Watershed (the Watershed). The NPV Groundwater Desalter will be able to produce 7,500 acre-feet per year (AFY) of potable water. Also, by removing salts from the Watershed via the SMP and avoiding import of salts with SWP water into the Watershed, more than 17,000 metric tons (MT) of salts will either be exported from or prevented from entering the Watershed each year. The project will also reduce emissions of greenhouse gases as it takes less energy to process water through a desalter than to import the water from Northern California.

A summary of all benefits and costs of the project are provided in Table A1. Monetized benefits and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Non-Monetized Benefits Analysis (Section D2)

Table A2 shows the non-monetized benefits checklist for the project. Narrative descriptions of the benefit categories marked "Yes" in the following table are provided in the narrative description of qualitative benefits section after the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus, although a benefit might apply, a "No" is entered into the table if the benefit has been physically quantified and/or monetized.

Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked "Yes" from the checklist in Table A2 are described below.

Provide Education or Technology Benefits

Currently, many individual customers served by Camarillo use self-regenerating home water softeners to reduce the hardness in the water to improve taste and avoid build up on water fixtures. These self-regenerating water softeners discharge brine to the sewer system that is ultimately processed at the Camarillo Sanitary District's wastewater treatment plant and increases the salinity of the recycled water produced to levels that are higher than desirable for many uses.

With the desalter, customers will receive higher quality water, and thereforethe customers themselves will no longer need to soften the water. In conjunction with the start-up of the desalter, Camarillo will conduct an education campaign to discourage water customers from softening the water they receive. The education campaign is important to undertake because if Camarillo's customers continue to use automatic water softeners in their homes (even though the softeners are no longer needed), the brine from the softeners would discharge to the sanitary sewer and degrade wastewater/recycled water quality.

TABLE A1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$73,280,300
Monetizable Benefits	
Avoided Imported Water Supply Costs	$103,413,024
Total Monetizable Benefits	*$103,413,024*
Physically Quantified Benefit or Cost (Not Monetized)	Project Life Total
Salt Removal and Avoided Introduction of Salts into the Watershed	425,550 MT
Reduced CO_2 Emissions	201,780 MT
Qualitative Benefit or Cost	Qualitative Indicator*
Increased Customers Education Regarding Water Softeners	+
Helps Meet Total Maximum Daily Load Requirements	+
Prevention of Groundwater Contamination By Brackish Groundwater Plume	+
Reduced Impact on Agriculture from Chlorides in Camarillo's Recycled Water	+
Better Groundwater Management	+
Increased Recharge With Lower Salt Concentration Water	+
Reduced Demand for Net Diversions from the Delta	+

* 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 net benefits.
– – Likely to decrease net benefits significantly.
U Uncertain, could be + or –.

CO_2 = carbon dioxide

TABLE A2 (PSP Table 12) **North Pleasant Valley Groundwater Desalter** 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? - 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: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	

TABLE A2 cont. **North Pleasant Valley Groundwater Desalter** Non-Monetized Benefits Checklist		
No.	Question	Enter "Yes", "No", or "Neg"
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[a]
	Examples are not limited to, but may include: - Reduce net production of greenhouse gases? - 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[a]
	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 practices with recognized sustainable practices?	

TABLE A2 cont. **North Pleasant Valley Groundwater Desalter** Non-Monetized Benefits Checklist		
No.	Question	Enter "Yes", "No", or "Neg"
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

[a] This benefit category is marked as no because it was already described as a physically quantified benefit in Attachment 7.

Help Avoid, Reduce or Resolve Various Public Water Resources Conflicts

There are Total Maximum Daily Loads (TMDLs) in effect for salt loading (including for boron, chloride, sulfate, and TDS) in the Watershed (LARWQCB 2007, provided with this Benefit Cost Analysis). The project will reduce salts in the Watershed by avoiding import of SWP water containing salts and accomplishing removal of salts from the Watershed via the SMP. By reducing the amount of salts present in the Watershed, this project will help achieve compliance with TMDLs and thus improve the condition of public water resources with associated ecological benefits. Camarillo is working cooperatively with other local dischargers and the Los Angeles Regional Water Quality Control Board (LARWQCB) to meet TMDL targets.

Improve Water Quality in Ways that Were Not Quantified in Attachment 7

Prevention of Groundwater Contamination by a Brackish Groundwater Plume

With this project, the plume of brackish groundwater originating from the northeast section of the North Pleasant Valley Basin will be pumped from the ground and processed by the desalter. Beginning in 1994, the brackish water that the desalter will process began migrating into the North Pleasant Valley Basin from the Arroyo Las Posas. Removing this water from the North Pleasant Valley Basin will prevent further migration of the groundwater plume and further contamination of usable groundwater.

Reduced Impacts on Agriculture from Chlorides in the Camarillo Sanitary District's Recycled Water

Water quality will also be improved with this project because the chloride concentration in the effluent (recycled water) produced by the Camarillo Sanitary District's (CSD) tertiary-treated wastewater facility is estimated to decrease from 200 milligrams per liter to 120 milligrams per liter (data provided by Camarillo Sanitary District). The chloride concentration in the effluent will decrease for two reasons: (1) Self-regenerating softeners will no longer be needed by individual customers and the brine discharge to the wastewater will decrease and (2) Water delivered from the desalter will have a lower chloride concentration than the water currently used, resulting in a corresponding decrease in wastewater salinity.

The project will also help reduce salt concentrations in tertiary-treated wastewater (recycled water) produced by the Camarillo Sanitary District. With a desalter, the decrease in salt concentration in delivered potable water will result in lower-salt wastewater. Currently the number and types of recycled water customers are limited by high salinity. Thus, the project will facilitate reuse of an additional 3,300 AFY of recycled water currently lost to the ocean. Recycled water reuse will further reduce imported water demand and will offset groundwater pumping in an area of documented overdraft.

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

By pumping groundwater and associated salts, the project will capture the brackish water plume and lower groundwater levels, thereby allowing stormwater with a lower salt concentration to recharge the North Pleasant Valley aquifer. This will improve water quality for enhanced long-term groundwater management. In the without project scenario, there would continue to be deterioration in long-term groundwater management as salts continue to migrate further into the Pleasant Valley Basin and elevated groundwater levels continue to prevent recharge of better quality stormwater.

Reduce Demand for Net Diversions from the Delta

By reducing the use of imported SWP water, this project will augment in-stream flows in the San Francisco Bay/Sacramento – San Joaquin Delta (the Delta) or will offset other diversions that may otherwise reduce flows. Lower demands on Delta supplies also will help reduce the overall salinity of the Delta and improve Delta habitat.

The Delta's environmental condition is vital to maintaining and improving the viability of the region. The Delta provides drinking water to 25 million people, supports thousands of industries and irrigation of 750,000 acres of agriculture, and serves as home to hundreds of plant, animal, and fish species – some of which are listed as threatened or endangered. The Delta's 1,600 square miles of marshes, islands, and sloughs support at least half of migratory water birds on the Pacific Flyway; 80 percent of California's commercial fisheries; and recreational uses including boating, fishing, and windsurfing.

Delta resources are in a state of crisis. Fish populations, including salmon and Delta smelt, have declined dramatically in recent years. The levee system is aging, and vulnerability of the Delta to flooding, sea level rise, or a major earthquake has contributed to concerns about possible levee collapse. In addition, water quality problems continue, and there is little consensus on how to manage water resources.

Accordingly, by reducing dependence on SWP water, this project reduces diversions of water from the Bay-Delta system and helps preserve this vital resource. In addition, by reducing demand for Bay-Delta diversions, this project may help free up some SWP water for other potential users or the environment.

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

Without the project, Camarillo would continue to rely on groundwater pumping and imported water to meet their water needs. Relying on groundwater pumping in this location is a short-term solution. Groundwater pumping (without desalting) can only occur here for a certain length of time before the salt concentration in that portion of the aquifer becomes too high. Relying on imported water is risky because of the many reliability issues associated with imported water.

With the project, Camarillo will be able to pump more groundwater with a high salt concentration and treat it so that it can be beneficially used and thereby avoid the need to import water. The City will have a solution for their water needs for at least 25 years.

Monetized Benefits Analysis (Section D3)

The primary monetized benefit anticipated to accrue over the expected 25-year life of the project is avoided imported water supply costs. Without the project, the groundwater in the area would become too salty to be usable and Camarillo and its project partners (the City of Thousand Oaks and the Camrosa Water District) would have to rely fully on imported water to meet their demands.

Avoided Imported Water Supply Costs

With the project, the NPV Groundwater Desalter will produce 7,500 AFY from brackish groundwater over the expected 25-year life of the project. This will allow the City of Camarillo and its project partners to avoid purchasing 7,500 AFY from Calleguas, resulting in significant cost savings.

In 2012, the cost of Tier 1 water delivered to Calleguas retail customers amounted to $1,056 per AF of water delivered. This includes

Metropolitan's base rate of $794, Calleguas' O&M surcharge of $54, and a capital construction surcharge of $208. Because the capital construction surcharge pertains to all Calleguas capital improvements, to determine avoided imported water supply costs, only the portion of the surcharge directly related to imported water delivery and/or treatment was applied. Based on Calleguas' 10-year capital improvement program (2012–2022), it appears that about 66 percent of Calleguas' planned capital improvements are directly related to the delivery and/or treatment of imported water. Thus the relevant portion of the capital construction surcharge is $137 (66 percent multiplied by $208). For the purposes of this analysis, avoided imported water supply costs therefore amount to $985 per AF for 2012, in 2012 dollars (including Metropolitan's base rate of $794, Calleguas' $54 O&M surcharge, and the $137 capital construction surcharge). The detailed calculation of costs of imported water is provided in Appendix A-8 which is included with Att8_IG2_BenCost_2of7.

In 2018, the first year that the desalter will be in operation, the cost per AF of imported water is $1,211. Multiplying this cost per AF by the number of AF that do not have to be imported, the avoided cost of imported water purchase in 2018 alone is $9,081,124, non-discounted. The cost reaches $1,800 per AF in 2042.

As is shown in Table A3, the present value of the benefit on the avoided imported water supply costs for the 25 year expected useful life of the project is $103,413,024.

Project Economic Costs

Table A4 summarizes the economic costs for the project. There are two sets of capital (initial) costs for this project: (1) costs for the construction of the desalter and (2) apportioned costs for the construction of the SMP (in Table A4, these capital costs are in the "other" column). The SMP is necessary for this project as it will remove brine produced by the desalter to the Pacific Ocean. There are also annual costs associated with processing water through the desalter over the expected 25-year life of the project.

The capital costs for the desalter are largely for buildings, RO equipment, pipelines, tanks, and two extraction wells; other costs include those for direct project administration, land purchase (for the land where the desalter will be located), design, and permits. These capital costs of the desalter total $42,781,600.

The project will use the SMP to dispose of brines, and therefore a share of SMP costs should be allocated to the project.[1] The City of Camarillo will pay $500 per AF of brine discharged into the SMP, or $170 per AF of water produced, to Calleguas, the owner of the SMP in order to pay a share of SMP capital and O&M costs (City of Camarillo 2013b, provided with this Cost Benefit Analysis). (The analysis that follows is based on the AF of water produced figure.) Of the $170 per AF of water produced, $43 per AF of water produced is for the operational cost of brine disposal, while $127 per AF of water produced goes towards paying the SMP's capital costs. However, the $127 per AF of water produced does not cover the full capital cost of the SMP that could be allocated to the NPV Groundwater Desalter because it does not account for state and federal grant funding that will pay part of the SMP costs. That is, the $127 per AF of water produced that the City of Camarillo is paying to Calleguas is only covering the non-grant funding capital costs, not the entire capital costs for constructing the SMP.

Specifically, the grant funding for the SMP for the sections built (or to be built) from the Pacific Ocean to Phase 2C (the relevant section for this analysis) is $29,034,623; the non-grant funding for the SMP for the same sections is $103,228,824 (Calleguas 2013b). The ratio of grant funding to non-grant funding is 0.28 ($29,034,623 divided by $103,228,824). Therefore, accounting for the state and federal grant funding, $48 per AF (0.28 multiplied by $127) should be added to the $127 per AF of water produced, for a total of $175 per AF of water produced as the true capital cost of the SMP allocated to this project. Each year, the non-discounted capital costs for the proportion

1 The SMP is being built in phases. Phase 1, connecting the Camrosa Water Reclamation Facility to the Pacific Ocean, and the outfall are already complete. Phases 2A and 2C are essentially complete, and Phase 2B will start construction soon. The NPV Groundwater Desalter will connect to Phase 2C.

TABLE A3 - ANNUAL BENEFITS (Table 15 of PSP) (All benefits in 2012 dollars) Project: North Pleasant Valley Groundwater Desalter									
(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 (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2012						$985		1.000	
2013						$1,019		0.943	
2014						$1,055		0.890	
2015						$1,092		0.840	
2016						$1,130		0.792	
2017						$1,170		0.747	
2018	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,211	$9,081,124	0.705	**$6,401,834**
2019	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,253	$9,398,963	0.665	**$6,250,847**
2020	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,297	$9,727,927	0.627	**$6,103,422**
2021	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,317	$9,873,846	0.592	**$5,844,314**
2022	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,336	$10,021,953	0.558	**$5,596,206**
2023	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,356	$10,172,283	0.527	**$5,358,632**
2024	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,377	$10,324,867	0.497	**$5,131,143**
2025	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,397	$10,479,740	0.469	**$4,913,311**
2026	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,418	$10,636,936	0.442	**$4,704,727**
2027	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,440	$10,796,490	0.417	**$4,504,998**
2028	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,461	$10,958,437	0.394	**$4,313,748**
2029	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,483	$11,122,814	0.371	**$4,130,617**
2030	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,505	$11,289,656	0.350	**$3,955,261**
2031	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,528	$11,459,001	0.331	**$3,787,349**
2032	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,551	$11,630,886	0.312	**$3,626,565**
2033	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,574	$11,805,349	0.294	**$3,472,607**
2034	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,598	$11,982,430	0.278	**$3,325,185**
2035	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,622	$12,162,166	0.262	**$3,184,022**
2036	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,646	$12,344,598	0.247	**$3,048,851**

TABLE A3 - ANNUAL BENEFITS cont.

(All benefits in 2012 dollars)

Project: North Pleasant Valley Groundwater Desalter

(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**	**Annual $ Value (f) x (g)**	**Discount Factor (1)**	**Discounted Benefits (h) x (i)**
2037	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,671	$12,529,767	0.233	**$2,919,419**
2038	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,696	$12,717,714	0.220	**$2,795,481**
2039	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,721	$12,908,480	0.207	**$2,676,805**
2040	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,747	$13,102,107	0.196	**$2,563,167**
2041	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,773	$13,298,638	0.185	**$2,454,353**
2042	Avoided SWP Imports	Acre-feet	0	7500	7500	$1,800	$13,498,118	0.174	**$2,350,159**
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		**$103,413,024**

Comments: Without the project, the City of Camarillo and its project partners would need to import 7,500 acre-feet of water every year (purchased through Calleguas Municipal Water District). With the project, Camarillo and its project partners will obtain the 7,500 acre-feet by processing brackish groundwater through a desalter.

The cost of imported water is assumed to be $985 in 2012, rise 3.5% a year from 2013 through 2020, and then rise 1.5% a year from 2021 through 2042.

TABLE A4 – ANNUAL COSTS OF PROJECT (Table 19 of PSP) (All costs in 2012 Dollars) Project: North Pleasant Valley Groundwater Desalter										
	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	200,000							200,000	1.000	**200,000**
2013	454,316							454,316	0.943	**428,420**
2014	2,077,900							2,077,900	0.890	**1,849,331**
2015	1,635,790							1,635,790	0.840	**1,374,064**
2016	23,042,259							23,042,259	0.792	**18,251,627**
2017	15,371,335							15,371,335	0.747	**11,486,356**
2018				2,250,000	112,500	480,000	1,312,500	4,155,000	0.705	**2,929,111**
2019				2,250,000	112,500	480,000	1,312,500	4,155,000	0.665	**2,763,312**
2020				2,250,000	112,500	480,000	1,312,500	4,155,000	0.627	**2,606,898**
2021				2,250,000	112,500	480,000	1,312,500	4,155,000	0.592	**2,459,338**
2022				2,250,000	112,500	480,000	1,312,500	4,155,000	0.558	**2,320,130**
2023				2,250,000	112,500	480,000	1,312,500	4,155,000	0.527	**2,188,802**
2024				2,250,000	112,500	480,000	1,312,500	4,155,000	0.497	**2,064,908**
2025				2,250,000	112,500	480,000	1,312,500	4,155,000	0.469	**1,948,026**
2026				2,250,000	112,500	480,000	1,312,500	4,155,000	0.442	**1,837,761**
2027				2,250,000	112,500	480,000	1,312,500	4,155,000	0.417	**1,733,736**
2028				2,250,000	112,500	480,000	1,312,500	4,155,000	0.394	**1,635,600**
2029				2,250,000	112,500	480,000	1,312,500	4,155,000	0.371	**1,543,019**
2030				2,250,000	112,500	480,000	1,312,500	4,155,000	0.350	**1,455,678**
2031				2,250,000	112,500	480,000	1,312,500	4,155,000	0.331	**1,373,282**
2032				2,250,000	112,500	480,000	1,312,500	4,155,000	0.312	**1,295,549**
2033				2,250,000	112,500	480,000	1,312,500	4,155,000	0.294	**1,222,216**
2034				2,250,000	112,500	480,000	1,312,500	4,155,000	0.278	**1,153,034**

TABLE A4 – ANNUAL COSTS OF PROJECT cont.
(All costs in 2012 Dollars)

Project: North Pleasant Valley Groundwater Desalter

	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)**
2035				2,250,000	112,500	480,000	1,312,500	4,155,000	0.262	**1,087,768**
2036				2,250,000	112,500	480,000	1,312,500	4,155,000	0.247	**1,026,196**
2037				2,250,000	112,500	480,000	1,312,500	4,155,000	0.233	**968,109**
2038				2,250,000	112,500	480,000	1,312,500	4,155,000	0.220	**913,311**
2039				2,250,000	112,500	480,000	1,312,500	4,155,000	0.207	**861,614**
2040				2,250,000	112,500	480,000	1,312,500	4,155,000	0.196	**812,843**
2041				2,250,000	112,500	480,000	1,312,500	4,155,000	0.185	**766,833**
2042				2,250,000	112,500	480,000	1,312,500	4,155,000	0.174	**723,428**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 73,280,300**

1. *If any, based on opportunity costs, sunk costs and associated costs*
2. *The incremental change in O&M costs associated with the project.*

Comments: Costs include initial (capital) costs, annual costs, and other costs. The initial costs are the costs to build the desalter, the annual costs are those to process water through the desalter, and the other costs are those associated with this desalter's portion of Salinity Management Pipeline capital costs.

Annual costs include operations, maintenance, and periodic replacement costs. Costs included as operations are those for electricity, chemicals, well pumping charges, and brine disposal. Costs included as maintenance are those for labor. Costs included as periodic replacement are those for membrane replacement, cartridge filters, and repairs and replacement.

Other costs are the capital costs for the proportion of the SMP associated with this project.

of the SMP associated with this project is $1,312,500 (7,500 AF produced multiplied by $175). Over the expected 25–year life of the project, the non-discounted cost for the proportion of the SMP associated with this project is $32,812,500 (25 years multiplied by 7,500 AFY multiplied by $175).

The annual costs associated with the desalter include the costs for pumping the water out of the ground and processing it through the desalter. In addition, there are costs to discharge brine to the SMP (the $43 per AF mentioned two paragraphs above). In particular, annual costs occur in the following categories: operations, maintenance, and periodic replacement. Operations costs include electricity, chemicals, well pumping charges, and brine disposal, for a total of $2,250,000 each year. Maintenance costs include labor and totals $112,500 each year. Periodic replacement costs include membrane replacement, cartridge filters, and repairs and replacement; these total $480,000 each year. The annual O&M costs associated with the project are $2,842,500.

The total present value capital costs are $46,127,412. The total present value annual costs are $27,152,888. The total present value for capital costs plus the annual O&M costs over the 25-year life of the project is $73,280,300.

Project Benefits and Cost Summary

The monetized benefits of this project come from avoided imported water supply costs. The monetized benefits are $103,413,024. The project economic costs are $73,280,300. The monetized benefits are greater than the project economic costs.

There are two benefits that are physically quantified but not monetized: the project will (1) Prevent introduction of or result in export of more than 17,000 MT salts every year and (2) Reduce emissions of greenhouse gases by more than 8,000 MT every year.

There are seven purely qualitative benefits:

(1) Educate customers on use of water softeners.

(2) Help meet Total Maximum Daily Load requirements.

(3) Prevent brackish groundwater plume from affecting other supplies.

(4) Reduce the concentration of chlorides in the Camarillo Sanitary District's tertiary-treated wastewater (recycled water), allowing wider usage of recycled water.

(5) Allow water with lower salt concentration to recharge the aquifer.

(6) Reduce demand for net diversions from the Delta.

(7) Provide a long-term solution in place of a short-term one.

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 this analysis, the main uncertainties are associated with avoided imported water supply costs. These issues are listed in Table A5.

References

The following items are being provided with this Benefit and Cost Analysis. These items are found in Att8_IG2_BenCost_2of7.

- Calleguas. 2013a. Email communication with Bryan Bondy. Calleguas Municipal Water District. February 1.
- Calleguas. 2013b. Salinity Management Pipeline Costs. Calleguas Municipal Water District.
- City of Camarillo. 2013a Reverse Osmosis Capital Costs and Maintenance Costs.
- LARWQCB, 2007. Proposed Amendment to the Water Quality Control Plan to Incorporate the Total Maximum Daily Load for Boron, Chloride, Sulfate, and TDS (Salts) in the Calleguas Creek Watershed. Attachment A to Resolution No. R4-2007-016.

TABLE A5
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided imported water supply costs	U	While the increase in real costs per AF of imported water used in this analysis is based on historical data (albeit conservatively), the cost of imported water in the future is still uncertain. A greater (lower) rate of change in costs per AF that will occur in the future will result in a larger (smaller) benefit over the project's lifetime.
Avoided imported water supply costs	–	Another uncertainty is whether the desalter will actually produce 7,500 AFY for 25 years (the amount of imported water offset claimed). If it does not, the benefit will be reduced because the City of Camarillo and project proponents would have to import some additional water. This could happen, for example, if the Fox Canyon Groundwater Management Agency does not allow Camarillo to pump sufficient groundwater (although Camarillo has calculated that it has sufficient credits).

*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 –.

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West Simi Valley Water Recycling Project Phases 1 and 2 (Simi RW Project)

Summary

The Simi RW Project will expand an existing recycled water distribution system to allow for the delivery of an additional 601.7 AFY of recycled water. The source of the recycled water is the City of Simi Valley Water Quality Control Plant (WQCP), which is owned and operated by the City of Simi Valley. The project proponent is the Ventura County Waterworks District No. 8/City of Simi Valley (Simi Valley).

Phase 1 will construct 4,300 linear feet (LF) of pipeline, which will extend the existing distribution system generally eastward. Phase 1 is scheduled for completion in mid-2014. Phase 2 includes the construction of 17,300 LF of pipeline, two new pump units at the existing Recycled Water Pump Station, and a new 1.25 MG storage tank. Phase 2 will extend the existing distribution network generally southward and will be completed in December 2015.

The new distribution network will serve 47 potential customers who currently use potable water supplied by Simi Valley for irrigation purposes. These customers include parks, homeowners associations (HOAs), and golf courses. Providing recycled water to these customers will directly offset the use of potable water supplies imported via the SWP.

A summary of all benefits and costs of the project are provided in Table B1. Both monetized and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Non-Monetized Benefits Analysis (Section D2)

As discussed in Attachment 7 and Section D3 below, this project will result in a number of physically quantifiable benefits (or avoided project costs) that can be monetarily valued. However, the project will also result in a number of benefits that cannot be easily quantified but are just as important. These benefits are qualitatively described in this section.

Table B2 shows the non-monetized benefits checklist for the project (using Table 12 from Exhibit C of the IRWM PSP). Narrative descriptions of the benefit categories marked “Yes” in the table are provided in the section following the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus although a benefit might apply, a “No” is entered into the table if the benefit has been physically quantified and/or monetized.

Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked “Yes” from the checklist in Table B2 are described below.

Provide Social, Recreation, or Access Benefits

By switching to recycled water, participating customers will no longer be subject to watering restrictions during times of drought. Thus, open space areas, golf courses, parks, and other recycled water customers who provide recreational or aesthetic services can continue to irrigate their landscape/turf areas regardless of drought conditions and remain green during dry periods. This will improve the aesthetics and enjoyment of these areas and, in extreme cases, may avoid closures that would otherwise be necessary to prevent further turf damage (e.g., on playing fields, parks, and golf courses).

TABLE B1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$10,380,848
Monetizable Benefits	
Avoided Imported Water Supply Costs	$12,191,403
Fertilizer Cost Savings	$145,175
Avoided Discharge Costs at the Simi Valley WQCP	$100,935
Avoided RO Treatment Costs for Wastewater Effluent	$22,521,580
Total Monetizable Benefits	*$34,959,093*
Physically Quantified Benefit or Cost (Not Monetized)	Project Life Total
Avoided Introduction of Salts into the Watershed	11,193 MT
Reduced CO_2 Emissions	36,827 MT
Qualitative Benefit or Cost	Qualitative Indicator*
Increased Social Recreation/Access Benefits	+
Helps Meet State Mandates for Water Conservation and Water Recycling	+
Reduced Demand for Net Diversions From the Delta	+
Improved Water Supply Reliability	+ +

* 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 net benefits.
– – Likely to decrease net benefits significantly.
U Uncertain, could be + or – .

MT = metric tons.
O&M = operations and maintenance.
RO = reverse osmosis.
CO_2 = carbon dioxide.
Watershed: Calleguas Creek Watershed

Calleguas: Calleguas Municipal Water District

Metropolitan: Metropolitan Water District of Southern California.

TABLE B2 (Table 12 of PSP) WEST SIMI VALLEY WATER RECYCLING PROJECT 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 firefighting 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?	

TABLE B2 cont.

	Question	Enter "Yes", "No", or "Neg"
	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[a]
	Examples are not limited to, but may include: - Reduce net production of greenhouse gases? - 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

TABLE B2 cont.

Question		Enter "Yes", "No", or "Neg"
13	Promote energy savings or replace fossil fuel-based energy sources with renewable energy and resources?	No[a]
	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 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?	

a. This benefit category is marked as no because it was already described as a physically quantified benefit in Attachment 7.

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

This project helps to meet requirements set forth in California Senate Bill 7 of Special Extraordinary Session 7 (SBx7-7), which sets an overall goal for urban water suppliers of reducing per capita water use by 20 percent by December 31, 2020 (and by at least 10 percent by December 31, 2015). Under this legislation, recycled water does not count against an agency's per capita use calculation and therefore essentially counts as "conserved" water. This project also helps to meet statewide goals to increase use of recycled wastewater by at least 1 million AFY by 2020 and by at least 2 million AFY by 2030 (State Water Resources Control Board 2009).

Reduce Demand for Net Diversions from the Delta

By reducing the use of imported SWP water, the Simi RW Project will augment in-stream flows in the Sacramento-San Joaquin River Delta (which provides the means by which the SWP delivers water from Northern California to the south) or will offset other diversions that may otherwise reduce flows. Lower demands on Delta supplies will also help reduce the overall salinity of the Delta and improve Delta habitat.

The Delta's environmental condition is vital to maintaining and improving the viability of the region. The Delta provides drinking water to 25 million people, supports irrigation of 4.5 million acres of agriculture, and serves as home to 750 plant and animal species. The Delta's 1,600 square miles of marshes, islands, and sloughs support at least half of migratory water birds on the Pacific Flyway; 80 percent of California's commercial fisheries; and recreational uses including boating, fishing, and windsurfing.

Delta resources are in a state of crisis. Fish populations, including salmon and Delta smelt, have declined dramatically in recent years. The levee system is aging, and the vulnerability of the Delta to flooding, sea level rise, or a major earthquake has contributed to concerns about possible levee collapse. In addition, water quality problems continue, and there is little consensus on how to manage water resources.

Accordingly, by reducing dependence on SWP waters, this project reduces diversions of water from the Bay-Delta system and helps preserve this vital resource. In addition, by reducing

demand for Bay-Delta diversions, this project may help free up some SWP water for other potential users or the environment.

Improve Water Supply Reliability in Ways Not Quantified In Attachment 7

The reliability of a water supply refers to its ability to meet water demands on a consistent basis, even in times of drought or other constraints on source water availability. As noted above, the reliability of imported SWP water is subject to a number of natural and human forces, ranging from increased population growth (and the accompanying increased demands) to drought and earthquakes, to environmental regulations and water rights determinations. Thus the project will help address reliability issues in Simi Valley by offsetting the use of SWP water with locally generated recycled water, a drought-proof source.

Although interest in water supply reliability is increasing (e.g., due to increasing water demands and concerns about climate-related events), only a few studies have directly attempted to quantify its value (i.e., through nonmarket valuation studies). The results from these studies indicate that residential and industrial (i.e., urban) customers seem to value supply reliability quite highly. Stated preference studies find that water customers are willing to pay $100 to more than $500 per household per year for total reliability (i.e., a 0 percent probability of their water supply being interrupted in times of drought).

The challenge in using these values to determine a value of increased reliability as a result of the Simi RW Project is recognizing how to reasonably interpret these survey-based household monetary values. The values noted above reflect a willingness to pay per household to ensure complete reliability (zero drought-related use restrictions in the future), whereas the Simi RW Project only enhances overall reliability; it does not guarantee 100 percent reliability. Thus if applied directly to the number of households within the Simi Valley service area, the dollar values from the studies would overstate the reliability value provided by the project.

A simple way to roughly adjust for this "whole versus part" problem is to attribute a portion of the total value of reliability to the portion of the problem that is solved by the project. To adjust for the partial improvement in reliability from the project, it is assumed that household willingness to pay for improved reliability is directly proportional to the amount of recycled water that will offset imported water as a percentage of the total potable water supply. This represents the percentage of total supply that has been improved in terms of overall reliability (i.e., by offsetting imported water demand with local sources).

For example, the project will offset 601.7 AFY of imported water beginning at full implementation. In 2020, total (non-agricultural) potable water demand within the Simi Valley service area will be about 25,825 AFY (RBF Consulting 2011).[2] Thus about 2.3 percent of total potable demand will be met by recycled water made available as a result of the project. To obtain a lower bound estimate for the value of improved reliability associated with this water, it is assumed that households within the Simi Valley service area are willing to pay about $2.30 per year ($100 multiplied by 2.3 percent). Applying this dollar value per household to the approximately 32,756 households[3] within the collective service areas would result in $75,338 of benefits in 2020. Taking into account increasing population and changing demands, this calculation could be completed for each year of the project's useful life.

Because of the uncertainty involved in applying these numbers to this situation, this benefit estimate is not included in the tables. However, it is provided here to give an idea of the potential magnitude of this benefit.

2 This includes a total demand of 25,969 AFY minus 34 AFY of agricultural demand and 100 AFY of non-potable demand, as reported in Simi Valley's 2010 Urban Water Management Plan (UWMP) (RBF Consulting 2011).

3 This is based on the estimated 2020 population of the service area of 99,251 (as reported in the 2010 UWMP, RBF Consulting, 2011) divided by the average number of people per household in Ventura County as reported by the U.S. Census Bureau.

Monetized Benefits Analysis (Section D3)

Several monetized benefits are expected to accrue over the expected 50-year life of the project, including:

- Avoided imported water costs.
- Fertilizer cost savings.
- Avoided discharge costs at the Simi Valley WQCP.
- Avoided costs associated with RO treatment of discharge at the WQCP.

Benefit: Avoided Imported Water Costs

Although Simi Valley uses a mix of imported water and local sources to supply their customers, the vast majority (97 percent) is imported water. It is also the more expensive source and has issues with supply reliability for various reasons (see reliability discussion above). For this analysis, imported water is considered to be the marginal water source for Simi Valley. Thus the increased use of recycled water will reduce reliance on SWP water supplies.

This project will directly offset the use of 601.7 AFY of imported water provided by Metropolitan and imported via Calleguas.[4] To calculate the total costs of avoided imported water over the 50-year project life, the amount of avoided imported water each year is multiplied by the projected cost of the water in that year.

In 2012, the cost of Tier 1 water delivered to Calleguas retail customers amounted to $1,056 per AF of water delivered. This includes Metropolitan's base rate of $794, Calleguas' O&M surcharge of $54, and a capital construction surcharge of $208. Because the capital construction surcharge pertains to all Calleguas capital improvements, to determine avoided imported water supply costs, only the portion of the surcharge directly related to imported water delivery and/or treatment was applied. Based on Calleguas' 10-year capital improvement program (2012–2022), it appears that about 66 percent of Calleguas' planned capital improvements are directly related to the delivery and/or treatment of imported water. Thus the relevant portion of the capital construction surcharge is $137 (66 percent multiplied by $208). For the purposes of this analysis, avoided imported water supply costs therefore amount to $985 per AF for 2012, in 2012 dollars (including Metropolitan's base rate of $794, Calleguas' $54 O&M surcharge, and the $137 capital construction surcharge). The detailed calculation of costs of imported water is provided in Appendix A-8 which is included with Att8_IG2_BenCost_2of7.

Annual Metropolitan Tier 1 rate increases have averaged about 7.7 percent in nominal terms from 2003 to 2012 (Metropolitan 2013, provided with this Benefit Cost Analysis). For this analysis, it is conservatively assumed that the cost of imported supplies will increase at a 6 percent nominal rate through 2020. After adjusting for annual inflation of about 2.5 percent,[5] the cost of imported water is therefore expected to increase annually by 3.5 percent in real terms over this time period. Beginning in 2021, a 1.5 percent annual real increase in water rates is assumed through the end of the project life to recognize that a possible Bay-Delta solution or other factors may reduce future Metropolitan Tier 1 rates below their historic 5.2 percent real rate of price increase or the assumed 3.5 percent rate of increase through 2020.

Given the schedule for Phase 1 and 2 construction, the project will avoid 30,242 AF of imported water over the expected 50-year project life. Based on the assumptions described above and an annual real discount rate of 6 percent (per IRWM PSP Guidelines), total present value benefits associated with the avoided purchase of this water amounts to

[4] The project will avoid 601.7 AFY beginning in 2016, following completion of Phase 2. In 2014 and 2015, the project will avoid 52.5 and 104.9 AF, respectively, as Phase 1 comes online.

[5] Based on long-range Consumer Price Index (CPI) projections from the Federal Reserve Bank of Philadelphia (2013) of 2.3 percent per year, for 2013 through 2022.

about $12.2 million over the 50-year project life as presented in Table B3.

Benefit: Fertilizer Cost Savings

Fertilizing compounds commonly present in recycled water are typically not found in potable water (e.g., nitrogen, phosphorus, potassium). Thus the use of recycled water for landscape irrigation will reduce fertilizer costs associated with the properties that will be served by the project.

The exact offset of fertilizer use from using recycled water is difficult to predict due to daily and seasonal nutrient variations in the recycled water and plant-specific fertilizer requirements. However, the amount of nutrients (i.e., pounds of fertilizer) per AF of recycled water can be calculated from average (tertiary-treated) effluent values for the Simi Valley WQCP.

The recycled water from the WQCP contains 25.0 lbs of nitrogen per AF and 8.2 lbs of phosphorus per AF (City of Simi Valley 2011; data for the amount of potassium present in the recycled water is not available). Thus for every AF of recycled water used in-lieu of potable water, the recycled water customers will avoid the use of a total of 33.2 lbs of fertilizer. The weighted average commercial value of this fertilizer is $0.54/lb.[6]

For the 601.7 AF of recycled water applied each year in-lieu of imported water, recycled water customers served by the project will avoid the use of 19,976 lbs of fertilizer. This will result in avoided costs of $10,787 annually (undiscounted).[7] Over the lifetime of the project, total present value avoided fertilizer costs will amount to $145,175 as presented in Table B3 Additional benefits would be expected for avoided fertilizer costs due to increased levels of potassium in recycled water compared to potable supplies.

Benefit: Avoided Discharge Costs at the Simi Valley WQCP

Under both the with and without project scenarios, the City of Simi Valley will continue to treat 601.7 AFY of wastewater effluent to tertiary standards at its WQCP. With the project, this treated effluent will be used by Simi Valley's customers for irrigation purposes. Without the project, the City will continue to discharge the treated effluent into the Arroyo Simi. Thus the project will result in avoided costs associated with the discharge of 601.7 AFY.

6 This represents the average weighted cost of nitrogen and phosphorus. Source: Asano, 1981, updated to 2006 using the national fertilizer price index. Updated from 2006 to 2012 based on the CPI.

7 Numbers do not add exactly due to rounding.

TABLE B3 – ANNUAL BENEFIT (Table 15 of PSP) (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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 (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2012	Avoided imported water costs	AF						1.000	
	Avoided fertilizer costs	lbs						1.000	
	Avoided discharge costs at WQCP	$/year						1.000	
2013	Avoided imported water costs	AF						0.943	
	Avoided fertilizer costs	lbs						0.943	
	Avoided discharge costs at WQCP	$/year						0.943	
2014	Avoided imported water costs	AF	0	52.5	52.5	$ 1,055	$ 55,396	0.890	**$ 49,302**
	Avoided fertilizer costs	lbs	0	1,743	1,743	$ 0.54	$ 941	0.890	**$ 838**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 654	$ 654	0.890	**$ 582**
2015	Avoided imported water costs	$/AF	0	104.9	104.9	$ 1,092	$ 114,560	0.840	**$ 96,187**
	Avoided fertilizer costs	lbs	0	3,483	3,483	$ 0.54	$ 1,881	0.840	**$ 1,579**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 1,308	$ 1,308	0.840	**$ 1,098**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
2020	Avoided imported water costs	AF	0	601.7	602	$ 1,297	$ 780,439	0.627	**$ 489,657**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.627	**$ 6,768**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.627	**$ 4,706**
2021	Avoided imported water costs	AF	0	601.7	602	$ 1,317	$ 792,146	0.592	**$ 468,870**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.592	**$ 6,385**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.592	**$ 4,439**
2022	Avoided imported water costs	AF	0	601.7	602	$ 1,336	$ 804,028	0.558	**$ 448,965**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.558	**$ 6,024**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.558	**$ 4,188**
2023	Avoided imported water costs	AF	0	601.7	602	$ 1,356	$ 816,088	0.527	**$ 429,905**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.527	**$ 5,683**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.527	**$ 3,951**
2024	Avoided imported water costs	AF	0	601.7	602	$ 1,377	$ 828,330	0.497	**$ 411,654**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.497	**$ 5,361**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.497	**$ 3,727**
2025	Avoided imported water costs	AF	0	601.7	602	$ 1,397	$ 840,755	0.469	**$ 394,179**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.469	**$ 5,057**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.469	**$ 3,516**
2026	Avoided imported water costs	AF	0	601.7	602	$ 1,418	$ 853,366	0.442	**$ 377,445**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.442	**$ 4,771**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.442	**$ 3,317**
2027	Avoided imported water costs	AF	0	601.7	602	$ 1,440	$ 866,166	0.417	**$ 361,421**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.417	**$ 4,501**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.417	**$ 3,129**
2028	Avoided imported water costs	AF	0	601.7	602	$ 1,461	$ 879,159	0.394	**$ 346,078**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.394	**$ 4,246**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.394	**$ 2,952**
2029	Avoided imported water costs	AF	0	601.7	602	$ 1,483	$ 892,346	0.371	**$ 331,386**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.371	**$ 4,006**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.371	**$ 2,785**
2030	Avoided imported water costs	AF	0	601.7	602	$ 1,505	$ 905,731	0.350	**$ 317,317**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.350	**$ 3,779**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.350	**$ 2,628**
2031	Avoided imported water costs	AF	0	601.7	602	$ 1,528	$ 919,317	0.331	**$ 303,846**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.331	**$ 3,565**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.331	**$ 2,479**
2032	Avoided imported water costs	AF	0	601.7	601.7	$ 1,551	$ 933,107	0.312	**$ 290,947**
	Avoided fertilizer costs	lbs	0	9,976	19,976	$ 0.54	$ 10,787	0.312	**$ 3,364**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.312	**$ 2,339**
2033	Avoided imported water costs	AF	0	601.7	601.7	$ 1,574	$ 947,104	0.294	**$ 278,596**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.294	**$ 3,173**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.294	**$ 2,206**
2034	Avoided imported water costs	AF	0	601.7	601.7	$ 1,598	$ 961,310	0.278	**$ 266,769**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.278	**$ 2,994**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.278	**$ 2,081**
2035	Avoided imported water costs	AF	0	601.7	601.7	$ 1,622	$ 975,730	0.262	**$ 255,443**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.262	**$ 2,824**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.262	**$ 1,963**
2036	Avoided imported water costs	AF	0	601.7	601.7	$ 1,646	$ 990,366	0.247	**$ 244,599**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.247	**$ 2,664**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.247	**$ 1,852**
2037	Avoided imported water costs	AF	0	601.7	601.7	$ 1,671	$ 1,005,221	0.233	**$ 234,215**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.233	**$ 2,513**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.233	**$ 1,747**
2038	Avoided imported water costs	AF	0	601.7	601.7	$ 1,696	$ 1,020,300	0.220	**$ 224,272**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.220	**$ 2,371**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.220	**$ 1,649**
2039	Avoided imported water costs	AF	0	601.7	601.7	$ 1,721	$ 1,035,604	0.207	**$ 214,751**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.207	**$ 2,237**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.207	**$ 1,555**
2040	Avoided imported water costs	AF	0	601.7	601.7	$ 1,747	$ 1,051,138	0.196	**$ 205,634**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.196	**$ 2,110**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.196	**$ 1,467**
2041	Avoided imported water costs	AF	0	601.7	601.7	$ 1,773	$ 1,066,905	0.185	**$ 196,905**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.185	**$ 1,991**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.185	**$ 1,384**
2042	Avoided imported water costs	AF	0	601.7	601.7	$ 1,800	$ 1,082,909	0.174	**$ 188,545**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.174	**$ 1,878**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.174	**$ 1,306**
2043	Avoided imported water costs	AF	0	601.7	601.7	$ 1,827	$ 1,099,153	0.164	**$ 180,541**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.164	**$ 1,772**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.164	**$ 1,232**
2044	Avoided imported water costs	AF	0	601.7	601.7	$ 1,854	$ 1,115,640	0.155	**$ 172,877**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.155	**$ 1,672**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.155	**$ 1,162**
2045	Avoided imported water costs	AF	0	601.7	601.7	$ 1,882	$ 1,132,375	0.146	**$ 165,538**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.146	**$ 1,577**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.146	**$ 1,096**
2046	Avoided imported water costs	AF	0	601.7	601.7	$ 1,910	$ 1,149,360	0.138	**$ 158,510**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.138	**$ 1,488**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.138	**$ 1,034**
2047	Avoided imported water costs	AF	0	601.7	601.7	$ 1,939	$ 1,166,601	0.130	**$ 151,781**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.130	**$ 1,403**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.130	**$ 976**
2048	Avoided imported water costs	AF	0	601.7	601.7	$ 1,968	$ 1,184,100	0.123	**$ 145,337**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.123	**$ 1,324**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.123	**$ 921**
2049	Avoided imported water costs	AF	0	601.7	601.7	$ 1,997	$ 1,201,861	0.116	**$ 139,167**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.116	**$ 1,249**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.116	**$ 868**
2050	Avoided imported water costs	AF	0	601.7	601.7	$ 2,027	$1,219,889	0.109	**$ 133,259**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.109	**$ 1,178**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.109	**$ 819**
2051	Avoided imported water costs	AF	0	601.7	601.7	$ 2,058	1,238,187	0.103	**$ 127,602**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.103	**$ 1,112**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.103	**$ 773**
2052	Avoided imported water costs	AF	0	601.7	601.7	$ 2,089	$ 1,256,760	0.097	**$ 122,185**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.097	**$ 1,049**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.097	**$ 729**
2053	Avoided imported water costs	AF	0	601.7	601.7	$ 2,120	$ 1,275,612	0.092	**$ 116,998**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.092	**$ 989**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.092	**$ 688**
2054	Avoided imported water costs	AF	0	601.7	601.7	$ 2,152	$ 1,294,746	0.087	**$ 112,031**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.087	**$ 933**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.087	**$ 649**
2055	Avoided imported water costs	AF	0	601.7	601.7	$ 2,184	$ 1,314,167	0.082	**$ 107,275**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.082	**$ 881**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.082	**$ 612**
2056	Avoided imported water costs	AF	0	601.7	601.7	$ 2,217	$ 1,333,879	0.077	**$ 102,721**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.077	**$ 831**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.077	**$ 578**
2057	Avoided imported water costs	AF	0	601.7	601.7	$ 2,250	$ 1,353,888	0.073	**$ 98,360**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.073	**$ 784**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.073	**$ 545**
2058	Avoided imported water costs	AF	0	601.7	601.7	$ 2,284	$1,374,196	0.069	**$ 94,184**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.069	**$ 739**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.069	**$ 514**
2059	Avoided imported water costs	AF	0	601.7	601.7	$ 2,318	$ 1,394,809	0.065	**$ 90,186**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.065	**$ 697**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.065	**$ 485**
2060	Avoided imported water costs	AF	0	601.7	601.7	$ 2,353	$ 1,415,731	0.061	**$ 86,357**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.061	**$ 658**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.061	**$ 457**
2061	Avoided imported water costs	AF	0	601.7	601.7	$ 2,388	$ 436,967	0.058	**$ 82,691**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.058	**$ 621**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.058	**$ 432**
2062	Avoided imported water costs	AF	0	601.7	601.7	$ 2,424	$ 1,458,521	0.054	**$ 79,181**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.054	**$ 586**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.054	**$ 407**
2063	Avoided imported water costs	AF	0	601.7	601.7	$ 2,460	$ 1,480,399	0.051	**$ 75,819**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.051	**$ 552**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.051	**$ 384**
2064	Avoided imported water costs	AF	0	601.7	601.7	$ 2,497	$ 1,502,605	0.048	**$ 72,601**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.048	**$ 521**

TABLE B3 – ANNUAL BENEFIT Cont.. (All benefits in 2012 dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2									
(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	Annual $ Value) (f) x (g)	Discount Factor)	Discounted Benefits (h) x (i)
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.048	**$ 362**
2065	Avoided imported water costs	AF	0	601.7	601.7	$ 2,535	$ 1,525,144	0.046	**$ 69,518**
	Avoided fertilizer costs	lbs	0	19,976	19,976	$ 0.54	$ 10,787	0.046	**$ 492**
	Avoided discharge costs at WQCP	$/year	N/A	N/A	N/A	$ 7,500	$ 7,500	0.046	**$ 342**
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$ 12,437,513**

Simi Valley estimates that costs associated with discharging the wastewater effluent amount to $7,500 per year (City of Simi Valley 2013). Over the 50-year project life, the total present value benefit associated with this benefit amounts to $100,935 (assuming a discount rate of 6 percent) as presented in Table B3.

Benefit: Avoided Costs Associated with RO Treatment of Discharge at the WQCP

As described in Attachment 7, the accumulation of salts due to historic and ongoing point and nonpoint source pollution poses a number of problems for beneficial uses within the Calleguas Creek Watershed including municipal, industrial, and agricultural water supply and habitat. Salt-related TMDLs have been established for Calleguas Creek (i.e., for boron, chloride, sulfate, and TDS). Due to requirements associated with the established TMDLs, the City of Simi Valley will not be able to continue discharging wastewater effluent into the Arroyo Simi unless it is highly treated using advanced treatment technologies (i.e., microfiltration/reverse osmosis [MF/RO]). By providing for an alternative to discharge through the use of recycled water, the project will avoid implementation of MF/RO to treat 601.7 AFY (about 0.54 MGD).

The capital costs for a 0.54-mgd MF/RO facility would amount to more than $1.74 million. Capital costs were determined by linearly scaling the estimated costs of a 2.5-mgd MF/RO facility designed for desalting wastewater at another location in the Watershed. A similar method was used to determine O&M costs for the avoided project. By scaling O&M costs for a 1.0-mgd facility, it is estimated that O&M costs for the 0.54-mgd facility would amount to about $110,000 per year.

This analysis assumes that the brine concentrate (i.e., the MF/RO by-product) from the facility would be discharged to Calleguas' SMP for disposal in the Pacific Ocean.[8] In the event that disposal via the SMP is not possible, brine disposal would pose a significant challenge as the only other available alternative would be to truck the brine to a disposal facility (at an estimated cost of $16,000 per AF of brine for disposal only not including trucking). To facilitate disposal to the SMP, Calleguas would need to extend the pipeline by 44,800 linear feet (about 8.5 miles). The estimated capital cost of this construction is $42.5 million. In addition, O&M costs associated with the SMP would amount to about $28,050 per year.

To determine the total present value of avoided costs, it was assumed that the MF/RO facility would be constructed in 2020 and 2021, and that operations would begin in 2022 (the year in which TMDL waste load allocations need to be met). It was also assumed that the facility would have a 30-year useful project life (through 2051). Based on these assumptions, the total present value of avoided project costs amounts to $22,521,580 as presented in Table B4.

Summary of Benefits

Table B3 summarizes the annual benefits from the project, including avoided imported water costs, fertilizer cost savings, and avoided costs associated with the discharge of 601.7 AFY of effluent into the Arroyo Simi.

Table B4 shows the avoided (present value) costs associated with RO/MF treatment of 601.7 AFY of effluent, including both capital and O&M costs. As shown, the avoided costs of RO/MF treatment amount to $22,521,580 over the 50-year project life.

Project Economic Costs

Capital costs for the project total $9,604,000. Construction and implementation costs (including construction administration and contingency) account for $7,790,000 (about 81 percent) of total capital costs. Project administration, planning, design, environmental documentation and compliance, and mitigation costs account for the remainder of the capital budget. In addition to the project capital costs,

8 The cost of connecting the MF/RO facility to the SMP is unknown and is therefore not included in the avoided cost analysis. These costs are expected to be nominal relevant to other facility costs.

TABLE B4 – ANNUAL COSTS OF AVOIDED PROJECTS (Table 16 of PSP) (All avoided costs in 2012 dollars) Project: Project: West Simi Valley Water Recycling Project Phases 1 and 2						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): _____ Avoided Project Description: Avoided MF/RO facility				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	$ -
2014				$ -	0.890	$ -
2015				$ -	0.840	$ -
2016				$ -	0.792	$ -
2017				$ -	0.747	$ -
2018				$ -	0.705	$ -
2019				$ -	0.665	$ -
2020	$ 17,567,797			$ 17,567,797	0.627	$ 11,022,253
2021	$ 17,567,797			$ 17,567,797	0.592	$ 10,398,352
2022			$ 135,132	$ 135,132	0.558	$ 75,457
2023			$ 135,132	$ 135,132	0.527	$ 71,186
2024			$ 135,132	$ 135,132	0.497	$ 67,157
2025			$ 135,132	$ 135,132	0.469	$ 63,355
2026			$ 135,132	$ 135,132	0.442	$ 59,769
2027			$ 135,132	$ 135,132	0.417	$ 56,386
2028			$ 135,132	$ 135,132	0.394	$ 53,194
2029			$ 135,132	$ 135,132	0.371	$ 50,183
2030			$ 135,132	$ 135,132	0.350	$ 47,343
2031			$ 135,132	$ 135,132	0.331	$ 44,663
2032			$ 135,132	$ 135,132	0.312	$ 42,135
2033			$ 135,132	$ 135,132	0.294	$ 39,750

TABLE B4 – ANNUAL COSTS OF AVOIDED PROJECTS cont. (All avoided costs in 2012 dollars) Project: Project: West Simi Valley Water Recycling Project Phases 1 and 2						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): _____ Avoided Project Description: Avoided MF/RO facility				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)		
2034			$ 135,132	$ 135,132	0.278	$ 37,500
2035			$ 135,132	$ 135,132	0.262	$ 35,377
2036			$ 135,132	$ 135,132	0.247	$ 33,375
2037			$ 135,132	$ 135,132	0.233	$ 31,486
2038			$ 135,132	$ 135,132	0.220	$ 29,703
2039			$ 135,132	$ 135,132	0.207	$ 28,022
2040			$ 135,132	$ 135,132	0.196	$ 26,436
2041			$ 135,132	$ 135,132	0.185	$ 24,940
2042			$ 135,132	$ 135,132	0.174	$ 23,528
2043			$ 135,132	$ 135,132	0.164	$ 22,196
2044			$ 135,132	$ 135,132	0.155	$ 20,940
2045			$ 135,132	$ 135,132	0.146	$ 19,754
2046			$ 135,132	$ 135,132	0.138	$ 18,636
2047			$ 135,132	$ 135,132	0.130	$ 17,581
2048			$ 135,132	$ 135,132	0.123	$ 16,586
2049			$ 135,132	$ 135,132	0.116	$ 15,647
2050			$ 135,132	$ 135,132	0.109	$ 14,762
2051			$ 135,132	$ 135,132	0.103	$ 13,926
Total Present Value of Discounted Costs (Sum of Column (g))						$ 22,521,580
(%) 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)						$ 22,521,580

Simi Valley estimates that the value of land where the recycled water storage tank will be built is approximately $500,000.[9] This is included as an additional project cost for the purposes of this analysis. O&M costs of the project will average about $81,000 per year, beginning in 2016. This includes an estimated $40,000 in operations costs (including close to $32,000 in energy costs) and $41,000 in general maintenance costs. It is assumed that O&M costs will increase (in real terms) by 2.5 percent per year over the 50-year project life.

In addition, Simi Valley believes that the recycled water storage tank will need to be recoated every 20 years. Thus it will need recoating in 2035 (20 years after project completion in 2016) and in 2054. The cost of recoating is estimated to be $170,000. Thus the total periodic recoating (categorized as a replacement cost) amount to $340,000 over the 50-year project life.

In total, the present value capital (including the value of the land where the tank site will be located) and O&M costs associated with the project amount to $10,380,848 over the 50-year project life (the 50-year project period runs from 2016, the first year following project completion, through 2065). Table B5 summarizes the economic project costs for the project.

Project Benefits and Cost Summary

As shown in Table B1 above, the total present value benefits associated with the West Simi Valley Water Recycling Project amount to $34,959,093 over the expected 50-year project life. This includes avoided imported water supply costs, fertilizer cost savings, avoided costs associated with the discharge of 601.7 AFY into the Arroyo Simi, and avoided costs associated with future MF/RO treatment costs at the WQCP.

The total present value cost of the project (including capital and O&M costs) is $10,380,848. The project will therefore result in total present value net benefits of $24,578,245.

In addition to the monetized benefits and costs, the project will also result in the following physically quantifiable and non-monetized benefits:

- Avoided introduction of salts into the Calleguas Creek Watershed (11,193 MT over the 50-year project life).
- Reduced CO_2 emissions (36,827 MT over the 50-year project life).
- Social recreation/access benefits due to recycled water customers being able to irrigate during times of drought.
- Help achieve compliance with state mandates associated with water recycling.
- Reduced demand for net diversions from the Delta.
- Improved water supply reliability through offsetting of the use of SWP water with locally generated recycled water.

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 this analysis, the main uncertainties are associated with avoided imported water supply costs and engineering cost estimates for the avoided MF/RO treatment. These issues are listed in Table B6.

9 This estimate is based on the value of comparable properties within the area. Values for these properties were obtained from the Ventura County Assessor's Office.

Table B5 – Annual Costs of Project (Table 19 of PSP) (All costs in 2012 Dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2										
	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	$ 288,120	$ 500,000						$ 788,120	0.943	$ 743,509
2014	$ 3,489,453							$3 ,489,453	0.890	$ 3,105,601
2015	$ 5,826,427							$5 ,826,427	0.840	$ 4,891,980
2016				$ 41,000	$ 40,000			$ 81,000	0.792	$ 64,160
2017				$ 42,025	$ 41,000			$ 83,025	0.747	$ 62,041
2018				$ 43,076	$ 42,025			$ 85,101	0.705	$ 59,993
2019				$ 44,153	$ 43,076			$ 87,228	0.665	$ 58,012
2020				$ 45,256	$ 44,153			$ 89,409	0.627	$ 56,096
2021				$ 46,388	$ 45,256			$ 91,644	0.592	$ 54,244
2022				$ 47,547	$ 46,388			$ 93,935	0.558	$ 52,453
2023				$ 48,736	$ 47,547			$ 96,284	0.527	$ 50,721
2024				$ 49,955	$ 48,736			$ 98,691	0.497	$ 49,046
2025				$ 51,203	$ 49,955			$ 101,158	0.469	$ 47,427
2026				$ 52,483	$ 51,203			$ 103,687	0.442	$ 45,861
2027				$ 53,796	$ 52,483			$ 106,279	0.417	$ 44,347
2028				$ 55,140	$ 53,796			$ 108,936	0.394	$ 42,882
2029				$ 56,519	$ 55,140			$ 111,659	0.371	$ 41,466
2030				$ 57,932	$ 56,519			$ 114,451	0.350	$ 40,097
2031				$ 59,380	$ 57,932			$ 117,312	0.331	$ 38,773
2032				$ 60,865	$ 59,380			$ 120,245	0.312	$ 37,493
2033				$ 62,386	$ 60,865			$ 123,251	0.294	$ 36,255

Table B5 – Annual Costs of Project cont. (All costs in 2012 Dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2										
	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)
2034				$ 63,946	$ 62,386			$ 126,332	0.278	**$ 35,058**
2035				$ 65,545	$ 63,946	$ 170,000		$ 299,491	0.262	**$ 78,406**
2036				$ 67,183	$ 65,545			$ 132,728	0.247	**$ 32,781**
2037				$ 68,863	$ 67,183			$ 136,046	0.233	**$ 31,699**
2038				$ 70,584	$ 68,863			$ 139,447	0.220	**$ 30,652**
2039				$ 72,349	$ 70,584			$ 142,933	0.207	**$ 29,640**
2040				$ 74,158	$ 72,349			$ 146,507	0.196	**$ 28,661**
2041				$ 76,012	$ 74,158			$ 150,169	0.185	**$ 27,715**
2042				$ 77,912	$ 76,012			$ 153,924	0.174	**$ 26,800**
2043				$ 79,860	$ 77,912			$ 157,772	0.164	**$ 25,915**
2044				$ 81,856	$ 79,860			$ 161,716	0.155	**$ 25,059**
2045				$ 83,903	$ 81,856			$ 165,759	0.146	**$ 24,232**
2046				$ 86,000	$ 83,903			$ 169,903	0.138	**$ 23,432**
2047				$ 88,150	$ 86,000			$ 174,151	0.130	**$ 22,658**
2048				$ 90,354	$ 88,150			$ 178,504	0.123	**$ 21,910**
2049				$ 92,613	$ 90,354			$ 182,967	0.116	**$ 21,186**
2050				$ 94,928	$ 92,613			$ 187,541	0.109	**$ 20,487**
2051				$ 97,301	$ 94,928			$ 192,230	0.103	**$ 19,810**
2052				$ 99,734	$ 97,301			$ 197,035	0.097	**$ 19,156**
2053				$ 102,227	$ 99,734			$ 201,961	0.092	**$ 18,524**

Table B5 – Annual Costs of Project cont. (All costs should be in 2012 Dollars) Project: West Simi Valley Water Recycling Project Phases 1 and 2										
	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)
2054				$ 104,783	$ 102,227	$ 170,000		$ 377,010	0.087	$ 32,622
2055				$ 107,403	$ 104,783			$ 212,186	0.082	$ 17,321
2056				$ 110,088	$ 107,403			$ 217,490	0.077	$ 16,749
2057				$ 112,840	$ 110,088			$ 222,927	0.073	$ 16,196
2058				$ 115,661	$ 112,840			$ 228,501	0.069	$ 15,661
2059				$ 118,552	$ 115,661			$ 234,213	0.065	$ 15,144
2060				$ 121,516	$ 118,552			$ 240,068	0.061	$ 14,644
2061				$ 124,554	$ 121,516			$ 246,070	0.058	$ 14,160
2062				$ 127,668	$ 124,554			$ 252,222	0.054	$ 13,693
2063				$ 130,860	$ 127,668			$ 258,527	0.051	$ 13,241
2064				$ 134,131	$ 130,860			$ 264,991	0.048	$ 12,803
2065				$ 137,484	$ 134,131			$ 271,615	0.046	$ 12,381
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$ 10,380,848

1. If any, based on opportunity costs, sunk costs and associated costs
2. The incremental change in O&M costs associated with the project.

References

All the references below are provided as attachments to this Benefit Cost Analysis (Att8_IG2_BenCost_3of7).

- Asano, T. 1981. Evaluation of Agricultural Irrigation Projects Using Reclaimed Water. Agreement 8-179-215-2. Office of Water Recycling. California State Water Resources Control Board. Sacramento, CA.
- City of Simi Valley, 2011. West Simi Valley Water Recycling Project Engineering Report. Ventura County Waterworks District No. 8. December 30.
- City of Simi Valley, 2013. Email from Joe Deakin and Ernie Wong. February 27.
- Federal Reserve Bank of Philadelphia. *2013. First Quarter 2013 Survey of Professional Forecasters*. February 15.
- Metropolitan, 2013. *Historical Water Rates*. Metropolitan Water District of Southern California. Accessed March 2013.
- RBF Consulting. 2011. *Ventura County Waterworks District No. 8, 2010 Urban Water Management Plan*. City of Simi Valley. June.
- State Water Resources Control Board. 2009. *Recycled Water Policy*. Accessed March 2013.

TABLE B6
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided imported water supply costs	–	Simi Valley expects that user agreements will be signed by all 47 customers identified as being served by the project; however, these agreements have not been finalized. If at least one customer does not connect to the system, total recycled water use will be less than 601.7 AFY (and avoided imported water costs will be less than anticipated). In addition, as stated in Attachment 3, recycled water service to customers would commence once they comply with the onsite requirements established by the CDPH and the LARWQCB. There could be a potential delay in benefits if customers do not meet onsite requirements by the time project construction is completed.
Avoided imported water supply costs	U	The calculation of avoided imported water costs assumes that Metropolitan water rates will increase annually (in real terms) by 3.5% through 2020. Beyond 2020, a 1.5% real increase in water rates is assumed. These projections are based on existing and planned Metropolitan financial commitments and recent increases in Metropolitan rates. It is uncertain whether actual future rate increases will be above or below these assumed rate increases.
Avoided costs associated with RO treatment of discharge at the WQCP	U	The estimated costs associated with MF/RO treatment of discharge at the WQCP are based on engineering cost estimates of similar facilities within the watershed (i.e., they are linearly scaled based on the expected size of the plant). No specific engineering estimates have been completed for this avoided project. Project costs may be less or greater, depending on site-specific conditions.
Avoided fertilizer costs	U	The exact offset of fertilizer use from using recycled water is difficult to predict due to daily and seasonal nutrient variations in the recycled water.

*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 – .

CDPH: California Department of Public Health.
LARWQCB: Los Angeles Regional Water Quality Control Board.

Moorpark Recycled Water Project Phase IV

Summary

The Moorpark Recycled Water Project, Phase IV, will expand the Ventura County Waterworks District No. 1's (WWD1's) recycled water distribution system to allow for the delivery of an additional 425 AFY of recycled water. The source of the recycled water is the Moorpark Wastewater Treatment Plant (MWWTP), which is owned and operated by WWD1.

Since 2000, WWD1 has been developing its recycled water system in phases. The Moorpark RW Project includes the construction of 16,500 LF of recycled water pipeline at the end of the existing Phase I pipeline and a 0.5 MGD booster pump station. The new distribution network will initially serve three customers who currently use potable water supplied by WWD1 for irrigation purposes. These customers include:

- Rustic Canyon Golf Course
- Moorpark Country Club Estates Homeowners Association (HOA)
- City of Moorpark Landscape Maintenance District.

In addition to the customers listed above, the infrastructure developed will provide opportunities for additional customers to hook up to the recycled water system (i.e., customers located along the distribution pipeline). Thus the project could potentially provide much more than 425 AFY of recycled water. For the purposes of this analysis, the 425 AFY serves as a lower-bound estimate for determining project benefits.

A summary of all benefits and costs of the project are provided in Table C1. Monetized and non-monetized benefits are presented in this attachment while physically quantified (but not monetized) benefits are described in Attachment 7.

Non-monetized Benefits Analysis (Section D2)

As discussed in Attachment 7 and Section D3 below, this project will result in a number of physically quantifiable benefits or avoided costs that can be monetarily valued. However, the project will also result in a number of benefits that cannot be easily quantified but are just as important. These benefits are qualitatively described in this section.

Table C2 shows the non-monetized benefits checklist for the project (using Table 12 from Exhibit C of the IRWM PSP). Narrative descriptions of the benefit categories marked "Yes" in the table are provided in the section following the table. It is important to note that this table is intended to identify only the benefits of the project that cannot be monetized. Thus although a benefit might apply, a "No" is entered into the table if the benefit has been physically quantified and/or monetized.

TABLE C1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$7,496,391
Monetizable Benefits	
Avoided Imported Water Supply Costs	$8,341,670
Fertilizer Cost Savings	$104,250
Total Monetizable Benefits	*$8,445,920*
Physically Quantified Benefit or Cost (Not Monetized)	Project Life Total
Avoided Introduction of Salts into the Watershed	7,865 MT
Reduced CO_2 Emissions	25,865 MT
Qualitative Benefit or Cost	Qualitative Indicator*
Additional Education or Technology Benefits	+
Increased Social Recreation/Access Benefits	+
Helps to Achieve Compliance with State Mandates for Water Conservation and Water Recycling	+
Reduced TDS in Groundwater Supplies	+
Reduced Demand for Net Diversions from the Delta	+
Improved Water Supply Reliability	+ +

* 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 net benefits.
– – Likely to decrease net benefits significantly.
U Uncertain, could be + or – .

Calleguas = Calleguas Municipal Water District
CO_2 = carbon dioxide
Metropolitan = Metropolitan Water District of Southern California
MT = metric tons
O&M = operations and maintenance
TDS = total dissolved solids
Watershed = Calleguas Creek Watershed

TABLE C2 (PSP Table 12) Moorpark Recycled Water Project Phase IV 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?	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: - 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?	

TABLE C2 cont. Moorpark Recycled Water Project Phase IV Non-monetized Benefits Checklist		
No.	Question	Enter "Yes", "No," or "Neg"
8	Reduce net emissions in ways that were not quantified in Attachment 7?	No[a]
	Examples are not limited to, but may include: - Reduce net production of greenhouse gases? - 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[a]
	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 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:	No
a. This benefit category is marked as no because it was already described as a physically quantified benefit in Attachment 7.		

Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked "Yes" from the checklist in Table C2 are described below.

Provide Education or Technology Benefits

As part of this project, WWD1 will provide annual training classes for recycled water users. Signage indicating recycled water use, specifically for the purpose of public education, will also be placed at the Rustic Canyon Golf Course. This signage will help to educate people who use the course on the benefits of recycled water use.

Provide Social Recreation or Access Benefits

By switching to recycled water, customers participating in the project will no longer be subject to watering restrictions during times of drought. Thus open space areas, golf courses, and the city can continue to irrigate their landscape/turf areas regardless of drought conditions allowing them to remain green during dry periods. This will improve the aesthetics and enjoyment of these areas and, in extreme cases, may avoid closures that would otherwise be necessary to prevent further turf damage (e.g., on playing fields, parks, and golf courses).

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

This project helps to meet requirements set forth in California Senate Bill X7-7 (2009), which sets an overall goal for urban water suppliers of reducing per capita water use by 20 percent by December 31, 2020 (and by at least 10 percent by December 31, 2015). Under this legislation, recycled water does not count against an agency's per capita use calculation and therefore essentially counts as "conserved" water. This project also helps to meet statewide goals to increase use of recycled wastewater by at least 1 million AFY by 2020 and by at least 2 million AFY by 2030 (State Water Resources Control Board 2009, provided with this Benefit Cost Analysis).

Improve Water Quality in Ways that Were Not Quantified in Attachment 7

Reduced TDS in Groundwater Supplies

This project will reduce the amount of wastewater discharged to the percolation ponds at the MWWTP. Without the project, 425 AFY would continue to be discharged and would ultimately percolate into the Las Posas Basin alluvial aquifer, which has elevated levels of chlorides and TDS. By avoiding percolation of wastewater effluent, this project will create additional storage in the groundwater basin allowing higher-quality stormwater (i.e., with lower TDS levels) to percolate into the groundwater. This will help to improve the overall groundwater in the basin.

Reduce Demand for Net Diversions from the Delta

By reducing the use of imported SWP water, the Moorpark RW Project will augment in-stream flows in the Bay-Delta or will offset other diversions that would otherwise reduce flows. Lower demands on Delta supplies will also help reduce the overall salinity of the Delta and improve Delta habitat.

The Delta's environmental condition is vital to maintaining and improving the viability of the region. The Delta provides drinking water to 25 million people, supports thousands of industries and irrigation of 750,000 acres of agriculture, and serves as home to hundreds of plant, animal, and fish species – some of which are listed as threatened or endangered. The Delta's 1,600 square miles of marshes, islands, and sloughs support at least half of migratory water birds on the Pacific Flyway; 80 percent of California's commercial fisheries; and recreational uses, including boating, fishing, and windsurfing.

Delta resources are in a state of crisis. Fish populations, including salmon and Delta smelt, have declined dramatically in recent years. The levee system is aging, and the vulnerability of the Delta to flooding, sea level rise, or a major earthquake has contributed to concerns about possible levee collapse. In addition, water quality problems continue, and there is little consensus on how to manage water resources.

Accordingly, by reducing dependence on SWP waters, this project reduces diversions of water from the Bay-Delta system and helps preserve this vital resource. In addition, by reducing demand for Bay-Delta diversions, this project may help free up some SWP water for other potential users or the environment.

Improve Water Supply Reliability in Ways Not Quantified in Attachment 7

The reliability of a water supply refers to its ability to meet water demands on a consistent basis even in times of drought or other constraints on source water availability. As noted above, the reliability of imported SWP water is subject to a number of natural and human forces ranging from increased population growth (and the accompanying increased demands) to drought and earthquakes, to environmental regulations and water rights determinations. Thus the project will help address reliability issues within the WWD1 service area by offsetting the use of SWP water with locally generated recycled water.

Although interest in water supply reliability is increasing (e.g., due to increasing water demands and concerns about climate-related events), only a few studies have directly attempted to quantify its value (i.e., through nonmarket valuation studies). The results from these studies indicate that residential and industrial (i.e., urban) customers seem to value supply reliability quite highly. Stated preference studies find that water customers are willing to pay $100 to more than $500 per household per year for total reliability (i.e., a 0 percent probability of their water supply being interrupted in times of drought).

The challenge in using these values to determine a value of increased reliability as a result of the Moorpark Recycled Water Project Phase IV is in recognizing how to reasonably interpret these survey-based household monetary values. The values noted above reflect a willingness to pay per household to ensure complete reliability (zero drought-related use restrictions in the future), whereas the Moorpark Recycled Water Project Phase IV only enhances overall reliability; it does not guarantee 100 percent reliability. Thus if applied directly to the number of households within the WWD1 service area, the dollar values from the studies would overstate the reliability value provided by the project.

A simple way to roughly adjust for this “whole versus part” problem is to attribute a portion of the total value of reliability to the portion of the problem that is solved by the project. To adjust for the partial improvement in reliability from the project, it is assumed that household willingness to pay for improved reliability is directly proportional to the amount of recycled water that will offset imported water as a percentage of the total potable water supply. This represents the percentage of total supply that has been improved in terms of overall reliability (i.e., by offsetting imported water demand with local sources).

For example, the project will offset more than 425 AFY of imported water at full implementation. In 2020, total potable water demand within the WWD1 service area will be about 13,285 AFY (VCWWD1 2011, provided with this Benefit Cost Analysis). Thus about 3.2 percent of total potable demand will be met by recycled water made available as a result of the project. To obtain a lower-bound estimate for the value of improved reliability associated with this water, it is assumed that households within the WWD1 service area are willing to pay about $3.20 per year ($100 multiplied by 3.2 percent). Applying this dollar value per household to the approximately 14,463 households[10] within the collective service areas would result in $46,282 of benefits in 2020. Taking into account increasing population and changing demands, this calculation could be completed for each year of the project’s useful life.

Because of the uncertainty involved in applying these numbers to this situation, this benefit estimate is not included in the tables. However, it is provided here to give an idea of the potential magnitude of this benefit.

10 This is based on the estimated 2020 population of the service area of 43,824 (as reported in the 2010 Urban Water Management Plan [VCWWD1 2011]) divided by the average number of people per household (3.03) in Ventura County as reported by the U.S. Census Bureau.

Monetized Benefits Analysis (Section D3)

Monetized benefits expected to accrue over the expected 50-year life of the project include:

- Avoided imported water costs
- Fertilizer cost savings

Benefit: Avoided Imported Water Costs

Although WWD1 uses a mix of imported water and local sources to supply their customers, imported water is the most expensive and is not considered to be a very reliable source of supply (see reliability discussion above). For this analysis, imported water is therefore considered to be the marginal water source for WWD1. The increased use of recycled water will reduce reliance on SWP water supplies.

This project will directly offset the use of 425 AFY of imported water provided by Metropolitan and imported via Calleguas.[11] To calculate the total costs of avoided imported water over the 50-year project life, the amount of avoided imported water each year is multiplied by the projected cost of the water in that year.

All of Calleguas' deliveries of SWP water are projected to be Tier 1 from Metropolitan's two-tier system. In 2012, the cost of Tier 1 water delivered to Calleguas retail customers amounted to $1,056 per acre-foot of water delivered. This includes Metropolitan's base rate of $794, Calleguas' O&M surcharge of $54, and a capital construction surcharge of $208. Because the capital construction surcharge pertains to all Calleguas capital improvements, only the portion of the surcharge directly related to imported water delivery and/or treatment was applied to determine avoided imported water supply costs. Based on Calleguas' 10-year capital improvement program (2012–2022), it appears that about 66 percent of Calleguas' planned capital improvements are directly related to the delivery and/or treatment of imported water. Thus the relevant portion of the capital construction surcharge is $137 (66 percent multiplied by $208). For the purposes of this analysis, avoided imported water supply costs therefore amount to $985 per AF for 2012, in 2012 dollars (including Metropolitan's base rate of $794, Calleguas' $54 O&M surcharge, and the $137 capital construction surcharge). The detailed calculation of costs of imported water is provided in Appendix A-8 which is included with Att8_IG2_BenCost_2of7.

Annual Metropolitan Tier 1 rate increases have averaged about 7.7 percent in nominal terms from 2003 to 2012 (Metropolitan 2013, provided with this Benefit Cost Analysis). For this analysis, it is conservatively assumed that the cost of imported supplies will increase at a 6 percent nominal rate through 2020. After adjusting for annual inflation of about 2.5 percent[12] the cost of imported water is therefore expected to increase annually by 3.5 percent in real terms over this time period. Beginning in 2021, a 1.5 percent annual real increase in water rates is assumed through the end of the project life to recognize that a possible Bay-Delta solution or other factors may reduce future Metropolitan Tier 1 rates below their historic 5.2 percent real rate of price increase or the assumed 3.5 percent rate of increase through 2020.

Given the schedule for construction, the project will avoid 21,250 AF of imported water over the expected 50-year project life. Based on the assumptions described above and an annual real discount rate of 6 percent (per IRWM PSP Guidelines), total present value benefits associated with the avoided purchase of this water amounts to about $8,341,670 over the 50-year project life as presented in Table C3.

Benefit: Fertilizer Cost Savings

Fertilizing compounds commonly present in recycled water are typically not found in potable water (e.g., nitrogen, phosphorus, potassium). Thus the use of recycled water for landscape irrigation will reduce fertilizer costs associated with the properties that will be served by the project.

11 The project will avoid 425 AFY beginning in 2017. In 2016, the project will avoid 212.5 AF because it will not come online until June.

12 Based on long-range Consumer Price Index (CPI) projections from the Federal Reserve Bank of Philadelphia (2013) of 2.3% per year, for 2013 through 2022.

The exact offset of fertilizer use from using recycled water is difficult to predict due to daily and seasonal nutrient variations in the recycled water and plant-specific nutrient requirements. However, the amount of nutrients (i.e., pounds of fertilizer) per AF of recycled water can be calculated from average (tertiary-treated) effluent values for the MWWTP.

The recycled water from the MWWTP contains 11.0 pounds of nitrogen per acre-foot and 43.5 pounds of potassium per acre-foot (VCWWD1 2012, Fruit Growers Laboratory 2011; data for the amount of phosphorus present in the recycled water is not available). Thus for every AF of recycled water used in-lieu of potable water, the recycled water customers will avoid the use of a total of 54.5 pounds of fertilizer. The weighted average commercial value of this fertilizer is $0.35/lb.[13]

For the 425 AF of recycled water applied each year in-lieu of imported water, recycled water customers served by the project will avoid the use of 23,163 pounds of fertilizer. This will result in avoided costs of $8,107 annually (undiscounted).[14] Over the lifetime of the project, total present value avoided fertilizer costs will amount to $104,250. Additional benefits would be expected through avoided fertilizer costs due to increased levels of phosphorus in recycled water compared to potable supplies.

Summary of Benefits

Table C3 summarizes the annual benefits from the project including avoided imported water costs and fertilizer cost savings.

Project Economic Costs

Capital costs for the project total $4,200,000. Direct construction and implementation costs account for $3,552,000 (about 85 percent) of total capital costs. Project administration, planning, design, environmental documentation and compliance, and mitigation costs account for the remainder of the capital budget. WWD1 estimates that the value of the easements necessary to complete the project is approximately $30,000. This is included as a project capital cost for the purposes of this analysis. Customer-funded costs to connect to the distribution system have not been included in this analysis but are expected to be nominal.

O&M costs will average about $306,500 per year at full implementation. This includes an estimated $200,000 in operations costs, $20,500 in general maintenance costs, $35,000 in administration costs, and $1,000 in periodic replacement costs (on average).

In total, the present value capital (including the value of easements) and O&M costs associated with the project amount to $7,496,391 over the 50-year project life (the 50-year project period runs from 2016, the first year following project completion, through 2065). Table C4 summarizes the economic project costs for the project.

Project Benefits and Cost Summary

As shown in Table C1 above, the total present value benefits associated with the Moorpark RW Project amounts to $8,445,920 over the expected 50-year project life. This includes avoided imported water supply costs and fertilizer cost savings. The total present value cost of the project (including capital and O&M costs) is $7,496,391. The project will therefore result in total present value net benefits of $949,529.

In addition to the monetized benefits and costs, the project will also result in the following physically quantifiable and non-monetized benefits:

- Avoided introduction of salts into the Watershed (7,865 MT over the 50-year project life).
- Reduced CO_2 emissions (25,865 MT over the 50-year project life).
- Education benefits associated with annual recycled water customer trainings, and signage related to the benefits of recycled water at the Rustic Canyon Golf Course.

13 This represents the average weighted cost of nitrogen and phosphorus. Source: Asano, 1981, updated to 2006 using the national fertilizer price index. Updated from 2006 to 2012 based on the CPI.

14 Numbers do not add exactly due to rounding.

TABLE C3 – ANNUAL BENEFIT (Table 15 of PSP) (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2012	Avoided imported water costs	AF						1.000	
	Avoided fertilizer costs	lbs/AF						1.000	
2013	Avoided imported water costs	AF						0.943	
	Avoided fertilizer costs	lbs/AF						0.943	
2014	Avoided imported water costs	AF						0.890	**$ -**
	Avoided fertilizer costs	$/AF						0.890	**$ -**
2015	Avoided imported water costs	$/AF	0					0.840	**$ -**
	Avoided fertilizer costs	$/AF	0					0.840	**$ -**
2016	Avoided imported water costs	AF	0	212.5	212.5	$1,130.31	$240,190.91	0.792	**$ 190,254**
	Avoided fertilizer costs	lbs	0	11,581.3	11581.3	$ 0.35	$ 4,053.46	0.792	**$ 3,211**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2017	Avoided imported water costs	AF	0	425	425	$ 1,169.87	$497,195.18	0.747	**$ 371,533**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.747	**$ 6,058**
2018	Avoided imported water costs	AF	0	425	425	$ 1,210.82	$ 514,597.01	0.705	**$ 362,771**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.705	**$ 5,715**
2019	Avoided imported water costs	AF	0	425	425	$ 1,253.20	$ 532,607.91	0.665	**$ 354,215**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.665	**$ 5,392**
2020	Avoided imported water costs	AF	0	425	425	$ 1,297.06	$ 551,249.18	0.627	**$ 345,861**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.627	**$ 5,086**
2021	Avoided imported water costs	AF	0	425	425	$ 1,316.51	$ 559,517.92	0.592	**$ 331,178**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.592	**$ 4,798**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2022	Avoided imported water costs	AF	0	425	425	$ 1,336.26	$ 567,910.69	0.558	**$ 317,118**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.558	**$ 4,527**
2023	Avoided imported water costs	AF	0	425	425	$ 1,356.30	$ 576,429.35	0.527	**$ 303,656**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.527	**$ 4,271**
2024	Avoided imported water costs	AF	0	425	425	$ 1,376.65	$ 585,075.79	0.497	**$ 290,765**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.497	**$ 4,029**
2025	Avoided imported water costs	AF	0	425	425	$ 1,397.30	$ 593,851.93	0.469	**$ 278,421**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.469	**$ 3,801**
2026	Avoided imported water costs	AF	0	425	425	$ 1,418.26	$ 602,759.71	0.442	**$ 266,601**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.442	**$ 3,586**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2027	Avoided imported water costs	AF	0	425	425	$ 1,439.53	$ 611,801.10	0.417	**$ 255,283**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.417	**$ 3,383**
2028	Avoided imported water costs	AF	0	425	425	$ 1,461.12	$ 620,978.12	0.394	**$ 244,446**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.394	**$ 3,191**
2029	Avoided imported water costs	AF	0	425	425	$ 1,483.04	$ 630,292.79	0.371	**$ 234,068**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.371	**$ 3,011**
2030	Avoided imported water costs	AF	0	425	425	$ 1,505.29	$ 639,747.18	0.350	**$ 224,131**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.350	**$ 2,840**
2031	Avoided imported water costs	AF	0	425	425	$ 1,527.87	$ 649,343.39	0.331	**$ 214,616**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.331	**$ 2,679**
2032	Avoided imported water costs	AF	0	425	425.0	$ 1,550.78	$ 659,083.54	0.312	**$ 205,505**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.312	**$ 2,528**
2033	Avoided imported water costs	AF	0	425	425.0	$ 1,574.05	$ 668,969.79	0.294	**$ 196,781**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.294	**$ 2,385**
2034	Avoided imported water costs	AF	0	425	425.0	$ 1,597.66	$ 679,004.34	0.278	**$ 188,427**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.278	**$ 2,250**
2035	Avoided imported water costs	AF	0	425	425.0	$ 1,621.62	$ 689,189.41	0.262	**$ 180,428**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.262	**$ 2,122**
2036	Avoided imported water costs	AF	0	425	425.0	$ 1,645.95	$ 699,527.25	0.247	**$ 172,768**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.247	**$ 2,002**
2037	Avoided imported water costs	AF	0	425	425.0	$ 1,670.64	$ 710,020.16	0.233	**$ 165,434**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.233	**$ 1,889**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2038	Avoided imported water costs	AF	0	425	425.0	$ 1,695.70	$ 720,670.46	0.220	**$ 158,411**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.220	**$ 1,782**
2039	Avoided imported water costs	AF	0	425	425.0	$ 1,721.13	$ 731,480.51	0.207	**$ 151,686**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.207	**$ 1,681**
2040	Avoided imported water costs	AF	0	425	425.0	$ 1,746.95	$ 742,452.72	0.196	**$ 145,246**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.196	**$ 1,586**
2041	Avoided imported water costs	AF	0	425	425.0	$ 1,773.15	$ 753,589.51	0.185	**$ 139,080**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.185	**$ 1,496**
2042	Avoided imported water costs	AF	0	425	425.0	$ 1,799.75	$ 764,893.36	0.174	**$ 133,176**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.174	**$ 1,411**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2043	Avoided imported water costs	AF	0	425	425.0	$ 1,826.75	$ 776,366.76	0.164	**$ 127,522**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.164	**$ 1,332**
2044	Avoided imported water costs	AF	0	425	425.0	$ 1,854.15	$ 788,012.26	0.155	**$ 122,108**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.155	**$ 1,256**
2045	Avoided imported water costs	AF	0	425	425.0	$ 1,881.96	$ 799,832.44	0.146	**$ 116,924**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.146	**$ 1,185**
2046	Avoided imported water costs	AF	0	425	425.0	$ 1,910.19	$ 811,829.93	0.138	**$ 111,961**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.138	**$ 1,118**
2047	Avoided imported water costs	AF	0	425	425.0	$ 1,938.84	$ 824,007.38	0.130	**$ 107,208**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.130	**$ 1,055**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2048	Avoided imported water costs	AF	0	425	425.0	$ 1,967.92	$ 836,367.49	0.123	**$ 102,656**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.123	**$ 995**
2049	Avoided imported water costs	AF	0	425	425.0	$ 1,997.44	$ 848,913.00	0.116	**$ 98,298**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.116	**$ 939**
2050	Avoided imported water costs	AF	0	425	425.0	$ 2,027.40	$ 861,646.69	0.109	**$ 94,125**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.109	**$ 886**
2051	Avoided imported water costs	AF	0	425	425.0	$ 2,057.82	$ 874,571.40	0.103	**$ 90,129**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.103	**$ 835**
2052	Avoided imported water costs	AF	0	425	425.0	$ 2,088.68	$ 887,689.97	0.097	**$ 86,303**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.097	**$ 788**
2053	Avoided imported water costs	AF	0	425	425.0	$ 2,120.01	$ 901,005.32	0.092	**$ 82,639**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.092	**$ 744**
2054	Avoided imported water costs	AF	0	425	425.0	$ 2,151.81	$ 914,520.40	0.087	**$ 79,131**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.087	**$ 701**
2055	Avoided imported water costs	AF	0	425	425.0	$ 2,184.09	$ 928,238.20	0.082	**$ 75,772**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.082	**$ 662**
2056	Avoided imported water costs	AF	0	425	425.0	$ 2,216.85	$ 942,161.77	0.077	**$ 72,555**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.077	**$ 624**
2057	Avoided imported water costs	AF	0	425	425.0	$ 2,250.10	$ 956,294.20	0.073	**$ 69,475**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.073	**$ 589**
2058	Avoided imported water costs	AF	0	425	425.0	$ 2,283.86	$ 970,638.61	0.069	**$ 66,525**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.069	**$ 556**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2059	Avoided imported water costs	AF	0	425	425.0	$ 2,318.11	$ 985,198.19	0.065	**$ 63,701**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.065	**$ 524**
2060	Avoided imported water costs	AF	0	425	425.0	$ 2,352.89	$ 999,976.17	0.061	**$ 60,997**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.061	**$ 495**
2061	Avoided imported water costs	AF	0	425	425.0	$ 2,388.18	$ 1,014,975.81	0.058	**$ 58,407**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.058	**$ 467**
2062	Avoided imported water costs	AF	0	425	425.0	$ 2,424.00	$ 1,030,200.45	0.054	**$ 55,928**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.054	**$ 440**
2063	Avoided imported water costs	AF	0	425	425.0	$ 2,460.36	$ 1,045,653.45	0.051	**$ 53,554**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.051	**$ 415**
2064	Avoided imported water costs	AF	0	425	425.0	$ 2,497.27	$ 1,061,338.25	0.048	**$ 51,280**

TABLE C3 – ANNUAL BENEFIT cont. (All benefits should be in 2012 dollars) Project: Moorpark Recycled Water Project Phase IV									
(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	Annual $ Value) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.048	**$ 392**
2065	Avoided imported water costs	AF	0	425	425.0	$ 2,534.73	$ 1,077,260.25	0.046	**$ 49,103**
	Avoided fertilizer costs	lbs	0	23,162.5	23,163	$ 0.35	$ 8,106.88	0.046	**$ 370**
2066	Avoided imported water costs	AF	0	212.5	212.5	$ 2,572.75	$ 546,709.38	0.043	**$ 23,509**
	Avoided fertilizer costs	lbs	0	11,581.3	11,581	$ 0.35	$ 4,053.44	0.043	**$ 174**
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$ 8,445,920**
								Avoided imported water costs	**$ 8,341,670**
								Avoided fertilizer costs	**$ 104,250**

- Social recreation/access benefits resulting from the ability of recycled water customers to irrigate during times of drought.
- Capability to help meet state mandates associated with water recycling.
- Improved groundwater quality due to increased stormwater recharge.
- Reduced demand for net diversions from the Delta, and the resulting environmental benefits.
- Improved water supply reliability through offsetting of the use of SWP water with locally generated recycled water.

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 this analysis, the main uncertainties are associated with avoided imported water supply costs. These issues are listed in Table C5.

References

All the references below are provided as attachments to this Benefit Cost Analysis (Att8_IG2_BenCost_4of7)

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TABLE C4 - ANNUAL COSTS OF PROJECT (Table 19 of PSP) (All costs in 2012 Dollars) Project: Moorpark Recycled Water Project Phase IV										
	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	$ 237,000							$ 237,000	0.943	**$ 223,585**
2014	$ 147,000							$ 147,000	0.890	**$ 130,829**
2015	$ 3,744,000							3,744,000	0.840	**$ 3,143,535**
2016	$ 72,000		$ 17,500	$ 125,000	$ 10,250	$ 500		$ 225,250	0.792	**$ 178,419**
2017			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.747	**$ 229,035**
2018			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.705	**$ 216,070**
2019			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.665	**$ 203,840**
2020			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.627	**$ 192,302**
2021			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.592	**$ 181,417**
2022			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.558	**$ 171,148**
2023			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.527	**$ 161,460**
2024			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.497	**$ 152,321**
2025			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.469	**$ 143,699**
2026			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.442	**$ 135,565**
2027			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.417	**$ 127,892**
2028			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.394	**$ 120,653**
2029			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.371	**$ 113,823**
2030			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.350	**$ 107,380**
2031			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.331	**$ 101,302**
2032			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.312	**$ 95,568**
2033			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.294	**$ 90,159**
2034			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.278	**$ 85,055**

TABLE C4 - ANNUAL COSTS OF PROJECT cont. (All costs in 2012 Dollars) Project: Moorpark Recycled Water Project Phase IV										
	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)
2035			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.262	**$ 80,241**
2036			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.247	**$ 75,699**
2037			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.233	**$ 71,414**
2038			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.220	**$ 67,372**
2039			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.207	**$ 63,558**
2040			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.196	**$ 59,961**
2041			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.185	**$ 56,567**
2042			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.174	**$ 53,365**
2043			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.164	**$ 50,344**
2044			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.155	**$ 47,494**
2045			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.146	**$ 44,806**
2046			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.138	**$ 42,270**
2047			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.130	**$ 39,877**
2048			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.123	**$ 37,620**
2049			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.116	**$ 35,491**
2050			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.109	**$ 33,482**
2051			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.103	**$ 31,587**
2052			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.097	**$ 29,799**
2053			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.092	**$ 28,112**
2054			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.087	**$ 26,521**
2055			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.082	**$ 25,019**
2056			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.077	**$ 23,603**
2057			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.073	**$ 22,267**

TABLE C4 - ANNUAL COSTS OF PROJECT cont. (All costs in 2012 Dollars) Project: Moorpark Recycled Water Project Phase IV										
	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)
2058			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.069	**$ 21,007**
2059			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.065	**$ 19,818**
2060			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.061	**$ 18,696**
2061			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.058	**$ 17,638**
2062			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.054	**$ 16,639**
2063			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.051	**$ 15,698**
2064			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.048	**$ 14,809**
2065			$ 35,000	$ 250,000	$ 20,500	$ 1,000		$ 306,500	0.046	**$ 13,971**
2066			$ 17,500	$ 125,000	$ 10,250	$ 500		$ 153,250	0.043	**$ 6,590**
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 7,496,391**

1. If any, based on opportunity costs, sunk costs and associated costs
2. The incremental change in O&M costs associated with the project.

TABLE C5
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided imported water supply costs	–	As stated in Attachment 3, recycled water service to customers would commence once they comply with the onsite requirements established by the CDPH and the LARWQCB. There could be a potential delay in benefits if customers do not meet onsite requirements by the time project construction is completed.
Avoided imported water supply costs	+ +	The infrastructure developed as part of this project will provide opportunities for additional customers to hook up to the recycled water system (i.e., customers located along the distribution pipeline). Thus the project would potentially provide much more than 425 AFY of recycled water. For the purposes of this analysis, the 425 AFY serves as a lower-bound estimate of project benefits.
Avoided imported water supply costs	U	The calculation of avoided imported water costs assumes that Metropolitan water rates will increase annually (in real terms) by 3.5% through 2020. Beyond 2020, a 1.5% real increase in water rates is assumed. These projections are based on existing and planned Metropolitan financial commitments and recent increases in Metropolitan rates. It is uncertain whether actual future rate increases will be above or below these assumed rate increases.
Avoided fertilizer costs	U	The exact offset of fertilizer use from using recycled water is difficult to predict due to daily and seasonal nutrient variations in the recycled water.

*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 – .

CDPH: California Department of Public Health.
LARWQCB: Los Angeles Regional Water Quality Control Board.

South Oxnard Stormwater Flood Management and Community Enhancement Project Phase 2B

Summary

The South Oxnard Flood Protection and Community Enhancement Project includes two components. The first component will cover 2,700 linear feet of an open-channel drainage running through a Disadvantaged Community (DAC) and environmental justice neighborhood. This component will reduce the impacts of flood control facilities, develop recreation opportunities, improve public safety, and unify a neighborhood currently divided by a fence and open channel. In addition to these improvements, the project will help to improve water quality in the Ormond Beach Lagoon by reducing the amount of trash, debris, and heavy metals entering the J Street drain.

The second component involves the purchase of 20 acres of wetlands near Ormond Beach for conservation and restoration. This acreage is part of a larger, 1,000 acre area considered to be the most important wetland restoration opportunity in southern California due to its intact dune-transition zone-marsh system and habitat for many migratory and shorebird species, including six threatened and endangered species: the tidewater goby, California brown pelican, American peregrine falcon, western snowy plover, California least tern, and Belding's savannah sparrow. When a sufficient acreage of wetlands has been restored, Ormond Beach is expected to return to a self-sustaining biological system capable of maintaining ecological health and hydrologic function (Aspen Environmental Group 2009, provided with this Benefit and Cost Analysis).

This component of the overall restoration project will improve water quality in the Ormond Beach Lagoon and wetlands, provide habitat for migratory and shorebirds and threatened and endangered species, contribute to improved tidal and freshwater hydrological processes in the Region, and provide water-related public access and recreation opportunities.

A summary of all benefits and costs of the project are provided in Table D1. Monetized benefits and non-monetized benefits are presented in this attachment while physically quantified (but not monetized) benefits are described in Attachment 7.

Non-Monetized Benefits Analysis (Section D2)

Table D2 shows the non-monetized benefits checklist for the project. Narrative descriptions of the benefit categories marked "Yes" in the following table are provided in the narrative description of qualitative benefits section after the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus, although a benefit might apply, a "No" is entered into the table if the benefit has been physically quantified and/or monetized.

Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked "Yes" from the checklist in Table D2 are described below.

Provide Social Recreation or Access Benefits

The newly covered channel will provide the City of Oxnard with a surface upon which it can develop a linear park and bike path. The linear park will provide direct recreation benefits to the 59,000 people residing within 1.5 miles of the covered channel. The park will connect a neighborhood that is currently divided, provide safe biking and walking routes to school, and offer a connector to recreation at the Ormond Beach Lagoon. While park development is not part of the project, the cover is an essential prerequisite for the linear park. This park is strongly supported by community members as well as the community action groups Saviers Road Design Team and the Central Coast United for Sustainability (CAUSE).

TABLE D1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$6,034,966
Monetizable Benefits	
Preserved Coastal Wetlands	$3,559,986
Avoided Cost from Removing Trash from Channel	$27,895
Total Monetizable Benefits	*$3,587,881*
Qualitative Benefit or Cost	**Qualitative Indicator***
Opportunity for City to Develop Future Linear Park	+
Improved Public Safety By Covering Channel	+
Unification of Neighborhood Divided by a Fence and Channel	+ +
Improved Habitat Quality for Threatened and Endangered Species	+
Improved Water Quality in Ormond Beach Lagoon	+

* 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 net benefits.
– – Likely to decrease net benefits significantly.
U Uncertain, could be + or –.

O&M = operations and maintenance

TABLE D2 (PSP Table 12) South Oxnard Flood Protection and Community Enhancement Project Phase 2B 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?	No
	Examples are not limited to, but may include:	
	- Provide more opportunities for public involvement in water management?	
	- Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation?	
	- Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	Promote social health and safety?	Yes
	Examples are not limited to, but may include:	
	- Increase urban water supply reliability for fire-fighting and critical services following seismic events?	
	- Reduce risk to life from dam failure or flooding?	
	- 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?	

TABLE D2 cont. South Oxnard Flood Protection and Community Enhancement Project Phase 2B Non-monetized Benefits Checklist		
No.	Question	Enter "Yes", "No", or "Neg"
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 gases?	
	- 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?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel-based energy sources with renewable energy and resources?	No
	Examples are not limited to, but may include:	
	- Reduce net energy use on a permanent basis?	
	- Increase renewable energy production?	
	- Include new buildings or modify buildings to include certified LEED features?	
	- Provide a net increase in recycling or reuse of materials?	
	- Replace unsustainable practices with recognized sustainable practices?	

TABLE D2 cont. South Oxnard Flood Protection and Community Enhancement Project Phase 2B Non-monetized Benefits Checklist		
Question		Enter "Yes", "No", or "Neg"
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

[a] This benefit category is marked as no because it was already described as a physically quantified benefit in Attachment 7.

Trash reduction from covering the channel will also increase non-contact water recreation benefits downstream. These include uses of water for recreational activities involving proximity to, but not contact with, water such as picnicking or any aesthetic enjoyment of the site.

Ormond Beach land purchased through this project is contiguous with an existing 580 acre parcel, a larger wetlands restoration initiative of the California Coastal Conservancy (CCC) and The Nature Conservancy (TNC). Eventually the goal is to create more than 1,000 acres of restored wetlands in the vicinity of the parcel to be purchased. Once this is complete, the CCC anticipates limited development of educational and recreational opportunities thereby increasing public access.

Promote Social Health and Safety

Currently the fence alongside the open channel presents a hazard to pedestrians and cyclists including the many students who use the road next to the channel. Once the channel is covered, the fence will be removed thereby making the road safer for pedestrians and cyclists. The current risk is clearly illustrated by the photograph and description of a recent incident provided in Attachment 7.

Have Other Social Benefits

The South Oxnard area has been disproportionately burdened with the environmental effects of intense industrial development. While covering the channel will not directly ameliorate these burdens, it will unite a large low-income, minority neighborhood that has been divided by the channel and its fence, the various eyesores associated with the open drain (trash, graffiti), and help address the environmental justice concerns this community has experienced.

Benefit Wildlife or Habitat in Ways that Were Not Quantified in Attachment 7

The Ormond Beach site is home to six federally and state listed species: the tidewater goby, California brown pelican, American peregrine falcon, western snowy plover, California least tern, and Belding's savannah sparrow (Aspen Environmental Group 2009). Protecting and restoring the 20 acres will improve habitat for these species as well as over 200 migratory bird species that frequent the area by protecting food supplies and reproductive and nursery areas. This project will improve freshwater, estuarine, wetland, and marine habitat in accordance with the Basin Plan for the Coastal Watershed of Los Angeles and Ventura Counties, and will help maintain substrate characteristics that support numerous plant and wildlife species and corridors (RWQCB 1995, provided with this Benefit and Cost Analysis).

Purchasing additional wetlands will also protect Ormond Beach Lagoon from future development. There is currently a power plant adjacent to the wetlands property, and the area could potentially be re-zoned for industrial uses.

Improve Water Quality in Ways that Were Not Quantified in Attachment 7

Preventing trash from entering the channel by constructing a drain cover will provide water quality benefits in the Ormond Beach Lagoon and possibly further out in the Pacific Ocean in addition to the avoided maintenance costs outlined in the Monetized Benefits Analysis section below.

Further water quality benefits will be achieved by gravel swales. Urban areas generate significant pollutants that are conveyed to the channel and ultimately the Lagoon and Pacific Ocean via stormwater runoff. These pollutants include oil and heavy metals such as zinc, copper, and lead from vehicles and their brake pads, and pesticides and fertilizers from landscaped areas. Upon the development of the future linear park, the gravel swales will be turned into bioswales and provide even more filtering capability thereby reducing the impact downstream on the Lagoon and Pacific Ocean.

Monetized Benefits Analysis (Section D3)

Two monetized benefits are expected to accrue over the expected 50-year life of the project. These include preserving 20 acres of coastal wetlands and cost savings from reduced trash in the channel.

Preserve 20 Acres of Coastal Wetlands

This project will protect and restore 20 acres of coastal wetlands at Ormond Beach, contributing to the larger goal of protecting at least 1,000 acres and creating a self-sustaining natural system. It is considered one of the most important wetland restoration opportunities in Southern California due to the intact dune-marsh transition area and the more than 200 migratory bird species that frequent the area including six threatened and endangered species.

The benefits of preserving these 20 acres were estimated using two methods: transferring non-market, household values that have been estimated for other wetland restoration projects and by applying per-acre market price associated with comparable wetland conservation through wetland conservation banking. The latter method is claimed for benefits of the project, and the former is shown here to provide perspective on the value claimed.

The per-household, non-market values applied here are derived from three primary stated preference studies: two in Wisconsin and one in Rhode Island (Bishop et al 2000, Bauer, Cyr, and Swallow 2004, and Mullarkey and Bishop 1999, provided with this Benefit Cost Analysis). These studies were selected as the wetlands being considered for restoration were all in areas that had been affected by human impacts similar to the Ormond Beach site. The studies all asked households in communities near the wetlands how much they would be willing to pay to preserve and restore particular wetland parcels. They are considered estimates of the wetlands' "total value" because they include the value that households may have for using the area such as wildlife viewing, as well as values they have even if they do not use the area, such as satisfaction from knowing the area is protected or that the area will be undeveloped for their children to enjoy.

To apply the values from each of the relevant stated preference studies to this project, they were translated into 2012 dollars per household per acre. In the case of one study which asked residents what they would pay per year for ten years, it was translated into net present value using a 6 percent discount rate. The average across the three studies is $0.35 per household per acre, or $7.00 for the 20 acres in question.

The 20 acres to be purchased are part of a wetland restoration effort of regional significance. Therefore the number of households of Ventura County is used as a lower bound of the benefitting population, and the households of Los Angeles and Ventura Counties is used as an upper bound. Multiplying the per-household value by the 266,920 households in Ventura County results in a benefit of $1.864 million. Multiplying the per-household value by the

3,508,124 households in Ventura and Los Angeles Counties results in an estimated benefit of $24.498 million.

The price of a wetland credit reflects the cost of purchasing and restoring an acre of wetlands and the value that buyers in the wetland credit market hold for this type of land. This per-acre value is used as a measure of the scarcity of wetlands in this region, not as an avoided cost, as credits would not be purchased if this project did not proceed. However, if this parcel was not purchased and restored but remained in agricultural use or was converted to industrial use, TNC and CCC would need to purchase land elsewhere in the area to satisfy their goal of at least 1,000 acres of wetlands to attain a self-sustaining ecological system.

In the south coastal region of California, wetlands banking credits currently cost approximately $200,000 per acre (Lawhead, D, personal communication, 2013). This value was provided based on observation by a California Department of Fish and Wildlife mitigation banking employee summarizing transactions in the southern coastal region of California – the area where the project is located. At this rate, the land purchased for this project would cost $4 million if it were purchased as part of a wetlands banking program.

The stated preference and wetlands banking methods result in benefit estimates of comparable orders of magnitude. This benefit-cost analysis uses the benefits estimated using the wetlands banking method in the final monetization for this project because it provides a region-specific value determined by a market. Differences in the type of wetlands and household demographics between the referenced stated preference studies and this Region make the stated preference value less certain.

As is shown in Table D3, assuming the purchase occurs in 2014 and the benefits accrue in 2014, the present value of benefits from purchasing these 20 acres is $3,559,986.

While the number of acres to be protected is certain, there is uncertainty regarding how much the exact value of this type of wetlands would cost in a mitigation banking setting. However, given that this area is considered to be one of the highest restoration priorities in the Region, it would likely cost at least the regional average for wetlands credits.

Avoided Cost from Removing Trash in Channel

Since the J Street Drain is currently an open channel protected on either side only by fencing, trash and other contaminants can enter either through human disposal or through runoff during storm events. Ventura County Watershed Protection District (VCWPD) cleans the channel of trash and sediment at least once a year using vacuum trucks and manual labor. The 2,700 LF cap will significantly reduce trash and debris that would otherwise enter the channel along this section. VCWPD estimates that preventing this debris accumulation will reduce the annual channel maintenance costs by approximately $2,000 per year. The actual savings per year will vary according to the amount of trash that would have entered the uncovered channel, which can increase significantly during the rainy season when heavy runoff causes larger trash deposits. Over the 50-year life of the project and assuming a discount rate of 6 percent, this results in a savings of $27,895 in avoided operation and maintenance costs. Table D4 shows the avoided costs from the project.

TABLE D3 – ANNUAL BENEFIT (Table 15 of PSP) (All benefits in 2012 dollars) Project: South Oxnard Flood Protection and Community Enhancement Project Phase 2B									
(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) (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2012								1.000	
2013								0.943	
2014	Value of Wetland Protection	Acres	0	20	20	$200,000	$4,000,000	0.890	**$3,559,986**
2015								0.840	
2016								0.792	
2017								0.747	
2018								0.705	
2019								0.665	
2020								0.627	
...									
Last Year of Project - 2113									
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$3,559,986**
Comments: Estimated value of a wetland banking credit in the South Coastal Region. Provided by David Lawson, California Department of Fish and Wildlife Contact for Conservation and Mitigation Banking in the South Coast Region in March 2013.									

TABLE D4 – ANNUAL COSTS OF AVOIDED PROJECTS (Table 16 of PSP) (All avoided costs in 2012 dollars) Project: South Oxnard Flood Protection and Community Enhancement Project Phase 2B						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Avoided Project Description: Avoided trash removal costs by covering channel				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	$ -
2014				$ -	0.890	$ -
2015				$ -	0.840	$ -
2016			$ 2,000	$ 2,000	0.792	$ 1,584
2017			$ 2,000	$ 2,000	0.747	$ 1,495
2018			$ 2,000	$ 2,000	0.705	$ 1,410
2019			$ 2,000	$ 2,000	0.665	$ 1,330
2020			$ 2,000	$ 2,000	0.627	$ 1,255
2021			$ 2,000	$ 2,000	0.592	$ 1,184
2022			$ 2,000	$ 2,000	0.558	$ 1,117
2023			$ 2,000	$ 2,000	0.527	$ 1,054
2024			$ 2,000	$ 2,000	0.497	$ 994
2025			$ 2,000	$ 2,000	0.469	$ 938
2026			$ 2,000	$ 2,000	0.442	$ 885
2027			$ 2,000	$ 2,000	0.417	$ 835
2028			$ 2,000	$ 2,000	0.394	$ 787
2029			$ 2,000	$ 2,000	0.371	$ 743
2030			$ 2,000	$ 2,000	0.350	$ 701

TABLE D4 – ANNUAL COSTS OF AVOIDED PROJECTS cont. (All avoided costs in 2012 dollars) Project: South Oxnard Flood Protection and Community Enhancement Project Phase 2B						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Avoided Project Description: Avoided trash removal costs by covering channel				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)		
2031			$ 2,000	$ 2,000	0.331	$ 661
2032			$ 2,000	$ 2,000	0.312	$ 624
2033			$ 2,000	$ 2,000	0.294	$ 588
2034			$ 2,000	$ 2,000	0.278	$ 555
2035			$ 2,000	$ 2,000	0.262	$ 524
2036			$ 2,000	$ 2,000	0.247	$ 494
2037			$ 2,000	$ 2,000	0.233	$ 466
2038			$ 2,000	$ 2,000	0.220	$ 440
2039			$ 2,000	$ 2,000	0.207	$ 415
2040			$ 2,000	$ 2,000	0.196	$ 391
2041			$ 2,000	$ 2,000	0.185	$ 369
2042			$ 2,000	$ 2,000	0.174	$ 348
2043			$ 2,000	$ 2,000	0.164	$ 329
2044			$ 2,000	$ 2,000	0.155	$ 310
2045			$ 2,000	$ 2,000	0.146	$ 292
2046			$ 2,000	$ 2,000	0.138	$ 276
2047			$ 2,000	$ 2,000	0.130	$ 260
2048			$ 2,000	$ 2,000	0.123	$ 245
2049			$ 2,000	$ 2,000	0.116	$ 232
2050			$ 2,000	$ 2,000	0.109	$ 218
2051			$ 2,000	$ 2,000	0.103	$ 206
2052			$ 2,000	$ 2,000	0.097	$ 194

TABLE D4 – ANNUAL COSTS OF AVOIDED PROJECTS cont. (All avoided costs in 2012 dollars) Project: South Oxnard Flood Protection and Community Enhancement Project Phase 2B						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Avoided Project Description: Avoided trash removal costs by covering channel				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)		
2053			$ 2,000	$ 2,000	0.092	$ 183
2054			$ 2,000	$ 2,000	0.087	$ 173
2055			$ 2,000	$ 2,000	0.082	$ 163
2056			$ 2,000	$ 2,000	0.077	$ 154
2057			$ 2,000	$ 2,000	0.073	$ 145
2058			$ 2,000	$ 2,000	0.069	$ 137
2059			$ 2,000	$ 2,000	0.065	$ 129
2060			$ 2,000	$ 2,000	0.061	$ 122
2061			$ 2,000	$ 2,000	0.058	$ 115
2062			$ 2,000	$ 2,000	0.054	$ 109
2063			$ 2,000	$ 2,000	0.051	$ 102
2064			$ 2,000	$ 2,000	0.048	$ 97
2065			$ 2,000	$ 2,000	0.046	$ 91
2066			$ 2,000	$ 2,000	0.043	$ 86
2067			$ 2,000	$ 2,000	0.041	$ 81
2068			$ 2,000	$ 2,000	0.038	$ 77
2069			$ 2,000	$ 2,000	0.036	$ 72
2070			$ 2,000	$ 2,000	0.034	$ 68
2071			$ 2,000	$ 2,000	0.032	$ 64
2072			$ 2,000	$ 2,000	0.030	$ 61
2073			$ 2,000	$ 2,000	0.029	$ 57
2074			$ 2,000	$ 2,000	0.027	$ 54
2075			$ 2,000	$ 2,000	0.025	$ 51

TABLE D4 – ANNUAL COSTS OF AVOIDED PROJECTS cont. (All avoided costs in 2012 dollars) Project: South Oxnard Flood Protection and Community Enhancement Project Phase 2B						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Avoided Project Description: Avoided trash removal costs by covering channel				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)		
2076			$ 2,000	$ 2,000	0.024	$ 48
2077			$ 2,000	$ 2,000	0.023	$ 45
2078			$ 2,000	$ 2,000	0.021	$ 43
2079			$ 2,000	$ 2,000	0.020	$ 40
2080			$ 2,000	$ 2,000	0.019	$ 38
2081			$ 2,000	$ 2,000	0.018	$ 36
2082			$ 2,000	$ 2,000	0.017	$ 34
2083			$ 2,000	$ 2,000	0.016	$ 32
2084			$ 2,000	$ 2,000	0.015	$ 30
2085			$ 2,000	$ 2,000	0.014	$ 28
2086			$ 2,000	$ 2,000	0.013	$ 27
2087			$ 2,000	$ 2,000	0.013	$ 25
2088			$ 2,000	$ 2,000	0.012	$ 24
2089			$ 2,000	$ 2,000	0.011	$ 23
2090			$ 2,000	$ 2,000	0.011	$ 21
2091			$ 2,000	$ 2,000	0.010	$ 20
2092			$ 2,000	$ 2,000	0.009	$ 19
2093			$ 2,000	$ 2,000	0.009	$ 18
2094			$ 2,000	$ 2,000	0.008	$ 17
2095			$ 2,000	$ 2,000	0.008	$ 16
2096			$ 2,000	$ 2,000	0.007	$ 15
2097			$ 2,000	$ 2,000	0.007	$ 14
2098			$ 2,000	$ 2,000	0.007	$ 13

TABLE D4 – ANNUAL COSTS OF AVOIDED PROJECTS cont. (All avoided costs in 2012 dollars) Project: South Oxnard Flood Protection and Community Enhancement Project Phase 2B						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): Avoided Project Description: Avoided trash removal costs by covering channel				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)		
2099			$ 2,000	$ 2,000	0.006	$ 13
2100			$ 2,000	$ 2,000	0.006	$ 12
2101			$ 2,000	$ 2,000	0.006	$ 11
2102			$ 2,000	$ 2,000	0.005	$ 11
2103			$ 2,000	$ 2,000	0.005	$ 10
2104			$ 2,000	$ 2,000	0.005	$ 9
2105			$ 2,000	$ 2,000	0.004	$ 9
2106			$ 2,000	$ 2,000	0.004	$ 8
2107			$ 2,000	$ 2,000	0.004	$ 8
2108			$ 2,000	$ 2,000	0.004	$ 7
2109			$ 2,000	$ 2,000	0.004	$ 7
2110			$ 2,000	$ 2,000	0.003	$ 7
2111			$ 2,000	$ 2,000	0.003	$ 6
2112			$ 2,000	$ 2,000	0.003	$ 6
2113			$ 2,000	$ 2,000	0.003	$ 6
Total Present Value of Discounted Costs (Sum of Column (g))						$ 27,895
(%) 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)						$ 27,895

Project Economic Costs

Table D5 summarizes the economic project costs for the project. The costs for the project include construction of the covered channel, environmental compliance, and construction/ implementation contingency. These costs will be incurred in 2014 and 2015. The 20 acre wetland parcel will be purchased and recorded in 2014 and will cost approximately $1,000,000. There are also administration costs spread across all three years and costs for planning, design, engineering, and environmental documentation costs incurred in 2013. The total cost for the project is $6,927,490. The present value of discounted costs is $6,034,296.

Project Benefits and Cost Summary

This project will generate $3,587,881 in monetized benefits through reduced channel maintenance costs and value associated with restored wetlands. The present value of costs of this project will be $6,034,296, including construction and land acquisition. This project will also include numerous non-quantified, non-monetized social benefits to a low-income, predominantly minority community, including elimination of a barrier dividing the neighborhood, providing the opportunity for local development of a linear park and recreation opportunity, and offering the potential to develop safe routes to school. These benefits are of great interest to the community, which has borne a high burden of environmental degradation. Additionally, the covered channel will improve lagoon water quality through reduced trash and sediment entering the channel and will support listed species populations through expanded and improved habitat.

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 this analysis, the main uncertainties are associated with the exact value of land based on wetland conservation banking. These issues are listed in Table D6.

References

All the references below are provided as attachments to this Benefit Cost Analysis (Att8_IG2_BenCost_5of7).

- Aspen Environmental Group. 2009. *Ormond Beach Wetland Restoration Feasibility Study*. Prepared for the California Coastal Conservancy. October, 2009.
- Bauer, D.M., N.E. Cyr and S.K. Swallow. 2004. "Public Preferences for Compensatory Mitigation of Salt Marsh Losses: A Contingent Choice of Alternatives" Conservation Biology 18, no.2 401-411.
- Bishop,R.C., W.S. Breffle, J.K. Lazo, R.D. Rowe and S.M. Wytinck. 2000. "Restoration Scaling Based on Total Value Equivalency: Green Bay Natural Resource Damage Assessment" U.S. Fish and Wildlife Service, U.S. Department of Interior and U.S. Department of Justice Final Report.
- Mullarkey, D. J. and R. C. Bishop. "Sensitivity to Scope: Evidence from a CVM Study of Wetlands". American Agricultural Economic Association Annual Meeting, Nashville, TN, August 8-11. 1999-08-01.
- Lawhead, David. 2013. California Department of Fish and Wildlife Contact for Conservation and Mitigation Banking in the South Coast Region. Personal communication March 12, 2013.
- RWQCB, 1995. *Water Quality Control Plan, Los Angeles Region: Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties*. Prepared by the California Regional Water Quality Control Board, Los Angeles Region. February.

TABLE D5 – ANNUAL COSTS OF PROJECT (Table 19 of PSP) (All costs in 2012 Dollars) Project: South Oxnard Flood Protection and Community Enhancement Project Phase 2B										
	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	$ 227,482							$ 227,482	0.943	$ 214,606
2014	$ 3,855,607							$2,855,607	0.890	$ 3,431,477
2015	$ 2,844,401							$2,844,401	0.840	$ 2,388,214
2016								$ -	0.792	$ -
2017								$ -	0.747	$ -
2018								$ -	0.705	$ -
2019								$ -	0.665	$ -
2020								$ -	0.627	$ -
…										
End of Project Life - 2113								$ -		$ -
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$ 6,034,296

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

TABLE D6
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Value of wetland banking credit, per acre	+	While the value used in this analysis was drawn from observations of the conservation banking market in Southern California, given its ecological importance, this site may be worth more per acre.
Avoided cost of trash removal	U	The avoided cost estimate is based on historical expenditures for trash removal from this channel using vacuum trucks and manual removal methods. Actual cost savings will vary depending on runoff and future trash volume.

*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 –.

Invasive Plant Removal, Ecosystem Restoration, and Habitat Protection in the Santa Clara River (Santa Clara River Restoration)

Summary

This project is a giant reed (*Arundo donax*; arundo) control and habitat restoration program on 150 to 200 acres in the Santa Clara River floodplain located in the river reach between Sespe Creek and Santa Paula Creek (six river miles) in the City of Santa Paula. The river reach between these confluences has an extensive and diverse riparian habitat and is a critical wildlife migration corridor in the Region. Arundo is the most problematic non-native, invasive weed in Southern California coastal rivers where it causes extensive flood damage, increases fire risk, uses substantially more water than native vegetation, and offers little to no habitat value. The project is part of a large-scale effort to eliminate arundo from the watershed - the Santa Clara River Parkway Project – to improve water resources in the Region.

The California Coastal Conservancy's strategic plan for arundo treatment and post-treatment revegetation (2011) for the lower watershed will be used to guide project implementation. The plan uses science-based information and data to identify and prioritize properties in the riparian zone for invasive plant control, restoration, and protection. The work will begin in October 2013 and occur in locations where arundo removal and restoration have not yet occurred. This includes up to 3 acres on the USC property, approximately 30 acres on the Taylor property, 50 to 60 acres on the Hedrick Ranch Natural Area, 20 to 25 acres on the Hedrick Property, and 70 to 80 acres on the Peto/McConica properties. All work areas are owned by project partners, The Nature Conservancy or the Friends of the Santa Clara River. The project will be completed by December 2017.

A summary of all benefits and costs of the project is provided in Table E1. Non-monetized and monetized benefits are presented in this attachment while physically quantified benefits are described in Attachment 7.

Non-Monetized Benefits Analysis

Table E2 shows the non-monetized benefits checklist for the project. Narrative descriptions of the benefit categories marked "Yes" in the following table are provided in the narrative description of qualitative benefits section after the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus, although a benefit might apply, a "No" is entered into the table if the benefit has been physically quantified and/or monetized.

Narrative Description of Qualitative Benefits

Provide Education or Technology Benefits

This project provides outstanding technology transfer benefits. The project's association with the University of California Santa Barbara (UCSB) ensures that this is a well-designed project with expected high-value research findings. Second, the research findings will be transferrable to the Ventura River Restoration (project in this Proposal) and to other future projects, increasing the benefits associated with future arundo control projects in Southern California.

Technology transfer objectives include:

- Design a long-term biological monitoring program to facilitate a scientific evaluation of outcomes and successes.
- Develop dual approaches to site restoration needs, including immediate large-scale restoration efforts and a plan for research plots to evaluate various restoration treatments to determine which factors will provide the necessary site characteristics for optimal plant establishment and habitat suitability.
- Coordinate with project partners to provide outreach, access, and natural resource information regarding local and watershed restoration.

While the data gathered from this project will be utilized to benefit similar future projects elsewhere in the Santa Clara River Watershed and beyond, this is first and foremost an implementation project. The research benefits are ancillary to the implementation.

TABLE E1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M Cost	$2,625,287
Monetizable Benefits	
Increased Groundwater Recharge	$5,649,650
Qualitative Benefit or Cost	Qualitative Indicator*
Increased Technology Transfer Benefits	+
Increased Recreation Benefits	+
Reduced Fire Risks	+ +
Improved Wildlife Habitat	+
Improve Water Quality	+
Reduced Stream Bank Erosion	+
Improved Overall Groundwater Management	+ +

* 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 net benefits.
– – Likely to decrease net benefits significantly.
U Uncertain, could be + or – .

AF = acre feet.

O&M = operations and maintenance.

TABLE E2 (PSP Table 12) Santa Clara River Restoration 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 benefits?	
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 benefits?	
3	Help avoid, reduce, or resolve various public water resources conflicts?	No
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	Promote social health and safety?	Yes
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - 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?	

TABLE E2 cont. Santa Clara River Restoration Non-monetized Benefits Checklist		
No.	Question	Enter Yes, No. or Neg
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 gases? - 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 nonrenewable groundwater? - Promote aquifer storage or recharge?	
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel-based energy sources with renewable energy and resources?	No
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified Leadership in Energy and Environmental Design (LEED) features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable practices with recognized sustainable practices?	

TABLE E2 cont. Santa Clara River Restoration Non-monetized Benefits Checklist		
No.	Question	Enter Yes, No. or Neg
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

Provide Social Recreation or Access Benefits

This project contributes to the overall Santa Clara River Parkway Project. The CCC initiated the Santa Clara River Parkway Project in collaboration with TNC, Friends of the Santa Clara River, and private landowners and local governments to acquire and restore floodplain lands for flood protection, wildlife habitat, and recreation. The overall restoration area covers more than 1,000 acres within the floodplain. The goal is to create a large, contiguous riparian zone through a series of related, but stand-alone, restoration projects.

This project, as part of the Santa Clara River Parkway Project, will contribute to the use of the area for recreation. Although there are no existing trails or access points associated with this specific project, the public will have increased viewing access from the road as arundo is tall and currently limits the view of the river from roadways. Additionally, improvements in habitat value will result in enhanced recreational opportunities for wildlife viewing.

Provide Social Health and Safety Benefits

Reduce Fire Hazard

Removal of arundo in the project area will contribute to reduced fire hazard. Under natural conditions, riparian areas act as firebreaks, but as they are overcome by invasive species, they not only enable wildfires to spread more rapidly but they can also become sites where fires may originate. Arundo, in particular, is highly flammable and burns more intensely than native riparian vegetation even when green (VCRCD 2006 from Bell 1997; Dudley 2000, provided with this Benefit and Cost Analysis).

Several accounts have suggested that infestations of arundo have increased fuel loads as well as fire frequency and intensity along riparian corridors. Growing from 13 to 26 feet in height and as fast as 4 inches per day (Coffman et al. 2010, provided with this Benefit and Cost Analysis), arundo produces abundant flammable biomass that accumulates during the summer and fall months (Coffman et al., 2010). Furthermore, several researchers have suggested that fire may increase the ability of arundo to invade natural riparian systems (studies identified in Coffman et al. 2010), and that it may be part of an invasive plant-fire regime cycle, changing riparian ecosystems from primarily flood- to fire-defined systems (Coffman et al. 2010 from Bell 1997).

For example, the 2007 Ranch fire in the Santa Clara Watershed burned 58,000 acres and destroyed one home and nine outbuildings at a cost of $9 million (CAL FIRE 2007b, provided with this Benefit and Cost Analysis). It was reported that firefighters pushed the fire toward the Santa Clara River, anticipating using the river as a firebreak. Unfortunately, due to arundo infestations, the fire spread quickly along the river, which acted as a vector to spread the fire much more quickly than anticipated.

Similar problems exist along Bouquet Canyon Creek on the upper portions of the Santa Clara River where the 2007 Buckweed fire burned

38,000 acres, destroyed 63 structures, and damaged an additional 30 structures at a cost of $7.4 million (CAL FIRE 2007a). Again, arundo played an important role in allowing the fire to spread quickly.

Coffman et al. (2010) evaluated the influence of wildfire on arundo invasion by investigating its relative rate of reestablishment versus native riparian species after the Simi/Verdale wildfire burned 300 hectares of riparian woodlands along the Santa Clara River in October 2003 (upstream of the project area). Post-fire arundo growth rates and productivity were compared to those of native woody riparian species in plots established before and after the fire. The researchers found that arundo resprouted within days after the fire, and exhibited higher growth rates and productivity compared to native riparian plants. One year post-fire, arundo density was nearly 20 times higher and productivity was 14 to 24 times higher than for native woody species.

The study concludes that the greater dominance of arundo after the wildfire increased the susceptibility of riparian woodlands along the Santa Clara River to subsequent fire potentially creating an invasive plant-fire regime cycle. Decreased moisture content and increased surface-to-volume ratio of arundo versus native vegetation may lead to altered or increased fire susceptibility or increased probability of ignition in these systems. Addition of this fuel to the riparian ecosystem has increased vertical continuity (i.e., the structure of fuel allows fire to spread from the surface to crowns of shrubs and trees). Due to its tall growth form, infestations of arundo mixed with native species may spread fire vertically into the canopy of riparian trees.

The October 2003 Simi/Verdale wildfire provides an excellent example of the invasive plant-fire regime cycle that the arundo invasion has created. The wildfire reached the Santa Clara River from the north, crossed the broad riverbed through large stands of arundo, and then burned through thousands of hectares of native shrublands and non-native grasslands before again entering extensive riparian woodlands intermixed with arundo to the west along the river. Without the presence of arundo, it is believed that the Santa Clara River would have served as a better firebreak, and the fire would not have burned as many acres.

Benefit Wildlife or Habitat in Ways that Were Not Quantified in Attachment 7

The Santa Clara River Parkway Project has identified the river reach of this project as a critical wildlife zone due to its size, natural resources, and potential wildlife habitat. Schwartzberg and Moore (1995) provided a detailed history of the rich biological diversity of the Santa Clara River Watershed and the intensification of agricultural, residential, and industrial development in the watershed that has impacted its integrity over the past 150 years. Human encroachment into and modification of the floodplain and riparian habitat have profoundly altered the ecosystem properties of the watershed, constraining or disrupting natural geomorphic and hydrologic processes often causing riparian and aquatic habitat loss or degradation (Stillwater Sciences 2008, provided with this Benefit and Cost Analysis).

Monitoring activities over the past 20 years have shown that many of the species listed by Schwartzberg and Moore (1995) are now either locally extinct or critically endangered, including southern steelhead trout, least Bell's vireo, and red legged frogs (Court et al. 2000, provided with this Benefit and Cost Analysis). The continued introduction and impacts of non-native, invasive species, including arundo, pose an additional and significant threat to biodiversity and natural resources in the region (Lafferty and Page 1997; Stoecker and Kelley 2005; Coffman et al. 2010), and have become a key issue in watershed planning and management. Arundo is the primary species of concern in the watershed where it outcompetes native species, reduces habitat value, and alters fire and flood regimes (Lambert et al. 2010, provided with this Benefit and Cost Analysis).

Arundo colonies threaten native riparian habitats and the wildlife that depends upon these habitats by excluding native plants from water resources by reducing growing space and sunlight, monopolizing water resources, reducing critical shading, and altering flood regimes critical to the establishment of native riparian vegetation (Bell 1997, Dudley 2000, provided with this Benefit and Cost Analysis).

Arundo reduces habitat quality and food supply for native wildlife including insects and bird species (Bell 1997, Dudley 2000). Insects and other grazers are unable to use arundo as a food source due to the noxious chemicals it contains and its defensive cellular structure (Bell 1997). This is particularly important for federal and state listed species such as least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo, which utilizes insects as a food source. Documented decreases in wildlife usage of riparian areas have occurred due to massive stands of arundo (Dudley 2000).

Based on a review of pertinent literature and historical sensitive plant species locations identified in the California Natural Diversity Database (CDFW 2002), a total of 19 special status plant species and 21 special status wildlife species have the potential to occur within the broader project area. Of the 21 wildlife species, eight are federally listed under the Federal Endangered Species Act. Specific species of concern associated with this project include the unarmored three-spine stickleback, western pond turtle, and red legged frog.

Removal and restoration activities on 15 acres at the Hedrick Ranch natural area (owned by Friends of the Santa Clara River and situated within the project area) have resulted in a significant increase in wildlife especially the endangered least Bell's vireo (Coffman 2007). Removal of arundo and native plant reestablishment through this project will allow restoration of high-quality habitat in the project area.

The project will also increase river flows available for salmon and southern steelhead. The County is currently negotiating the amount of surface water that needs to be maintained in-stream for migration upstream and downstream. The additional water provided by this project will be available to supplement in-stream flows without reducing the amount of water being used for other purposes.

Improve Water Quality in Ways that Were Not Quantified in Attachment 7

Improved Surface Water and Groundwater Quality

Since it is a giant grass, arundo provides little shade along the river compared to native vegetation such as willows, sycamores, and live oaks, which have strong branches that can support wide-spreading growth habitat and/or large leaves that shade streamside habitats in the summer.

Where arundo is dominant, the lack of shade causes water temperatures in the river to increase compared to areas where native vegetation is dominant, which can ultimately lead to a reduction in dissolved oxygen, making the water unsuitable for aquatic organisms (VCRCD 2006 from Bell 1997, provided with this Benefit and Cost Analysis). In addition, increased light exposure and temperature may encourage algal blooms, which can increase pH levels and severely reduce available habitat for aquatic organisms (VCRCD 2006). Increased pH also facilitates the conversion of usable ammonia to a toxic byproduct, which degrades water quality. All of these changes can adversely affect beneficial uses of the river including habitat for rare and sensitive species.

Decreased Stream Bank Erosion

Non-native arundo is known to increase the potential for erosion of adjacent lands along the Santa Clara River. Arundo can alter stream geomorphology by trapping and stabilizing sediment, which narrows stream channels, widens floodplains, and causes increased flooding (VCRCD 2006). Large stands of arundo may also obstruct flows and shunt floodwaters into areas that historically have not experienced water flow. This can exacerbate bank erosion problems and lead to an unnatural increase in the loss of adjacent public and private properties that are often valuable farmland (VCRCD 2006).

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

The removal of arundo can significantly reduce groundwater consumption in the Santa Paula Groundwater Basin, which continues to experience overdraft. The reduction of groundwater consumption can only improve the overall, long-term management of not only the Santa Paula Groundwater Basin but also the down-gradient Oxnard Basin.

Summary of Non-Monetized Benefits

Although the benefits described above are not monetizable, they are nonetheless extremely valuable. In addition to improving groundwater management, arundo removal provides significant other benefits for the Watershed. Those benefits include improved surface water and groundwater quality, decreased stream bank erosion, restoration of native habitat, reduced fire hazard, and increased educational and technology transfer opportunities related to arundo removal.

Monetized Benefits Analysis

The project is expected to result in additional water supplies in the groundwater basin that are of equal value as water that is imported through the SWP by UWCD for groundwater replenishment in the project area. The monetization of this benefit is discussed below.

Value of Increased Groundwater Recharge

Ventura County has significant groundwater management issues. This project will directly increase water to groundwater basins that are in significant overdraft conditions. The additional water made available due to the project's reduction in water used by the non-native invasive species arundo will either percolate directly into the Santa Paula Groundwater Basin or be diverted at the Freeman Diversion for recharge of the Oxnard Plain and Pleasant Valley Basins through the use of spreading basins and in-lieu deliveries. A map of Ventura County groundwater basins is provided in Figure 1. (Note that the project site is near the City of Santa Paula.)

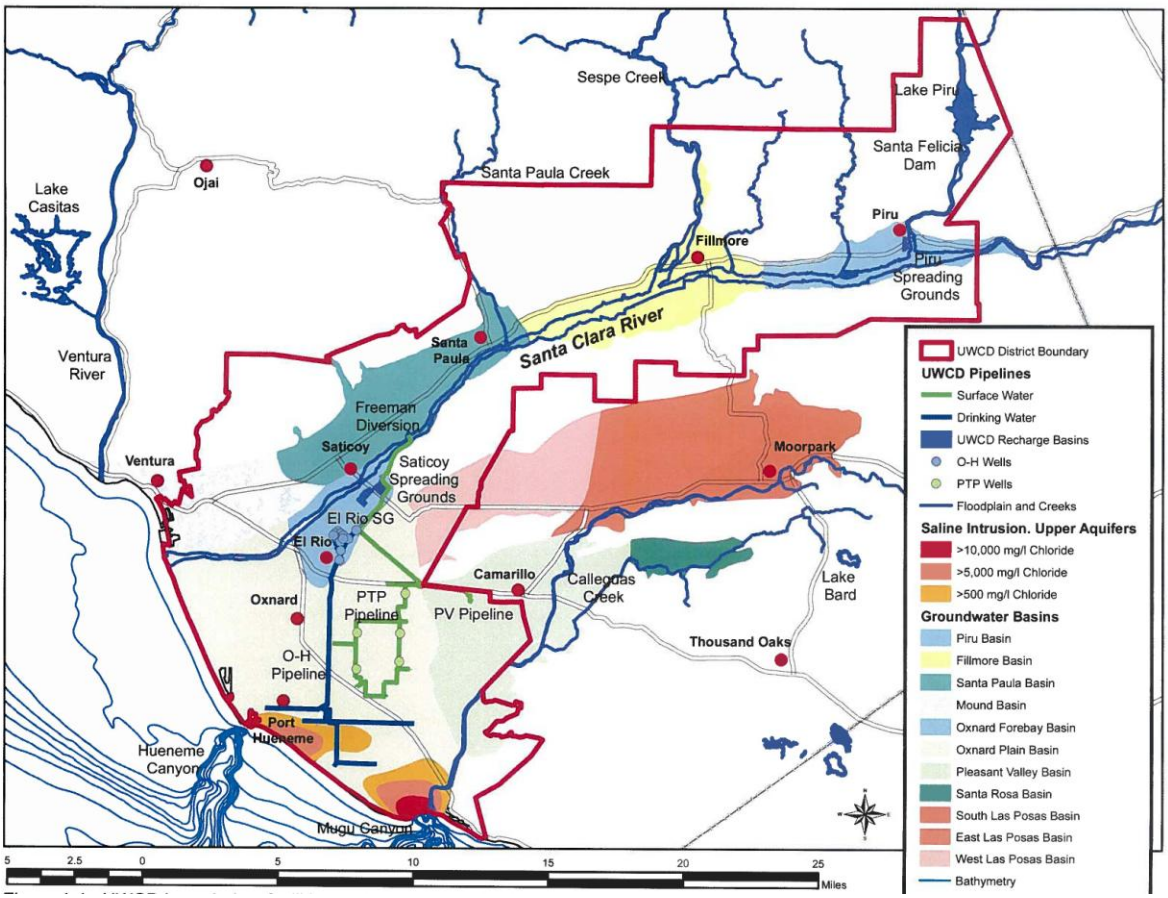
The City of Ventura, UWCD, many other regional municipal water agencies, and agriculture have historically relied upon the Santa Paula Basin and Oxnard Basin (Fox Canyon Aquifer) as water supply sources (Ventura 2013, provided with this Benefit and Cost Analysis). Both basins are currently considered to be in overdraft conditions (UWCD 2011, provided with this Benefit and Cost Analysis).

In March 1996, the courts ended a five-year stalemate over the use of the Santa Paula Basin. Under a court-stipulated judgment, all users – the City of Ventura, UWCD, and the Santa Paula Basin Pumpers Association (an association of ranchers and businesses) – have established pumping allocations based on the need to reduce pumping to reduce overdraft conditions.

However, overdraft conditions in the Oxnard Plain continue today with the annual overdraft estimated to be about 20,000 to 25,000 AFY (UWCD 2012a, provided with this Benefit and Cost Analysis). Overdraft has resulted in seawater intrusion into the southern portion of the Oxnard Basin and was one of the reasons for the creation of the UWCD. As intrusion of seawater increased in the 1950s through the 1980s, UWCD responded by increasing recharge and decreasing pumping. Because of the significant interaction of the groundwater basins on the Santa Clara River, recharging in the Santa Paula Basin has positive impacts on saline intrusion in the Oxnard Basin (UWCD 2011). Any improvements to overdraft conditions in the Santa Paula and Oxnard Basins will help reduce the severity of seawater intrusion.

This project will reduce the uptake of scarce water resources by non-native plants, improving the overall, long-term management of California groundwater resources. As described in Attachment 7, the project is expected to increase water supply in the very water-limited region by 3,500 AFY. As discussed in Attachment 7, this estimate is conservative; actual water savings could be twice as high. Additionally, for the purposes of monetizing benefits, it is assumed that on average about 50 percent of the water that is estimated to be saved as a result of this project will be available for UWCD, as either direct percolation into the Santa Paula and Oxnard Plain groundwater basins or as surface water flows that are diverted at the Freeman Diversion for artificial recharge of the Oxnard Plain and Pleasant Valley Basins. This is a conservative assumption because only in wettest periods (few years per decade on average) will the recharge areas of the basins be so full as to reject the recharge from the additional flows created by this project.

FIGURE 1
UNITED WATER CONSERVATION DISTRICT (UWCD) BOUNDARIES, FACILITIES, AND GROUNDWATER BASINS



Source: UWCD, 2012a.

Currently UWCD is importing water that is used directly for recharge of the same groundwater basins as this project benefits. The cost paid by UWCD for imported water to recharge the groundwater basin is used to represent the value of arundo water savings used to meet the same purpose. This should be viewed a lower bound on the value of contributions to mitigating overdraft conditions in the aquifer because this is a regionally agreed and state mandated goal, and actual willingness to pay to reverse groundwater overdraft and its deleterious effects is likely much higher.

UWCD currently receives 3,150 AF of imported water, which is released from Pyramid Lake and travels downstream to Lake Piru. This water is later released from Santa Felicia Dam in a manner designed to maximize percolation into the groundwater basin while also providing for recharge via in-lieu deliveries (UWCD 2011). This means that the water saved due to this project will be used in exactly the same way, for the exact same purpose, as imported SWP water – to contribute to groundwater basin recharge.

In 2012, UWCD paid $153 per acre-foot for its allotment of SWP water from San Felicia Dam, (UWCD 2012b). Given the recent and projected rate of change of SWP supplies, this cost is expected to increase in real terms over the anticipated 50-year lifetime of the project. It is estimated that the cost of SWP imports will rise at a real rate (above inflation) of 3.5 percent annually through 2020, after which prices will likely escalate at a rate of 1.5 percent annually. Assuming this rise in rates, the present value of saved water made available for recharge over the 50-year life of the project is estimated to be $5,649,650. A summary of monetized benefits for this project is shown in Table E3.

Project Economic Costs

The project has implementation costs of $2,886,023, to support four years of arundo removal beginning in 2013. The project will be completed in 2017. Maintenance costs are required in years 5 and 6 to ensure arundo eradication and native replantings are complete (with costs of $34,320 and $11,440, respectively). Additional costs will be incurred following flooding events to prevent arundo reinfestation. Flooding events are assumed to occur every 12–13 years. The following flood maintenance costs will be incurred: first flood event $21,690, second flood event $23,760, third flood event $25,560, and fourth flood event $27,360. As is shown in Table E4, this project has a total discounted present value cost of $2,625,287 over the 50-year project life.

Project Benefits and Cost Summary

This project is estimated to save approximately 3,500 AFY through removal of arundo and 175,000 AF over the estimated 50-year project life. This water will help to alleviate overdraft conditions immediately downstream through recharge to groundwater in the Santa Paula Basin and in the Oxnard Plain and Pleasant Valley Basins through the Freeman Diversion as part of UWCD's operations. This saved water is valued at the cost UWCD pays to purchase imported SWP water to recharge the aquifer. The value of water savings totals $5,649,650 in present value over the 50-year project life (assumes 50 percent of water savings contributes to recharge – see prior section for details concerning this assumption).

Non-monetized benefits include:

- Opportunities for educational and technology transfer
- Increases in recreational opportunities
- Improvements in wildlife and habitat
- Improvements in water quality
- Reductions in stream bank erosion
- Reductions in fire risk and fire management concerns
- Improved groundwater management

TABLE E3 – ANNUAL BENEFIT (Table 15 of PSP) (All benefits in 2012 dollars) Project: Santa Clara River Restoration									
(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	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2012						$ 153		1.000	
2013						$ 158		0.943	
2014	Recharge of saved water	AF	0	700	700	$ 164	$ 114,728	0.890	**$ 102,108**
2015	Recharge of saved water	AF	0	1225	1225	$ 170	$ 207,801	0.840	**$ 174,474**
2016	Recharge of saved water	AF	0	1575	1575	$ 176	$ 276,524	0.792	**$ 219,033**
2017	Recharge of saved water	AF	0	1750	1750	$ 182	$ 318,003	0.747	**$ 237,630**
2018	Recharge of saved water	AF	0	1750	1750	$ 188	$ 329,133	0.705	**$ 232,026**
2019	Recharge of saved water	AF	0	1750	1750	$ 195	$ 340,653	0.665	**$ 226,554**
2020	Recharge of saved water	AF	0	1750	1750	$ 201	$ 352,576	0.627	**$ 221,210**
2021	Recharge of saved water	AF	0	1750	1750	$ 204	$ 357,864	0.592	**$ 211,819**
2022	Recharge of saved water	AF	0	1750	1750	$ 208	$ 363,232	0.558	**$ 202,827**
2023	Recharge of saved water	AF	0	1750	1750	$ 211	$ 368,681	0.527	**$ 194,216**
2024	Recharge of saved water	AF	0	1750	1750	$ 214	$ 374,211	0.497	**$ 185,971**
2025	Recharge of saved water	AF	0	1750	1750	$ 217	$ 379,824	0.469	**$ 178,076**
2026	Recharge of saved water	AF	0	1750	1750	$ 220	$ 385,521	0.442	**$ 170,517**
2027	Recharge of saved water	AF	0	1750	1750	$ 224	$ 391,304	0.417	**$ 163,278**

TABLE E3 – ANNUAL BENEFIT cont. (All benefits in 2012 dollars) Project: Santa Clara River Restoration									
(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)	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2028	Recharge of saved water	AF	0	1750	1750	$ 227	$ 397,174	0.394	**$ 156,346**
2029	Recharge of saved water	AF	0	1750	1750	$ 230	$ 403,131	0.371	**$ 149,709**
2030	Recharge of saved water	AF	0	1750	1750	$ 234	$ 409,178	0.350	**$ 143,353**
2031	Recharge of saved water	AF	0	1750	1750	$ 237	$ 415,316	0.331	**$ 137,267**
2032	Recharge of saved water	AF	0	1750	1750	$ 241	$ 421,546	0.312	**$ 131,440**
2033	Recharge of saved water	AF	0	1750	1750	$ 244	$ 427,869	0.294	**$ 125,860**
2034	Recharge of saved water	AF	0	1750	1750	$ 248	$ 434,287	0.278	**$ 120,517**
2035	Recharge of saved water	AF	0	1750	1750	$ 252	$ 440,801	0.262	**$ 115,401**
2036	Recharge of saved water	AF	0	1750	1750	$ 256	$ 447,413	0.247	**$ 110,502**
2037	Recharge of saved water	AF	0	1750	1750	$ 259	$ 454,125	0.233	**$ 105,810**
2038	Recharge of saved water	AF	0	1750	1750	$ 263	$ 460,936	0.220	**$ 101,318**
2039	Recharge of saved water	AF	0	1750	1750	$ 267	$ 467,850	0.207	**$ 97,017**
2040	Recharge of saved water	AF	0	1750	1750	$ 271	$ 474,868	0.196	**$ 92,899**
2041	Recharge of saved water	AF	0	1750	1750	$ 275	$ 481,991	0.185	**$ 88,955**
2042	Recharge of saved water	AF	0	1750	1750	$ 280	$ 489,221	0.174	**$ 85,178**

TABLE E3 – ANNUAL BENEFIT cont. (All benefits in 2012 dollars) Project: Santa Clara River Restoration									
(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)	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2043	Recharge of saved water	AF	0	1750	1750	$ 284	$ 496,559	0.164	**$ 81,562**
2044	Recharge of saved water	AF	0	1750	1750	$ 288	$ 504,008	0.155	**$ 78,100**
2045	Recharge of saved water	AF	0	1750	1750	$ 292	$ 511,568	0.146	**$ 74,784**
2046	Recharge of saved water	AF	0	1750	1750	$ 297	$ 519,241	0.138	**$ 71,609**
2047	Recharge of saved water	AF	0	1750	1750	$ 301	$ 527,030	0.130	**$ 68,569**
2048	Recharge of saved water	AF	0	1750	1750	$ 306	$ 534,936	0.123	**$ 65,658**
2049	Recharge of saved water	AF	0	1750	1750	$ 310	$ 542,960	0.116	**$ 62,871**
2050	Recharge of saved water	AF	0	1750	1750	$ 315	$ 551,104	0.109	**$ 60,202**
2051	Recharge of saved water	AF	0	1750	1750	$ 320	$ 559,371	0.103	**$ 57,646**
2052	Recharge of saved water	AF	0	1750	1750	$ 324	$ 567,761	0.097	**$ 55,199**
2053	Recharge of saved water	AF	0	1750	1750	$ 329	$ 576,278	0.092	**$ 52,856**
2054	Recharge of saved water	AF	0	1750	1750	$ 334	$ 584,922	0.087	**$ 50,612**
2055	Recharge of saved water	AF	0	1750	1750	$ 339	$ 593,695	0.082	**$ 48,463**
2056	Recharge of saved water	AF	0	1750	1750	$ 344	$ 602,601	0.077	**$ 46,406**
2057	Recharge of saved water	AF	0	1750	1750	$ 350	$ 611,640	0.073	**$ 44,436**
2058	Recharge of saved water	AF	0	1750	1750	$ 355	$ 620,815	0.069	**$ 42,549**

TABLE E3 – ANNUAL BENEFIT cont. (All benefits in 2012 dollars) Project: Santa Clara River Restoration									
(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)	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2059	Recharge of saved water	AF	0	1750	1750	$ 360	$ 630,127	0.065	**$ 40,743**
2060	Recharge of saved water	AF	0	1750	1750	$ 365	$ 639,57	0.061	**$ 39,013**
2061	Recharge of saved water	AF	0	1750	1750	$ 371	$ 649,172	0.058	**$ 37,357**
2062	Recharge of saved water	AF	0	1750	1750	$ 377	$ 658,910	0.054	**$ 35,771**
2063	Recharge of saved water	AF	0	1750	1750	$ 382	$ 668,794	0.051	**$ 34,253**
2064	Recharge of saved water	AF	0	1050	1050	$ 388	$ 407,295	0.048	**$ 19,679**
2065	Recharge of saved water	AF	0	525	525	$ 394	$ 206,702	0.046	**$ 9,422**
2066	Recharge of saved water	AF	0	175	175	$ 400	$ 69,934	0.043	**$ 3,007**
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									**$ 5,649,650**

Water savings equals 20 AFY per acre of arundo removed. In 2014 40% of the project will have been completed; in 2015 70% of the project will have been completed; in 2017 100% of the project will have been completed. 150 - 200 acres will be treated in this project for a total savings of 3000 - 4000 AFY. 3500 ac-ft/yr is used. It is assumed that 50% will be available to recharge to address groundwater overdraft downstream. Recharge is valued according to the cost of imported water which is being used for the same purpose to recharge the aquifer. A 3.5% real increase in imported water rates is assumed through 2020, and 1.5% thereafter.

TABLE E4 – ANNUAL COSTS OF PROJECT (Table 19 of PSP) (All costs in 2012 Dollars) Project: Santa Clara River Restoration										
	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	$ 1,154,409							$ 1,154,409	0.943	$ 1,089,065
2014	$ 865,807							$ 865,807	0.890	$ 770,565
2015	$ 577,205							$ 577,205	0.840	$ 484,632
2016	$ 288,602							$ 288,602	0.792	$ 228,600
2017					$ 34,320	$ -		$ 34,320	0.747	$ 25,646
2018					$ 11,440	$ -		$ 11,440	0.705	$ 8,065
2019						$ -		$ -	0.665	$ -
2020						$ -		$ -	0.627	$ -
2021						$ -		$ -	0.592	$ -
2022						$ -		$ -	0.558	$ -
2023						$ -		$ -	0.527	$ -
2024						$ -		$ -	0.497	$ -
2025						$ 21,960		$ 21,960	0.469	$ 10,296
2026						$ -		$ -	0.442	$ -
2027						$ -		$ -	0.417	$ -
2028						$ -		$ -	0.394	$ -
2029						$ -		$ -	0.371	$ -

TABLE E4 – ANNUAL COSTS OF PROJECT cont. (All costs in 2012 Dollars) Project: Santa Clara River Restoration										
	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)
2030						$ -		$ -	0.350	$ -
2031						$ -		$ -	0.331	$ -
2032						$ -		$ -	0.312	$ -
2033						$ -		$ -	0.294	$ -
2034						$ -		$ -	0.278	$ -
2035						$ -		$ -	0.262	$ -
2036						$ -		$ -	0.247	$ -
2037						$ -		$ -	0.233	$ -
2038						$ 21,960		$ 21,960	0.220	$ 4,827
2039						$ -		$ -	0.207	$ -
2040						$ -		$ -	0.196	$ -
2041						$ -		$ -	0.185	$ -
2042						$ -		$ -	0.174	$ -
2043						$ -		$ -	0.164	$ -
2044						$ -		$ -	0.155	$ -
2045						$ -		$ -	0.146	$ -
2046						$ -		$ -	0.138	$ -
2047						$ -		$ -	0.130	$ -
2048						$ -		$ -	0.123	$ -
2049						$ -		$ -	0.116	$ -
2050						$ 21,960		$ 21,960	0.109	$ 2,399
2051						$ -		$ -	0.103	$ -
2052						$ -		$ -	0.097	$ -

TABLE E4 – ANNUAL COSTS OF PROJECT cont. (All costs in 2012 Dollars) Project: Santa Clara River Restoration										
	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)
2053						$ -		$ -	0.092	$ -
2054						$ -		$ -	0.087	$ -
2055						$ -		$ -	0.082	$ -
2056						$ -		$ -	0.077	$ -
2057						$ -		$ -	0.073	$ -
2058						$ -		$ -	0.069	$ -
2059						$ -		$ -	0.065	$ -
2060						$ -		$ -	0.061	$ -
2061						$ -		$ -	0.058	$ -
2062						$ 21,960		$ 21,960	0.054	$ 1,192
2063						$ -		$ -	0.051	$ -
2064						$ -		$ -	0.048	$ -
2065						$ -		$ -	0.046	$ -
2066						$ -		$ -	0.043	$ -
2067						$ -		$ -	0.041	$ -
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$ 2,625,287

1. If any, based on opportunity costs, sunk costs and associated costs
2. If any, based on opportunity costs, sunk costs and associated costs

Initial costs and O&M costs for the project total $2,625,287 over the 50-year project life. Thus, estimated monetized benefits for the project substantially outweigh the costs.

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 this analysis, the main uncertainties are associated with the amount of water savings that can be accomplished by arundo removal. These issues are listed in Table E5.

TABLE E5
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Value of Increased Groundwater Recharge	+ +	In estimating arundo stand water use through evapotranspiration, researchers made conservative assumption and reported arundo water use values half of the measured transpiration rate. If the greater measured transpiration rate of 40 mm/day is used instead of the assumed 20 mm/day, then water savings from arundo use would be significantly larger than the value used in monetizing water savings for this analysis.
Value of Increased Groundwater Recharge	+ +	It is assumed that only 50% of the water saved via arundo removal will recharge the groundwater basins. This is a conservative assumption because only in wettest periods (few years per decade on average) will the recharge areas of the basins be so full as to reject the recharge from the additional flows created by this project.
Value of Increased Groundwater Recharge	+	The cost to UWCD to recharge imported water is underestimated in this analysis. The cost of water has been used to value water savings, but there are additional incremental costs of running the Santa Felicia Dam and operating the spreading grounds that have not been accounted for.
Reductions in health and safety issues	+ +	Fire management is greatly improved with arundo removal. Estimates of the incremental contribution of arundo to fire incidents are not available; however, the impact of highly flammable arundo in allowing fire to bridge natural firebreaks is apparent. If the incremental value of arundo removal to fire risk reduction could be monetized, it would significantly increase monetized benefits for the project.
Timeframe of project benefits	-	Reinfestation of arundo following a fire or flood could reduce the timeframe of project benefits.

*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 -.

References

All the references below are provided as attachments to this Benefit Cost Analysis (Att8_IG2_BenCost_6of7), unless otherwise specified.

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Ventura River Invasive Plant Removal and Ecosystem Restoration Project (Ventura River Restoration

Summary

The primary goal of this project is to control invasive non-native plants within 135 acres along the Ventura River in the vicinity of Foster Park in unincorporated Ventura County, including the Rio Vista and Steelhead preserves owned by the Ojai Valley Land Conservancy (OVLC) and two Ventura Hillsides Conservancy (VHC) parcels. The project objectives include:

- Achieve control within the project area by removing 90 percent of invasive non-native plants on 43 out of 135 acres along the Ventura River.
- Restore habitat and wildlife corridors for endangered and threatened species.
- Reduce flood and fire threats within the Ventura River.
- Improve water quality and water supply.

The project will also add improvements to the Steelhead Preserve as part of a larger effort to create an Education and Conservation Center (the Center).

A summary of all the benefits and costs of the project is provided in Table F1. Non-monetized and monetized benefits are presented in this attachment, while physically quantified benefits are described in Attachment 7.

Non-Monetized Benefits Analysis

Table F2 shows the non-monetized benefits checklist for the project. Narrative descriptions of the benefit categories marked “Yes” in the following table are provided in the narrative description of qualitative benefits section after the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus, although a benefit might apply, a “No” is entered into the table if the benefit has been physically quantified and/or monetized.

Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked “Yes” from the checklist in Table F2 are described below.

Provide Education or Technology Benefits

This project provides positive educational benefits by contributing toward the development of the Center at the OVLC Ventura River Steelhead Preserve. This preserve was acquired in June 2011 with funding in part from the California Coastal Conservancy. The work in this project will include design and construction work.

At the Center, the following educational uses are anticipated:

- Environmental Education.
- Community Meetings and Events.
- Interpretative Exhibits for Preserve Visitors.

The Center will also provide the following technology transfer benefits:

- Research: The Center will offer workspace for researchers studying climate change and riparian ecology, including local staff of state and federal agencies and other conservation organizations.
- Habitat Restoration: The Center will serve as the home base for habitat restoration projects on the Ventura River.
- Watershed Coordination: Centrally located in the heart of the watershed, the Center will be the home base for the Ventura River Watershed Coordinator who will use the Center for Ventura River Watershed Council and other related meetings.

TABLE F1
BENEFIT-COST ANALYSIS OVERVIEW

	Present Value
Costs – Total Capital and O&M	$1,778,172
Monetizable Benefits	Project Life Total
Avoided Water Supply Costs	$704,259
Qualitative Benefit or Cost	Qualitative Indicator*
Increased Educational and Technology Transfer Opportunities	+
Increased Social Recreation Benefits	+
Reduced Health and Safety Issues	+
Reduced Fire Risk	+ +
Improved Wildlife Habitat	+
Improved Surface and Ground Water Quality	+
Reduced Stream Bank Erosion	+
Improved Overall California Groundwater Management	+

* 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 net benefits.
– – Likely to decrease net benefits significantly.
U Uncertain, could be + or – .

AF = acre feet.
O&M = operations and maintenance

TABLE F2 (PSP Table 12) Ventura River Restoration 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 benefits?	
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 benefits?	
3	Help avoid, reduce, or resolve various public water resources conflicts?	No
	Examples are not limited to, but may include:	
	- Provide more opportunities for public involvement in water management?	
	- Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation?	
	- Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	Promote social health and safety?	Yes
	Examples are not limited to, but may include:	
	- Increase urban water supply reliability for fire-fighting and critical services following seismic events?	
	- Reduce risk to life from dam failure or flooding?	
	- 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?	

TABLE F2 cont. Ventura River Restoration Non-monetized Benefits Checklist		
Question		Enter Yes, No, or Neg
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 habitats?	
	- Contribute to an existing biological opinion or recovery plan for a listed special status species?	
	- Preserve or restore a 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 gases?	
	- Reduce net emissions of other harmful chemicals into the air or water?	
9	Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?	No
Sustainability Benefits: *Will the proposal:*		
10	Improve the overall, long-term management of California groundwater resources?	Yes
	Examples are not limited to, but may include:	
	- Reduce extraction of non-renewable groundwater?	
	- Promote aquifer storage or recharge?	
11	Reduce demand for net diversions for the regions from the Delta?	No
12	Provide a long-term solution in place of a short-term one?	No
13	Promote energy savings or replace fossil fuel-based energy sources with renewable energy and resources?	No
	Examples are not limited to, but may include:	
	- Reduce net energy use on a permanent basis?	
	- Increase renewable energy production?	
	- Include new buildings or modify buildings to include certified Leadership in Energy and Environmental Design (LEED) features?	
	- Provide a net increase in recycling or reuse of materials?	
	- Replace unsustainable practices with recognized sustainable practices?	

TABLE F2 cont. Ventura River Restoration Non-monetized Benefits Checklist		
Question		Enter Yes, No, or Neg
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

This project also includes additional education benefits in the form of:

- Construction of a trailhead kiosk and interpretive trail signage.
- Installation of creative exhibits (already planned) in the Center.

The Center will also play an important role in increasing educational opportunities about regional native plants and animals. School age children will be taught to respect the environment and to appreciate its value to the future. Nature walks will help children recognize different species and their role in a healthy environment and assist children in understanding the importance of conservation. In addition, children who experience a hands-on educational experience in school often take their new-found knowledge home and increase the interest and knowledge of other family members.

Interpretive exhibits will help visitors to the Steelhead Preserve better understand the watershed and the importance of preserving its natural resources. Educated visitors are better prepared to appreciate the habitat surrounding them during their visit and to respect the flora and fauna within it. Also, understanding the history of the Watershed gives visitors a greater appreciation for the past and the importance of protecting and preserving the environment for the future.

Provide Social Recreation or Access Benefits

This project increases social recreation and access in the area. The properties benefitted by this project are bordered by recreational trails. These trails, designed for use by horse, and now used by bikers and hikers as well, will have both increased access and value as a recreational opportunity by removing the large stands of arundo. It is important to note that the Center and the trails provide free recreation for low income area residents.

Provide Social Health and Safety

Reduces Homeless Camp Hazards

Thick arundo colonies in the river bottom portion of the project area currently have homeless encampments. Because arundo grows in large, dense clumps in intermittent streams, the homeless have found that they can hollow out clumps and create a semi-protected camp that provides some measure of privacy and safety. Groups of homeless have created “communities” in which they gather for additional security. While on the surface this seems as if this could be a successful social adaptation, it has inherent problems. First, it makes the residents extremely vulnerable to both flood and fire dangers. Second, it gives an illusion of safety that does not exist in reality. Perhaps most importantly, it creates major pollution problems. Because there are no sanitary facilities in the river bed, all biological functions occur in the open river bed. Furthermore, because the river bed is seen as “endless” and self-cleaning, waste material and trash are not removed, leading to major trash pollution especially during flood events when all

of the material is washed downstream into the ocean. In addition, removing arundo provides better access for emergency responders to see homeless who need assistance.

Reduced Fire Hazard

Removal of arundo in the project area will contribute to reduced fire hazard. Under natural conditions, riparian areas act as firebreaks, but as they are overcome by invasive species, they not only enable wildfires to spread more rapidly, but they can also become sites where fires may originate (i.e., homeless encampments). Arundo, in particular, is highly flammable and burns more intensely than native riparian vegetation even when green (Dudley 2000, VCRCD 2006, provided with this Benefit and Cost Analysis).

Several accounts have suggested that infestations of arundo have increased fuel loads as well as fire frequency and intensity along riparian corridors. Growing from 13 to 26 feet in height and as fast as 4 inches per day (Coffman et al. 2010, provided with this Benefit and Cost Analysis), arundo produces abundant flammable biomass that accumulates during the summer and fall months (Rundel 2000, Coffman et al. 2010, provided with this Benefit and Cost Analysis). Furthermore, several researchers have suggested that fire may increase the ability of arundo to invade natural riparian systems (studies identified in Coffman et al., 2010), and that it may be part of an invasive plant-fire regime cycle, changing riparian ecosystems from primarily flood-defined to fire-defined systems (Coffman 2007, provided with this Benefit and Cost Analysis).

For example, the 2007 Ranch fire, in the nearby Santa Clara River Watershed, burned 58,000 acres, and destroyed one home and nine outbuildings at a cost of $9 million (CAL FIRE 2007b, provided with this Benefit and Cost Analysis). It was reported that firefighters pushed the fire toward the Santa Clara River, anticipating using the river as a firebreak. Unfortunately, due to arundo infestations, the fire spread quickly along the river, which acted as a vector to spread the fire much more quickly than anticipated.

Similar problems exist along Bouquet Canyon Creek on the upper portions of the nearby Santa Clara River, where the 2007 Buckweed fire burned 38,000 acres, destroyed 63 structures, and damaged an additional 30 structures at a cost of $7.4 million (CAL FIRE 2007a). Again, arundo played an important role in allowing the fire to spread quickly.

Coffman et al. (2010) evaluated the influence of wildfire on arundo invasion by investigating its relative rate of reestablishment versus native riparian species after the Simi/Verdale wildfire burned 300 hectares of riparian woodlands along the nearby Santa Clara River. Post-fire arundo growth rates and productivity were compared to those of native woody riparian species in plots established before and after the fire. The researchers found that arundo resprouted within days after the fire and exhibited higher growth rates and productivity compared to native riparian plants. One year post-fire, the arundo density was nearly 20 times higher and productivity was 14 to 24 times higher than for native woody species.

The study concludes that the greater dominance of arundo after the wildfire increased the susceptibility of riparian woodlands along the Santa Clara River to subsequent fire potentially creating an invasive plant-fire regime cycle. Decreased moisture content and increased surface-to-volume ratio of arundo versus native vegetation may lead to altered or increased fire susceptibility or increased probability of ignition in these systems. Addition of this fuel to the riparian ecosystem has increased vertical continuity (i.e., the structure of fuel allows fire to spread from the surface to crowns of shrubs and trees). Due to its tall growth form, infestations of arundo mixed with native species may spread fire vertically into the canopy of riparian trees.

The October 2003 Simi/Verdale wildfire provides an excellent example of the invasive plant-fire regime cycle that the arundo invasion has created. The wildfire reached the Santa Clara River from the north, crossed the broad riverbed through large stands of arundo, and then burned through thousands of hectares of native shrublands and non-native grasslands before again entering extensive riparian woodlands intermixed with arundo to the west along the river. Without the presence of arundo, it is believed that the Santa Clara River would

have served as a better firebreak, and the fire would not have burned as many acres.

Benefit Wildlife or Habitats in Ways that Were Not Quantified in Attachment 7

This project provides wildlife habitat improvements. Establishing control over invasive species allows native species to recolonize the treated areas. Colonies of arundo are dense and do not provide either food or habitat for native wildlife (Bell, Undated). Arundo colonies threaten native riparian habitats and the wildlife that depends upon these habitats by excluding native plants from water resources by reducing growing space and sunlight, monopolizing water resources, reducing critical shading, and altering flood regimes critical to the establishment of native riparian vegetation (Bell 1997, Dudley 2000). Arundo reduces habitat quality and food supply for native wildlife, including insects and bird species (Bell 1997, Dudley 2000, provided with this Benefit and Cost Analysis). Insects and other grazers are unable to use arundo as a food source due to the noxious chemicals it contains and its defensive cellular structure (Bell 1997). This is particularly important for federal and state listed species such as least Bell's vireo, southwestern willow flycatcher, and yellow-billed cuckoo, which utilize insects as a food source. Documented decreases in wildlife usage of riparian areas have occurred due to massive stands of arundo (Dudley 2000).

Based on a review of pertinent literature and of historical-sensitive plant species locations identified in the California Natural Diversity Database (CDFW 2002), a total of 40 sensitive wildlife species have the potential to occur within the broader project area. Specific species of concern associated with this project include the tidewater goby, southern steelhead, and red legged frog.

The project will also increase river flows available for southern steelhead. The additional water provided by this project will be available to supplement in-stream flows without reducing the amount of water being used for other purposes. The removal of arundo and native plant reestablishment through this project will allow restoration of high-quality habitat in the project area.

Improve Water Quality in Ways that Were Not Quantified in Attachment 7

Improved Surface and Ground Water Quality

Since it is a giant grass, arundo provides little shade along the river compared to native vegetation such as willows, sycamores, and live oaks, which have strong branches that can support wide-spreading growth habitat, and/or large leaves that shade streamside habitats in the summer.

Where arundo is dominant, the lack of shade causes water temperatures in the river to increase compared to areas where native vegetation is dominant, which can ultimately lead to a reduction in dissolved oxygen, making the water unsuitable for aquatic organisms (VCRCD 2006). In addition, increased light exposure and temperature may encourage algal blooms, which can increase pH levels and severely reduce available habitat for aquatic organisms (VCRCD 2006). Increased pH also facilitates the conversion of usable ammonia to a toxic byproduct, which degrades water quality. All of these changes can adversely affect beneficial uses of the river including habitat for rare and sensitive species.

Decreased Stream Bank Erosion

This project will reduce stream bank erosion and geomorphology changes to the river. Arundo is known to increase the potential for erosion of adjacent lands along the Ventura River. Arundo can alter stream geomorphology by trapping and stabilizing sediment, which narrows stream channels, widens floodplains, and causes increased flooding (VCRCD 2006). Large stands of arundo may also obstruct flows and shunt floodwaters into areas that historically have not experienced water flow. This can exacerbate bank erosion problems and lead to an unnatural increase in the loss of adjacent public and private property that is often valuable farmland (VCRCD 2006).

Improve the Overall, Long-term Management of California Groundwater Resources

The Ventura River Groundwater Basin is shallow with an estimated storage capacity of no more than 14,000 AF (WPD 2012), and there are limited opportunities for groundwater recharge. The Ventura River system and groundwater system serve many beneficial

uses including water supply and fishery habitat. Water from the Ventura River and Ventura River Groundwater Basin is diverted and extracted by various users including the City of Ventura, Meiners Oaks Water District, Ventura River County Water District, and other local pumpers along the length of the mainstem. Currently the water supply of the Ventura River and Ventura River Groundwater Basin are the subject of scrutiny as water purveyors, private irrigators, and public trust agencies try to balance competing water demands. The entire portion of the Ventura River overlying the Upper Basin has been listed by the LARWQCB as impaired due to water diversions and pumping (SWRCB 2012). Recently the National Marine Fisheries Service included the Ventura River in its Southern California Steelhead Recovery Plan. The plan calls for better river and groundwater management to improve local fisheries.

This project will reduce the uptake of scarce water resources by non-native plants, which in turn will make more water available for groundwater recharge improving the overall, long-term management of California groundwater resources.

Summary of Non-monetized Benefits

Although the benefits described above are not monetizable, they are nonetheless extremely valuable. Benefits include improved surface water and groundwater quality, decreased stream bank erosion, restoration of native habitat, reduced fire hazard, and increased educational and technology transfer opportunities related to arundo removal. In addition, this project will reduce the uptake of scarce water resources by non-native plants improving the overall, long-term management of California groundwater resources.

Monetized Benefits Analysis

The reduced water usage by non-native arundo is expected to provide in-stream flows in the Ventura River that can be used by the City of Ventura to replace purchased water from Casitas Municipal Water District (Casitas).

Avoided Water Supply Costs

This project provides water that is available as an additional water supply source for the City of Ventura. The City of Ventura owns and operates the Avenue Water Treatment Plant (WTP) downstream from the project location for treating groundwater that is extracted from the Ventura River bed. The City of Ventura is limited in their ability to use Ventura River water at this facility due to low flows. Currently, the City of Ventura treats about 2,300 AFY of Ventura River water at Avenue WTP. They would like to almost double this use to 4,200 AFY if flows allowed (Kennedy/Jenks Consultants 2011, provided with this Benefit and Cost Analysis). However, due to low flows, the City is often forced to instead purchase potable water supplies from Casitas. Additional flows will allow the City to replace purchased water from Casitas with groundwater flows that can be treated at the Avenue WTP.

As described in Attachment 7, this project will save an average of 284 AFY. Assuming that 90 percent of the water savings is available for the City of Ventura for water supply (i.e., that 90 percent of the water savings flows downstream and is extracted by the City of Ventura), the City will have access to additional water supplies of 256 AFY. This is a reasonable assumption given the short distance between the project location and the City's wells.

The City of Ventura buys water from Casitas at a cost of $340 per acre foot (Raftelis Financial Consultants 2012, provided with this Benefit and Cost Analysis). Due to distribution system limitations, the City of Ventura can only purchase treated water from Casitas. If flows were available in the Ventura River, they would not need to purchase expensive treated water. Therefore, based on these assumptions, 90 percent of the physical water savings that will occur by removing invasive non-native arundo (256 AFY) will be available to offset imported water from Casitas at $340/AF.

However, the water provided under the without project baseline from Casitas is treated. Therefore, in order to identify the cost savings to the City of Ventura of replacing treated imported Casitas water with additional in-stream flows (provided by the project), the cost of treating surface water must be deducted. Avenue WTP costs are $125/AF. Therefore, the total savings to the City of Ventura of replacing imported treated water from Casitas with Ventura River water that is then treated at the

Avenue WTP is $215 per AF ($340/AF per minus $125/AF).

The project will result in a savings to the City of Ventura of $55,040 per year (undiscounted, $215 AF * 256 AF). As is shown in Table F3, the present value of this benefit over the 50-year project life is $704,259.

Project Economic Costs

The project has implementation costs of $2,156,509 to support four years of arundo removal beginning in 2014. The project will be completed in 2017. Additional costs will be incurred following flooding events to prevent arundo re-infestation. Flooding events are assumed to occur every 12–13 years; flood maintenance costs of $5,490 will be incurred after each event. As is shown in Table F4, this project has a total discounted present value cost of $1,778,172 over the assumed 50-year project life.

Project Benefits and Cost Summary

The project will provide a range of monetized and non-monetized benefits. Removal of non-native invasive species arundo in the Watershed will result in a reduction in the water loss by of 284 AFY, and 14,200 AF over the 50-year project life. The City of Ventura is seeking additional water from the Ventura River and will avoid purchase of water from Casitas. The present value of this annual benefit equals $704,259 over the 50-year project life.

The total present value of project implementation and O&M costs over the 50-year project life is $1,748,576. Although the monetized present value benefits do not offset the present value costs of the project, this project will result in a number of benefits that are not able to be monetized. Non-monetized benefits for the project include:

- Improvements in overall California groundwater management.
- Opportunities for educational and technology transfer.
- Increases in recreational opportunities.
- Reductions in health and safety issues.
- Improvements in wildlife and habitat.
- Improvements in water quality.
- Reductions in stream bank erosion.
- Reductions in fire risk and fire management concerns.

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 this analysis, the main uncertainties are associated with the amount of water savings that can be accomplished by arundo removal. These issues are listed in Table F5.

TABLE F3 – ANNUAL BENEFIT (Table 15 of the PSP) (All benefits in 2012 dollars) Project: Ventura River Restoration									
(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	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2012						$215		1.000	
2013						$215		0.943	
2014	Avoided Water Supply Cost	AF	0	0	0	$215	$ -	0.890	**$ -**
2015	Avoided Water Supply Cost	AF	0	64	64	$215	$ 13,739	0.840	**$ 11,535**
2016	Avoided Water Supply Cost	AF	0	128	128	$215	$ 27,477	0.792	**$ 21,764**
2017	Avoided Water Supply Cost	AF	0	192	192	$215	$ 41,216	0.747	**$ 30,799**
2018	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.705	**$ 38,740**
2019	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.665	**$ 36,548**
2020	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.627	**$ 34,479**
2021	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.592	**$ 32,527**
2022	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.558	**$ 30,686**
2023	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.527	**$ 28,949**
2024	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.497	**$ 27,310**
2025	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.469	**$ 25,765**
2026	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.442	**$ 24,306**
2027	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.417	**$ 22,930**
2028	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.394	**$ 21,632**
2029	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.371	**$ 20,408**
2030	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.350	**$ 19,253**
2031	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.331	**$ 18,163**
2032	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.312	**$ 17,135**
2033	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.294	**$ 16,165**
2034	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.278	**$ 15,250**
2035	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.262	**$ 14,387**
2036	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.247	**$ 13,572**
2037	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.233	**$ 12,804**
2038	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.220	**$ 12,079**

TABLE F3 – ANNUAL BENEFIT cont. (All benefits in 2012 dollars) Project: Ventura River Restoration									
(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 (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2039	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.207	**$ 11,396**
2040	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.196	**$ 10,751**
2041	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.185	**$ 10,142**
2042	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.174	**$ 9,568**
2043	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.164	**$ 9,026**
2044	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.155	**$ 8,516**
2045	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.146	**$ 8,034**
2046	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.138	**$ 7,579**
2047	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.130	**$ 7,150**
2048	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.123	**$ 6,745**
2049	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.116	**$ 6,363**
2050	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.109	**$ 6,003**
2051	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.103	**$ 5,663**
2052	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.097	**$ 5,343**
2053	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.092	**$ 5,040**
2054	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.087	**$ 4,755**
2055	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.082	**$ 4,486**
2056	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.077	**$ 4,232**
2057	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.073	**$ 3,992**
2058	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.069	**$ 3,766**
2059	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.065	**$ 3,553**
2060	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.061	**$ 3,352**
2061	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.058	**$ 3,162**
2062	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.054	**$ 2,983**
2063	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.051	**$ 2,814**
2064	Avoided Water Supply Cost	AF	0	256	256	$215	$ 54,954	0.048	**$ 2,655**

TABLE F3 – ANNUAL BENEFIT cont. (All benefits in 2012 dollars) Project: Ventura River Restoration									
(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 (f) x (g)	Discount Factor	Discounted Benefits (h) x (i)
2065	Avoided Water Supply Cost	AF	0	192	192	$215	$ 41,216	0.046	$ 1,879
2066	Avoided Water Supply Cost	AF	0	128	128	$215	$ 27,477	0.043	$ 1,182
2067	Avoided Water Supply Cost	AF	0	64	64	$215	$ 13,739	0.041	$ 557
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)									$ 704,259
Physical change in water savings equals 20 AFY per acre of arundo removed. In 2014 40% of the project will have been completed, in 2015 70% of the project will have been completed in 2017 100% of the project will have been completed.									

TABLE F4 – ANNUAL COSTS OF PROJECT (Table 19 of PSP) (All costs in 2012 Dollars) Project: Ventura River Restoration 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	$ 56,073							$ 56,073	0.943	$ 52,899
2014	$ 517,266							$ 517,266	0.890	$ 460,365
2015	$ 517,266							$ 517,266	0.840	$ 434,307
2016	$ 517,266							$ 517,266	0.792	$ 409,723
2017	$ 517,266							$ 517,266	0.747	$ 386,531
2018								$ -	0.705	$ -
2019								$ -	0.665	$ -
2020								$ -	0.627	$ -
2021								$ -	0.592	$ -
2022								$ -	0.558	$ -
2023								$ -	0.527	$ -
2024								$ -	0.497	$ -
2025						$ 5,490		$ 5,490	0.469	$ 2,574
2026								$ -	0.442	$ -
2027								$ -	0.417	$ -
2028								$ -	0.394	$ -
2029								$ -	0.371	$ -
2030								$ -	0.350	$ -
2031								$ -	0.331	$ -
2032								$ -	0.312	$ -

TABLE F4 – ANNUAL COSTS OF PROJECT cont. (All costs in 2012 Dollars) Project: Ventura River Restoration 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)
2033								$ -	0.294	$ -
2034								$ -	0.278	$ -
2035								$ -	0.262	$ -
2036								$ -	0.247	$ -
2037						$ 5,490		$ 5,490	0.233	$ 1,279
2038								$ -	0.220	$ -
2039								$ -	0.207	$ -
2040								$ -	0.196	$ -
2041								$ -	0.185	$ -
2042								$ -	0.174	$ -
2043								$ -	0.164	$ -
2044								$ -	0.155	$ -
2045								$ -	0.146	$ -
2046								$ -	0.138	$ -
2047								$ -	0.130	$ -
2048								$ -	0.123	$ -
2049								$ -	0.116	$ -
2050						$ 5,490		$ 5,490	0.109	$ 600
2051								$ -	0.103	$ -
2052								$ -	0.097	$ -
2053								$ -	0.092	$ -
2054								$ -	0.087	$ -

TABLE F4 – ANNUAL COSTS OF PROJECT cont.
(All costs in 2012 Dollars)

Project: Ventura River Restoration 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)
2055								$ -	0.082	$ -
2056								$ -	0.077	$ -
2057								$ -	0.073	$ -
2058								$ -	0.069	$ -
2059								$ -	0.065	$ -
2060								$ -	0.061	$ -
2061								$ -	0.058	$ -
2062						$ 5,490		$ 5,490	0.054	$ -
2063								$ -	0.051	$ -
2064								$ -	0.048	$ -
2065								$ -	0.046	$ -
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										**$ 1,748,576**

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

Comments: 2013 Costs = 10 months of project Admin costs ($24,945) plus Planning Costs of 62,500 =$87,445

TABLE F5
OMISSIONS, BIASES, AND UNCERTAINTIES, AND THEIR EFFECT ON THE PROJECT

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Avoided Water Supply Cost	+ +	In estimating arundo stand water use through evapotranspiration, researchers made conservative assumption and reported arundo water use values half of the measured transpiration rate. If the greater measured transpiration rate of 40 mm/day is used instead of the assumed 20 mm/day, then water savings from arundo use will be significantly larger than the value used in monetizing water savings for this analysis
Reduced Fire Risk	+ +	Fire management is greatly improved with arundo removal. Estimates of the incremental contribution of arundo to fire incidents are not available; however, the impact of highly flammable arundo in allowing fire to bridge natural firebreaks is apparent. If the incremental value of arundo removal to fire risk reduction could be monetized, it will significantly increase monetized benefits for the project.
Timeframe of project benefits	-	Reinfestation of arundo following a fire or flood could reduce the timeframe of project benefits.

*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 -.

References

All the references below are provided as attachments to this Benefit Cost Analysis (Att8_IG2_BenCost_7of7), unless otherwise specified.

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