Introduction

This attachment presents the technical justification for the projects included in this Proposal. Below is the table of contents for this attachment.

Table of Contents

Acronyms Used in this Technical Justification 7-1
North Pleasant Valley Groundwater Desalter 7-3
West Simi Valley Water Recycling Project Phases 1 and 2 7-15
Moorpark Recycled Water Project Phase IV 7-33
South Oxnard Stormwater Flood Management & Community Enhancement Phase 2B 7-49
Santa Clara River Restoration 7-53
Ventura River Restoration 7-63

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
CDPH	California Department of Public Health
Casitas	Casitas Municipal Water District
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CO_2	carbon dioxide
EPA	Environmental Protection Agency
GHG	greenhouse gases
GIS	Geographic Information Systems
GMA	Groundwater Management Agency
GPM	gallons per minute
HOA	Homeowners Association
IRWM	Integrated Regional Water Management
LARWQCB	Los Angeles Regional Water Quality Control Board
LF	Linear feet
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
PV	Pleasant Valley
RO	Reverse Osmosis
RWQCB	Regional Water Quality Control Board
SMP	Salinity Management Pipeline
SMCLs	Secondary Maximum Contaminant Levels
SWP	State Water Project
TDS	total dissolved solids
TMDLs	Total Maximum Daily Loads
United	United Water Conservation District
VCWWD	Ventura County Water Works 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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North Pleasant Valley Groundwater Desalter (NPV Groundwater Desalter)

This section presents the technical justification for the NPV Groundwater Desalter. A project abstract and general discussion of the without project baseline are followed by a discussion of each physically quantified benefit and a summary of physically quantified benefits claimed.

Project Abstract

To help meet the challenges of increasing salt concentrations in groundwater and rising groundwater levels, the City of Camarillo, in conjunction with project partners, the City of Thousand Oaks and Camrosa Water District (Camrosa), is constructing the NPV Groundwater Desalter. Reverse osmosis (RO) treatment technology will be used to remove salts in the groundwater. The desalter will allow Camarillo to pump groundwater that is very brackish and unusable without blending or treatment. The water produced by the desalter will then be delivered to Camarillo's customers and potentially to customers in the Calleguas Municipal Water District (Calleguas) service area during periods of low demand. Brines 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 preventing associated salts from entering 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.

Without Project Baseline

In recent years, groundwater pumping in Camarillo has been affected by high salt concentrations and rising groundwater levels. Since 1994, the concentration of salts in groundwater has increased from 500 milligrams per liter (mg/L) to 1,800 mg/L. In fact, Camarillo has recently had to stop pumping one of its groundwater wells because the concentration of salts in the water produced by the well became too high to address via blending with imported water and has had to decrease pumping in two other wells for the same reason.

Without the project, the quality of groundwater pumped by Camarillo would continue to decline as well as in the remainder of the Pleasant Valley Groundwater Basin. Camarillo would very likely use less groundwater than it does today. Camarillo would increase the fraction of imported water it uses to blend down salt concentrations within its potable distribution system to meet secondary drinking water standards as required by the California Department of Public Health (CDPH). Moreover, Camarillo, Thousand Oaks, and Camrosa Water District would not be able to increase the use of local groundwater supply, despite its availability, due to its poor quality. Overall, there would be less local groundwater use relative to today, no opportunity to increase brackish groundwater use, and increased reliance on imported water without the project, amounting to approximately 7,500 AFY.

In addition, without the project Camarillo would continue to purchase imported water through Calleguas, salts would continue to enter the Watershed from imported water, existing salts would remain in the Watershed, and there would be higher emissions of greenhouse gases compared to without the project.

Relationship of Project to Other Projects Included in the Proposal

The NPV Groundwater Desalter is one of three projects in this Proposal that share the common goals of improving local water supply reliability, reducing dependency on imported water, and reducing salt loading in the Watershed. The other two projects are the Moorpark Recycled Water Project Phase IV and the West Simi Valley Water Recycling Project Phases 1 and 2.

However, the NPV Groundwater Desalter does not depend on either of these projects to achieve the benefits claimed.

Description of Expected Physical Benefits

The following (quantifiable) physical benefits are expected from this project:

- Avoid 7,500 AFY of imported water use.
- Remove/avoid more than 17,000 MT of salts every year.
- Reduce emissions of greenhouse gases by more than 8,000 MT every year.

Each benefit is discussed in further detail below.

Benefit: Reduce Imported Water Usage by 7,500 AFY

The NPV Groundwater Desalter will produce 7,500 AF of water per year from brackish groundwater over the expected 25 year life of the project (City of Camarillo 2008, provided with this Technical Justification). This will allow Camarillo and its project partners (City of Thousand Oaks and Camrosa Water District) to avoid purchasing 7,500 AF of imported water every year from Calleguas.

Background and Historical Conditions

In 2012, Camarillo delivered about 9,500 AF of water to its customers, with roughly 40 percent of the water coming from groundwater pumping and 60 percent from imports (City of Camarillo 2012b, provided with this Technical Justification). Thousand Oaks is 100 percent dependent on imported water, while Camrosa Water District relies on imported water for more than two-thirds of its potable supplies. All three agencies purchase imported water from Calleguas, a member agency of the Metropolitan Water District of Southern California (Metropolitan). The imported water served to Calleguas is all SWP water.

Without Project Conditions

In the without project condition, groundwater pumping would increasingly be affected by high salt concentrations, causing Camarillo to use less groundwater than it does today. Camarillo would increase the fraction of imported water it uses to blend down salt concentrations within its potable distribution system to meet secondary drinking water standards as required by CDPH. Moreover, Camarillo, Thousand Oaks, and Camrosa Water District would not be able to increase the use of the local groundwater supply despite its availability due to poor quality. Overall, there would be less local groundwater use relative to today, no opportunity to increase brackish groundwater use, and increased reliance on imported water without the project amounting to approximately 7,500 AFY.

Methods Used to Estimate Benefits

The NPV Groundwater Desalter is designed to produce 7,500 AF of potable water each year. Based on modeling studies, it is estimated that there is enough brackish groundwater in the Pleasant Valley basin for the NPV Groundwater Desalter to produce 7,500 AF each year for 25 years. The infrastructure associated with the desalter will likely have useful life closer to 30 years. However, the assumed useful life of the project is limited to the years in which brackish groundwater is expected to be available for pumping. A groundwater modeling analysis determined there is brackish groundwater available to the NPV Groundwater Desalter for 25 years because other desalters will become operational in the area, themselves taking brackish groundwater from the upstream groundwater basin (Bachman 2012, provided with this Technical Justification).

Due to overdraft conditions, the groundwater basin is regulated by the Fox Canyon Groundwater Management Agency. Camarillo had determined that it has sufficient groundwater pumping credits to allow brackish groundwater pumping of 9,000 AFY needed to produce 7,500 AFY of desalted water for at least 25 years. The difference between the 9,000 AFY of pumping and 7,500 AFY of desalted water is the concentrate produced as part of the desalting process that is disposed of via the SMP.

Over the expected life of the project from 2018 to 2042, the total amount of avoided SWP water imports due to the desalter totals 187,500 AF (7,500 AFY multiplied by 25 years equals 187,500 AF).

Benefit Uncertainty

The groundwater study completed for the project concluded the NPV Groundwater Desalter is expected to operate for 25 years based on the amount of groundwater present and the future demand for the groundwater by other sources (Bachman 2012). The estimate is based on numerical modeling of complex hydrogeologic conditions in the project area which are, by necessity, a simplified approximation of future groundwater conditions (Bachman 2012). As with any modeling assessment, there is uncertainty in the predictions. However, the project modeling was based on conservative assumptions regarding the future conditions and, under these assumptions, the model predicts a 25-year project lifespan. Given the use of conservative assumptions, the benefit uncertainty is believed to be relatively low.

New Facilities Required to Achieve Benefits

In order to avoid imported water use, the desalter and SMP are required. The desalter is necessary to produce potable water from brackish groundwater; the SMP is necessary to dispose of the brine created from the desalting process. The portions of the SMP that will serve the NPV Groundwater Desalter are either currently under construction or in final design and will be completed ahead of the desalter.

Potential Adverse Physical Effects

There are no significant adverse physical effects from operating the NPV Groundwater Desalter. Energy use by the desalter is accounted for below when discussing the net reduction in energy use for this project compared to avoided SWP water imports.

Summary of Benefit

As is shown in Table A1, this project will allow Camarillo and its project partners to avoid 187,500 AF of SWP water use over the 25 year life of the project.

Benefit: Remove/Avoid More Than 17,000 MT of Salts Every Year

The project will prevent salts from entering the Watershed by reducing the amount of SWP use and by removing salts from desalted groundwater. In all, more than 17,000 MT of salts will be removed/avoided in the Watershed every year.

Background and Historical Conditions

Continued reliance on imported water under the without project scenario will exacerbate salt-related water quality issues in the Watershed. Most of the soils, surface water, and groundwater in the Watershed contain high levels of salts, including total dissolved solids (TDS), boron, sulfate, and chloride. Primary sources of salts in surface water and groundwater include imported surface water (i.e., SWP supplies), fertilizer used in agricultural activities, and discharges from wastewater treatment plants (Larry Walker Associates 2004, LARWQCB 2007a, both provided with this Technical Justification). Salts continue to accumulate, and the mass of salts and minerals currently coming into the Region, primarily from imported water, is greater than the mass of salts and minerals leaving the Region.

The accumulation of salts due to historical and ongoing point and nonpoint source pollution poses a number of problems for beneficial uses within the Watershed, including municipal, industrial, and agricultural water supply and habitat. Rising salinity is also harmful to agriculture primarily for growers of high-value strawberries and avocados who are increasingly unable to use local surface water or groundwater for irrigation without reducing agricultural productivity. High salinity levels in soils and surface water can also be detrimental to sensitive habitat and can have negative effects on ecosystems in the Watershed.

TABLE A1 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: North Pleasant Valley Groundwater Desalter Type of Benefit Claimed: Reduce Imported Water Usage Measure of Benefit Claimed (Name of Units): Acre-feet Additional Information About this Measure: (None)			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012			
2013			
2014			
2015			
2016			
2017			
2018	7,500	0	7,500
2019	7,500	0	7,500
2020	7,500	0	7,500
2021	7,500	0	7,500
2022	7,500	0	7,500
2023	7,500	0	7,500
2024	7,500	0	7,500
2025	7,500	0	7,500
2026	7,500	0	7,500
2027	7,500	0	7,500
2028	7,500	0	7,500
2029	7,500	0	7,500
2030	7,500	0	7,500
2031	7,500	0	7,500
2032	7,500	0	7,500
2033	7,500	0	7,500
2034	7,500	0	7,500
2035	7,500	0	7,500
2036	7,500	0	7,500
2037	7,500	0	7,500
2038	7,500	0	7,500
2039	7,500	0	7,500
2040	7,500	0	7,500
2041	7,500	0	7,500
2042	7,500	0	7,500
Comments: Without the project, the City of Camarillo and its project partners (City of Thousand Oaks and Camrosa Water District) would need to import more than 7,500 AF of water each year (purchased through Calleguas Municipal Water District). With the project, they will obtain 7,500 AF by processing brackish groundwater through a desalter.			

As a result of these factors, salt total maximum daily loads (TMDLs) have been established for the Watershed (including for boron, chloride, sulfate, and TDS). Calleguas Creek is currently on the Clean Water Act 303(d) list of impaired waters for salts as well as for a number of other constituents (LARWQCB 2007b, provided with this Technical Justification).

Without Project Conditions

In the without project condition, the City of Camarillo will increase its use of imported water and its project partners will continue to purchase imported water. Without the project, the amount of additional imported water purchased will be 7,500 AF each year from 2018 to 2042. In addition, groundwater salts will not be exported. As a result, from 2018 to 2042, 425,550 MT of salts will be imported to the Watershed or remain in the groundwater (detailed calculations are below).

Methods Used to Estimate Benefits

With the project, salts are reduced in two ways: (1) salts in the groundwater that is desalted are removed from the Watershed via the SMP and (2) salts in the 7,500 AFY of avoided imported water purchases that will not be introduced into the Watershed.

Based on the *Brackish Water Desalination Pilot Study* for the project (provided with this Technical Justification) it is estimated that the concentrate produced by the desalter will have a concentration of 7,700 mg/L, or 9.5 MT of salt per AF.[1] Since 1,500 AF of brine will be produced each year, 14,247 MT of salts will be removed from the Watershed via the SMP each year.

To calculate the avoided import of salts, it is assumed that the average TDS concentration in imported water is 300 mg/L. This is based on data from the following sources:

- 2011 Calleguas Water Quality report, which states that TDS levels in imported water from the Metropolitan averaged 310 mg/L in 2010 (Calleguas 2011, provided with this Technical Justification).
- 2012 Calleguas Water Quality report, which states that TDS levels in imported water from Metropolitan averaged 280 mg/L in 2011 (Calleguas 2012, provided with this Technical Justification).

Using a salt concentration of 300 mg/L, each AF of imported water contains 0.370 MT of salts, on average.[2] Thus, each year from 2018 to 2042, when 7,500 AF of water will not be imported because of the project, 2,775 MT of salts will not be brought into the Watershed. Overall, considering both of the methods of salt reduction, approximately 17,022 MT of salts will be eliminated from the Watershed each year starting in 2018 that would otherwise be present in the Watershed without the project (14,247 MT from the desalter plus 2,775 MT from avoided SWP imports equals 17,022 MT).

Over the expected life of the project from 2018 to 2042, the total amount of salts eliminated from the Watershed that would otherwise be present without the project is 425,550 MT.

Benefit Uncertainty

For both of the ways that salts are reduced with this project (described in the “Methods Used to Estimate Benefits” section), it is assumed that 7,500 AFY of water is produced by the desalter and 7,500 AFY of imported water is not purchased when it otherwise would be without the project. If less water is produced by the desalter and/or less imported water is purchased than is assumed in the without project scenario, the amount of salts not entering the Watershed because of the project will be reduced.

New Facilities Required to Achieve Benefits

The desalter and SMP are required to avoid salt imports into the Watershed. The desalter is necessary to remove the salts from the

[1] 9.5 MT of salt per acre-foot = (7,700 milligrams/liter)*(1,233,482 liters/acre-foot)*(1 MT/1,000,000,000 milligrams)

[2] 0.37 MT of salts = (300 milligrams/liter)* (1,233,482 liters/acre-foot)*(1 MT/1,000,000,000 milligrams)

groundwater and reduce the need to purchase imported water; the SMP is necessary to dispose of the brine created from the desalting process. The portions of the SMP that will serve the NPV Groundwater Desalter are either currently under construction or in final design and will be completed ahead of the desalter.

Potential Adverse Physical Effects

The brine produced by the desalter is not expected to have a negative impact on the ocean environment where it is to be discharged. The discharge is regulated by a National Pollution Discharge Elimination Standards permit issued by the RWQCB and will comply with all Ocean Plan standards. Additionally, extensive monitoring and reporting will be performed to ensure that the SMP discharge has no negative impact on the environment.

Summary of Benefit

As is shown in Table A2, the project will remove or prevent from entering 17,022 MT of salts every year from the Watershed. In total, the project will remove or prevent import of 425,550 MT salts over the life of the project.

Benefit: Reduce Emissions of Greenhouse Gases by More Than 8,000 MT Every Year

Using local groundwater processed through the desalter, instead of importing water from Northern California, will reduce emissions of carbon dioxide (CO_2), a greenhouse gas, by more than 8,000 MT every year.

Background and Historical Conditions

Calleguas estimates that it takes 4.053 megawatt hours (MWh) to convey an AF of imported water from Northern California to Ventura County, the county where Camarillo is located (Calleguas 2007, provided with this Technical Justification). In addition to the energy it takes to move the water, it takes energy to treat the water before it can be delivered to customers; the amount of energy to treat the water is approximately 0.037 MWh per AF (using numbers from Metropolitan's Jensen Treatment Plant [Calleguas 2007]). Thus, the total amount of energy to import and treat an AF of water to Ventura County is approximately 4.090 MWh.

In contrast, the amount of energy it takes to pump local groundwater and move it through the reverse osmosis processes at the desalter is 1.05 MWh per AF, including pump, motor, and transmission losses (Kennedy/Jenks 2013, provided with this Technical Justification). Thus, the difference in energy requirements between importing water and processing water through the desalter is 3.04 MWh per AF.

Electricity used in California is generated within three different energy subregions [known as Western Electricity Coordinating Council (WECC) subregions]: California, the Northwest, and the Southwest (CEC 2011, provided with this Technical Justification). Almost 70 percent of California's electricity is generated within the state. The approximate breakdown of California's major sources of electricity is as follows: 45 percent is provided by natural gas, 18 percent is provided by nuclear power, 21 percent is provided by hydroelectric plants, 2 percent is provided by coal-fired power plants, and 14 percent comes from renewable sources (CEC 2011).

CO_2 emissions resulting from the production of electricity, measured as tons of CO_2 per MWh, vary by energy source. Based on the current mix of energy sources for California, the CO_2 emissions rate for energy is estimated to be 0.354 MT/MWh.

Without Project Conditions

Without the project, increased dependence on imported water supplies will result in increased energy use and CO_2 emissions.

Methods Used to Estimate Benefits

To calculate energy savings associated with the project, the amount of energy required to transport and treat one AF of imported water (4.090 MWh per AF) is multiplied by the amount of imported water usage that will be avoided as a result of the project. Next, the amount of energy that would be required to process water through the desalter with the project (1.05 MWh per AF) is multiplied by the amount of water produced by the desalter. The difference in the amount of energy required without and with the project is the net energy savings.

TABLE A2 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: North Pleasant Valley Groundwater Desalter Type of Benefit Claimed: Salts Removed/Avoided Measure of Benefit Claimed (Name of Units): Metric Tons Additional Information About this Measure: (None)			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012			
2013			
2014			
2015			
2016			
2017			
2018	17,022	0	17,022
2019	17,022	0	17,022
2020	17,022	0	17,022
2021	17,022	0	17,022
2022	17,022	0	17,022
2023	17,022	0	17,022
2024	17,022	0	17,022
2025	17,022	0	17,022
2026	17,022	0	17,022
2027	17,022	0	17,022
2028	17,022	0	17,022
2029	17,022	0	17,022
2030	17,022	0	17,022
2031	17,022	0	17,022
2032	17,022	0	17,022
2033	17,022	0	17,022
2034	17,022	0	17,022
2035	17,022	0	17,022
2036	17,022	0	17,022
2037	17,022	0	17,022
2038	17,022	0	17,022
2039	17,022	0	17,022
2040	17,022	0	17,022
2041	17,022	0	17,022
2042	17,022	0	17,022
Comments: Without the project, more than 17,000 metric tons of salts would enter the Calleguas Creek Watershed each year via imported water or would not be exported in desalter concentrate via the SMP. With the project, these 17,000+ metric tons of salts will be prevented from entering the Watershed each year or be exported via the SMP.			

Next, the CO_2 emissions rate associated with energy use in California using 2009 U.S. Environmental Protection Agency (EPA) eGrid data was calculated. As noted above, the California Energy Commission (CEC, 2011) reports that 70 percent of electricity used in California is generated in-state, 20 percent is generated in the WECC Southwest subregion, and 10 percent is generated in the WECC Northwest subregion. EPA publishes average CO_2 emissions rates for these subregions based on the various energy sources used to generate electricity within them (e.g., natural gas, hydropower). Table A3 shows the CO_2 emissions rate for the three regions that produce the electricity used in California and the average weighted rate for electricity used within the state. It is assumed that the mix of energy sources used by the state overall is representative of the mix of energy sources used to import water from Northern California (without the project) and to desalt water (with the project).

Given the calculated weighted average CO_2 emissions rate of 0.354 MT of CO_2 emitted per MWh, approximately 1.45 MT of CO_2 are produced for every AF of imported water delivered to the City of Camarillo (4.090 MWh per AF multiplied by 0.354 MT/MWh). In 2018, when 7,500 AF of water is not imported due to the project, the project will avoid emissions of 10,859 MT of CO_2 (7,500 AF multiplied by 4.090 MWh/AF multiplied by 0.354 MT/MWh equals 10,859 MT of CO_2).

Avoided CO_2 emissions will be offset to some extent by the CO_2 emissions associated with the energy used to process groundwater through the desalter; as mentioned, this is about 1.05 MWh per AF (based on the *Brackish Water Desalination Pilot Study* performed for the project). Assuming the same emissions rate of 0.354 MT of CO_2 emitted per MWh, CO_2 production of desalted water is estimated to be about 0.372 MT per AF (1.05 MWh per AF multiplied by 0.354 MT/MWh). Thus, in 2018, when 7,500 AF are not imported due to the project, CO_2 emissions associated with desalted water use will amount to about 2,788 MT of CO_2 (7,500 AF multiplied by 1.05 MWh/AF multiplied by 0.354 MT/MWh equals 2,788 MT of CO_2). The difference in CO_2 emissions between without and with the project is 8,071 MT of CO_2 in 2018 (10,859 MT of CO_2 minus 2,788 MT of CO_2).

Over the expected life of the project from 2018 to 2042, the total amount of water not imported due to the desalter is 187,500 AF. The net energy savings is 570,000 MWh [(187,500 AF)*(4.090 MWh per AF – 1.05 MWh per AF)]. With this energy savings, net CO_2 emissions reductions are estimated to be 201,780 MT (570,000 MWh*0.354 MT per MWh).

Benefit Uncertainty

The reduction in greenhouse gas emissions associated with this project is dependent on the project avoiding usage of 7,500 AF of imported water each year. If the project reduces the amount of imported water less than expected, the reduction in greenhouse gas emissions will be smaller. Other uncertainties are those

TABLE A3
CO_2 EMISSIONS RATES FOR ENERGY USED IN CALIFORNIA BY REGIONS THAT PRODUCE ELECTRICITY

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

Source: U.S. EPA, 2012.

associated with the actual energy use per AF for imported water and water processed through the desalter and the mix of energy sources that are used in both the with and without project conditions.

New Facilities Required to Achieve Benefits

The reduction in greenhouse gas emissions is dependent on the desalter. Without the desalter, Camarillo would continue to import water, and thus greenhouse gas emissions would not be reduced.

Potential Adverse Physical Effects

Energy savings and associated CO_2 emissions reductions due to avoided use of imported water are not expected to result in any potential adverse physical effects.

Summary of Benefits

Processing brackish water through a desalter is less energy intensive than importing water from Northern California. Thus, with the project, the emissions of greenhouse gases are reduced compared to the without project scenario. As is shown in Table A4, in the first year of the project, 10,859 MT of CO_2 emissions will be avoided which is offset somewhat by the 2,788 MT of CO_2 emissions from the desalter. The total CO_2 savings over the project lifetime is expected to be 201,775 MT.

Summary of Annual Project Physical Benefits

The physical benefits claimed for this project include (1) reducing the amount of imported water by more than 7,500 AFY, (2) avoiding or exporting more than 17,000 MT of salts every year, and (3) reducing emissions of greenhouse gases by more than 8,000 MT every year.

References

All the references below are provided as attachments to this Technical Justification (Att7_IG2_TechJust_2of7).

- AWWA. 1999. *Manual of Water Supply Practices. Reverse Osmosis and Nanofiltration,* American Water Works Association, Denver, CO.
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- Kennedy/Jenks Consultants. 2013. Email communication from Meredith Clement. February 13.
- LARWQCB. 2007a. *Proposed Amendment to the Water Quality Control Plan – Los Angeles Region 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 A4 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: North Pleasant Valley Groundwater Desalter Type of Benefit Claimed: Reduce Emissions of Greenhouse Gases Measure of Benefit Claimed (Name of Units): Metric Tons Additional Information About this Measure: (None)			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012			
2013			
2014			
2015			
2016			
2017			
2018	10,859	2,788	8,071
2019	10,859	2,788	8,071
2020	10,859	2,788	8,071
2021	10,859	2,788	8,071
2022	10,859	2,788	8,071
2023	10,859	2,788	8,071
2024	10,859	2,788	8,071
2025	10,859	2,788	8,071
2026	10,859	2,788	8,071
2027	10,859	2,788	8,071
2028	10,859	2,788	8,071
2029	10,859	2,788	8,071
2030	10,859	2,788	8,071
2031	10,859	2,788	8,071
2032	10,859	2,788	8,071
2033	10,859	2,788	8,071
2034	10,859	2,788	8,071
2035	10,859	2,788	8,071
2036	10,859	2,788	8,071
2037	10,859	2,788	8,071
2038	10,859	2,788	8,071
2039	10,859	2,788	8,071
2040	10,859	2,788	8,071
2041	10,859	2,788	8,071
2042	10,859	2,788	8,071
Comments: In each year 2018 to 2042, without the project, carbon dioxide emissions would be 10,859 metric tons; with the project, carbon dioxide emissions would be 2,788 metric tons. The difference between without and with the project is 8,071 metric tons.			

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

This attachment presents the technical justification for the Simi RW Project. A project abstract and general discussion of the without project baseline are followed by a discussion of each physically quantified benefit and a summary of physically quantified benefits claimed.

Project Abstract

The Simi RW Project will expand an existing recycled water distribution system to allow for the delivery of an additional 600 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. Recycled water production at the plant currently amounts to about 50 AFY.

Under Phase 1 of the project, Simi Valley 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 million gallon 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 as Simi Valley is almost fully dependent on imported water for its potable supply.

Without Project Baseline

The City of Simi Valley WQCP, which provides sewage treatment for the City of Simi Valley, is located within the Calleguas Creek Watershed. The plant is operated by the Sanitation Services Division of the City's Public Works Department. Through operation of the WQCP, the City currently treats about 9,900 AFY of wastewater effluent using a tertiary treatment process. Most of this effluent is discharged directly into the Arroyo Simi, which leads to Calleguas Creek (and ultimately the Pacific Ocean). Without the project, wastewater effluent at the plant will continue to be discharged and will not be directly put to beneficial use.

Simi Valley supplies potable water to approximately 60 percent of the City of Simi Valley. Simi Valley currently delivers more than 23,000 AFY to 24,000 service connections. According to recent water production records (2006–2010), approximately 97 percent of potable water consumed in Simi Valley service area is imported water, which comes from the SWP and is supplied to Simi Valley by Metropolitan via Calleguas.

The availability of imported water is subject to a number of natural and human forces, ranging from increased population growth (and the accompanying increased demands on the SWP system) to drought and earthquakes, to environmental regulations, and water rights determinations. Without the Simi RW Project, 600 AFY of potable water will continue to be used for non-potable purposes (e.g., landscape irrigation). Reliance on imported water will continue, and therefore water supply reliability will not improve for Simi Valley as it would with the project.

Continued reliance on imported water under the without project scenario will also exacerbate salt-related water quality issues in the Calleguas Creek Watershed (Watershed). Most of the soils, surface water, and groundwater in the Watershed contain high levels of salts, including TDS, boron, sulfate, and chloride. Primary sources of salts in surface water and groundwater include imported surface water (i.e., SWP supplies), fertilizer used in agricultural activities, and discharges from wastewater treatment plants (Larry Walker Associates 2004 and LARWQCB 2007a, provided with this Technical Justification). Salts continue to accumulate, and the mass of salts and minerals currently coming into the Region,

primarily from imported water, is greater than the mass of salts and minerals leaving the Region.

The accumulation of salts due to historical and ongoing point and nonpoint source pollution poses a number of problems for beneficial uses within the Watershed, including municipal, industrial, and agricultural water supply and habitat. Rising salinity is harmful to agriculture primarily for growers of high-value strawberries and avocados who are increasingly unable to use local surface water or groundwater for irrigation without reducing agricultural productivity. High salinity levels in soils and surface water can also be detrimental to sensitive habitat and can have detrimental effects on ecosystems in the Watershed.

As a result of these factors, salt TMDLs have been established for the Watershed (including for boron, chloride, sulfate, and TDS). Calleguas Creek is currently on the Clean Water Act 303(d) list of impaired waters for salts, as well as for a number of other constituents (LARWQCB 2007b, provided with this Technical Justification).

To help reduce salts in the Watershed, the Los Angeles Regional Water Quality Control Board (LARWQCB) set waste load allocations for discharge of TDS from the Simi Valley WQCP to be achieved by 2022. The LARWQCB identified microfiltration/reverse osmosis (MF/RO) of effluent from the Simi Valley WQCP as an option for meeting the TMDL requirement (Larry Walker Associates, 2004). However, through offsetting imported water use and avoiding import of salts into the Watershed, the recycled water project is considered by the City to be the preferred option for reducing TDS mass discharge from the WQCP.

Without the Simi RW Project, the only other option for preventing salt loading to the Watershed from the Simi Valley WQCP is an MF/RO facility. It is assumed that under the without project scenario, the MF/RO facility would be built and would treat the 600 AFY that would otherwise be made available for recycled water use (as well as the rest of the WQCP effluent flow).

Simi Valley would continue to rely on imported water under the without project scenario. Without the project, it would not avoid the energy usage [and associated greenhouse gas (GHG) emissions] involved with pumping and distributing imported water over long distances. The energy requirements will be much lower if locally generated recycled water is used.

Relationship of Project to Other Projects Included in the Proposal

The Simi RW Project is one of two projects in this Proposal that provide recycled water; the other is the Moorpark RW Project. These two projects, along with the NPV Groundwater Desalter, share the common goals of improving local water supply reliability, reducing dependency on imported water, and reducing salt loading into the Watershed. However, the Simi RW Project does not depend on any of the other projects in this Proposal to achieve the benefits claimed.

Description of Expected Physical Benefits

The following (quantifiable) physical benefits are expected from this project:

- Reduce use of imported water by 600 AFY.
- Avoid 19,976 lbs per year of fertilizer use.
- Prevent more than 223 MT of salts from entering the Watershed every year.
- Reduce emissions of greenhouse gases by more than 733 MT every year.

Each benefit is discussed in further detail below.

Benefit: Reduce the Use of Imported Water by 600 AFY

This project will enable Simi Valley customers to use recycled water in-lieu of potable water for irrigation. This will reduce reliance on water imported into Simi Valley via the SWP, which will improve water supply reliability within Simi Valley. A reduction in Simi Valley demand for imported water will also make more water

available for other districts and municipalities that rely on SWP water.

Background and Historical Conditions

Simi Valley currently delivers more than 23,000 AFY of potable water to 24,000 service connections. Approximately 97 percent of water consumed in Simi Valley service area is imported water. Imported water comes from the SWP and is supplied to Simi Valley by Calleguas, who purchases it from Metropolitan. Simi Valley also owns three wells in the Tapo Canyon area, which supply water to the Tapo Canyon Water Treatment Plant. This is the only non-imported source of potable water available to Simi Valley.

Without Project Conditions

The recycled water provided by the project will be used by golf courses, parks, and HOAs for irrigation purposes. Without the Simi RW Project, 600 AFY of potable water will continue to be used for non-potable purposes (e.g., landscape irrigation) by these customers. Reliance on imported water will increase, which will decrease water supply reliability within the Watershed.

Methods Used to Estimate Benefits

Phase 1 of the Simi RW Project is scheduled for completion in mid-2014. In that year, Phase 1 will supply 52.5 acre-feet (AF) of recycled water. By 2015, Phase 1 will supply 104.9 AF of recycled water and will continue to do so over the 50-year project life. Phase 2 will be fully implemented by 2016, bringing an additional 496.8 AFY of recycled water online (City of Simi Valley 2011, provided with this Technical Justification). Thus beginning in 2016, recycled water use associated with the project (Phases 1 and 2) will amount to about 601.7 AFY. This will directly offset the use of 601.7 AFY of potable water within Simi Valley.

Although Simi Valley uses a mix of imported water and groundwater to supply its customers, imported water is more expensive to provide and is the marginal water source. Thus, the reduced overall water demand resulting from the increased use of recycled water will reduce reliance on imported SWP water.

Benefit Uncertainty

Simi Valley has identified 25 potential Phase 1 customers and 22 potential Phase 2 customers and expects that user agreements will be signed by all of these potential customers. 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 imported water use reductions will also be less than anticipated). There could be a potential delay in benefits if customers do not meet onsite requirements by the time project construction is completed.

Overall, the uncertainty in achieving the full subscription target of 600 AFY is considered to be low because recycled water will be offered to potential customers at a discount relative to their existing potable service. Furthermore, if additional customers are identified and choose to connect to the recycled water system, then the imported water demand offset benefits could be increased beyond 600 AFY.

New Facilities Required to Achieve Benefit

In order to achieve this benefit, facilities planned under Phases 1 and 2 of the Simi RW Project must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been included in this analysis as they are expected to be nominal.

Potential Adverse Physical Effects

Replacing potable water with recycled water for irrigation is not expected to result in any potential adverse physical effects. Potential water quality effects will be managed via the Salt and Nutrient Management Plan for the Calleguas Creek Watershed, currently under development, as required by the SWRCB.

Summary of Benefit

As is shown in Table B1, at full implementation, the project will result in the avoided use of 601.7 AFY of SWP water within Simi Valley. The project will result in a total of 30,242 AF of avoided SWP water over the 50-year project life.

Benefit: Avoid Use of 19,976 Pounds per Year of Fertilizer

This project will enable Simi Valley customers to use recycled water in-lieu of potable water for irrigation supplies, which will result in reduced fertilizer use.

Background and Historical Conditions

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 use associated with the properties that will be served by the project.

Without Project Conditions

The recycled water provided by the project will be used by golf courses, parks, and HOAs for irrigation purposes. Without the Simi RW Project, 601.7 AFY of potable water will continue to be used. The potable water will not provide fertilizer benefits. Customers will therefore continue to apply more fertilizer than would be needed if the project is implemented.

Methods Used to Estimate Benefits

The amount of nutrients (i.e., pounds of fertilizer) per acre-foot 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 pounds of nitrogen per AF and 8.2 pounds 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 acre-foot of recycled water used in-lieu of potable water, the recycled water customers will avoid the use of a total of 33.2 pounds of fertilizer. To calculate total fertilizer savings, the AFY of recycled water provided by the project in each year of the project life is multiplied by 33.2 pounds.

Benefit Uncertainty

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. In addition, avoided fertilizer use also depends on the knowledge and behavior of the landscape manager at each site.

New Facilities Required to Achieve Benefit

In order to achieve this benefit, facilities planned under Phases 1 and 2 of the Simi RW Project must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been included in this analysis as they are expected to be nominal.

Potential Adverse Physical Effects

Reduced fertilizer use is not expected to result in any potential adverse physical effects.

Summary of Benefit

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 pounds of fertilizer. As is shown in Table B2, over the lifetime of the project, total avoided fertilizer use will amount to 1,004,026 pounds. Additional benefits would be expected for avoided fertilizer costs due to increased levels of potassium in recycled water compared to potable supplies.

TABLE B1 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP)			
Project Name: West Simi Valley Water Recycling Project			
Type of Benefit Claimed: Avoided Imported Water Supply			
Measure of Benefit Claimed (Name of Units): Acre-feet (AF)			
Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Imported Water Use (AF)	With Project Imported Water Use (AF)	Change Resulting from Project (b) – (c) Avoided Imported Water Use (AF)
2012			
2013			
2014	52.5	0	52.5
2015	104.9	0	104.9
2016	601.7	0	601.7
2017	601.7	0	601.7
2018	601.7	0	601.7
2019	601.7	0	601.7
2020	601.7	0	601.7
2021	601.7	0	601.7
2022	601.7	0	601.7
2023	601.7	0	601.7
2024	601.7	0	601.7
2025	601.7	0	601.7
2026	601.7	0	601.7
2027	601.7	0	601.7
2028	601.7	0	601.7
2029	601.7	0	601.7
2030	601.7	0	601.7
2031	601.7	0	601.7
2032	601.7	0	601.7
2033	601.7	0	601.7
2034	601.7	0	601.7
2035	601.7	0	601.7
2036	601.7	0	601.7
2037	601.7	0	601.7
2038	601.7	0	601.7
2039	601.7	0	601.7
2040	601.7	0	601.7
2041	601.7	0	601.7

TABLE B1. cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Imported water use (AF)	With Project Imported water use (AF)	Change Resulting from Project (b) – (c) Avoided Imported Water Use (AF)
2042	601.7	0	601.7
2043	601.7	0	601.7
2044	601.7	0	601.7
2045	601.7	0	601.7
2046	601.7	0	601.7
2047	601.7	0	601.7
2048	601.7	0	601.7
2049	601.7	0	601.7
2050	601.7	0	601.7
2051	601.7	0	601.7
2052	601.7	0	601.7
2053	601.7	0	601.7
2054	601.7	0	601.7
2055	601.7	0	601.7
2056	601.7	0	601.7
2057	601.7	0	601.7
2058	601.7	0	601.7
2059	601.7	0	601.7
2060	601.7	0	601.7
2061	601.7	0	601.7
2062	601.7	0	601.7
2063	601.7	0	601.7
2064	601.7	0	601.7
2065	601.7	0	601.7

TABLE B2 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP)			
Project Name: West Simi Valley Water Recycling Project			
Type of Benefit Claimed: Avoided Fertilizer Use			
Measure of Benefit Claimed (Name of Units): Pounds			
Additional Information About this Measure:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Fertilizer Use	With Project Fertilizer Use	Change Resulting from Project (b) – (c) Avoided Fertilizer Use (Pounds)
2012			
2013			
2014	1,743	0.0	1,743
2015	3,483	0.0	3,483
2016	19,976	0.0	19,976
2017	19,976	0.0	19,976
2018	19,976	0.0	19,976
2019	19,976	0.0	19,976
2020	19,976	0.0	19,976
2021	19,976	0.0	19,976
2022	19,976	0.0	19,976
2023	19,976	0.0	19,976
2024	19,976	0.0	19,976
2025	19,976	0.0	19,976
2026	19,976	0.0	19,976
2027	19,976	0.0	19,976
2028	19,976	0.0	19,976
2029	19,976	0.0	19,976
2030	19,976	0.0	19,976
2031	19,976	0.0	19,976
2032	19,976	0.0	19,976
2033	19,976	0.0	19,976
2034	19,976	0.0	19,976
2035	19,976	0.0	19,976
2036	19,976	0.0	19,976
2037	19,976	0.0	19,976
2038	19,976	0.0	19,976
2039	19,976	0.0	19,976
2040	19,976	0.0	19,976
2041	19,976	0.0	19,976
2042	19,976	0.0	19,976
2043	19,976	0.0	19,976

TABLE B2 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Fertilizer Use	With Project Fertilizer Use	Change Resulting from Project (b) – (c) Avoided Fertilizer Use (Pounds)
2044	19,976	0.0	19,976
2045	19,976	0.0	19,976
2046	19,976	0.0	19,976
2047	19,976	0.0	19,976
2048	19,976	0.0	19,976
2049	19,976	0.0	19,976
2050	19,976	0.0	19,976
2051	19,976	0.0	19,976
2052	19,976	0.0	19,976
2053	19,976	0.0	19,976
2054	19,976	0.0	19,976
2055	19,976	0.0	19,976
2056	19,976	0.0	19,976
2057	19,976	0.0	19,976
2058	19,976	0.0	19,976
2059	19,976	0.0	19,976
2060	19,976	0.0	19,976
2061	19,976	0.0	19,976
2062	19,976	0.0	19,976
2063	19,976	0.0	19,976
2064	19,976	0.0	19,976
2065	19,976	0.0	19,976
Comments: Under both the with and without project scenarios, recycled water customers will use a baseline level of fertilizer. This table shows avoided fertilizer use due to nutrients provided in the recycled water. In addition, this quantified benefit is a result of nitrogen and phosphorous levels in the recycled water. Data was not available for levels of potassium in the recycled water, which would result in additional benefits.			

Benefit: Prevent 223 Metric Tons of Salts from Entering the Watershed each Year

Avoided SWP water imports as a result of this project will reduce the amount of salts imported into the Watershed.

Background and Historical Conditions

Most of the soils, surface water, and groundwater in the Watershed contain high levels of salts, including TDS, boron, sulfate, and chloride. The primary source of salts in surface water and groundwater is surface water imported from the SWP (LARWQCB 2007a; Larry Walker Associates 2004). Salts continue to accumulate, and currently the mass of salts and minerals coming into the Region is greater than the mass of salts and minerals leaving the Region.

The accumulation of salts due to historic and ongoing point and nonpoint source pollution poses a number of problems for beneficial uses within the Watershed, including municipal, industrial, and agricultural water supply and habitat. Rising salinity is harmful to agriculture and can be detrimental to sensitive habitat. It can have detrimental effects on ecosystems in the Watershed as well. Calleguas Creek is currently 303(d)-listed for salts (LARWQCB 2007b), and salt TMDLs have been established for the Watershed (including for boron, chloride, sulfate, and TDS).

Without Project Conditions

Without the project, continued dependence on imported water supplies will result in the import of additional salts into the Watershed.

Methods Used to Estimate Benefits

To calculate the avoided import of salts due to reduced imports of SWP water, it is assumed that the average TDS concentration in SWP water is 300 mg/L. This is based on data from the following sources:

- 2011 Calleguas Water Quality report, which states that TDS levels in imported water from Metropolitan averaged 310 mg/L in 2010.
- 2012 Calleguas Water Quality report, which states that TDS levels in imported water from Metropolitan averaged 280 mg/L in 2011.
- Simi Valley's 2010 Urban Water Management Plan, which states that TDS levels in imported water from Metropolitan range from 250 to 350 mg/L.

For this analysis, 300 mg/L is used as it represents the general midpoint of these estimates. At this concentration, each AF of SWP water contains 0.370 MT of salts on average.[3] As noted above, by 2016, avoided imported water use will amount to 601.7 AFY. Thus the project will avoid the introduction of about 223 MT of salts into the Watershed each year.

Benefit Uncertainty

As noted above, the total recycled water use of 601.7 AFY is dependent on all identified potential customers connecting to the new recycled water distribution system. If at least one customer does not connect to the system, total recycled water use will be less than 601.7 AFY (and avoided salt introduction would be less than anticipated). In addition, there could be a potential delay in benefits if customers do not meet onsite requirements by the time project construction is completed.

Overall, the uncertainty in achieving the full subscription target of 600 AFY, and therefore, salt loading reduction, is considered to be low because recycled water will be offered to potential customers at a discount relative to their existing potable service. Furthermore, if additional customers are identified and choose to connect to the recycled water system, then the salt loading reduction could be greater.

New Facilities Required to Achieve Benefit

In order to achieve this benefit, facilities planned under Phases 1 and 2 of the Simi RW Project must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been

[3] 300 mg/L multiplied by 1,233,482 L per acre-foot, divided by 1,000,000,000 mg/MT.

included in this analysis as they are expected to be nominal.

Potential Adverse Physical Effects

Reduced introduction of salts into the Watershed via imported SWP water is not expected to result in any potential adverse physical effects.

Summary of Benefit

As is shown in Table B3, reduced demand for imported water as a result of the project will avoid the introduction of 223 MT of salts into the Watershed each year (starting in 2016). Based on the schedule for project construction, the project will avoid the introduction of 11,193 MT of salts over the 50-year project life. The avoided introduction of salts into the Watershed will reduce salt loading into Calleguas Creek and improve water quality for beneficial uses.

Benefit: Reduce Emissions of Greenhouse Gases by More Than 733 MT Every Year

Reduced SWP water use will avoid the extensive energy requirements associated with transporting SWP water from Northern California to Simi Valley. This will result in avoided CO_2 emissions (a GHG), which are associated with the production of this energy.

Background and Historical Conditions

Based on information from the pumping plants used to move water to Ventura County, Calleguas estimates that the electricity required for the conveyance of 1 acre-foot of imported SWP water is 4.053 MWh (Calleguas, 2007). When energy requirements at the Jensen Filtration Plant are taken into account, the total amount of energy required for every AF of water delivered to Ventura County amounts to 4.09 MWh (Calleguas, 2007). Comparatively, Simi Valley estimates that about 0.65 MWh per acre-foot is required to pump and treat recycled water within its service area. Thus, imported water requires 3.44 more MWh on a per AF basis compared to recycled water.

Electricity used in California is generated within three different energy subregions [known as Western Electricity Coordinating Council (WECC) subregions]: California, the Northwest, and the Southwest (CEC, 2011). Almost 70 percent of California's electricity is generated within the state. The approximate breakdown of California's major sources of electricity is as follows: 45 percent is provided by natural gas, 18 percent is provided by nuclear power, 21 percent is provided by hydroelectric plants, 2 percent is provided by coal-fired power plants, and 14 percent comes from renewable sources (CEC, 2011).

CO_2 emissions resulting from the production of electricity, measured as tons of CO_2 per MWh, vary by energy source. Based on the current mix of energy sources for California, the CO_2 emissions rate for energy used to transport SWP water to Ventura County is estimated to be 0.354 MT/MWh.

Without Project Conditions

Without the project, continued dependence on imported water supplies would result in continued energy use and CO_2 emissions.

Methods Used to Estimate Benefits

To calculate energy savings associated with the project, the amount of energy required to transport and treat 1 acre-foot of imported water is multiplied by the amount of imported water that will be avoided as a result of the project (4.090 MWh per acre-foot). Then the amount of energy that would be required to treat and distribute the recycled water produced with the project (0.65 MWh per acre-foot) is multiplied by the amount of recycled water produced with the project to obtain a net energy savings.

Next, the CO_2 emissions rate associated with energy use in California was calculated using 2009 U.S. Environmental Protection Agency (EPA) eGrid data. As noted above, the California Energy Commission (CEC, 2011) reports that 70 percent of electricity used in California is generated in-state, 20 percent is generated in the WECC Southwest subregion, and 10 percent is generated in the WECC Northwest subregion. EPA publishes average CO_2 emissions rates for

TABLE B3 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: West Simi Valley Water Recycling Project Type of Benefit Claimed: Avoided Salts Import Measure of Benefit Claimed (Name of Units): Metric Tons (MT) Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project, Salts Imported into Watershed (MT)	With Project, Salts Imported into Watershed (MT)	Change Resulting from Project (b) – (c) Reduction in Salt Imports (MT)
2012			
2013			
2014	19.4	0.0	19.4
2015	38.8	0.0	38.8
2016	222.7	0.0	222.7
2017	222.7	0.0	222.7
2018	222.7	0.0	222.7
2019	222.7	0.0	222.7
2020	222.7	0.0	222.7
2021	222.7	0.0	222.7
2022	222.7	0.0	222.7
2023	222.7	0.0	222.7
2024	222.7	0.0	222.7
2025	222.7	0.0	222.7
2026	222.7	0.0	222.7
2027	222.7	0.0	222.7
2028	222.7	0.0	222.7
2029	222.7	0.0	222.7
2030	222.7	0.0	222.7
2031	222.7	0.0	222.7
2032	222.7	0.0	222.7
2033	222.7	0.0	222.7
2034	222.7	0.0	222.7
2035	222.7	0.0	222.7
2036	222.7	0.0	222.7
2037	222.7	0.0	222.7
2038	222.7	0.0	222.7
2039	222.7	0.0	222.7
2040	222.7	0.0	222.7
2041	222.7	0.0	222.7
2042	222.7	0.0	222.7

TABLE B3 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project, Salts Imported into Watershed (MT)	With Project, Salts Imported into Watershed (MT)	Change Resulting from Project (b) – (c) Reduction in Salt Imports (MT)
2043	222.7	0.0	222.7
2044	222.7	0.0	222.7
2045	222.7	0.0	222.7
2046	222.7	0.0	222.7
2047	222.7	0.0	222.7
2048	222.7	0.0	222.7
2049	222.7	0.0	222.7
2050	222.7	0.0	222.7
2051	222.7	0.0	222.7
2052	222.7	0.0	222.7
2053	222.7	0.0	222.7
2054	222.7	0.0	222.7
2055	222.7	0.0	222.7
2056	222.7	0.0	222.7
2057	222.7	0.0	222.7
2058	222.7	0.0	222.7
2059	222.7	0.0	222.7
2060	222.7	0.0	222.7
2061	222.7	0.0	222.7
2062	222.7	0.0	222.7
2063	222.7	0.0	222.7
2064	222.7	0.0	222.7
2065	222.7	0.0	222.7

TABLE B4
CO_2 EMISSIONS RATES FOR ENERGY USED IN CALIFORNIA BY REGIONS THAT PRODUCE ELECTRICITY

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

Source: U.S. EPA, 2012.

these subregions based on the various energy sources used to generate electricity within them (e.g., natural gas, hydropower). Table B4 shows the CO_2 emissions rate for the three regions that produce the electricity used in California and the average weighted rate for electricity used within the state. It is assumed that the mix of energy sources used by the state overall is representative of the mix of energy sources used by the SWP.

Given the calculated weighted average CO_2 emissions rate of 0.0.354 MT of CO_2 emitted per MWh, 1.45 MT of CO_2 are produced for every acre-foot of SWP water delivered to Ventura County (4.090 MWh per acre-foot multiplied by 0.354 MT/MWh). By eliminating use of 601.7 AFY of imported water (at full implementation), the project will avoid emissions of more than 871 MT of CO_2 per year.

Avoided CO_2 emissions will be offset to some extent by the CO_2 emissions associated with the energy used to pump and distribute recycled water from the WQCP to customers. Simi Valley estimates that this requires about 0.65 MWh per AF of recycled water. Assuming the same emissions rate of 0.354 MT of CO_2 emitted per MWh, CO_2 production per acre-foot of recycled water is estimated to be about 0.23 MT. Thus CO_2 emissions associated with recycled water use will amount to about 138 MT per year for these two phases. Net CO_2 emissions reductions are estimated to be 733 MT per year.

Benefit Uncertainty

Total recycled water use associated with the project, and therefore CO_2 emissions reductions, is dependent on all potential customers connecting to the new recycled water distribution system. If at least one customer does not connect to the system, total recycled water use will be less than 601.7 AFY. This would decrease the amount of imported water avoided with the project as well as the associated energy savings and CO_2 emissions reduction. There could also be a potential delay in benefits if customers do not meet onsite requirements by the time project construction is completed.

Overall, the uncertainty in achieving the full subscription target of 600 AFY, and therefore, CO_2 emissions reduction, is considered to be low because recycled water will be offered to potential customers at a discount relative to their existing potable service. Furthermore, if additional customers are identified and choose to connect to the recycled water system, then the CO_2 emissions reduction could be greater.

In addition, some uncertainty exists with the carbon emissions rate calculated based on the average mix of electricity sources in California. Local electricity production may use a slightly different mix of sources (e.g., more hydropower, less natural gas, or less imported electricity). This could result in a slightly higher or lower emissions rate depending on the mix of sources used.

New Facilities Required to Achieve Benefit

In order to achieve this benefit, facilities planned under Phases 1 and 2 of the Simi RW Project must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been included in this analysis as they are expected to be nominal.

Potential Adverse Physical Effects

Energy savings and associated CO_2 emissions reductions due to avoided use of imported water are not expected to result in any potential adverse physical effects.

Summary of Benefit

As is shown in Table B5, at full implementation the project will result in a net reduction in CO_2 emissions of 733 MT per year which is associated with a net energy savings of 2,070 MWh per year. Given the schedule for project construction (with some benefits beginning to accrue in 2014 under Phase 1), the project will result in a net energy savings of 104,034 MWh and a net CO_2 emissions reduction of 36,827 MT over the 50-year project life.

Summary of Annual Project Physical Benefits

By providing a local source of recycled water, the project will result in the avoided use of 601.7 AFY of imported water from the SWP (at full implementation). This will improve water supply

reliability within Simi Valley and make more SWP water available for other users within the state. Over its 50-year life, the project will avoid a total of 30,242 AF of imported SWP water.

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 use. For this project, every acre-foot 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. Over the lifetime of the project, total avoided fertilizer use will amount to 1,004,026 pounds.

Reduced reliance on SWP water will reduce the amount of salts imported into the Watershed. This will help to improve salt-related water quality issues within the Watershed and help to meet TMDL standards for boron, chloride, sulfate, and TDS. As a result of the project, the introduction of 223 MT of salts into the Watershed will be avoided each year. This amounts to 11,193 MT of salts over the 50-year project life.

TABLE B5 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: West Simi Valley Water Recycling Project Type of Benefit Claimed: Reduced Emissions of Greenhouse Gases Measure of Benefit Claimed (Name of Units): Metric Tons (MT) Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Carbon Emissions (MT)	With Project Carbon Emissions (MT)	Change Resulting from Project (b) – (c) Net Carbon Emissions Reduction (MT)
2012			
2013			
2014	76.0	12.1	63.9
2015	151.9	24.1	127.8
2016	871.2	138.5	732.7
2017	871.2	138.5	732.7
2018	871.2	138.5	732.7
2019	871.2	138.5	732.7
2020	871.2	138.5	732.7
2021	871.2	138.5	732.7
2022	871.2	138.5	732.7
2023	871.2	138.5	732.7
2024	871.2	138.5	732.7
2025	871.2	138.5	732.7
2026	871.2	138.5	732.7
2027	871.2	138.5	732.7
2028	871.2	138.5	732.7
2029	871.2	138.5	732.7
2030	871.2	138.5	732.7
2031	871.2	138.5	732.7
2032	871.2	138.5	732.7
2033	871.2	138.5	732.7
2034	871.2	138.5	732.7
2035	871.2	138.5	732.7
2036	871.2	138.5	732.7
2037	871.2	138.5	732.7
2038	871.2	138.5	732.7
2039	871.2	138.5	732.7
2040	871.2	138.5	732.7
2041	871.2	138.5	732.7
2042	871.2	138.5	732.7
2043	871.2	138.5	732.7
2044	871.2	138.5	732.7

TABLE B5 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Carbon Emissions (MT)	With Project Carbon Emissions (MT)	Change Resulting from Project (b) – (c) Net Carbon Emissions Reduction (MT)
2045	871.2	138.5	732.7
2046	871.2	138.5	732.7
2047	871.2	138.5	732.7
2048	871.2	138.5	732.7
2049	871.2	138.5	732.7
2050	871.2	138.5	732.7
2051	871.2	138.5	732.7
2052	871.2	138.5	732.7
2053	871.2	138.5	732.7
2054	871.2	138.5	732.7
2055	871.2	138.5	732.7
2056	871.2	138.5	732.7
2057	871.2	138.5	732.7
2058	871.2	138.5	732.7
2059	871.2	138.5	732.7
2060	871.2	138.5	732.7
2061	871.2	138.5	732.7
2062	871.2	138.5	732.7
2063	871.2	138.5	732.7
2064	871.2	138.5	732.7
2065	871.2	138.5	732.7

Finally, reductions in imported water will avoid having to expend the energy required to pump and treat the imported water, which in turn will reduce CO_2 emissions. Taking into account the energy used to treat and distribute recycled water, the project will result in a net energy savings of 2,070 MWh per year and a net reduction in CO_2 emissions of 733 MT per year. This amounts to a net energy savings of 104,034 MWh and a net CO_2 emissions reduction of 36,827 MT over the 50-year project life.

References

All the references below are provided as attachments to this Technical Justification (Att7_IG2_TechJust_3of7).

- Calleguas. 2007. *CO_2 Emissions and Imported State Project Water to Ventura County. Memorandum from General Manager to Board of Directors.* Calleguas Municipal Water District. January 25.
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- City of Simi Valley, 2011. *West Simi Valley Water Recycling Project Engineering Report.* Ventura County Waterworks District No. 8. December 30.
- Larry Walker Associates. 2004. *Progress Report on Efforts to Address Salts on the Calleguas Creek Watershed. Submitted to Calleguas Creek Watershed Management Plan.* June 30.
- LARWQCB. 2007a. *Proposed Amendment to the Water Quality Control Plan – Los Angeles Region 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.
- LARWQCB. 2007b. Watershed Management Initiatives. Calleguas Creek Watershed Summary. Los Angeles Regional Water Quality Control Board. December.
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Moorpark Recycled Water Project Phase IV

Introduction

This attachment presents the technical justification for the Moorpark Recycled Water Project, Phase IV, by Ventura County Waterworks District No. 1 (WWD1). A project abstract and general discussion of the without project baseline are followed by a discussion of each physically quantified benefit and a summary of physically quantified benefits claimed.

Project Abstract

The Moorpark Recycled Water Project Phase IV, will expand 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 four phases. The first phase of the project was completed in 2002, while Phase II and the first half of Phase III (Phase IIIA) were completed in 2012. Phase IIIB, a pipeline extension to Phase IIIA not yet complete, is not necessary to accrue benefits from this phase (Phase IV) of the project. WWD1's existing recycled water system includes the tertiary treatment facility at MWWTP, a recycled water pump station, a 1.5 million gallon storage tank, and close to five miles of recycled water pipeline. Recycled water production at the MWWTP is currently about 600 AFY.

Phase IV includes the construction of 16,500 LF of recycled water pipeline at the end of the Phase I pipeline and a 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.

Without Project Baseline

The MWWTP, which is owned and operated by WWD1, provides sewage treatment for the City of Moorpark and contiguous unincorporated areas to the north and west. The plant is located within the Calleguas Creek Watershed approximately four miles west of the City of Moorpark. Through operation of the MWWTP, WWD1 currently treats about 2,500 AFY of wastewater effluent. Most of this effluent is treated to secondary standards and discharged directly to percolation ponds located onsite. About 600 AFY is treated to tertiary standards and used for golf course irrigation. Without the project, wastewater effluent will continue to be discharged to land and will not be directly put to beneficial use.

WWD1 uses a combination of water supplies to meet demands within its service area (i.e., the City of Moorpark and contiguous unincorporated areas to the north and west), including imported water, groundwater, and recycled water. In 2010, WWD1 delivered more than 11,714 AF of water to 10,400 residential and commercial service connections and 172 agricultural connections. Currently, about 78 percent of water consumed within WWD1's service area is imported water, while about 22 percent comes from local sources.

Imported water comes from the SWP through Metropolitan and Calleguas. Metropolitan treats the water at Jensen Treatment Plant located in Granada Hills. Calleguas purchases water from Metropolitan and delivers it to 26 water suppliers within Ventura County including WWD1. Local water, treated by chlorination, is supplied from six groundwater wells located within the East Los Posas Basin. As noted above, WWD1 also generates about 600 AFY of recycled water at the MWWTP, which is used primarily for golf course irrigation.

The availability of imported water is subject to a number of natural and human forces ranging from increased population growth (and the

accompanying increased demands on the SWP system) to drought and earthquakes, to environmental regulations, and water rights determinations. Without the Moorpark Recycled Water Project Phase IV, 425 AFY of potable water will continue to be used for non-potable purposes (e.g., landscape irrigation). Reliance on imported water will continue, and therefore water supply reliability will not improve within the WWD1 service area as it would with the project.

Continued reliance on imported water under the without project scenario will also exacerbate salt-related water quality issues in the Calleguas Creek Watershed (Watershed). Most of the soils, surface water, and groundwater in the Watershed contain high levels of salts including TDS, boron, sulfate, and chloride. Primary sources of salts in surface water and groundwater include imported surface water (i.e., SWP supplies), fertilizer used in agricultural activities, and discharges from wastewater treatment plants (Larry Walker Associates 2004 and LARWQCB 2007a, provided with this Technical Justification). Salts continue to accumulate, and the mass of salts and minerals currently coming into the region, primarily from imported water, is greater than the mass of salts and minerals leaving the region.

The accumulation of salts due to historical and ongoing point and nonpoint source pollution poses a number of problems for beneficial uses within the Watershed including municipal, industrial, and agricultural water supply, and habitat. Rising salinity is harmful to agriculture primarily for growers of high-value strawberries and avocados who are increasingly unable to use local surface water or groundwater for irrigation without reducing agricultural productivity. High salinity levels in soils and surface water can also be detrimental to sensitive habitat and can have detrimental effects on ecosystems in the Watershed. As a result of these factors, salt TMDLs have been established for the Watershed (including for boron, chloride, sulfate, and TDS). Calleguas Creek is currently 303(d)-listed for salts, as well as for a number of other constituents (LARWQCB 2007b, provided with this Technical Justification).

Without the project, the City of Moorpark and surrounding unincorporated area will continue its current level of reliance on imported water. Increased use of imported water will result in the increased energy usage (and associated GHG emissions) involved with pumping and distributing imported water over long distances. The energy requirements would be much lower if locally generated recycled water were used instead of imported water.

Relationship of Project to Other Projects Included in the Proposal

The Moorpark Recycled Water Project Phase IV Project is one of two projects in this Proposal that provide recycled water; the other is the Simi RW Project. These two projects, along with the NPV Groundwater Desalter, share the common goals of improving local water supply reliability, reducing dependency on imported water, and reducing salt loading into the Watershed. However, the Moorpark Recycled Water Project Phase IV does not depend on any of the other projects in this proposal to achieve the benefits claimed.

Description of Expected Physical Benefits

The following (quantifiable) physical benefits are expected from this project:

- Reduce use of imported water by 425 AFY.
- Avoid 23,163 lbs per year of fertilizer use.
- Prevent more than 157 MT of salts from entering the Watershed every year.
- Reduce emissions of greenhouse gases by more than 517 MT every year.

Each benefit is discussed in further detail below.

Benefit: Reduce Use of Imported Water by 425 AFY

This project will enable WWD1 customers to use recycled water in-lieu of potable water for irrigation supplies. This will reduce reliance on water imported via the SWP, which will improve water supply reliability within the City of Moorpark. A reduction in WWD1 demand for imported water will also make more water available for other districts and municipalities that rely on SWP water.

Background and Historical Conditions

WWD1 currently delivers about 11,300 AFY of potable water to 10,400 service connections. Approximately 78 percent of water consumed within the service area is imported water, which comes from the SWP and is supplied to WWD1 by Calleguas who purchases it from Metropolitan. WWD1 also owns six active wells in the East Las Posas Groundwater Basin.

Without Project Conditions

The recycled water provided by the project will be used for irrigation purposes by Rustic Canyon Golf Course, Moorpark Country Club Estates HOA, and the City of Moorpark Landscape Maintenance District. Without the Moorpark Recycled Water Project Phase IV, 425 AFY of potable water will continue to be used for non-potable purposes (e.g., landscape irrigation) by these customers. Reliance on imported water will increase, which will decrease water supply reliability within the Watershed.

Methods Used to Estimate Benefits

Phase IV is scheduled for completion in mid-2016. In that year, Phase IV will supply 212.5 AF of recycled water. By 2017, Phase IV will supply 425 AF of recycled water and will continue to do so over the 50-year project life. This will directly offset the use of 425 AFY of potable water within the WWD1 service area.

Although WWD1 uses a mix of imported water and groundwater to supply its customers, imported water is more expensive to provide and is the marginal water source. The reduced overall water demand resulting from the increased use of recycled water will reduce reliance on imported SWP water.

Benefit Uncertainty

Three customers will receive recycled water from the project. WWD1 expects that user agreements will be signed by each of these customers. However, recycled water service to these customers would only begin once the customers comply with the onsite requirements established by 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. Overall, the uncertainty in achieving the full subscription target of 425 AFY is considered to be low because recycled water will be offered to the customers at a discount relative to their existing potable service.

At the same time, 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 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 of project benefits.

New Facilities Required to Achieve Benefit

To achieve this benefit, facilities planned under Phase IV of the Moorpark Recycled Water Project (as described in this grant application) must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been included in this analysis but are expected to be nominal.

Potential Adverse Physical Effects

Replacing potable water with recycled water for irrigation is not expected to result in any potential adverse physical effects. Potential water quality effects will be managed via the Salt and Nutrient Management Plan for the Calleguas Creek Watershed, currently under development, as required by the SWRCB.

Summary of Benefit

As shown in Table C1, at full implementation the project will result in the avoided use of 425 AFY of SWP water within the WWD1 service area. The project will result in a total of 21,250 AF of avoided SWP water over the 50-year project life.[4]

[4] The expected 50-year project life runs from mid-2016, following project construction, through mid-2066.

TABLE C1 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of the PSP) Project Name: Moorpark Recycled Water Project Type of Benefit Claimed: Avoided Imported Water Supply Measure of Benefit Claimed (Name of Units): Acre-feet (AF) Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Imported water use (AF)	With Project Imported water use (AF)	Change Resulting from Project (b) – (c)
2012			
2013			
2014			
2015			
2016	425	212.5	212.5
2017	425	0	425
2018	425	0	425
2019	425	0	425
2020	425	0	425
2021	425	0	425
2022	425	0	425
2023	425	0	425
2024	425	0	425
2025	425	0	425
2026	425	0	425
2027	425	0	425
2028	425	0	425
2029	425	0	425
2030	425	0	425
2031	425	0	425
2032	425	0	425
2033	425	0	425
2034	425	0	425
2035	425	0	425
2036	425	0	425
2037	425	0	425
2038	425	0	425
2039	425	0	425
2040	425	0	425
2041	425	0	425
2042	425	0	425
2043	425	0	425

TABLE C1. cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Imported water use (AF)	With Project Imported water use (AF)	Change Resulting from Project (b) – (c)
2044	425	0	425
2045	425	0	425
2046	425	0	425
2047	425	0	425
2048	425	0	425
2049	425	0	425
2050	425	0	425
2051	425	0	425
2052	425	0	425
2053	425	0	425
2054	425	0	425
2055	425	0	425
2056	425	0	425
2057	425	0	425
2058	425	0	425
2059	425	0	425
2060	425	0	425
2061	425	0	425
2062	425	0	425
2063	425	0	425
2064	425	0	425
2065	425	0	425
2066	212.5	0	212.5

Benefit: Avoid Use of 23,163 Pounds per Year of Fertilizer

This project will enable WWD1 customers to use recycled water in-lieu of potable water for irrigation supplies, which will result in reduced fertilizer use.

Background and Historical Conditions

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 use for properties that will be served by the project.

Without Project Conditions

The recycled water provided by the project will be used by Rustic Canyon Golf Course, Moorpark Country Club Estates HOA, and the City of Moorpark Landscape Maintenance District for irrigation purposes. Without the Moorpark Recycled Water project, these customers will continue to use 425 AFY of potable water for this purpose, which will not provide fertilizer benefits. Customers would therefore continue to apply more fertilizer than needed if the project is not implemented.

Methods Used To Estimate Benefits

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 AF and 43.5 pounds of potassium per AF (Fruit Growers Laboratory 2011 and VCWWD1 2012) [provided with this Technical Justification]; 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. To calculate total fertilizer savings, the AFY of recycled water provided by the project in each year of the project life is multiplied by 54.5 pounds.

Benefit Uncertainty

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. In addition, avoided fertilizer use also depends on the knowledge and behavior of the landscape manager at each site.

New Facilities Required to Achieve Benefit

To achieve this benefit, facilities planned under the Moorpark Recycled Water Project Phase IV must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been included in this analysis but are expected to be nominal.

Potential Adverse Physical Effects

Reduced fertilizer use is not expected to result in any potential adverse physical effects.

Summary of Benefit

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. As shown in Table C2, over the lifetime of the project, total avoided fertilizer use will amount to 1,158,125 pounds. Additional benefits would be expected through avoided fertilizer costs because of the increased levels of phosphorus in recycled water compared to potable supplies.

Benefit: Prevent 157 Metric Tons of Salts from Entering the Watershed each Year

Avoided SWP water imports as a result of this project will reduce the amount of salts imported into the Watershed.

Background and Historical Conditions

Most of the soils, surface water, and groundwater in the Watershed contain high levels of salts, including TDS, boron, sulfate, and chloride. The primary source of salts in surface water and groundwater is surface water imported from the SWP (Larry Walker Associates 2004 and LARWQCB, 2007a, provided with this Technical Justification). Salts continue to accumulate and, currently, the mass of salts and minerals coming into the Region, primarily from imported water, is greater than the mass of salts and minerals leaving the Region.

TABLE C2 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: West Simi Valley Water Recycling Project Type of Benefit Claimed: Avoided Fertilizer Use Measure of Benefit Claimed (Name of Units): Pounds Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Fertilizer Use	With Project Fertilizer Use	Change Resulting from Project (b) – (c) Avoided Fertilizer Use (Pounds)
2012			
2013			
2014			
2015			
2016	11,581	0.0	11,581
2017	23,163	0.0	23,163
2018	23,163	0.0	23,163
2019	23,163	0.0	23,163
2020	23,163	0.0	23,163
2021	23,163	0.0	23,163
2022	23,163	0.0	23,163
2023	23,163	0.0	23,163
2024	23,163	0.0	23,163
2025	23,163	0.0	23,163
2026	23,163	0.0	23,163
2027	23,163	0.0	23,163
2028	23,163	0.0	23,163
2029	23,163	0.0	23,163
2030	23,163	0.0	23,163
2031	23,163	0.0	23,163
2032	23,163	0.0	23,163
2033	23,163	0.0	23,163
2034	23,163	0.0	23,163
2035	23,163	0.0	23,163
2036	23,163	0.0	23,163
2037	23,163	0.0	23,163
2038	23,163	0.0	23,163
2039	23,163	0.0	23,163
2040	23,163	0.0	23,163
2041	23,163	0.0	23,163
2042	23,163	0.0	23,163
2043	23,163	0.0	23,163
2044	23,163	0.0	23,163
2045	23,163	0.0	23,163
2046	23,163	0.0	23,163
2047	23,163	0.0	23,163
2048	23,163	0.0	23,163
2049	23,163	0.0	23,163
2050	23,163	0.0	23,163

TABLE C2 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Fertilizer Use	With Project Fertilizer Use	Change Resulting from Project (b) – (c) Avoided Fertilizer Use (Pounds)
2051	23,163	0.0	23,163
2052	23,163	0.0	23,163
2053	23,163	0.0	23,163
2054	23,163	0.0	23,163
2055	23,163	0.0	23,163
2056	23,163	0.0	23,163
2057	23,163	0.0	23,163
2058	23,163	0.0	23,163
2059	23,163	0.0	23,163
2060	23,163	0.0	23,163
2061	23,163	0.0	23,163
2062	23,163	0.0	23,163
2063	23,163	0.0	23,163
2064	23,163	0.0	23,163
2065	23,163	0.0	23,163
2066	11,581	0.0	11,581

Comments: Under both the with and without project scenarios, recycled water customers will use a baseline level of fertilizer. This table shows avoided fertilizer use due to nutrients provided in the recycled water. In addition, this quantified benefit is a result of nitrogen and potassium levels in the recycled water. Data was not available for levels of phosphorous in the recycled water, which would result in additional benefits.

The accumulation of salts from historical and ongoing point and nonpoint source pollution poses a number of problems for beneficial uses within the Watershed including municipal, industrial, and agricultural water supply and habitat. Rising salinity is also harmful to agriculture and can be detrimental to sensitive habitat. It can have detrimental effects on ecosystems in the Watershed as well. Calleguas Creek is currently on the Clean Water Act 303(d)-list of impaired waters for salts (LARWQCB 2007b, provided with this Technical Justification), and salt TMDLs have been established for the Watershed (including for boron, chloride, sulfate, and TDS).

Without Project Conditions

Without the project, continued dependence on imported water supplies will result in the import of additional salts into the Watershed.

Methods Used to Estimate Benefits

To calculate the avoided import of salts that will result from reduced imports of SWP water, it is assumed that the average TDS concentration in SWP water is 300 mg/L. This is based on data from the following sources:

- *2011 Calleguas Water Quality Report*, which states that TDS levels in imported water from Metropolitan averaged 310 mg/L in 2010.
- *2012 Calleguas Water Quality Report*, which states that TDS levels in imported water from Metropolitan averaged 280 mg/L in 2011.
- Calleguas' *2010 Urban Water Management Plan*, which states that TDS levels in imported water from Metropolitan range from 250 to 325 mg/L.

For this analysis, 300 mg/L is used, as it represents the general midpoint of these estimates. At this concentration, each AF of SWP water contains 0.370 MT of salts, on average.[5] As noted above, by 2016, avoided imported water use will amount to 425 AFY. Thus, the project will avoid the introduction of about 157 MT of salts into the Watershed each year.

Benefit Uncertainty

As noted above, the total recycled water use of 425 AFY is dependent on all identified customers connecting to the new recycled water distribution system in a timely manner. There could be a potential delay in benefits if customers do not meet onsite requirements by the time project construction is completed.

Overall, the uncertainty in achieving the full subscription target of 425 AFY, and therefore salt loading reduction, is considered to be low because recycled water will be offered to potential customers at a discount relative to their existing potable service. Furthermore, if additional customers are identified and choose to connect to the recycled water system, then the salt loading reduction could be greater.

New Facilities Required to Achieve Benefit

To achieve this benefit, facilities planned under the Moorpark Recycled Water Project Phase IV Project must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been included in this analysis but are expected to be nominal.

Potential Adverse Physical Effects

Reduced introduction of salts into the Watershed via imported SWP water is not expected to result in any potential adverse physical effects.

Summary of Benefit

As is shown in Table C3, reduced demand for imported water as a result of the project will avoid the introduction of 157 MT of salts into the Watershed each year (starting in 2017). Based on the schedule for project construction, the project will avoid the introduction of 7,865 MT of salts over the 50-year project life. The avoided introduction of salts into the Watershed will reduce overall salt loading and improve water quality for beneficial uses.

[5] 300 mg/L multiplied by 1,233,482 L per AF, divided by 1,000,000,000 mg/MT.

TABLE C3 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of the PSP)			
Project Name: Moorpark Recycled Water Project Phase IV			
Type of Benefit Claimed: Avoided Salts Import			
Measure of Benefit Claimed (Name of Units): Metric Tons (MT)			
Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project, Salts Imported into Watershed (MT)	With Project, Salts Imported into Watershed (MT)	Change Resulting from Project (b) – (c) Net Carbon Emissions Reduction (MT)
2012			
2013			
2014			
2015			
2016	78.6	0.0	78.6
2017	157.3	0.0	157.3
2018	157.3	0.0	157.3
2019	157.3	0.0	157.3
2020	157.3	0.0	157.3
2021	157.3	0.0	157.3
2022	157.3	0.0	157.3
2023	157.3	0.0	157.3
2024	157.3	0.0	157.3
2025	157.3	0.0	157.3
2026	157.3	0.0	157.3
2027	157.3	0.0	157.3
2028	157.3	0.0	157.3
2029	157.3	0.0	157.3
2030	157.3	0.0	157.3
2031	157.3	0.0	157.3
2032	157.3	0.0	157.3
2033	157.3	0.0	157.3
2034	157.3	0.0	157.3
2035	157.3	0.0	157.3
2036	157.3	0.0	157.3
2037	157.3	0.0	157.3
2038	157.3	0.0	157.3
2039	157.3	0.0	157.3
2040	157.3	0.0	157.3
2041	157.3	0.0	157.3
2042	157.3	0.0	157.3
2043	157.3	0.0	157.3
2044	157.3	0.0	157.3

TABLE C3 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project, Salts Imported into Watershed (MT)	With Project, Salts Imported into Watershed (MT)	Change Resulting from Project (b) – (c) Net Carbon Emissions Reduction (MT)
2045	157.3	0.0	157.3
2046	157.3	0.0	157.3
2047	157.3	0.0	157.3
2048	157.3	0.0	157.3
2049	157.3	0.0	157.3
2050	157.3	0.0	157.3
2051	157.3	0.0	157.3
2052	157.3	0.0	157.3
2053	157.3	0.0	157.3
2054	157.3	0.0	157.3
2055	157.3	0.0	157.3
2056	157.3	0.0	157.3
2057	157.3	0.0	157.3
2058	157.3	0.0	157.3
2059	157.3	0.0	157.3
2060	157.3	0.0	157.3
2061	157.3	0.0	157.3
2062	157.3	0.0	157.3
2063	157.3	0.0	157.3
2064	157.3	0.0	157.3
2065	157.3	0.0	157.3
2066	78.6	0.0	78.6

Benefit: Reduce Emissions of Greenhouse Gases by More Than 517 MT Every Year

Reduced reliance on SWP water will avoid the extensive energy requirements associated with transporting SWP water from Northern California to Ventura County. This will result in avoided CO_2 emissions (a GHG), which are associated with the production of this energy.

Background and Historical Conditions

Based on information from the pumping plants used to move water to Ventura County, Calleguas estimates that the electricity required for the conveyance of 1 AF of imported SWP water is 4.053 MWh (Calleguas 2007, provided with this Technical Justification). When energy requirements at the Jensen Filtration Plant are taken into account, the total amount of energy required for every AF of water delivered to Ventura County amounts to 4.09 MWh (Calleguas 2007). Comparatively, Moorpark estimates that about 0.65 MWh per AF is required to pump and treat recycled water within its service area. Thus, imported water requires 3.44 more MWh on a per AF basis compared to recycled water.

Electricity used in California is generated within three different energy subregions [known as WECC subregions]: California, the Northwest, and the Southwest (CEC 2011, provided with this Technical Justification). Almost 70 percent of California's electricity is generated within the state. The approximate breakdown of California's major sources of electricity is as follows: 45 percent is provided by natural gas, 18 percent is provided by nuclear power, 21 percent is provided by hydroelectric plants, 2 percent is provided by coal-fired power plants, and 14 percent comes from renewable sources (CEC 2011).

CO_2 emissions resulting from the production of electricity, measured as tons of CO_2 per MWh, vary by energy source. Based on the current mix of energy sources for California, the CO_2 emissions rate for energy used to transport SWP water to Ventura County is estimated to be 0.354 MT/MWh.

Without Project Conditions

Without the project, continued dependence on imported water supplies would result in continued energy use and CO_2 emissions.

Methods Used to Estimate Benefits

To calculate energy savings associated with the project, the amount of energy required to transport and treat 1 AF of imported water was multiplied by the amount of imported water that will be avoided as a result of the project (4.090 MWh per AF). Then the amount of energy that will be required to treat and distribute the recycled water produced through the project (0.65 MWh per AF) was multiplied by the amount of recycled water produced through the project to obtain a net energy savings.

Next, the CO_2 emissions rate associated with energy use in California was calculated using 2009 EPA eGrid data. The California Energy Commission (CEC 2011) reports that 70 percent of electricity used in California is generated in-state, 20 percent is generated in the WECC Southwest subregion, and 10 percent is generated in the WECC Northwest subregion. EPA publishes average CO_2 emissions rates for these subregions based on the various energy sources used to generate electricity within them (e.g., natural gas, hydropower). Table C4 shows the CO_2 emissions rate for the three regions that produce the electricity used in California and the average weighted rate for electricity used within the state. It is assumed that the mix of energy sources used by the state overall is representative of the mix of energy sources used by the SWP.

TABLE C4
CO_2 EMISSIONS RATES FOR ENERGY USED IN CALIFORNIA BY REGIONS THAT PRODUCE ELECTRICITY

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

Source: U.S. EPA, 2012.

Given the calculated weighted average CO_2 emissions rate of 0.0.354 MT of CO_2 emitted per MWh, 1.45 MT of CO_2 are produced for every AF of SWP water delivered to Ventura County (4.090 MWh per AF multiplied by 0.354 MT/MWh). By eliminating use of 425 AFY of imported water (at full implementation), the project will avoid emissions of about 615 MT of CO_2 per year. This does not include the energy required to distribute the imported water to customers.

Avoided CO_2 emissions will be offset to some extent by the CO_2 emissions associated with the energy used to pump and distribute recycled water from the MWWTP to customers. WWD1 estimates that this requires about 0.65 MWh per AF of recycled water. Assuming the same emissions rate of 0.354 MT of CO_2 emitted per MWh, CO_2 production per AF of recycled water is estimated to be about 0.23 MT. Thus CO_2 emissions associated with recycled water use will amount to about 98 MT per year. Net CO_2 emissions reductions are estimated to be 517 MT per year.

Benefit Uncertainty

There could be a potential delay in benefits if customers do not meet onsite requirements for recycled water by the time project construction is completed. This would delay the amount of imported water avoided with the project as well as the associated energy savings and CO_2 emissions reduction.

Overall, the uncertainty in achieving the full subscription target of 425 AFY, and therefore CO_2 emissions reduction, is considered to be low because recycled water will be offered to potential customers at a discount relative to their existing potable service. Furthermore, if additional customers are identified and choose to connect to the recycled water system, then the CO_2 emissions reduction could be greater.

In addition, some uncertainty exists with the carbon emissions rate calculated based on the average mix of electricity sources in California. Local electricity production may use a slightly different mix of sources (e.g., more hydropower, less natural gas, or less imported electricity). This could result in a slightly higher or lower emissions rate depending on the mix of sources used.

New Facilities Required to Achieve Benefit

To achieve this benefit, facilities planned under the Moorpark Recycled Water Project Phase IV must be completed. The customers served by the project will also need to connect to the new distribution system. Customer-funded costs to connect to the distribution system (e.g., signage, irrigation system modifications) have not been included in this analysis but are expected to be nominal.

Potential Adverse Physical Effects

Energy savings and associated CO_2 emissions reductions due to avoided use of imported water are not expected to result in any potential adverse physical effects.

Summary of Benefit

As is shown in Table C5, at full implementation the project will result in a net reduction in CO_2 emissions of 517 MT per year with an associated net energy savings of 1,462 MWh per year. Given

TABLE C5 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: Moorpark Recycled Water Project Phase IV Type of Benefit Claimed: Reduced Emissions of Greenhouse Gases Measure of Benefit Claimed (Name of Units): Metric Tons (MT) Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Carbon Emissions (MT)	With Project Carbon Emissions (MT)	Change Resulting from Project (b) – (c) Net Carbon Emissions Reduction (MT)
2012			
2013			
2014			
2015			
2016	307.7	49.0	258.7
2017	615.3	98.0	517.3
2018	615.3	98.0	517.3
2019	615.3	98.0	517.3
2020	615.3	98.0	517.3
2021	615.3	98.0	517.3
2022	615.3	98.0	517.3
2023	615.3	98.0	517.3
2024	615.3	98.0	517.3
2025	615.3	98.0	517.3
2026	615.3	98.0	517.3
2027	615.3	98.0	517.3
2028	615.3	98.0	517.3
2029	615.3	98.0	517.3
2030	615.3	98.0	517.3
2031	615.3	98.0	517.3
2032	615.3	98.0	517.3
2033	615.3	98.0	517.3
2034	615.3	98.0	517.3
2035	615.3	98.0	517.3
2036	615.3	98.0	517.3
2037	615.3	98.0	517.3
2038	615.3	98.0	517.3
2039	615.3	98.0	517.3
2040	615.3	98.0	517.3
2041	615.3	98.0	517.3
2042	615.3	98.0	517.3
2043	615.3	98.0	517.3

TABLE C5 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project Carbon Emissions (MT)	With Project Carbon Emissions (MT)	Change Resulting from Project (b) – (c) Net Carbon Emissions Reduction (MT)
2044	615.3	98.0	517.3
2045	615.3	98.0	517.3
2046	615.3	98.0	517.3
2047	615.3	98.0	517.3
2048	615.3	98.0	517.3
2049	615.3	98.0	517.3
2050	615.3	98.0	517.3
2051	615.3	98.0	517.3
2052	615.3	98.0	517.3
2053	615.3	98.0	517.3
2054	615.3	98.0	517.3
2055	615.3	98.0	517.3
2056	615.3	98.0	517.3
2057	615.3	98.0	517.3
2058	615.3	98.0	517.3
2059	615.3	98.0	517.3
2060	615.3	98.0	517.3
2061	615.3	98.0	517.3
2062	615.3	98.0	517.3
2063	615.3	98.0	517.3
2064	615.3	98.0	517.3
2065	615.3	98.0	517.3
2066	307.7	49.0	258.7

the schedule for project construction (with benefits beginning to accrue in 2016), the project will result in a net energy savings of 73,238 MWh and a net CO_2 emissions reduction of 25,865 MT over the 50-year project life.

Summary of Annual Project Physical Benefits

By providing a local source of recycled water, the project will result in the avoided use of 425 AFY of imported water from the SWP (at full implementation). This will increase water supply reliability within the WWD1 service area and make more SWP water available for other users within the state. Over its 50-year life, the project will avoid a total of 21,250 AF of imported SWP water.

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 use. For this project, 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. Over the lifetime of the project, total avoided fertilizer use will amount to 1,158,149 pounds.

Reduced reliance on SWP water will reduce the amount of salts imported into the Watershed. This will help to improve salt-related water quality issues within the Watershed. As a result of the project, the introduction of 157 MT of salts into the Watershed will be avoided each year, which amounts to 7,865 MT of salts over the 50-year project life.

Finally, reductions in imported water will avoid having to expend the energy required to pump and treat the imported water, which in turn will reduce CO_2 emissions. Taking into account the energy used to treat and distribute recycled water, the project will result in a net energy savings of 1,462 MWh per year and a net reduction in CO_2 emissions of 517 MT per year. This amounts to a net energy savings of 73,238 MWh and a net CO_2 emissions reduction of 25,865 MT over the 50-year project life.

References

All the references below are provided as attachments to this Technical Justification (Att7_IG2_TechJust_4of7).

- Calleguas. 2007. *CO2 Emissions and Imported State Project Water to Ventura County. Memorandum from General Manager to Board of Directors.* Calleguas Municipal Water District. January 25.
- CEC. 2011. *Energy Almanac. California Electrical Energy Generation, 1997 to 2011, Total Production, by Resource Type*.
- Fruit Growers Laboratory. 2011. *General Irrigation Suitability Analysis.* Fruit Growers Laboratory, Inc., Santa Paula, CA. February 23.
- Larry Walker Associates. 2004. *Progress Report on Efforts to Address Salts on the Calleguas Creek Watershed. Submitted to Calleguas Creek Watershed Management Plan.* June 30.
- LARWQCB. 2007a. *Proposed Amendment to the Water Quality Control Plan – Los Angeles Region 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.*
- LARWQCB. 2007b. *Watershed Management Initiatives. Calleguas Creek Watershed Summary.* Los Angeles Regional Water Quality Control Board. December.
- U.S. EPA. 2012. *eGrid2012 Version 1.0 Year 2009 GHG Annual Output Emission Rates.*
- VCWWD1. 2012. *Moorpark Wastewater Treatment Plant 2011 Annual Report.* Ventura County Waterworks District No. 1.

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

Introduction

This attachment presents the technical justification for the South Oxnard Stormwater Flood Management and Community Enhancement Project Phase 2B. A project abstract and general discussion of the without project baseline are followed by a discussion of each physically quantified benefit and a summary of physically quantified benefits claimed.

Project Abstract

The South Oxnard Stormwater Flood Management and Community Enhancement Project Phase 2B includes two components. The first component will construct a cover for 2,700 linear feet of an open-channel drainage channel running through a South Oxnard disadvantaged community (DAC). This component will reduce the impacts of flood control facilities on an environmental justice community, improve public safety, unify a neighborhood currently divided by a fence and open channel, and allow the City of Oxnard to develop a linear park in the future. In addition to these improvements in the neighborhood through which the channel runs, 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 channel.

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 Technical Justification).

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.

Without Project Baseline

If the channel is not covered, it would remain open, lined by fences on either side that divide the neighborhood. The Ventura County Watershed Protection District (WPD) would have to continue to maintain the open channel and remove the trash and sediment that would be eliminated by covering the channel. Urban runoff would continue to carry contaminants such as heavy metals and fertilizers into the drain and eventually the Ormond Beach Lagoon. There would be no opportunity for the City of Oxnard to plant bioswales that would provide additional filtration benefits. The facility would continue to be a graffiti magnet and an eyesore.

Without this project, safety hazards associated with public walkways and bikeways adjacent to the J Street Drain would remain. The public hazard presented by the J Street Drain is documented in the photograph below. After swerving to avoid a bike, a car knocked down the fencing and crashed into J Street Drain. Without this project the City of Oxnard would not have the ability to develop a linear park that would allow the realization of future recreation benefits. Additionally, an environmental justice community would continue to be disproportionately burdened by the flood control facilities while deprived of benefits and resources like parks and open space in the vicinity.

The open configuration of the J Street Drain is a public safety hazard and allows trash and debris to enter the drain.

If the 20 acre parcel is not purchased, the land would remain in private ownership. The land, which was most recently under agricultural production, would not be available to the public for recreation. Without the project, this parcel is subject to future industrial development similar to the existing industrial development adjacent to the parcel.

The larger 1,000+ acre wetland restoration project requires a critical mass of acreage to function as a healthy system; the acreage included in this project, which is contiguous to 540 acres already purchased by The Nature Conservancy and targeted for restoration, would help to achieve that critical size. This acreage has been targeted by the California Coastal Conservancy (CCC) as contributing to the goal of maximizing restored aquatic habitat, creating new wetland habitat, and minimizing barriers between habitats (Aspen Environmental Group 2009). If it were not purchased, the CCC would not be able to proceed with the restoration project in the manner it expects to be most successful, potentially making restoration efforts more expensive or less likely to succeed.

Relationship of Project to Other Projects Included in the Proposal

This project is not dependent upon any other projects in this Proposal.

Description of Expected Physical Benefits

The following (quantifiable) physical benefits are expected from this project:

- Preserve Coastal Wetlands.

This benefit is discussed in further detail below.

Benefit: Preserve 20 acres of Coastal Wetlands

Background and Historical Conditions

The 20-acre parcel to be purchased and protected is part of the larger wetland restoration project being undertaken by the CCC and The Nature Conservancy. Currently 540 acres have been acquired with the goal of acquiring 1,000-1,500 acres in the Ormond Beach wetlands area. The area has been degraded due to agricultural and industrial use, but it remains a rare example in Southern California of an intact dune-transition zone-marsh system. The site is home to six federally protected species and more than 200 migratory bird species. Due to its unique ecology providing habitat for numerous migratory species, it is considered to be a highly important wetland restoration project in Southern California (California Coastal Conservancy 2010).

Without Project Conditions

If this land is not purchased, it would remain vulnerable to industrial development. The greater Ormond Beach restoration effort's goal is to preserve a wetland area large enough to be self-sustaining. If these acres are not added to the restoration project, this goal of a self-sustaining system may be more difficult to attain.

Methods Used to Estimate Benefits

The parcel to be purchased is 20 acres.

Benefit Uncertainty

There is no uncertainty about the size of the parcel in question. However, it is not possible to reliably quantify the additive effect that an additional 20 acres will have on the functioning of the larger wetland system.

New Facilities Required to Achieve Benefits

No new facilities will be required to achieve these benefits.

Potential Adverse Physical Effects

No adverse physical effects are expected from this project.

Summary of Benefits

The purchase of this parcel will preserve 20 acres of former wetlands in an area considered to be the best wetland restoration opportunity in Southern California. The acreage is contiguous to land that has already been purchased for the same purpose and will contribute to the greater goal of restoring at least 1,000 acres of wetlands in the area. The physical benefit associated with preserving 20 acres of coastal wetlands claimed for the project is shown in Table D1.

Summary of Annual Project Physical Benefits

This project will preserve 20 acres of coastal wetlands at Ormond Beach, an area considered one of the best opportunities for coastal wetland restoration in Southern California.

References

All the references below are provided as attachments to this Technical Justification (Att7_IG2_TechJust_5of7).

- Aspen Environmental Group. 2009. *Ormond Beach Wetland Restoration Feasibility Study*. Prepared for the California Coastal Conservancy. October, 2009.

- California Coastal Conservancy. 2010. *Ormond Beach Wetlands Restoration Project*. http://scc.ca.gov/2010/01/07/ormond-beach-wetlands-restoration-project/ Accessed March 8, 2013.

TABLE D1 – ANNUAL PROJECT PHYSICAL BENEFITS

Project Name: South Oxnard Stormwater Flood Management & Community Enhancement Project

Type of Benefit Claimed: Preservation of 20 Acres of Coastal Wetlands

Measure of Benefit Claimed (Name of Units): Acres

Additional Information About this Measure: None

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012	0	0	0
2013	0	0	0
2014	0	20	20
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0
...	0	0	0
End of Project Life - 2113	0	0	0

Comment: Reflects a one-time purchase of 20 acres of coastal wetlands in the Ormond Beach area.

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

Introduction

This attachment presents the technical justification for the Santa Clara River Restoration. A project abstract and general discussion of the without project baseline are followed by a discussion of each physically quantified benefit and a summary of the physically quantified benefits claimed.

Project Abstract

This project implements a giant reed (*Arundo donax;* arundo) control and habitat restoration program on 150 to 200 acres in the Santa Clara River floodplain for the river reach between Sespe Creek and Santa Paula Creek (six river miles) near 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 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 occur in locations where arundo removal and restoration have not yet occurred, including 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 and the Friends of the Santa Clara River.

The California Coastal Conservancy's goal is to create a large, contiguous riparian zone through a series of related but stand-alone restoration projects. Currently, arundo has been removed from 26.6 acres within the overall project area. The project will perform complementary restoration work on an additional 150 to 200 acres in the broader project area. Densities of invasive species in the project area increased significantly following a 2005 flood. Arundo densities are now 95 to 100 percent, whereas the density had been up to 50 percent previously.

Without Project Baseline

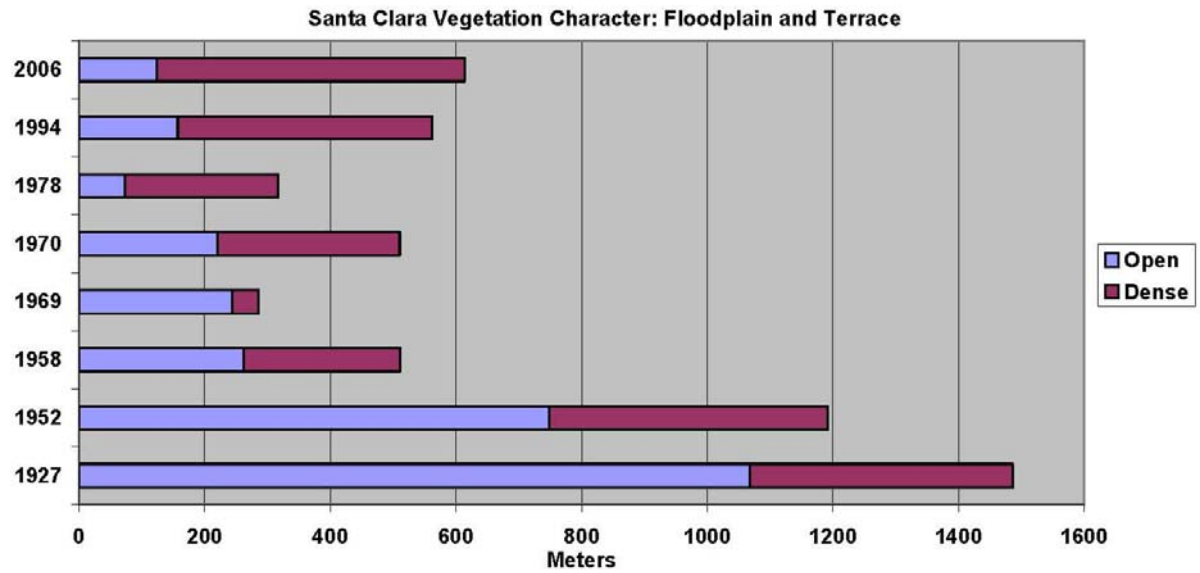
The project is part of a large-scale effort to eliminate arundo from the Santa Clara River Watershed to improve water resources in the Region. Figure E1 illustrates the change in arundo cover from 1927 to 2006 in the Santa Clara River Watershed where dense cover in the area is predominately arundo. Without this project, the trend established in Figure E1 would persist with the percentage of arundo dominant vegetation increasing.

An arundo-specific vegetation mapping of the area in 2007 (Giessow et al. 2011, provided with this Technical Justification) found that, "Arundo is abundant and well distributed throughout the 500-year floodplain of the lower Santa Clara River" (p. 4). They also identified that there has been no significant arundo removal from this area.

An Environmental Impact Report (EIR) prepared in 2006 evaluated the impacts of removal of arundo to the Santa Clara River and its tributaries. The findings showed that without removal the plants would continue to spread, using large amounts of water resources, and resulting in a decline in native habitats (VCRCD 2006).

Arundo is a large non-native grass that is characterized by extensive infestations and a range of severe impacts to both ecosystems and human infrastructure. The Invasive Species Group of the World Conservation Union includes arundo in its top 100 worst invaders of the world (Lowe et al. 2000, provided with this Technical Justification).

FIGURE E1
SANTA CLARA RIVER OPEN AND DENSE VEGETATION CLASSIFICATION ON FLOODPLAIN AND LOWER TERRACE AREAS FROM 1927 TO 2006



Source: Giessow et al., 2011.

Arundo has successfully invaded many rivers in Southern California, including the Santa Clara River, forming extensive monocultures and altering physical and biological processes (Coffman 2007). In California, infestations of arundo are known to increase risks of flooding, create fire hazards, out-compete indigenous riparian species for scarce water resources, and reduce the value of riparian habitat for most wildlife (Dudley and Collins 1995, Bell 1997, DiTomaso 1998, and Dudley 2000, all provided with this Technical Justification).

The large winter floods that occur naturally every few years is one of the primary factors contributing to the extensive distribution of arundo along rivers in this area (Bell 1997, provided with this Technical Justification). Pieces of arundo (rhizomes and culms) are dispersed downstream during flooding and establish vegetatively wherever they are deposited. Arundo is the most problematic weed in Southern California coastal rivers where it causes extensive flood damage, increases fire risk, and uses substantially more water than native vegetation.

Without the project, arundo would both remain and continue to spread, covering a greater percentage of the floodplain. Due to its high rate of water consumption and transpiration, the expansion of arundo would have a negative impact on surface water flows and groundwater recharge particularly in the Santa Paula Basin which is in overdraft downstream of the project area. Due to its flammable nature, the spread of arundo would increase fire danger in the area. Due to the large biomass that can accumulate during flooding events at bridges, continued arundo infestation would increase flooding impacts. The following impacts of arundo would continue and increase without this project:

- Significant increase in water usage compared to water use by native vegetation.
- Significant reduction in flow capacity, including a deepening of the channel and a transformation from a braided unstable channel to a laterally stable, single-thread channel.
- Modifications in sediment transport during flood events.

- Impacts associated with fire, including high fuel loads, hotter burn temperatures, and fire suppression impacts.
- Wildlife impacts, including Bell's vireo and the arroyo toad, the southwestern willow flycatcher, southern steelhead, and tidewater goby. Additionally, without the project, this area would continue to experience higher risk and consequence of both wildfires and floods. Arundo would continue to crowd out and out-compete native plant species, leading to a continued decline in native habitats and limited habitat value for special-status and other native wildlife species.

Relationship of Project to Other Projects Included in the Proposal

This project is one of two invasive species removal projects in this Proposal. The other project is the Ventura River Invasive Plant Removal and Ecosystem Restoration Project. This project is not dependent upon any other projects in this Proposal.

Description of Expected Physical Benefits

The following *quantifiable* physical benefit is expected from this project:

- Water savings of 3,500 AFY (Giessow et al. 2011).

This benefit is discussed in further detail below.

Benefit: Water Savings of 3,500 AFY

This project reduces water consumed by vegetation by removing the non-native invasive species especially arundo. The reduction in arundo creates an increase in water available for surface water flows and groundwater recharge of between 3,000 and 4,000 AFY. Using an estimate of 3,500 AFY over the 50-year project life, arundo removal will conserve 175,000 AF.

Background and Historical Conditions

The project area is located upstream of both the Santa Paula and Oxnard groundwater basins, both of which are in overdraft. Surface water and groundwater flowing through the project area is the primary source of recharge to these groundwater basins and is also needed for in-stream habitat flows for steelhead. Surface water diversions at the Freeman Diversion, about 10 miles downstream of the project, are delivered to spreading basins and pipelines to recharge the Oxnard Plain and Pleasant Valley, both of which are in overdraft. A map outlining the groundwater basins in Ventura County is provided in Figure E2. A recent study by the California Invasive Plant Council (Giessow et.al *Arundo donax Distribution and Impact Report*, March 2011, provided with this Technical Justification) shows that arundo can use up to six times as much water as native vegetation. Thus, the amount of water available for in-stream habitat uses and the amount reaching the recharge areas of the overdrafted basins located downstream is unnecessarily reduced by arundo.

Groundwater and surface water in the Santa Clara River Watershed is the primary supply but is oversubscribed as evidenced by:

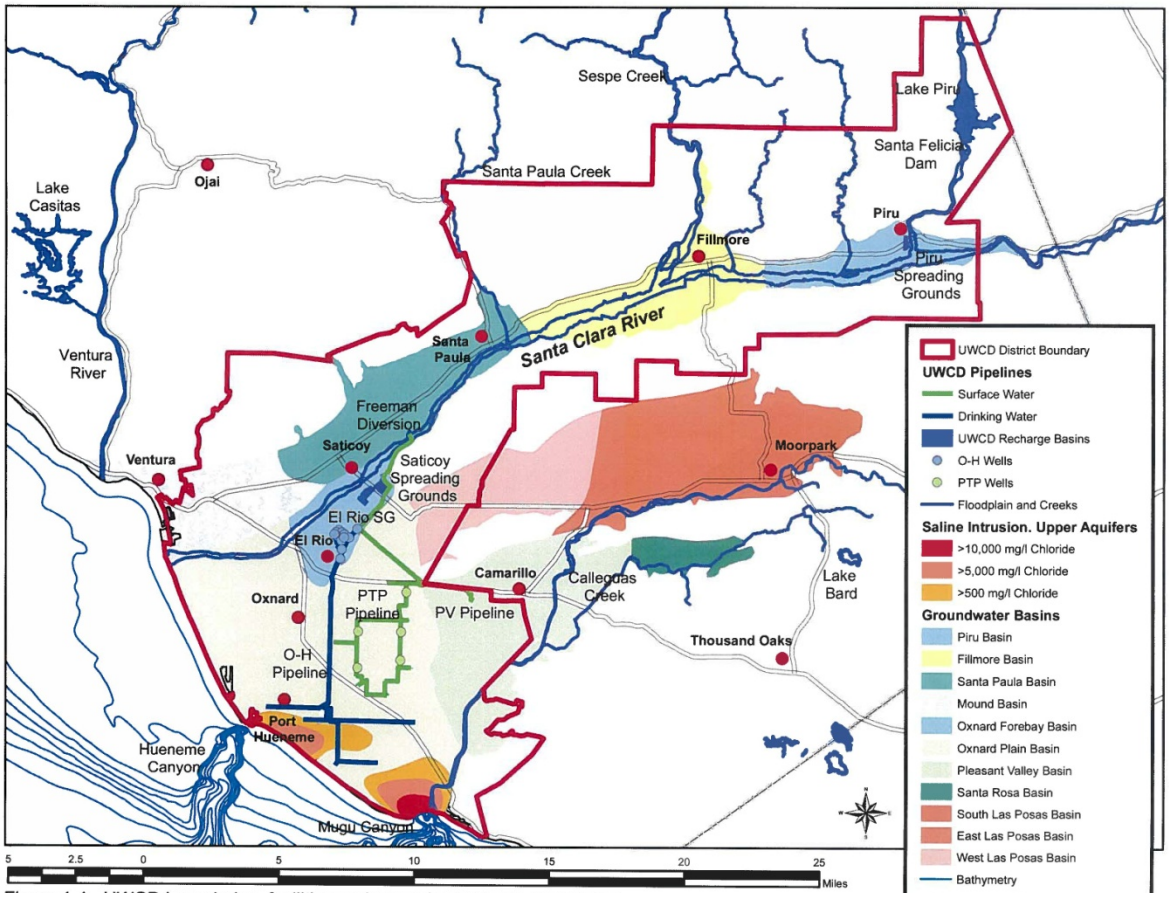
- The current overdraft conditions in the Santa Paula groundwater basin located directly downstream of this section of the Santa Clara River (UWCD 2011, provided with this Technical Justification).
- The current discussions concerning the need to increase in-stream flows in this river reach and downstream reaches to meet the needs of salmon and steelhead fisheries (VCRCD 2006, provided with this Technical Justification).
- The need for imported water to meet local water demand (UWCD 2011).

Each of these issues are discussed here briefly.

Overdraft Conditions

The surface and groundwater from the project area flow down-gradient to the Santa Paula groundwater basin and ultimately to the Oxnard groundwater basin. The City of Ventura, United Water Conservation District (UWCD), and 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). Both basins are currently considered to be in overdraft conditions (UWCD 2011).

FIGURE E2
GROUNDWATER BASIN BOUNDARIES AND UNITED WATER CONSERVATION DISTRICT FACILITIES



Source: UWCD, 2012a.

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 Basin continue today with the annual overdraft amount estimated to be about 20,000 to 25,000 AFY (UWCD 2012). Overdraft has resulted in seawater intrusion the southern portion of the Oxnard Basin and was one of the reasons for the creation of UWCD. As intrusion of seawater increased in the 1950s through the 1980s, UWCD responded by increasing recharge and decreasing pumping. Climate change related sea level rise is likely to exacerbate saline intrusion in the Oxnard Basin. It is well understood that elimination of groundwater overdraft conditions will largely mitigate the worsening of chloride impacts on the southern Oxnard Basin. Because of the significant interaction between all the groundwater basins in the Region, recharge at spreading grounds and reduced pumping in the Santa Paula Basin have positive impacts on saline intrusion in the Oxnard Basin (UWCD 2011). Improvement of overdraft conditions in the Santa Paula and Oxnard Basins contributes to reducing the extent of and impact of seawater intrusion.

In-Stream Flow Discussions

The Freeman Diversion, located just downstream from the project area, diverts water from the Santa Clara River to provide artificial recharge and direct water deliveries in the overdrafted Oxnard Plain Basin and Pleasant Valley Basin (located in Calleguas Creek Watershed). Recently, the facility has been required to provide bypass flows for the upstream and downstream migration of the endangered Southern California steelhead. In 2011 an estimated 2,400 to 3,000 AF of water was directed to fish migration flows that otherwise would have been used for groundwater recharge (UWCD 2011). The allocation for fisheries at the Freeman Diversion is currently being debated as part of a proposal to build a new fish passage structure at this location (UWCD 2011). In summary, there will be more water needed for in-stream uses and less water available for groundwater replenishment, making excess water use by arundo increasingly problematic.

Imported Water

The Santa Clara River Watershed has very limited access to imported water. UWCD imports roughly 3,000 to 4,000 AFY (UWCD 2011) water from the SWP to its Santa Felicia Dam for later release to recharge the aforementioned groundwater basins. Although there are 20,000 AFY of SWP entitlements available to water agencies located outside of Calleguas service area, there is no direct conveyance. UWCD receives its water from Pyramid Lake via Piru Creek and is limited by environmental restrictions associated with this method of conveyance. Given the limited access to imported water, it is that much more important to avoid unnecessary excess water use by arundo.

Without Project Conditions

Arundo, originally introduced as an ornamental plant, has successfully invaded many rivers in Southern California, including the Santa Clara, forming extensive monocultures and altering physical and biological processes (Coffman 2007, provided with this Technical Justification). In California, infestations of arundo are known to increase risks of flooding, create unnatural fire hazards, outcompete indigenous riparian species for scarce water resources, and reduce the value of riparian habitat for most wildlife (Dudley and Collins 1995, Bell 1997, and Dudley 2000 all provided with this Technical Justification).

Without this project, water that is currently being used by the non-native water intensive species arundo would not be available for any of the unmet water needs in Ventura County, principally, in-stream flows and groundwater recharge. Specifically, without this project 150 to 200 acres of riparian zone in the Santa Clara River Watershed would not be treated for arundo removal. Arundo density on these acres is reported to be 95 to 100 percent and is assumed to be 100 percent for analysis purposes. Thus, without the project, 3,500 AFY of water would continue to be wasted by arundo.

Methods Used to Estimate Water Savings Benefit

In the Giessow et al. (2011) study, *Arundo Donax: Distribution and Impact Report*, conducted by the California Invasive Plant Council, a review of recent studies and literature, as well as regional field data, was conducted to develop a geographically specific value for the water loss resulting from arundo infestation. One of the research sites was the Santa Clara River Watershed.

The researchers concluded that, on average, removing arundo from 1 acre will result in a net gain of 20 AFY of water compared to water use by native vegetation. Arundo was estimated to use 24 AFY per acre while native vegetation was estimated to use 4 AFY per acre. This was considered a conservative estimate because onsite values of water use from arundo in the Santa Clara River Watershed were identified as more than 40 AFY. The more conservative value was selected in order for the values to be more in line with national findings.

In the Executive Summary of the *Arundo Donax: Distribution and Impact Report*, the authors conclude:

> Removing arundo from one acre would result in a net gain of 20 AFY of water. This estimate includes adjustments for replacement vegetation, as well as a reduction of arundo water use to bring it into

alignment with other forms of vegetation that consume large amounts of water. This is a large potential water use reduction that could have significant implications for both the ecosystem and human water use. Spatial data, used in conjunction with stand leaf area measurements and published leaf transpiration rates, generated an arundo stand-based water use value that was extremely high (40 mm/day) compared to most other plants.

This project will treat and remove arundo from 150 to 200 acres for an annual water supply savings of 3,000 AFY to 4,000 AFY. 3,500 AFY was used to calculate a total water savings of 175,000 AF over the 50-year project life. Water savings are assumed to be proportional to the percent of project budget spent during the implementation period of the project after allowing a one-year lag for arundo removal to result in savings – e.g., with 40 percent of the project budget spent in year 2013, 40 percent of the total savings are assumed to start accruing in 2014; with 70 percent of the project budget spent by year 2014, 70 percent of total water savings is assumed to be accruing by year 2015. The pattern continues for 90 percent of the project budget having been spent by 2015 and 100 percent spent by 2016. Savings are assumed to last for 50 years.

Benefit Uncertainty

Reinfestation of arundo following a fire or flood could reduce the timeframe of project benefits.

Arundo stand-based transpiration values are derived based on average leaf area and leaf transpiration values. The uncertainty surrounding the assumptions used in selecting these values define the uncertainty for arundo water uptake values. The *Arundo Donax: Distribution and Impact Report* (Giessow et al., 2011; the study used in generating values in this analysis) found an average leaf area for arundo stands in the Santa Clara River Watershed of 15.8 m^2/m^2. This value was within the range of values reported in other studies. The leaf area value for the study area was then used with published leaf transpiration values to generate a stand-based transpiration value of 40 mm/day. There are only two published studies for arundo stand-based transpiration. Another study conducted on the Santa Clara River Watershed found a similar stand transpiration value of 41.1 mm/day (Abichandani 2007, provided with this Technical Justification). Stand structure, density, and leaf area were all comparable to data collected for this study. The other published paper found a much lower stand-based transpiration value of 9.1 mm/day (Watts 2009, provided with this Technical Justification). This study was on the Rio Grande River in Texas. Stands there were shorter and had significantly lower leaf area.

The assumptions used are directly applicable to this study as one of the research sites was within the Santa Clara River Basin. The *Arundo Donax: Distribution and Impact Report* authors take a very conservative approach for assigning transpiration values to arundo. Although they find a value of 41.1 mm/day, this value is so high that they chose to use a lower value of 20 mm/day in order to be conservative. Therefore, it is believed that the water savings benefits presented here are very conservative and actual water savings are likely to be higher.

New Facilities Required to Achieve Benefit

No new facilities are required to achieve this benefit.

Potential Adverse Physical Effects

No potential adverse physical effects are anticipated to occur due to this project.

Summary of Benefit

As is shown in Table E1, this project will treat and remove arundo from 150 to 200 acres for an annual water supply savings of 3,000 AFY to 4,000 AFY. Using a value of 3,500 AFY results in a total water savings of 175,000 AF over the 50-year project life.

Summary of Annual Project Physical Benefits

By reducing the use of water by non-native plants, the project will create a water savings of between 3,000 AFY and 4,000 AFY. A mid-range value of 3,500 AFY was used for all calculations.

TABLE E1 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP)			
Project Name: Santa Clara River Restoration			
Type of Benefit Claimed: Water savings from arundo removal			
Measure of Benefit Claimed (Name of Units): acre-feet per year			
Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012	0		
2013	0		
2014	0	1400	1400
2015	0	2450	2450
2016	0	3150	3150
2017	0	3500	3500
2018	0	3500	3500
2019	0	3500	3500
2020	0	3500	3500
2021	0	3500	3500
2022	0	3500	3500
2023	0	3500	3500
2024	0	3500	3500
2025	0	3500	3500
2026	0	3500	3500
2027	0	3500	3500
2028	0	3500	3500
2029	0	3500	3500
2030	0	3500	3500
2031	0	3500	3500
2032	0	3500	3500
2033	0	3500	3500
2034	0	3500	3500
2035	0	3500	3500
2036	0	3500	3500
2037	0	3500	3500
2038	0	3500	3500
2039	0	3500	3500

TABLE E1 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2040	0	3500	3500
2041	0	3500	3500
2042	0	3500	3500
2043	0	3500	3500
2044	0	3500	3500
2045	0	3500	3500
2046	0	3500	3500
2047	0	3500	3500
2048	0	3500	3500
2049	0	3500	3500
2050	0	3500	3500
2051	0	3500	3500
2052	0	3500	3500
2053	0	3500	3500
2054	0	3500	3500
2055	0	3500	3500
2056	0	3500	3500
2057	0	3500	3500
2058	0	3500	3500
2059	0	3500	3500
2060	0	3500	3500
2061	0	3500	3500
2062	0	3500	3500
2063	0	3500	3500
2064	0	2100	2100
2065	0	1050	1050
2066	0	350	350
Comments: Water savings assumptions: Arundo removal reduces vegetative water use by 20 AFY. This project will treat and remove arundo from 150 – 200 acres for a water supply savings of 3,000 AFY to 4,000 AFY. A middle value of 3,500 AFY was used for all calculations.			

References

All the references below are provided as attachments to this Technical Justification (Att7_IG2_TechJust_6of7).

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

Introduction

This attachment presents the technical justification for the Ventura River Restoration Project. A project abstract and general discussion of the without project baseline are followed by a discussion of each physically quantified benefit and a summary of the physically quantified benefits claimed.

Project Abstract

This project primarily implements a giant reed (*Arundo donax;* arundo) control and habitat restoration program in approximately 43 acres along 6 miles of 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, as well as some private property immediately adjacent to the VHC parcels. 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.

Methods for invasive plant removal will be based on best management practices described in the WPD's *Matilija Dam Giant Reed Removal Plan*. In order to minimize re-establishment of arundo, retreatment will be conducted over three subsequent years upon removal.

The project will also enhance public access to the Ventura River and water-related recreation activities. WPD will improve an existing access road on the OVLC Steelhead Preserve, upgrade existing bathroom facilities to meet Americans with Disabilities Act (ADA) standards, install a trailhead kiosk, and landscape the grounds surrounding the public restrooms and future Education and Conservation Center.

Without Project Baseline

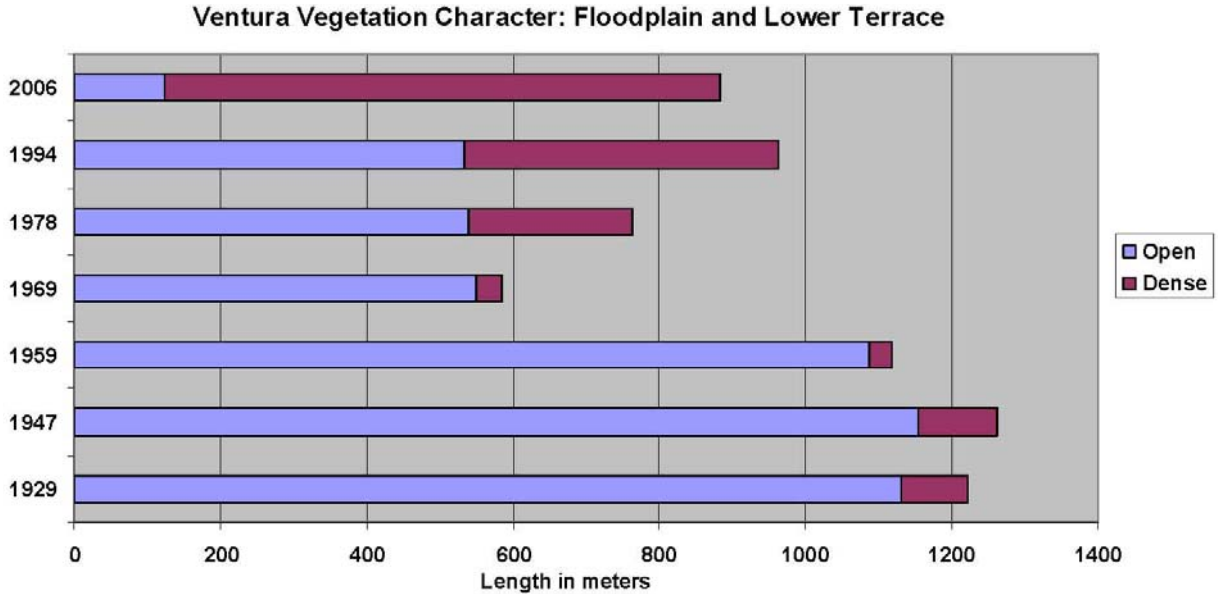
The project is part of a large-scale effort to eliminate giant reed (Arundo donax; arundo) from the Ventura River Watershed to improve water resources in the Region. Figure F1 illustrates the change in arundo cover from 1927 to 2006 in the Ventura River Watershed – where dense cover in the area is predominantly arundo. Without this project, the trend established in Figure F1 would continue with the percentage of arundo-dominant vegetation increasing.

Arundo is a large non-native grass that is characterized by extensive infestations (Figure F2) and a range of severe impacts to both ecosystems and human infrastructure. The Invasive Species Group of the World Conservation Union includes arundo in its top 100 worst invaders of the world (Lowe et al. 2000, provided with this Technical Justification).

Arundo has successfully invaded many rivers in Southern California, including the Ventura River, forming extensive monocultures and altering physical and biological processes (Coffman 2007, provided with this Technical Justification). In California, infestations of arundo are known to increase risks of flooding, create fire hazards, out-compete indigenous riparian species for scarce water resources, and reduce the value of riparian habitat for most wildlife (Dudley and Collins 1995, Bell 1997, DiTomaso 1998, and Dudley 2000, all provided with this Technical Justification).

The large winter floods that occur naturally every few years is one of the primary factors contributing to the extensive distribution of arundo along rivers in this area (Bell 1997, provided with this Technical Justification). Pieces of arundo (rhizomes and culms) are dispersed downstream during flooding and establish vegetatively wherever they are deposited. Arundo is the most problematic weed in Southern California coastal rivers where it causes extensive flood damage, increases fire risk, and uses substantially more water than native vegetation.

FIGURE F1
VENTURA RIVER OPEN AND DENSE VEGETATION CLASSIFICATION ON FLOODPLAIN AND LOWER TERRACE AREAS FROM 1929 TO 2006



Source: Giessow et al., 2011.

FIGURE F2
THICK STANDS OF ARUNDO

Without the project, arundo would continue to spread, covering a greater percentage of the Watershed. Due to its high rate of water consumption and transpiration, the expansion of arundo would have a negative impact on groundwater supply and surface water flows downstream. Due to its flammable nature, the spread of arundo would increase fire danger in the area. Due to the large biomass that can accumulate during flooding events at bridges, continued arundo infestation would increase flooding impacts.

The following impacts of arundo would continue and increase without this project:

- Significant increase in water usage versus native vegetation.
- Significant reduction in flow capacity, including a deepening of the channel and a transformation from a braided unstable channel to a laterally stable, single-thread channel.
- Modifications in sediment transport during flood events.
- Impacts associated with fire, including high fuel loads, transient camps as ignition sources, hotter burn temperatures, and fire suppression impacts.
- Wildlife impacts, including Bell's vireo and the arroyo toad, the southwestern willow flycatcher, southern steelhead, and tidewater goby.

This project also includes work to benefit a future Education and Conservation Center. The work in this project will include design and construction work. Funding for the Center is primarily from a California Coastal Conservancy grant and may occur simultaneously with the work in this grant application. Without funding for this project, the following Center design and installation activities would not occur:

- Construction of a trailhead kiosk and interpretive trail signage.
- Installation of creative exhibits (already planned) in the Center.
- Landscaping of the grounds around the areas surrounding the Center.
- Upgrade of an existing bathroom to ensure ADA accessibility.
- Upgrade of the access road to meet Ventura County standards for "all-weather" access.

Relationship of Project to Other Projects Included in the Proposal

This project is one of two invasive species removal projects in this Proposal. The other project is the Santa Clara River Restoration, located in the Santa Clara River Watershed. This project is not dependent upon any other projects in this Proposal.

Description of Expected Physical Benefits

The following quantifiable physical benefits are expected from this project:

- Water savings of 284 AFY.

This benefit is discussed in further detail below.

Benefit: Water Savings of 284 AFY

This project reduces the water consumed by vegetation by removing the non-native invasive species especially arundo. The reduction in arundo creates an increase in water available for surface water flows and groundwater recharge of 284 AFY and 14,200 AF over the 50-year project life.

Background and Historical Conditions

The project is part of the overall Matilija Dam Ecosystem Restoration Project (MDERP), which will span the next 10 to 15 years as the project is implemented and followed with monitoring and maintenance. The overarching MDERP covers nearly 33 miles of the Ventura River and Matilija Creek from the ocean to the headwaters. The WPD is the local sponsor to the U.S. Army Corps of Engineers for this ecosystem restoration project. The Matilija Dam, built in 1947, was designed for water storage and flood control. Accumulation of approximately 6 million cubic yards of sediment has nearly completely displaced the water storage capacity. The dam removal and the Matilija Creek restoration will open 17.3 miles of spawning and rearing habitat in Matilija Creek and its tributaries to endangered southern steelhead (*Oncorhynchus mykiss)*. It will also

restore sediment transport to reverse river floodplain and beach erosion. Removal of arundo and other non-native plants will improve native habitats that support 26 special-status species and reduce water consumption by arundo on more than 2,000 acres of the river corridor.

Through projects already in place, the WPD has restored habitat on over 17 miles of Matilija Creek and the upper Ventura River. The work started with the initial project, funded in part under a Proposition 40 Consolidated Grant, which treated 190 acres of invasive plants within 1,100 acres, starting from the headwaters of Matilija Creek to an area about 3 miles upstream of the Highway 150 bridge. The work continued downstream on an additional 3 miles to the Highway 150 Bridge, funded in part through a grant from The California Natural Resources Agency River Parkways Program.

Both surface water and groundwater in the Ventura River Basin move down-gradient either through direct percolation or through diversion of water at the City of Ventura's Foster Park facilities.

There is no access to imported water in the Ventura River Watershed; residents, agriculture, and businesses are dependent on local supplies, including surface water from the Ventura River and local groundwater. The surface water supply is variable. The groundwater basin is shallow with an estimated storage capacity of no more than 14,000 AF (WPD 2012) and there are limited opportunities for 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 main stem. 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).

Additionally, 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 the local fisheries. The City of Ventura's historical water rights to the Ventura River may be significantly limited in the future as concern for the health of the endangered Southern California steelhead and its habitat ecosystem restrict how much and at what time of the year this water source is available (Ventura 2013).

Without Project Conditions

Arundo has successfully invaded many rivers in Southern California, including the Ventura River, forming extensive monocultures and altering physical and biological processes (Coffman 2007). In California, infestations of arundo are known to increase risks of flooding, create unnatural fire hazards, out-compete indigenous riparian species for scarce water resources, and reduce the value of riparian habitat for most wildlife (Dudley and Collins 1995, Bell 1997, DiTomaso 1998, and Dudley 2000).

Specifically, without this project, 43 acres of highly infested riparian zone would not be treated for arundo removal. Without arundo removal, Ventura River water users would continue to have 284 AFY less groundwater supplies or surface water supplies to draw upon.

Methods Used to Estimate Benefits

In the Giessow et al. (2011) study *Arundo Donax: Distribution and Impact Report* (conducted by the California Invasive Plant Council), a review of recent studies and literature, as well as regional field data, was conducted to develop a geographical specific value for the water loss in watershed systems resulting from arundo invasion. One of the research sites was the nearby Santa Clara River Watershed.

The researchers concluded that, on average, removing arundo from 1 acre would result in a

net gain of 20 AFY of water. Arundo was estimated to use 24 AFY per acre, while native vegetation was estimated to use 4 AFY per acre. This was considered a conservative estimate because onsite values of water use from arundo in the nearby Santa Clara River Watershed were identified as over 40 AFY. The more conservative value was selected in order for the values to be more in line with national findings.

In the Executive Summary of the *Arundo Donax: Distribution and Impact Report*, the authors conclude:

> Removing Arundo from one acre would result in a net gain of 20 AFY of water. This estimate includes adjustments for replacement vegetation, as well as a reduction of Arundo water use to bring it into alignment with other forms of vegetation that consume large amounts of water. This is a large potential water use reduction that could have significant implications for both the ecosystem and human water use. Spatial data, used in conjunction with stand leaf area measurements and published leaf transpiration rates, generated an Arundo stand-based water use value that was extremely high (40 mm/day) compared to most other plants.

This project will treat and remove arundo from 43 acres at three different sites: Rio Vista Preserve, Ventura River Steelhead Preserve, and North and South Foster Park Preserve. It is estimated that approximately 23 acres will be treated at the Rio Vista Preserve, and a total of 20 acres will be treated at Ventura River Steelhead and North and South Foster Park Preserves. WPD estimates that arundo currently covers between 33 percent and 50 percent of the 23 acres that will be treated at Rio Vista Preserve, and 40 percent density of arundo coverage was used. Based on recent vegetation mapping, WPD also estimates a density of 20 percent to 25 percent of the acreage at the other two sites (25 percent density of arundo coverage was assumed). Thus, to estimate water supply savings, 20 AFY (total water savings per acre assuming 100 percent coverage of arundo) was multiplied by the number of treated acres (43 acres) and adjusted for the percentage of the 43 acres that is currently covered by arundo (weighted average of about 33 percent).

Based on these assumptions, this project will result in an annual water supply savings of 284 AFY. Over the 50-year project life, 14,200 AF of water will be saved.

Benefit Uncertainty

Reinfestation of arundo following fire or flood could decrease the timeframe of project benefits.

Arundo stand-based transpiration values are derived based on average leaf area and leaf transpiration values. The uncertainty surrounding the assumptions used in selecting these values define the uncertainty for arundo water uptake values. The *Arundo Donax: Distribution and Impact Report* (Giessow et al. 2011; the study used in generating values in this report) found an average leaf area (Leaf Area Index; LAI) for arundo stands in the nearby Santa Clara River Watershed of 15.8 m^2/m^2. This value was within the range of LAI values reported in other studies. The study area LAI value was then used with published leaf transpiration values to generate a stand-based transpiration value of 40 mm/day. There are only two published studies for arundo stand-based transpiration. One study found a similar stand transpiration value of 41.1 mm/day (Abichandani 2007). It was conducted in the nearby Santa Clara River Watershed. The only other published paper found a much lower stand-based transpiration value of 9.1 mm/day (Watts 2009). This study was on the Rio Grande River in Texas. Stands there were shorter and had significantly lower leaf area.

The assumptions used are directly applicable to this study as one of the research sites was within the nearby Santa Clara River Basin. The *Arundo Donax: Distribution and Impact Report* authors take a very conservative approach for assigning transpiration values to arundo. Although they find a value of 41.1 mm/day, this value is so high that they chose to use a lower value of 20 mm/day in order to be conservative and more in line with other study findings. Therefore, it is believed that the water savings benefits presented here are very conservative, and actual water savings are likely to be higher.

New Facilities Required to Achieve Benefits

No new facilities are required to achieve this benefit.

Potential Adverse Physical Effects

No potential adverse physical effects are anticipated to occur due to this project.

Summary of Benefit

This project will treat and remove arundo from 43 highly arundo-infested acres for an annual water supply savings of 284 AFY. Assuming the project life is 50 years, the project has a water savings of 14,200 AF. The physical benefit associated with an increase in water supply claimed for this project is shown in Table F1.

Summary of Annual Project Physical Benefits

This project claims physical benefits associated with water supply savings from arundo removal. By reducing the use of water by non-native plants, the project will create a water savings of 284 AFY.

References

All the references below are provided as attachments to this Technical Justification (Att7_IG2_TechJust_7of7).

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TABLE F1 – ANNUAL PROJECT PHYSICAL BENEFITS (Table 9 of PSP) Project Name: Ventura River Restoration Type of Benefit Claimed: Water savings from arundo removal Measure of Benefit Claimed (Name of Units): Acre-Feet Additional Information About this Measure:_____			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	71	71
2016	0	142	142
2017	0	213	213
2018	0	284	284
2019	0	284	284
2020	0	284	284
2021	0	284	284
2022	0	284	284
2023	0	284	284
2024	0	284	284
2025	0	284	284
2026	0	284	284
2027	0	284	284
2028	0	284	284
2029	0	284	284
2030	0	284	284
2031	0	284	284
2032	0	284	284
2033	0	284	284
2034	0	284	284
2035	0	284	284
2036	0	284	284
2037	0	284	284
2038	0	284	284
2039	0	284	284
2040	0	284	284
2041	0	284	284
2042	0	284	284
2043	0	284	284
2044	0	284	284
2045	0	284	284

TABLE F1 cont.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2046	0	284	284
2047	0	284	284
2048	0	284	284
2049	0	284	284
2050	0	284	284
2051	0	284	284
2052	0	284	284
2053	0	284	284
2054	0	284	284
2055	0	284	284
2056	0	284	284
2057	0	284	284
2058	0	284	284
2059	0	284	284
2060	0	284	284
2061	0	284	284
2062	0	284	284
2063	0	284	284
2064	0	284	284
2065	0	213	213
2066	0	142	142
2067	0	71	71
Comments: Arundo removal reduces vegetative water use by 20 AFY, assuming 100% full coverage of arundo. This project will treat and remove arundo from 43 acres with an average density of 33%. It is assumed 25% of project benefits are realized in 2015, 50% benefits in 2016; 75% of project benefits by 2017, and 100% by 2018. The useful life of the project is assumed to be 50 years, and so benefits in the last years of project life are phased out in the same way as they were phased in.			

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