SOUTH ORANGE COUNTY WMA 2015 IRWM IMPLEMENTATION GRANT PROPOSAL

ATTACHMENT 2

PROJECT JUSTIFICATION

I. PROJECT SUMMARY TABLE

Complete the following table by marking the applicable IRWM project element(s) in the table. Each project must match at least one project element. The applicant must submit one Table 4 that includes one column for each proposed project.

Table 4. 2015 IRWM Grant Solicitation Project Summary Table

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table							
IRWM Project Element		Dairy Fork Wetland	San Juan Aquatic Passage and Habitat Improvement	Crown Valley Park Channel Entry Improvements	Strategic Turfgrass Removal & Design Assistance Program	3A Water Recycling Plant Tertiary Expansion	Recycled Water Distribution Upgrade
IR.1	Water supply reliability, water conservation, and water use efficiency			X	X	X	X
IR.2	Stormwater capture, storage, clean-up, treatment, and management	X		X			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands	X	X	X	X		
IR.4	Non-point source pollution reduction, management, and monitoring	X	X	X	X		
IR.5	Groundwater recharge and management projects						
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users					X	X
IR.7	Water banking, exchange, reclamation, and improvement of water quality		X			X	X
IR.8	Planning and implementation of multipurpose flood management programs			X			
IR.9	Watershed protection and management	X	X	X			
IR.10	Drinking water treatment and distribution						
IR.11	Ecosystem and fisheries restoration and protection	X	X	X			

II. PROJECT DESCRIPTION

1. Dairy Fork Wetland

- **Brief description project:** The Project includes habitat restoration and construction of a wetland for treating 325 acre-feet per year (AFY) of urban runoff draining from 1,500 acres.

- **Expanded project description:** The Dairy Fork Wetland Project (Project) includes two phases. The first phase includes the construction of a wetland to reduce pollutant loads in urban runoff from the Dairy Fork sub-watershed, which is a tributary area of Aliso Viejo Creek Watershed. The wetland will treat 325 AFY of urban runoff draining from 1,500 acres of highly urbanized land. This Project will enhance the protection of Aliso Creek as well as the surrounding native species through the removal of invasive non-native plants from around the wetland site and re-vegetation of 2 acres of native species. Runoff from the Dairy Fork sub-watershed area was found to carry pollutants such as bacteria, metals, nutrients, total suspended solids (salts) and motor oil that impact the quality of receiving water. This contamination has created conditions that threaten the purity of Aliso beach, vegetation, and habitat, along with Aliso Creek and its tributary. The Project will decrease water pollution by filtering contaminants from urban runoff through the wetland. Specifically, Aliso Creek will benefit from the proposed wetland as it will reduce sediment, bacteria, metals, nutrients, and motor oil found in the runoff from the Dairy Fork sub-watershed. The average Total Suspended Solids (TSS) in dry weather runoff is 45 mg/L. The wetland is expected to remove 90% of TSS to achieve 5 mg/L. Streams in Southern Orange County like Aliso Creek have persistent issues with nutrients; intercepting dry weather flows and reducing wet weather flows through the wetland will assist removal of nutrients and TSS which may in turn reduce algal growth and resultant impacts such as reduced dissolved oxygen and increased bacteria (Orange County Stormwater Program, State of the Environment Report, 2014). The native plant species that replace invasive or non-native plants over the 2 acre wetland area will serve as a natural purification system; thus decreasing potential water pollution from draining into Aliso Beach.

  The second phase is the removal of approximately 5 acres of invasive non-native *Arundo donax* (Arundo) stands over 9 total acres of riparian corridor in the Dairy Fork sub-watershed to Aliso Creek. Previous assessments of Arundo extent conducted by the Laguna Canyon Foundation and Orange County Transportation Authority (OCTA) have identified approximately 5 acres of dense Arundo severely impacting the creek dispersed along 9 acres of riparian corridor. Removal of these invasive plants will reduce stress on the riparian ecosystem, restore native habitat upstream and downstream of the wetland, as well as complement and expand the water quality improvement goals of the 2-acre Dairy Fork constructed wetland, resulting in greater biofiltration of pollutants, lower and more natural water temperatures and increased groundwater recharge due to the removal of high water-use Arundo.

- **Implementing agency/organization:** City of Aliso Viejo

- **How the project will address a current need of the region:** The current needs of the region include drought preparedness, improving water quality and protecting natural resources. The Project addresses drought preparedness by achieving long-term reduction of water use and water conservation through re-establishment of native plant species following invasive species removal. Invasive plant removal will enhance aquatic habitat and leave more water available for other resources. The Project will improve water quality for the Aliso Creek Watershed by treating polluted urban runoff in a constructed wetland, resulting in at least 90% reduction in TSS pollutant concentration in urban runoff. The Project is part of the Aliso Creek Comprehensive Load Reduction Plan (CLRP) that will assist the local participating watershed agencies (cities of Aliso Viejo, Lake Forest, Laguna Hills, and Laguna Woods) in achieving pollutant load reduction in compliance with regulations such as National Pollutant Discharge Elimination System municipal separate storm sewer systems (NPDES-MS4) Permit and bacteria Total Maximum Daily Loads (TMDLs) for Beaches and Creeks adopted by the San Diego Regional Water Quality Control Board (SDRWQCB) in 2011. The Project will also restore habitat by removing invasive plants from the wetland area and adjacent nine acres of riparian area. Reestablishment of native plants will also provide a more natural flow through the Dairy Fork sub-watershed providing more opportunities for native habitat and sensitive wildlife, including the endangered Least Bell's Vireo (*Vireo bellii pusillus*) and Species of Special Concern Southwestern Pond Turtle (*Actinemys marmorata pallida*), whose Aliso Creek population is among the most important yet imperiled in Orange County.

2. San Juan Aquatic Passage and Habitat Improvement

- **Brief description project:** The Project includes providing aquatic passage for two miles of stream, improving 145 acres of habitat and reducing sediment loading (concentration) by approximately 31 mg/liter.

- **Expanded project description**: The San Juan Aquatic Passage and Habitat Improvement Project (Project) includes removal of 16 dams, improvements to three stream crossings, and invasive weed removal along 2 miles of stream (Project area). Nine (9) of the rock and mortar dams were removed in 2014. Therefore, the remaining 7 dams will be removed as part of the proposed Project. Of the three stream crossings, the proposed Project includes improving one stream by replacing an undersized culvert with a large bridge, and the design of the other two stream crossings. Only one stream crossing will be replaced with a bridge as part of the proposed project, while the other bridge for the stream crossing will be funded by federal grant funds (not included in Project cost). The dam removals and stream improvements will connect 2 miles of stream that are currently disconnected by the dams, thereby improving 145 acres of riparian habitat. Dam removal and replacement of the undersized culvert stream crossing is also estimated to reduce sediment loading by a total of 145 cubic yards; estimates for reductions in sediment loading are calculated based upon average annual discharge and equate to approximately 31 mg/liter in Total Suspended Solids (TSS) reduced as a result of the Project.

  The proposed Project will improve aquatic habitat and aquatic passage in the San Juan watershed headwaters and implement the watershed plan for this area as well as the recovery plan for Southern California Steelhead. There is an ongoing effort by various entities to increase steelhead habitat and improve aquatic passage in the San Juan Watershed. The Project will improve and restore riparian areas impacted by invasive weeds, primarily treating invasive fig and Arundo in Holy Jim Creek. The invasive fig has taken over much of the canyon for over a mile of riparian corridor and Arundo annually uses 20 acre-feet per year per acre (AFY/acre) of water more than riparian vegetation (California Invasive Plant Council, Arundo donax Distribution and Impact Report. March 2011). The proposed fig treatment will serve as an investigation into methodologies by allowing the USDA Forest Service, Cleveland National Forest (Forest Service) to treat part of the infestation to assess the method that works best. Future treatments will be implemented based on adaptive management from treatment results.

  This Project began in 2014 when the Cleveland National Forest removed 9 of the rock and mortar dams using a grant from US Fish and Wildlife Service. An undersized culvert/stream crossing that poses an eight-foot jump for fish, or an aquatic passage barrier, has historically been a chronic sediment source and therefore is planned for bridge replacement during summer of 2015. In 2016, the replacement of two stream crossings will be designed and the invasive weed removal will begin. Between 2017 and 2019, the proposed Project will implement the replacement of 1 stream crossing and remove 7 of the rock and mortar dams.

- **Implementing agency/organization:** USDA Forest Service, Cleveland National Forest

- **How the project will address a current need of the region:** The current needs of the region include protecting natural resources, habitat restoration, and drought preparedness. The Project will protect natural resources by improving and restoring riparian areas impacted by invasive weeds, primarily treating invasive fig in Holy Jim Creek. The Project will provide habitat restoration by removing dams and replacing three crossings that will connect 2 miles of stream (that are currently disconnected) thereby improving 145 acres of riparian habitat. The Project will also stabilize the stream channel through dam removal/invasive plant removal, which will help reduce anthropogenic sedimentation in the San Juan Creek Watershed. The Project addresses drought preparedness by achieving long-term reduction of water use and water conservation through re-establishment of native plant species following invasive species removal. Regional climate change projections of rising temperatures will increase stresses on native plant and aquatic species as they compete for scarce resources. Invasive plant removal will enhance aquatic habitat and leave more water available for other resources. Invasive plants such as Arundo have been shown to use more than 20 AFY/acre of water compared to riparian vegetation (California Invasive Plant Council, 2011). Restoring natural habitat and stream connectivity will promote a supportive setting for native species to become more sustainable and successful.

3. Crown Valley Park Channel Entry Improvements

- **Brief description project:** Project responds to drought by reducing water consumption; improves the quality of surface flow from 1,197 watershed acres; mitigates flooding; and restores habitat.

- **Expanded project description**: The Crown Valley Park Channel Entry Improvements (Project) provides drought response, water supply, water use efficiency, water quality and flood management benefits in two phases: Phase 1 includes conversion of 20 acres of landscaping from potable to recycled water supply, reducing potable consumption up to 32 AFY. Phase 2 will A) replace 2.3 acres of turf with drought-tolerant plants; B) improve dry and wet weather runoff quality from a 1,197-acre contributory drainage area by implementing trash controls, a treatment wetland and bioswales; C) restore 1.54 acres of riparian habitat from hardened and grass-lined channel bed; and D) mitigate flooding by installing a culvert crossing at the Park entry.

  The 50-acre Crown Valley Community Park has 250,000 visitors annually, and features 10 acres of active recreation area, a 20-acre botanical garden, and 20 acres of passive use/open space that include large areas of turfgrass. Public vehicular access to the park is from Crown Valley Parkway, via a dipcrossing that regularly floods during storm events, requiring the heavily-used park to be closed down and evacuated. The dip crossing's pavement and grouted rockwork cut perpendicularly across the flowline of the mostly turfgrass-lined flood control channel, which outlets into Sulphur Creek downstream of the Project limits.

  Phase 1 includes conversion of the 20-acre botanical garden area of the Park to a recycled water supply, directly offsetting 32 AFY of potable water use. Phase 2 is multi-faceted and includes construction/implementation of the following elements:

  a) A 1,900 sq. ft. sediment-removal forebay and trash boom system will be installed at the storm drain (J03P01) outfall at the upstream end of the park to improve water quality; and
  b) A 0.4 acre wet-weather native-plant bioswales and 0.25 acre treatment wetland with native emergent vegetation will replace existing grouted rock and irrigated turfgrass within the channel.
  c) A 0.5 acre of irrigated turfgrass on the channel banks will be replaced with transitional riparian vegetation types and an additional 1.25 acres of irrigated turfgrass outside the channel bed will be replaced by California-friendly vegetation, parking, hydromodification controls and modular treatment wetland units;
  d) Irrigation will be converted to higher-efficiency systems.
  e) The existing dip crossing will be replaced with an arched culvert crossing, allowing stormwater to flow freely underneath. The grouted-rock aprons currently protecting the dip crossing will be replaced by ungrouted rocks and boulders, interspersed with native riparian vegetation to enhance habitat connectivity.

- **Implementing agency/organization:** City of Laguna Niguel

- **How the project will address a current need of the region.** The current needs/goals of the region include drought preparedness through enhancing water supply and improving water use efficiency; improving water quality in response to TMDL and 303(d) priorities; improving flood control for public and property protection; and protection/enhancement of natural resources and habitat. The Project offsets use of 32 AFY of potable water supply by converting 20 acres of landscaping to recycled water for irrigation. It also enhances water use efficiency by 7 AFY through replacement of turfgrass with native plants and inefficient irrigation systems in upland areas with efficient devices. The Project also addresses water quality by removing constituents of concern (nutrients and fecal indicator bacteria) from urban runoff draining a 1,197-acre urbanized area; a sediment forebay, trash boom, treatment wetland and bioswales provide treatment in the park, supporting beneficial uses downstream along lower Sulphur Creek and the 40-acre Sulphur Creek Lake. Additionally, the Project will completely eliminate operational flooding and associated public safety impacts through installation of a new arched culvert crossing. Lastly, replacement of in-channel irrigated turfgrass and grouted rockwork with native plants will restore open-water, floodplain, transitional riparian habitats and connectivity to existing riparian habitat downstream.

4. **Strategic Turfgrass Removal & Design Assistance Program**

- **Brief Project Description**: The Project includes converting 1,796,330 square-feet (approximately 42 acres) of turfgrass to California-friendly landscapes and providing technical design assistance to save 252 AFY of water.

- **Expanded Project Description**: The Strategic Turfgrass Removal and Design Assistance Program (Project) will enhance Municipal Water District of Orange County (MWDOC's) current Turf Removal Program by reducing landscape water consumption, reducing irrigation runoff, increasing onsite infiltration, and increasing market transformation towards sustainable landscapes. MWDOC will administer this Project as the lead agency on behalf of the cities and retail water agencies within the South Orange County WMA. The Project will target the highest water users and provide technical assistance for the voluntary removal of 1,796,330 square-feet (approximately 42 acres) of ornamental turfgrass and installation of California-friendly landscapes with climate appropriate greenscape and permeable hardscape. Use of the term drought tolerant is inclusive of California-friendly and native plants that are low-water use. The Project will save up to 252 AFY of water supply used for irrigation and convert approximately 42 acres of turf grass to native and/or California-friendly plant species. Landscape water use accounts for 50% of Orange County water use and is a critical component to ensure domestic water use efficiency. California-friendly plantings require less than half the irrigation required by turfgrass. Turfgrass requires more irrigation than any other ornamental plant and is often over-irrigated. The turfgrass removal component of the Project will be available to residential, commercial, and public properties. MWDOC proposes to facilitate the removal of turfgrass, providing incentives through a rebate-style format to residential and commercial property owners. Rebates will be provided to property owners for qualifying Project. The technical assistance component of the Project will be offered as a pilot to approximately 4,000 residential, commercial, and public sites as a means to promote landscape renovations yielding optimum benefits. Based on past participant follow-up, the predominant barrier to Project completion by the participant was the need for technical assistance. The Project will provide a tutorial on how to remove existing turfgrass and detailed site design plans. The site design plans will include the following: plant and permeable surface recommendations, hydrozones by plant type or water use category, irrigation equipment, location of point of connection, meters, sensors, supplemental water sources, etc. Providing technical assistance will ensure the comprehensive Californian Friendly landscape includes selecting a climate appropriate plant palette, encouraging onsite infiltration, and implementing efficient irrigation design and management.

- **Implementing agency/organization:** Municipal Water District of Orange County

- **How the project will address a current need of the region**: The current needs of the region include water use efficiency, protecting natural resources, water quality enhancement, and drought preparedness. The Project will promote the replacement of non-functional turf grass with native and California-friendly plants in approximately 42 acres of urban landscapes. The Project will incentivize the replacement of high-volume irrigation technologies used on turfgrass, with low-volume irrigation technologies or no irrigation utilized after the conversion. This will contribute up to 252 AFY of water saved. The Project will promote the use of efficient irrigation management practices through the use of smart timers, where irrigation remains at the landscape conversion site. The Project will enhance water quality by constructing Best Management Practices (BMP's) and other landscape improvements on public and private property to prevent pollutants from entering storm drains on 1,019 acres of urban landscape. The BMPs will target anthropogenic pollutants through landscape conversion. There will be improvement in the quality of water that may reach receiving water through reduction of irrigation runoff. The Project will reduce dry-weather runoff and pathogen levels on 1,019 acres of urban landscapes as verified in the 2004 Residential Runoff Reduction Study. The proposed Program will effectively address long-term drought by promoting water conservation, improve landscape efficiencies, and achieving long-term reduction of water use by conserving 252 AFY of water. Lastly, the Project will educate and increase awareness and knowledge of water quality through the technical assistance and video component of the application process.

5. 3A Water Recycling Plant Tertiary Expansion

- **Brief Project Description**: The Project includes expanding the existing 3A Water Recycling Plant to provide at least 3,000 acre-feet per year (AFY) of recycled water and energy savings.

- **Expanded Project Description:** The 3A Water Recycling Plant (WRP) Tertiary Expansion (Project) includes expansion of the existing 3A Water Reclamation Plant for tertiary treatment capabilities. The Project will provide at least 3,000 AFY of new recycled water. The Project includes construction for expanding the existing 3A WRP facility and requires the following components: Increasing the reliability of the aeration system, expanding and or replacing the existing filters with more effective tertiary filters, expanding the disinfection system, expanding the tertiary effluent pumps, the possible upsizing of the discharge pipeline where it connects to the District's recycled water distribution system, the modification to various in-plant piping and electrical systems and the addition of a standby generator to the facility to be able to maintain some level of operation during a power outage. The implementation of this Project will result in installing 3.0 mgd of tertiary equipment; however due to back wash water/solids the Project will produce at least 3,000 AFY (including an approximate loss of 10%). Overall, the Project will increase the local water supply/sustainability by reliably producing an additional 3,000 AFY of recycled water and reduce dependency on imported water – approximately 12% of Santa Margarita Water District's (SMWD) current imported water volume. The Project will save 5,653,000 kWh of energy per year by producing and distributing recycled water in place of imported water.

- **Implementing agency/organization:** Santa Margarita Water District

- **How the project will address a current need of the region**: The current needs of the region include increasing water supply, drought preparedness, and energy savings. The Project will provide at least 3,000 AFY of additional recycled water for irrigation, which currently uses imported potable water. This will result in a reduced imported water demand as well as provide a more reliable, sustainable local supply of water to meet customers' needs. The Project provides immediate and long-term reduction of water use by providing 3,000 AFY of recycled water to the region for irrigation, thereby promoting potable water conservation, conjunctive use, reuse and recycling. The Project promotes water recycling by expanding the existing 3A WRP to produce at least 3,000 AFY of new recycled water. Using recycled water in place of potable water for irrigation supply reduces the total domestic water demand for SMWD. The Project helps decrease the reliance on imported water for the delivery of safe drinking water by providing recycled water for non-potable uses. Additionally, the use of recycled water in place of imported potable water will result in energy savings, as it will reduce the need to pump and distribute imported potable water from either northern California or the Colorado River to southern California and its associated energy.

6. Recycled Water Distribution Upgrade

- **Brief Project Description:** The Project will replace an existing 6,600 feet section of 10-inch recycled distribution system supply main with a 16-inch main to eliminate a hydraulic bottleneck.

- **Expanded Project Description:** The Recycled Water Distribution Upgrade (Project) includes upgrading the existing recycled water distribution pipeline to eliminate an existing hydraulic bottleneck that currently limits the recycled water distribution in the region. A new pipeline will eliminate an existing hydraulic bottleneck and increase capacity by up to 530 gallons per minute (gpm), or approximately 850 acre-feet per year (AFY). The Project components include replacement of an existing 6,600 feet section of 10-inch Polyvinyl Chloride (PVC) pipe with 16-inch new High Density Polyethylene (HDPE) pipe, replacement of a manual gate valve with an electrically-actuated ball valve inside an underground vault, and abandonment of the existing 10-inch pipe and 16-inch casing. The Project increases recycled water system flow capacity that will allow service to South Coast Water District large landscape customers using potable water such as: the County of Orange Dana Point Harbor, State of California Doheny State Beach, City of Dana Point Lantern Bay Park, City of Dana Point medians and parkways, hotel landscapes (e.g., Marina Inn, Marriott, Montage, St. Regis, etc.), and a number of Homeowner Association (HOA) common areas. The Project will increase recycled water supply, thereby reducing imported water demand for the users. Ultimately, the Project will reduce the amount of imported potable water used for irrigation. The Project will save a total of 1,700,000 kWh per year of energy by supplying recycled water locally in place of imported water supply.

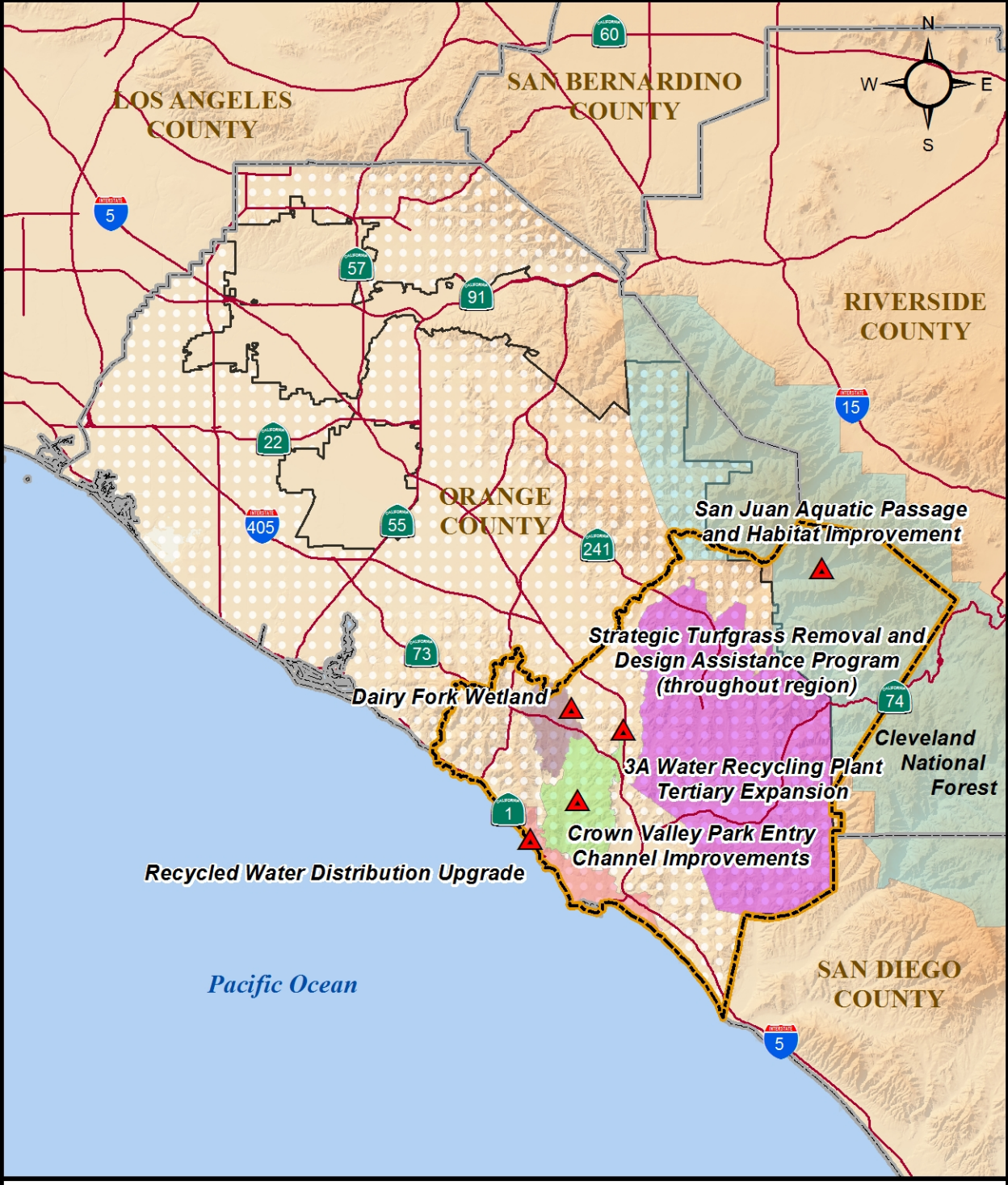
- **Implementing agency/organization:** South Coast Water District

- **How the project will address a current need of the region**: The current needs of the region include increasing water supply, drought preparedness, and energy savings. The Project will provide up to 850 AFY of recycled water supply, thereby increasing water reliability for the region. The Project will help alleviate drought impacts by reducing imported potable water used for landscape irrigation by up to 850 AFY. The Project also provides a critical expansion of the distribution main to provide recycled water to more users throughout the region, therefore, the ultimate impacts of expanding recycled water distribution are widespread. Additionally, the use of recycled water in place of imported potable water will result in energy savings, as it will reduce the need to pump and distribute imported potable water from either northern California or the Colorado River to southern California and its associated energy.

III. REGIONAL AND PROJECT MAP

Regional and project maps are provided and include the following:

- Individual project maps are provided that show, as applicable:
  - The project's geographical location and the surrounding work boundaries
  - Facilities of the project
  - The water resources (groundwater or surface water) that will be affected
  - DACs within the project service area
  - Proposed monitoring locations
- A regional map with IRWM regional boundaries with project locations



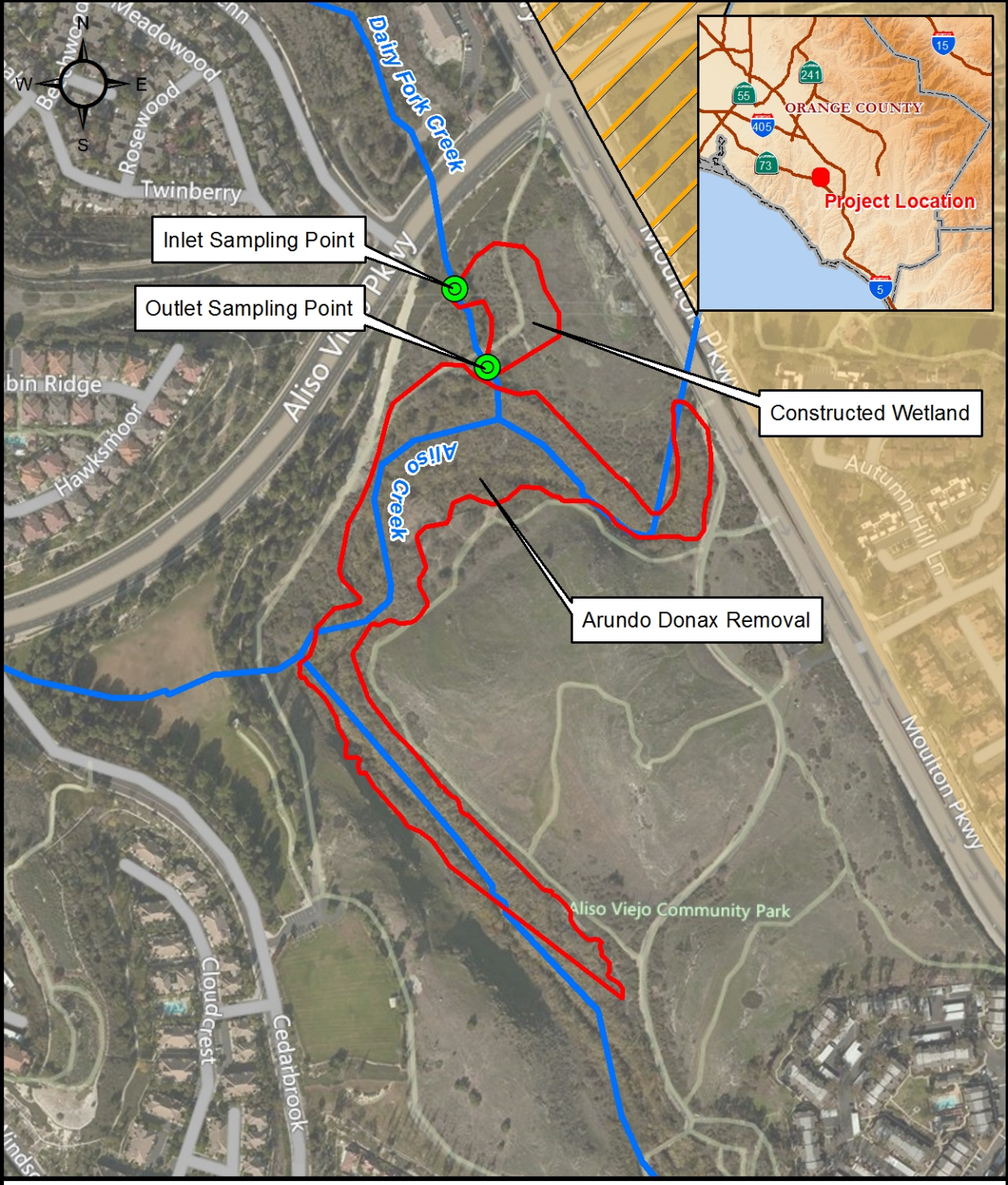
South Orange County
Integrated Regional Watershed
Management Program

Regional Map

0 2 4 8 Miles

- Project Locations
- South OC WMA
- City of Aliso Viejo
- City of Laguna Niguel
- USDA Forest Service
- Santa Margarita Water District
- South Coast Water District
- Municipal Water District of Orange County*

*Strategic Turfgrass Removal and Design Assistance Program: Project encompasses entire South OC WMA



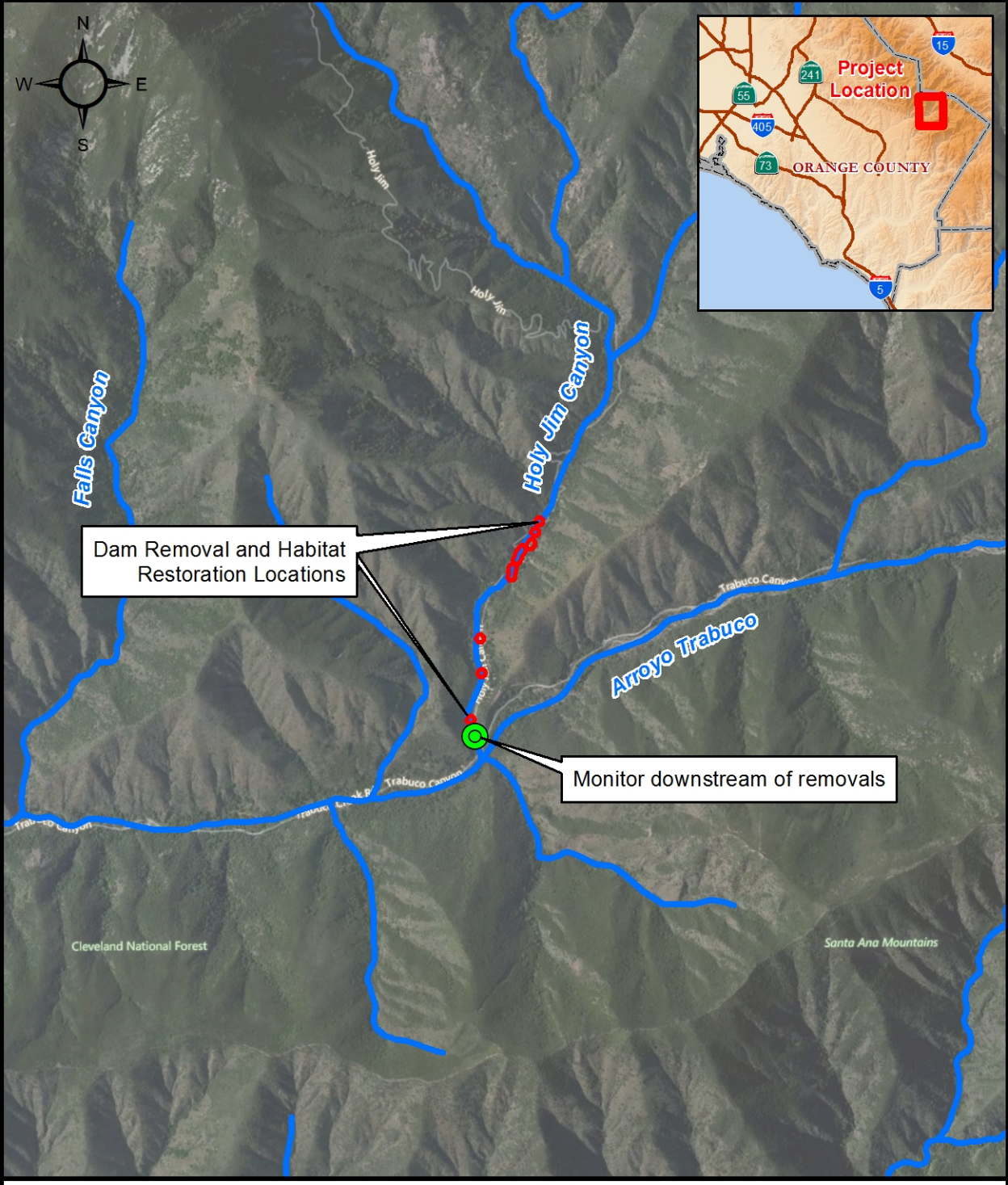
South Orange County
Integrated Regional Watershed
Management Program

Project Map
Dairy Fork Wetland

0 100 200 400
Feet

Project Footprint
Monitoring Locations
StreamRiver
Disadvantaged Community Block Groups
Disadvantaged Community Tracts

*No groundwater in project area



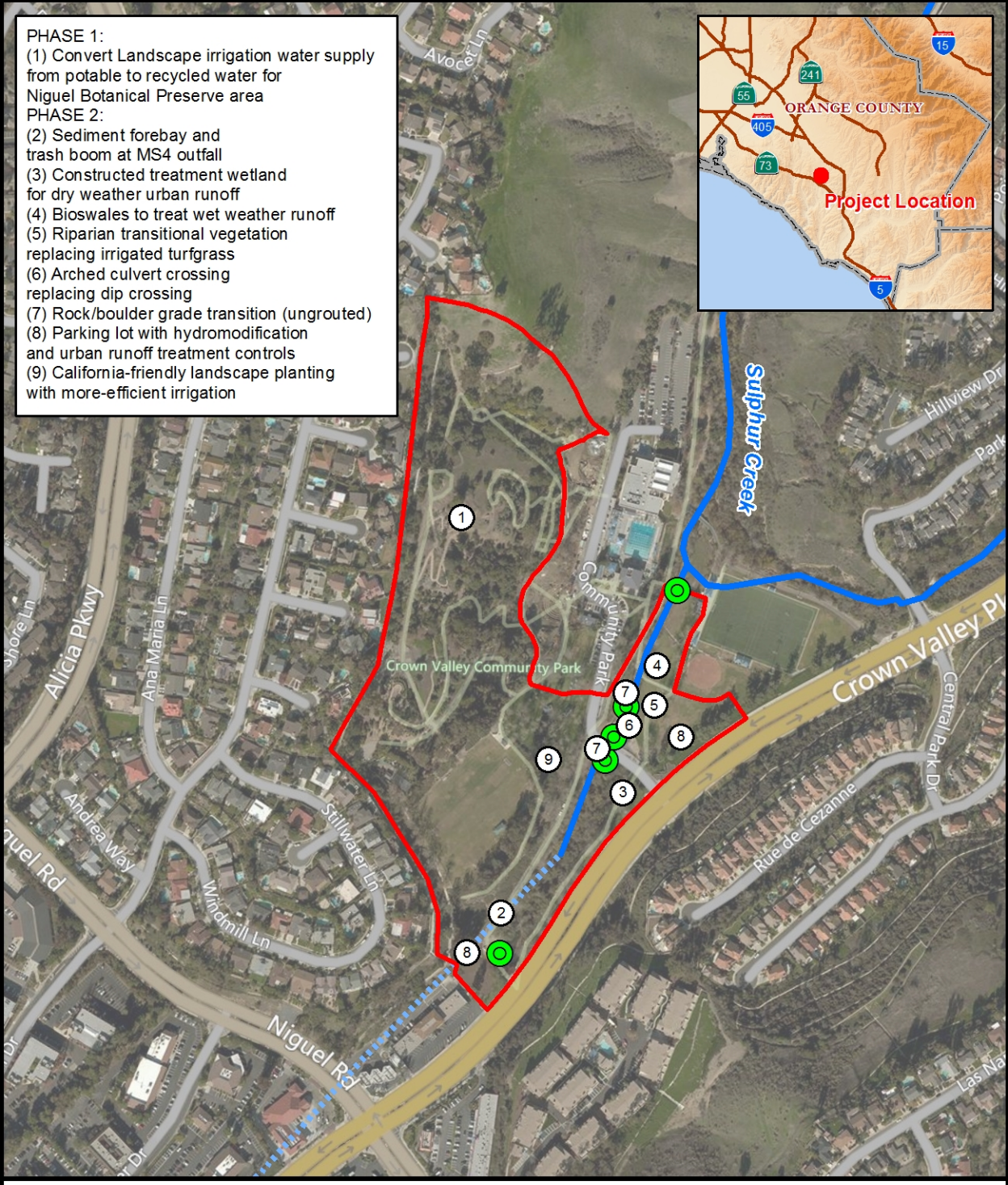
South Orange County
Integrated Regional Watershed
Management Program

Project Map
San Juan Aquatic Passage
and Habitat Improvement

0 600 1,200 2,400
Feet

Project Footprint
StreamRiver
Monitoring Locations

*No groundwater in project area
**No Disadvantaged Communities in project area



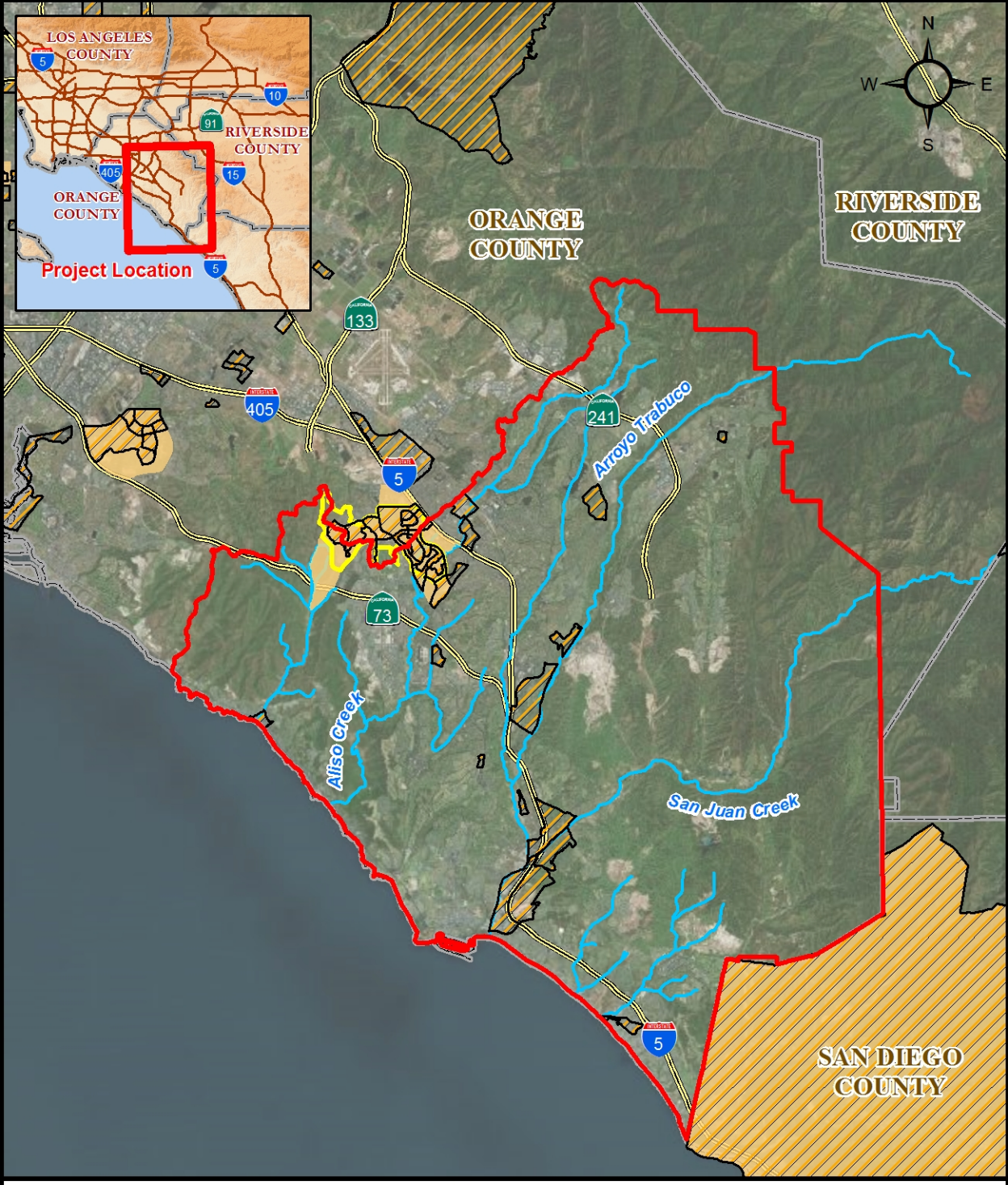
South Orange County Integrated Regional Watershed Management Program

Project Map
Crown Valley Park
Entry Channel Improvements

0 150 300 600 Feet

Project Footprint
Monitoring Locations
Connector
StreamRiver

*No groundwater in project area
**No Disadvantaged Communities in project area



South Orange County
Integrated Regional Watershed
Management Program

Project Map
Strategic Turfgrass Removal & Design Assistance Program

0 1 2 4 Miles

Project Footprint
StreamRiver
Disadvantaged Community Block Groups
Disadvantaged Community Place
Disadvantaged Community Tracts
Monitoring Locations

*NOTE: Monitoring locations located throughout the anticipated 4,000 number of participant sites

*Project located throughout South OC WMA

*No Impact to Surface Water Quality
**No Impact to Groundwater

South Orange County
Integrated Regional Watershed
Management Program

Project Map
3A Water Recycling
Plant Tertiary Expansion

0 50 100 200
Feet

Project Footprint
Monitoring Locations

*No groundwater in project area
**No impact on surface water
*** No Disadvantaged Communities in project area

South Orange County Integrated Regional Watershed Management Program

Project Map Recycled Water Distribution Upgrade

0 300 600 1,200 Feet

Project Footprint

Monitoring Locations

*NOTE: Monitoring will occur via recycled water meter readings from all customer uses throughout the district

*No groundwater in project area
**No impact on surface water
***No Disadvantaged Communities in project area

IV. PROJECT PHYSICAL BENEFITS

1. Dairy Fork Wetland

Table 5a – Annual Project Physical Benefits (Primary Benefit) Project Name: Dairy Fork Wetland Type of Benefit Claimed: Total Suspended Solids Reduction Units of the Benefit Claimed : mg/L Anticipated Useful Life of Project (years): 20 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project
			(c) – (b)
2015	45	45	0
2016	45	5	- 40
2035	45	5	- 40

Comments: The Dairy Fork Wetland System will treat approximately 325 acre-feet of urban runoff annually with a total treatment capacity of 161,000 cubic feet at any given time. Based on the dry weather runoff of 0.45 cubic feet per second, the area required to create proper retention time for surface water will require 2 acres of land, as was calculated by the design engineer. The 161,000 cubic feet of water retention was based upon the design which has a depth of 8 feet with a surface area of 26,533 square feet, and of 1 foot deep with 3,570 square feet for a total of 30,103 square feet or 0.7 acres. Additionally, the foot print of the wetland includes access roads and fencing for an area of approximately 1.3 acres. The estimation for the reduction in TSS was derived from the County of Orange Stormwater Program Dry Weather Monitoring Data 2005-2011 and California Stormwater BMP Handbook, 2003. The average concentration of Total Suspended Solids in urban runoff is 45 mg/L. The Dairy Fork Wetland is expected to remove 90% of the suspended solids in urban runoff. Therefore, it is expected that 90% of 45 mg/L will be treated resulting in a reduction of approximately 40 mg/L of TSS per year. The treated runoff will contain about 5 mg/L before its confluence with Aliso Creek.

Table 5b – Annual Project Physical Benefits (Secondary Benefit) **Project Name: Dairy Fork Wetland** **Type of Benefit Claimed: Habitat restoration** **Units of the Benefit Claimed : Acres** **Anticipated Useful Life of Project (years): 20 years**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project**
			(c) – (b)
2015	0	0	0
2016	0	11	11
2035	0	11	11
Comments: The Project will restore 2 acres of land to a wetland environment and provide suitable habitat for fauna and flora, especially native plants. The Dairy Fork Wetland System will treat approximately 325 acre-feet of urban runoff annually with a total treatment capacity of 161,000 cubic feet at any given time. Based on the dry weather runoff of 0.45 cubic feet per second, the area required to create proper retention time for surface water will require 2 acres of land, as was calculated by the design engineer. The 161,000 cubic feet of water retention was based upon the design which has a depth of 8 feet with a surface area of 26,533 square feet, and of 1 foot deep with 3,570 square feet for a total of 30,103 square feet or 0.7 acres. Additionally, the foot print of the wetland includes access roads and fencing for an area of approximately 1.3 acres. An additional 9 acres of riparian area will be treated for invasive, non-native Arundo, replaced by native plants to re-establish native habitat. Approximately five total acres of Arundo has been identified interspersed within nine acres of riparian area. Arundo removal is a Statewide priority due to the uniquely damaging watershed impact of this species. Its removal and the subsequent native re-vegetation of the site will provide substantial enhancements to habitat for State and Federally-listed wildlife species, natural hydrologic regimes, pollutant biofiltration, and erosion reduction.			

2. San Juan Aquatic Passage and Habitat Improvement

Table 5a – Annual Project Physical Benefits (Primary Benefit) Project Name: San Juan Aquatic Passage and Riparian Habitat Improvement Project Benefit: Improved riparian habitat Units of the Benefit Claimed : Acres Anticipated Useful Life of Project (years): 50 years			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	1	1
2016	0	1.5	1.5
2017	0	145	145
2065	0	145	145

Comments: Acres of habitat improved are calculated based on improving the connectivity within 2 stream miles and associated 145 acres of riparian habitat. The acreage is based on a 600 foot buffer area for the 2 miles of stream with the presence of steelhead habitat, an aquatic habitat dependent species. In 2015, 1 acre of habitat will be improved because a bridge will be constructed in place of a road and there is an 8 foot aquatic passage barrier that will be removed (no longer impacted by roadway). An additional 0.5 acre in 2016 will be improved due to the invasive plant removal. Currently, several dams and stream crossings are barriers for aquatic organisms (2012 Forest Service stream assessment). This Project is part of a greater effort to improve aquatic habitat and aquatic passage in the San Juan watershed headwaters. Removal of all the dams and the two stream crossings in Holy Jim Canyon will result in opening up 2 miles of habitat for aquatic organisms. The Project's habitat restoration is included in the San Juan Creek Watershed Plan, as well as the recovery plan for Southern California Steelhead. Assessments from the past decade confirm the ecological importance of providing passage to all native aquatic and riparian species through road-stream crossings and for all life stages of those species, particularly to provide for robust communities and for resilience to climate change (2007 Hoffman, Dunham. USDI US Geological Survey report). In 2012, the Forest Service treated a large patch of Arundo in Trabuco Canyon (downstream of the Project area). Treatment of fig, Arundo, and other invasives through this grant would further these efforts. Benefitting acres are included in the acreage provided for the fish passage part of Project. Estimates are based on the Forest Service's experience in invasive removal and aquatic habitat improvement. The Forest Service continues to address the aquatic organism passage and sediment issues in the San Juan Creek Watershed. In 2014, the Forest Service removed 9 of the rock and mortar dams using a grant from US Fish and Wildlife Service. In 2015, an undersized culvert/stream crossing will be replaced with bridge in order to address issues with the crossing, which is an eight-foot jump for fish, an aquatic passage barrier, and has historically been a chronic sediment source (2013 CDFW Fish passage website http://www.calfish.org).

Table 5b – Annual Project Physical Benefits (Secondary Benefit)

Project Name: San Juan Aquatic Passage and Riparian Habitat Improvement
Project Benefit: Improved water quality through sediment reduction
Units of the Benefit Claimed : mg/L

Anticipated Useful Life of Project (years): 50 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (c) – (b)**
2014	0	4	4
2015	0	23	23
2016	0	24	24
2017	0	31	31
2065	0	31	31

Comments: Sediment reductions would occur from a reduction in non-point source sediment sources, such as erosion related to the dams, stream crossings, and diversions created by the invasive fig. Most of the erosion sites are localized around structures/weeds and spread out through the stream system. Since the dams have not been maintained for 30 years or more, many are currently storing sediment which, during flood events, may cause the stream to flow around the dam, creating increased flooding risk for adjacent roads and structures. Erosion at dams is especially diverse and challenging to measure, although several have deep plunge pools (measurable) that have resulted from channel erosion. To estimate non-point source sediment, an estimate of 2 cubic yard of sediment for each dam (estimated diversion gully and plunge pool) and 1 cubic yard of sediment for each of 15 diversions created by the invasive fig was used. Actual diversions, gullies, and plunge pools vary in size and number. Erosion around the two smaller stream crossings is estimated based on the depth of the plunge pools and erosion around the banks (4 cubic yards each). The stream crossing that will be replaced with a bridge, has washed out twice in the last 15 years. During each washout, approximately 90 cubic yards of road fill was washed into the stream system. Replacement of the stream crossings will reduce anthropogenic sedimentation and will proactively prevent introduction of road fill. Replacement of the undersized culvert and inadequate stream crossings will provide greater flood management capacity, allowing them to pass larger flows that may result from more extreme weather. The following summarizes the assumptions: 1) Removal of 9 dams in Holy Jim Canyon resulting in a reduction of 18 cubic yards of sediment. 2) Replacement of Forest Service crossing with a bridge resulting in a reduction of 90 cubic yards of sediment. 3) Partial treatment of invasive weeds resulting in a reduction of 4 cubic yards of sediment. 4) Replacement of one Forest Service crossing, removal of 7 dams, and remaining treatment of invasive weeds, resulting in a reduction of 33 cubic yards of sediment. 5) Total reduction of 145 cubic yards of sediment. The estimated cubic yards of sediment and the average annual discharge (USGS gage station 11047000) was used to estimate the decrease in milligrams of non-point source sediment per liter of discharge. By upgrading the three stream crossings, sediment related to washouts, road drainage, and flow restrictions will be minimized, improving water quality. Improving floodplains and channel conditions will benefit natural resources, which in turn contributes to healthy headwaters for downstream beneficial uses. Although it is difficult to measure reductions in non-point source sediment, using estimates from a previous blown out crossing and site erosion, the Project would result in a reduction of 145 cubic yards of sediment or 31 mg of sediment/liter of discharge per year, which will be measured by Total Suspended Solids (TSS).

3. Crown Valley Park Entry Channel Improvements

Table 5a – Annual Project Physical Benefits (Primary Benefit)

Project Name: Crown Valley Park Channel Entry Improvements Project
Type of Benefit Claimed: Water quality benefit: Reduces phosphorus concentration in dry-weather urban runoff
Units of the Benefit Claimed : mg/L
Anticipated Useful Life of Project (years): 40 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0.35	0.21	0.14
2057	0.35	0.21	0.14

Comments: The Project would begin operation in 2017. The Project will help reduce nutrient concentrations (Total Phosphorus (TP), including both dissolved and particulate phosphorus, as well as nitrogen compounds) in dry and wet weather discharges from the 1,197-acre contributory drainage area within the Sulphur Creek watershed, which is 303(d) listed for nutrients impairment[1]. Primary sources of TP in the contributory watershed include naturally-high-phosphorus soil/geological substrate, decomposing vegetative debris, pet/wildlife fecal material, landscape fertilizers, and irrigation runoff by recycled water. TP concentration (n=20) was measured on-site at an average of 0.35 mg/L in 2013,3.5 times higher than the 0.1 mg/L San Diego Basin Plan Water Quality Objective (WQO) for Total Phosphorus. Dry weather urban runoff flow rates in 2013 averaged 0.5 CFS, or 352 AFY, of which 2/3 would be treated through the constructed wetland, with a hydraulic retention time (HRT) of 12 hours. For particulate phosphorus, the dry-weather and wet-weather treatment mechanisms in the proposed sediment forebay, treatment wetlands and bioswales are through depositional and biofiltration processes that remove sediments and fine organic particulates. Removal mechanisms for dissolved phosphorus compounds are primarily effective for lower, slower dry-weather flows; they include uptake by wetland plants and microbiota; sorption to wetland soils; fixation and precipitation. Although the 12-hour HRT is less-than-optimal for phosphorus reduction even for dry weather, local research at the nearby Narco Channel Restoration Project (also tributary to Sulphur Creek) showed a reduction of up to 41% in phosphorus concentration through a restored wetlands that was not specifically designed for treatment, with only a 6-hour retention time. Given the doubled HRT and 1/3 of dry-weather flow that will enter the wetland, the project is estimated to achieve, on average, between 41% and 54% phosphorus reduction under dry weather conditions. Based on the 35mg/L measured in the dry-weather influent, a 41% reduction would produce a dry-weather effluent value of 0.21 mg/L. For wet weather, measured TP value at the upstream end of the site (n=1 in 2015) was 0.8 mg/L, which would be consistent with an increase in particulate TP as turbulent storm waters discharge from this watershed, which has naturally high-phosphorus soils. If a storm were small enough not to overwhelm the proposed system, the combined sediment forebay, treatment wetland and bioswales are estimated to perform as well during wet weather as predicted by the International Stormwater BMP Database's "wetland" phosphorus removal rate, which would be -39%. Based on an average influent value of 0.8 mg/L, the wet-weather effluent concentration, assuming 39% reduction, would be estimated to be around 0.5 mg/L, which is shown in the "With Project" column above. References: 1) Bacteria and phosphorus data collected by City of Laguna Niguel in Summer 2013, n = 20; 2) Final Report for Wetland Capture And Treatment (WetCAT) Network, Agreement No. 01-122-259-0, March 2004, prepared for the San Diego Regional Water Quality Control Board by the City of Laguna Niguel. 3) Findings from follow-up summary of 2012 treatment performance, PowerPoint presented by the OC Watersheds, County of Orange in 1/30/2013 for The Sulphur Solution: Prevent, Control Restore Project, under Agreement No. 04-066-559-0, March 2008, prepared for the San Diego Regional Water Quality Control Board by the City of Laguna Niguel. 4) International Stormwater BMP Database (www.bmpdatabase.org), 2014 Performance Summary. 5) Kadlec, Robert & Knight, Robert, Treatment Wetlands, Lewis Publishers, New York 1996, pp.443=478.

[1] The Project will be even more effective at reducing fecal coliform concentrations in the dry weather discharge from the contributory drainage area. The Aliso Creek watershed is subject to a Bacteria Total Maximum Daily Load (TMDL), with "interim" bacteria load reduction requirement of 50% by 2018, and

reduction of 95.58% for final compliance. The water body is a REC-1-designated surface water that is subject to load reduction requirements in an approved Fecal Indicator Bacteria TMDL. Concentration reduction equates to load reduction if there is no change to flow rate. Fecal coliform concentration measured by the City at the Project site in 2013 (n=20) showed a geomean of 1,010 mpn/100 ml. The 12-hour HRT within the treatment wetland is, by itself, sufficient (as determined from local research) to achieve, conservatively, at least 70% fecal coliform bacteria reduction in treated flows, which is calculated to produce a geomean concentration of 303 mpn/100 ml in dry weather. Local research at the Narco Channel Restoration showed a reduction of up to 80% in bacteria concentration with only a 6-hour retention time, from higher influent concentrations. The water quality benefits of 70%+ reduction in fecal coliform in 352 acre-feet annually (14,080 acre-feet over 40 years) are projected to be consistent each year, or surpassed if future water conservation efforts in the contributory drainage area reduce the volume of urban runoff to be treated (which would increase the HRT and therefore increase project effectiveness).

Table 5b – Annual Project Physical Benefits (Secondary Benefit)

Project Name: Crown Valley Park Channel Entry Improvements Project

Type of Benefit Claimed: Restore riparian habitats

Units of the Benefit Claimed : Acres

Anticipated Useful Life of Project (years): 40 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (c) – (b)**
2017	4.4	5.95	1.55
2057	4.4	5.95	1.55

Comments: The Project construction will be complete in 2017. Existing riparian habitat mapped within the Project limit, includes a riparian willow canopy area of 4 acres, disconnected from downstream habitat by the existing dip crossing and grouted rock aprons; and an 18' wide x700' long (0.4 acres) low-flow stream with emergent marsh vegetation, sycamores and alders. After completion, the constructed treatment wetland would add 0.25 acres of open-water pond and emergent marsh vegetation; the bioswales with native reed and sedge vegetation will add 0.4 acres; and riparian transitional vegetation of 0.5 acres would be added to the east channel embankment and 0.4 acres at the rocky channel grade transition. A total of 5.95 acres of contiguous riparian area will be available for habitat as a result of the Project, connecting 4.4 acres of existing to the 1.55 acres of newly restored riparian habitat proposed in the Project. . Once restored, benefits resulting from the additional 1.55 acres of riparian habitat will be maintained in accordance with long-term routine maintenance agreements to be negotiated with the resource agencies; these benefits are expected to remain for at least 40 years. Additionally, removal of the existing dip crossing will provide habitat connectivity for the 4 acres of willow canopy upstream, to the 15 acres of natural habitat along Sulphur Creek downstream, as well as to the 40 acre Sulphur Creek Lake.

4. Strategic Turfgrass Removal & Design Assistance Program

Table 5a – Annual Project Physical Benefits (Primary Benefit)
Project Name: Strategic Turfgrass Removal & Design Assistance Program
Type of Benefit Claimed: Water Supply Saved
Units of the Benefit Claimed: Acre-Feet per Year (AFY)
Anticipated Useful Life (years): 14 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015	0	42	42
2016	0	84	84
2017	0	126	126
2018	0	168	168
2019	0	210	210
2020	0	252	252
2021	0	252	252
2022	0	252	252
2023	0	252	252
2024	0	245	245
2025	0	210	210
2026	0	168	168
2027	0	126	126
2028	0	84	84
2029	0	42	42

Comments: The average annual water saving was initially calculated utilizing the theoretical irrigation requirement water need, taking local evapotranspiration (ETo) and rainfall (Pe) into consideration. As part of this analysis, the crop coefficients (Kc) varies from turfgrass (0.8) to a California-friendly landscape comprised of low water need plants (0.3). Following the theoretical analysis, actual water use at sites was evaluated utilizing historic water use data as well as the water use data following the turf removal landscape conversion. Metropolitan Water District of Southern California reviewed their regional turf removal program and found water savings of approximately 44 to 49 gallons per year per square foot (Baum-Haley, Melissa. 2014. "Turf Removal as a Potential Best Management Practice" Prepared for the California Urban Water Conservation Council. Sacramento, CA). The annual water savings is associated with the square feet of turf converted per year. Implementation of the Project's 4,000 sites will occur from 2015 through 2019, with 10 year life expectancy of the sites beginning in the year of implementation, resulting in a 14 year anticipated useful life of the Program. The last year of implementation will be in 2019, therefore the benefits are shown through year 2029. As the program ramps up, the water savings increases. In years 2020-2023, the water savings will be the full 252 AFY. In year 2024, the water savings associated with first years of the Program will be beyond the expected life and therefore decrease. The remaining years reflect the water savings for the conversion square footage for that area that is still generating water savings per the 10 yr. life. The ramp up in program activity is illustrated through the increase in water savings, then a subsequent decrease in the water savings illustrates the ramp down in activity. The 44 to 49 gallons per year per square foot savings rate is the conversion for the acre foot savings that is listed.

Total Square footage = 1,796,330
Water saving rate = 45.6 gal/yr. or 0.125 gal per day
Total water savings = 1,796,330 x 0.125 gpd = 224,541 gpd
Lifetime water savings rate = 224,541 gpd x 365 days/yr. x 10 yrs. = 819,575,563 gallons per life
Lifetime acre foot = 819,575,563 gallons per life / 325,866 gal/AFY
Annual water savings = 252 AFY

Table 5b – Annual Project Physical Benefits (Secondary Benefit) Project Name: Strategic Turfgrass Removal & Design Assistance Program Type of Benefit Claimed: Habitat Restoration Units of the Benefit Claimed: Acres Anticipated Useful Life (years): 14 years			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2015	0	7	7
2016	0	14	14
2017	0	21	21
2018	0	28	28
2019	0	35	35
2020	0	42	42
2029	0	42	42

Comments: The Project includes converting approximately 1,796,330 square-feet (or approximately 42 acres) of turfgrass to California-friendly landscapes. Implementation of the Project's 4,000 sites will occur from 2015 through 2019, with 10 year life expectancy of the sites beginning in the year of implementation, and a 14 year anticipated useful life of the Program. The last year of implementation will be in 2019, therefore the benefits are shown through year 2029. This estimate is based on previous results from implementing the program, including customer participation, marketing/promotional efforts, rebate incentives, and implementing water conservation measures. Municipal Water District of Orange County's (MWDOC) service area encompasses all of the South Orange County Watershed Management Area (WMA) and it is anticipated that users will be dispersed throughout the WMA. This estimate is also based on MWDOC's Residential Runoff Reduction Study (July 2004) and SmarTimer and Edgescape Evaluation Study (October 2008) which include the conversion of the urban landscape from turf intensive to climate appropriate focusing on climate appropriate and native vegetation. Implementation of the California-friendly landscapes is expected to be permanent. There is potential that total the 42 acres converted to California-friendly landscapes will remain from year 2029 on.

5. 3A Water Recycling Plant Tertiary Expansion

Table 5a – Annual Project Physical Benefits (Primary Benefit)

Project Name: 3A Water Recycling Plant Tertiary Treatment Expansion

Type of Benefit Claimed: Increase Recycled Water Supply

Units of the Benefit Claimed : Acre-Feet per Year (AFY)
Anticipated Useful Life of Project (years): 20 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	0	0
2016	0	1,500	1,500
2017	0	3,000	3,000
2036	0	3,000	3,000

Comments: The Project would be in operation in 2016 and by 2017 would produce at least 3,000 AFY of recycled water for irrigation. Hence, over the 50-year life of the Project, approximately 150,000 acre-feet of recycled water would be delivered. This same amount would be used in place of imported potable water. Recycled water is not being fully utilized for irrigation throughout Santa Margarita Water District's (SMWD) service area. Thus the benefit without the Project is 0 AFY of recycled water. The 3,000 AFY produced will be the result of expanding the tertiary treatment capacity of the existing 3A Water Recycling Plant (WRP) by 3.0 million gallons per day (MGD). The 3.0 MGD is the equivalent of 3,360 AFY and allowing for a 90% capture rate due to 10% losses associated to solids dewatering, filter backwash and other in-plant uses results in 3,000 AFY. Using the SMWD's existing recycled water distribution system it will be possible to connect existing potable water irrigation users to the recycled water system. The additional recycled water will be used as a supply to existing potable water irrigation demands within both the Santa Margarita and Moulton Niguel Water Districts. SMWD is in the process of converting over 2,500 AFY worth of domestic uses to be supplied with recycled water.

Table 5b – Annual Project Physical Benefits (Secondary Benefit)
Project Name: 3A Water Recycling Plant Tertiary Treatment Expansion
Type of Benefit Claimed: Energy Saved And Greenhouse Gases Avoided
Units of the Benefit Claimed : Kilowatt hours (kWh)
Anticipated Useful Life of Project (years): 20 years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2015	7,500,000	0	0
2016	7,500,000	923,500	6,576,500
2017	7,500,000	1,847,000	5,653,000
2036	7,500,000	1,847,000	5,653,000

Comments: The Project would be in operation in 2016 and by 2017 would produce at least 3,000 AFY of recycled water for irrigation. 2016 reflects only partial energy savings, as the Project will be in the early stages of operation and the full energy savings benefits will not be realized until 2017 when the project is in full operation. Imported water is a blend of State Project Water at 3,000 kWh/AF and Colorado River Water at 2,000 kWh/AF. Assuming an even blend of water results in 2,500 kWh/AF. This assumption is based on the publication "California's Water – Energy Relationship" prepared by the California Energy Commission (November 2005, page 51), that states the amount of electrical energy required to transfer 1 acre-foot of water from northern California to an area just north of the District requires 3,000 kWh. The same publication also identifies 2,000 kWh for each acre-foot of water that is imported from the Colorado River to southern California. Using an assumed 50-50 split of water sources the amount of power per acre-ft required to transfer the water is 2,500 kWh for a total of 7,500,000 kWh/year. The calculation is 3,000 AFY * 2,500 kWh =7,500,000 kWh. The savings are approximately 1,880 kWh/AF which can be directly measured using the plants effluent meters (5,653,000 kWh/year/3,000 AF/year = 1,884 kwh/AF). The amount of power required to produce the tertiary water from secondary effluent and to pump the water into the recycled water system is approximately 1,847,000 kWh/year. This value is generated by calculating the power associated with 400 feet of pumping head and the additional in-plant energy required for (3) 5-hp motors and a minor amount of backwash water being used on the filters. The effective reduction in energy required to supply the 3,000 AFY is the difference between the 7,500,000 kWh/year associated to the potable water delivery and the 1,847,000 kWh/year for the tertiary production or 5,653,000 kWh/year. There is a great need for reducing energy usage and greenhouse gas emissions. The amount of greenhouse gas, or carbon dioxide, is based on the statistical analysis of data collected by the United States Environmental Protection Agency. From the data collected on the amount of CO_2 produced for the generation of electricity, CO_2 generation factors were determined as a way of estimating the total CO_2 that will be emitted based on a given energy consumption. The most current factor applicable in the state of California, released in 2014, was used to determine this Secondary Physical Benefit. The carbon emission estimates of 0.61 lbs of CO_2/kWh are based on the United States Environmental Protection Agency's 9th edition of eGrid, "Year 2010 eGRID Subregion Emissions - Greenhouse Gases". The calculation for emissions saved: .61 lbs of CO_2/kWh * 5,653,000 kWh = 3,448,330 lbs of CO_2.

6. Recycled Water Distribution Upgrade

Table 5a – Annual Project Physical Benefits (Primary Benefit) **Project Name: Recycled Water Distribution Upgrade** **Type of Benefit Claimed: Increased Delivery of Recycled Water for Local Reliability & Decreased Dependence on Potable Water** **Units of the Benefit Claimed : Acre-feet per year (AFY)** **Anticipated Useful Life of Project (years): 50 years**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2015	0	0	0
2016	0	0	0
2017	0	850	850
2066	0	850	850

Comments: The Project would be in operation in 2017 and would produce up to an additional 850 AFY of recycled water for irrigation. Hence, over the 50-year life of the Project, up to 42,500 acre-feet of recycled water would be delivered. This same amount would be used in place of imported potable water. Recycled water is not being fully utilized for irrigation throughout the District service area. Thus the benefit without the Project is 0 AFY of recycled water. In 2008, the South Coast Water District developed an Infrastructure Master Plan that included a Recycled Water System Master Plan. In that Master Plan, analyses of potential expansions to the existing recycled water system were developed. All domestic water irrigation customers' records were reviewed to determine those that could be converted to recycled water use. That study (and the Master Plan Update, in-progress) presents a list of new customers and reviewed the ease at which they could be converted to recycled water to group them in to several categories. The total recycled water demand for these new customers (along with subsequently identified customers) is over 1,000 AFY.

Table 5b – Annual Project Physical Benefits (Secondary Benefit)

Project Name: Recycled Water Distribution Upgrade

Type of Benefit Claimed: Reduced Energy Usage and Greenhouse Gases Avoided

Units of the Benefit Claimed : Kilowatt-Hours

Anticipated Useful Life of Project (years): 50 years

Additional Information About this Benefit: Energy required to recycled water is less than the energy required to import potable water.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2015	0	0	0
2016	0	0	0
2017	2,125,000	425,000	1,700,000
2066	2,125,000	425,000	1,700,000

Comments: The Project would be in operation in 2015. The power required to import one acre-foot (AF) of water is 2,500 kwh. Imported water is a blend of State Project Water at 3,000 kWh/AF and Colorado River Water at 2,000 kWh/AF. Assuming an even blend of water results in 2,500 kWh/AF. One acre-foot of recycled water requires 500 kwh of energy to produce and deliver. Imported Water Calculation for Total Energy: 850 AFY X 2,500 kWh/AF = 2,125,000 kWh. Recycled Water Calculation for Total Energy: 850 AFY X 500 kWh/AF = 425,000 kWh. The benefits is equal to the Annual Energy Savings: 2,125,000 kWh-425,000 kWh= 1.7 million kWh. Thus, over the 50-year life of the Project the Total Energy Savings is up to 85 million kWh.

Reduced energy usage results in reduced greenhouse gas emissions. The amount of greenhouse gas, or carbon dioxide, is based on the statistical analysis of data collected by the United States Environmental Protection Agency. From the data collected on the amount of CO_2 produced for the generation of electricity, CO_2 generation factors were determined as a way of estimating the total CO_2 that will be emitted based on a given energy consumption. The most current factor applicable in the state of California, released in 2014, was used to determine this Secondary Physical Benefit. The carbon emission estimates of 0.61 lbs of CO_2/kWh are based on the United States Environmental Protection Agency's 9th edition of eGrid, "Year 2010 eGRID Subregion Emissions - Greenhouse Gases". The calculation for emissions saved: .61 lbs of CO_2/kWh * 1,700,000 kWh = 1,037,000 lbs of CO_2.

The reduced energy consumption for imported water versus recycled water has been documented in a number of technical studies including the following:
• "Analysis of the Energy Intensity of Water Supplies for West Basin Municipal Water District". Robert C. Wilkinson, Ph.D. March, 2007. Page 4. Source for the power required to import one acre-foot (AF) of water is approximately 2,500 kWh, based on the average of approximately 3,000 kWh/AF for State Water Project water and approximately 2,000 kWh/AF for Colorado River water). Also source for one acre-foot of recycled water requires approximately 500 kWh of energy to produce and deliver.
• "Seawater Desalination Power Consumption". White Paper. Watereuse. November, 2011. Page 12 and Page 15. Source supporting the power required to import one acre-foot (AF) of water is approximately 2,500 kWh, based on average of approximately 3,000 kWh/AF for State Water Project water and approximately 2,000 kWh/AF for Colorado River Aqueduct).
• "Direct Potable Reuse: Benefits for Public Water Supplies, Agriculture, the Environment, and Energy Conservation". Edward Schroeder, George Tchobanoglous, Harold L. Leverenz, and Takashi Asano. Department of Civil and Environmental Engineering, University of California, Davis. January, 2012. Page 9. Resource for approximately 2,500 kWh energy required to import 1 AF.

V. TECHNICAL ANALYSIS OF PHYSICAL BENEFITS CLAIMED

1. Dairy Fork Wetland

Primary Benefit: Water Quality – TSS Reduction

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems. Recent and historical conditions that provide background for benefits to be claimed.

The Project is needed because it will treat urban runoff from the Aliso Creek Watershed, protect beneficial uses and reduce its high levels of bacteria. Aliso Creek watershed is a 35 square mile area encompassing Portola Hills, Foothill Ranch, portions of the cities of Laguna Hills, Laguna Niguel, Laguna Woods, Mission Viejo, and Laguna Beach. The area has been designated to have the following uses; agricultural supply, non-contact water recreation, warm freshwater habitat, and wildlife habitat. As an urban watershed, Aliso Creek is subject to a wide variety of non-point sources of pollutants, such as bacteria, nutrients, metals and pesticides from urban stormwater runoff. Historically, Aliso Creek has high levels of bacterial presence due to multiple factors such as waterfowl and animal presence coupled with high temperatures due to a lack of natural riparian plant coverage. Another concern is the lack of channel stability and its associated threat to aquatic and riparian habitat. The adjacent Arundo removal efforts will provide additional direct improvements to water quality through expanded biofiltration of pollutants, lower water temperatures (resulting in lower bacterial and algal counts), reduced bank erosion and reduced human waste and debris from transient encampments commonly found in Arundo.

2. Estimates of without-project conditions; e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned.

Without the Project, reduction of approximately 40 mg/L of TSS per year would not be achieved. Continued water quality degradation would occur without Project implementation because the urban runoff from 1,500-acre drainage area would continue to flow into Aliso Creek untreated. Continued degradation of water quality and habitat of Aliso Creek will reduce available public use of water resources stemming from the creek and destroy available habitat for native fauna and flora and will allow easier access for invasive species such as Arundo to take root in more of the creek's riparian corridor. The wetland will provide treatment to enhance water quality for native species. TSS levels are highly correlated to both phosphorous levels (Barden et al. 2003) and heavy metals such as lead, iron and aluminum (Herngren et al 2004) in surface water. Decreasing TSS levels in surface water decreases the suspended load of pollutants which would otherwise be sequestered into sediment in low flow depositional environments such as wetlands. Similarly, bacterial concentrations in surface water utilize suspended loads of sediment to move downstream, and high levels of suspended solids create a more hospitable environment for bacteria to thrive in.

3. Description of methods used to estimate physical benefits

Contractors hired by the City and the County generated data using sampling of outfalls for flow rates and bacterial levels, and visual observations were utilized to estimate physical changes which would result from the Project. The wetland will restore 2 acres of land to a wetland environment and provide suitable habitat for fauna and flora, especially native California plants. The Dairy Fork Wetland System will treat approximately 325 acre-feet of urban runoff annually with a total treatment capacity of 161,000 cubic feet at any given time. Based on the dry weather runoff of 0.45 cubic feet per second, the area required to create proper retention time for surface water will require 2 acres of land, as was calculated by the design engineer. The 161,000 cubic feet of water retention was based upon the design which has a depth of 8 feet with a surface area of 26,533 square feet, and of 1 feet deep with 3,570 square feet for a total of 30,103 square feet or 0.7 acres. Additionally, the foot print of the wetland include access roads and fencing for an area of approximately 1.3 acres. As part of the Project, Arundo removal will occur over 9 acres of land previously identified through GIS mapping and ground-truthing.

The estimation for the reduction in Total Suspended Solids (TSS) was derived from the County of Orange Stormwater Program Dry Weather Monitoring Data 2005-2011 and California Stormwater BMP Handbook, 2003. The average concentration of TSS in urban runoff is 45 mg/L. The Dairy Fork Wetland is expected to remove 90% of the suspended solids in urban runoff. Therefore, it is expected that 90% of 45 mg/L will be treated resulting in a reduction of approximately 40 mg/L of TSS per year. The treated runoff will contain about 5 mg/L before its confluence with Aliso Creek.

4. Acknowledgement of all new facilities, policies, and actions required to obtain the physical benefits.

A constructed wetland and a 20 year monitoring program will be put into place to ensure that the physical benefits are met and maintained. In addition, environmental documentation (CEQA exemption) has been completed. A stream alteration permit from California Department of Fish and Wildlife and a general construction permit will be required. An easement agreement between 4 participating cities – Aliso Viejo, Lake Forest, Laguna Woods, and Laguna Hills is in place. An agreement with Southern California Edison will also be required for the Project area located under their power line. An easement deed and agreement with OC Parks are almost final. The City of Aliso Viejo, the Project lead, is committing operation and maintenance for 20 years, or as long as the wetland and habitat exists.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

The potentially adverse effect of the Project stems from temperature concerns. If shade plants are not maintained over the area, there is a potential to increase the temperature of the water in the system. This is because the velocity of low flow water will be decreased and increase the exposure to sunlight, this would in turn create warmer temperatures and create a more hospitable environment for bacterial growth and development.

To mitigate this harm, regularly scheduled maintenance and inspections of the site will be in place to ensure the health of the aquatic and riparian flora are maintained to the specifications of the plan to guarantee temperatures are kept at a proper level to mitigate bacteria growth.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project addresses long-term drought preparedness by achieving water conservation and long-term reduction of water use through replacing high-water consuming invasive species with low-water consuming native species; thereby increasing the total amount of surface water in the creek system. The removal of existing and prevention of spreading of invasive species such as Arundo donax from the area will contribute to overall drought preparedness in that the Arundo absorbs large amounts of water and crowds out other bank stabilizing plants which are native to California. The presence of the invasive plants decreases the amount of water which successfully infiltrates into groundwater, and will put the riparian area at a higher risk of erosion, which increases turbidity and decreases water quality, thereby increasing reproduction rates for bacteria who flourish in turbid environments.

Secondary Benefit: Habitat Restoration

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

Aliso Creek watershed is a 35 square mile area which encompasses Portola Hills, Foothill Ranch, portions of the cities of Laguna Hills, Laguna Niguel, Laguna Woods, Mission Viejo, and Laguna Beach. The area has been designated to have the following uses; agricultural supply, non-contact water recreation, warm freshwater habitat, and wildlife habitat. As an urban watershed, Aliso Creek is subject to a lack of riparian plant coverage. Another concern is the lack of channel stability and its associated threat to aquatic and riparian habitat.

Currently, approximately 9 acres of riparian area includes dense patches of Arundo, which denude the ability of native vegetation to establish along the riparian corridor, remove considerable amounts of water from the creek, reduce native wildlife populations and modify flow through the Dairy Fork sub-watershed.

Removal of invasive, non-native Arundo and replacement with native vegetation will restore much needed refugia and habitat for wildlife within the largely urbanized Aliso Creek watershed (Bell, Gary P., Ecology and Management of Arundo donax, and Approaches to Riparian Habitat Restoration in Southern California. Plant Invasions. Backhuys Publ., Leiden, The Netherlands. Published 1998). Combined, the wetland and riparian restoration will also help stabilize flow into Aliso Creek through the abatement of flashy storm flows through the wetland and removal of Arundo stands that cause sedimentation, thereby reducing flow capacity (California Invasive Plant Council, Arundo donax Distribution and Impact Report. March 2011. Submitted to the State Water Resources Control Board per Agreement No. 06-374-559-0).

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without conducting Arundo removal, habitat available for the diverse range of sensitive wildlife, including a number of threatened or endangered species, will continue to become more fragmented as Arundo spreads downstream. Studies have shown that Arundo forms dense, monotypic stands that both replace native vegetation and fill in naturally open areas along the riparian corridor that would naturally occur between native plant groups. Displacement of native vegetation over time reduces food sources for native species and negatively impacts biological diversity (California Invasive Plant Council, 2011).

Additionally, without Arundo removal, less water is available in the system for native plants and wildlife. Estimates of water savings from Arundo removal range from 528 gallons of water per square meter in a year (Bell, 1998) to 20 AFY/acre (California Invasive Plant Council, 2011). For the 9 acre riparian area, this equates to approximately 59 AFY to 180 AFY of water currently being taken out of the riparian corridor by Arundo, impairing native habitat and limiting water available for native plants. Additionally, studies have indicated that Arundo establishment along creeks and rivers can trap sediment, furthering deposition, vertical accretion and narrowing of the cross-sectional area of the stream bed (California Invasive Plant Council, 2011). As a result, native habitat without Arundo removal will continue to degrade due to channelization, sedimentation and significant water uptake.

Removal of Arundo from the site and adjacent area will eliminate the growing Arundo impact to native habitat; Arundo populations are presently expanding at a rate of 10 – 20% per year (Dendra: 2008), significantly degrading the native riparian ecosystem. Arundo removal will also prevent additional downstream establishment of new Arundo infestations which would further reduce habitat for sensitive wildlife populations and water available for natural ecosystem functions.

3. Description of methods used to estimate physical benefits.

Contractors hired by the city and the county generated data using sampling of outfalls for flow rates and pollutant levels, and visual observations were utilized to estimate physical changes which would result from the Project. The Dairy Fork Wetland System will treat approximately 325 acre-feet of urban runoff annually with a total treatment capacity of 161,000 cubic feet at any given time. Based on the dry weather runoff of 0.45 cubic feet per second, the area required to create proper retention time for surface water will require 2 acres of land, as was calculated by the design engineer. The 161,000 cubic feet of water retention was based upon the design which has a depth of 8 feet with a surface area of 26,533 square feet, and of 1 feet deep with 3,570 square feet for a total of 30,103 square feet or 0.7 acres. Additionally, the foot print of the wetland include access roads and fencing for an area of approximately 1.3 acres.

The 2 acres of wetland area combined with an additional 9 acres of Arundo removal result in the 11 acre total for habitat restoration. Natural resource restoration benefits achieved as a result of non-native and invasive plant removal within the 9 acres of riparian area were determined based upon Geographic Information System (GIS) mapping of vegetation observations and ground-truthing in 2008 as part of the comprehensive Aliso Creek Watershed Invasive Species Mapping and Management Plan. Additional recent Arundo removal efforts within The Aliso Creek watershed have further field-verified and supported these observations; current estimates indicate that Arundo extent may be up to 40% greater than 2008 estimates, which identified dense stands within the 9 acre area. Additionally, calculations of increased water stress from Arundo uptake are based upon widely recognized scientific research and included in the 2011 *Arundo donax Distribution and Impact Report* published by the California Invasive Plant Council.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

A constructed wetland and a 20 year monitoring program will be put into place to ensure that the physical benefits are met and maintained. In addition, environmental documentation (CEQA exemption) will be completed. A stream alteration permit from California Department of Fish and Wildlife and a general construction permit will be required. An easement agreement between 4 participating cities – Aliso Viejo, Lake Forest, Laguna Woods, and Laguna Hills is in place. An agreement with Southern California Edison has been achieved for the Project area located under their power line. An agreement with OC Parks is almost final. The City of Aliso Viejo, the Project lead, is committing operation and maintenance for 20 years, or as long as the wetland and habitat exists. Environmental documentation has been completed for the Arundo removal activities and an encroachment permit will be obtained from the County of Orange Parks (OC Parks) prior to the start of removal efforts.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

None; the removal of non-native invasive plants does not have the potential to adversely affect the restoration of habitat in the area. The existing permits for the invasive species removal have been comprehensively evaluated by the US Fish and Wildlife Service, CA Department of Fish and Wildlife, Army Corps of Engineers, San Diego Regional Water Quality Control Board and CEQA. Their reviews resulted in the permits including a number of species avoidance and low-impact implementation measures which, combined, considerably limit the potential for adverse physical effects. Due to their length, these species avoidance measures are available for reference upon request in the completed permit documents.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project addresses long-term drought preparedness by achieving long term reduction of use and water conservation by replacing high water-consuming invasive species with low water-consuming native species; thereby increasing the total amount of surface water in the creek system. The removal of existing and prevention of spreading of invasive species such as Arundo donax from the area will contribute to overall drought preparedness in that the Arundo absorbs large amounts of water and crowds out other bank stabilizing plants which are native to California. Estimates of water savings from Arundo removal range from 528 gallons of water per square meter in a year (Bell, 1998) to 20 AFY/acre (California Invasive Plant Council, 2011). For the 9 acre riparian area, this equates to approximately 59 AFY to 180 AFY of water currently being taken out of the riparian corridor by Arundo, impairing native habitat and limiting water available for native plants. Additionally, studies have indicated that Arundo establishment along creeks and rivers can trap sediment, furthering deposition, vertical accretion and narrowing of the cross-sectional area of the stream bed (California Invasive Plant Council, 2011). As a result, native habitat already stressed due to four consecutive years of low precipitation and drought conditions has less water in the system and reduced habitat variation to provide refugia. Removal of Arundo will reduce water taken from the riparian corridor, provide greater habitat variation and reduce stress on native flora and fauna during periods of drought, as well as facilitate improved groundwater recharge due to the large amount of water being available in the system following Arundo removal.

2. San Juan Aquatic Passage and Habitat Improvement

Primary Benefit: Riparian habitat improvement

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The proposed Project is needed to improve 145 acres of habitat to address loss of aquatic habitat and aquatic passage in the San Juan watershed headwaters, implement the watershed plan for this area as well as the recovery plan for Southern California Steelhead (National Marine Fisheries Service (NMFS), 2011; Trout Unlimited (TU) and California Department of Fish and Wildlife (CDFW), 2007), and contribute to ongoing regional, multiagency efforts to increase steelhead habitat. Assessments from the past decade confirm the ecological importance of providing passage to all native aquatic and riparian species through road-stream crossings and for all life stages of those species, particularly to provide for robust communities and for resilience to climate change stresses. Regional climate change projections of rising temperatures will increase stresses on native plant and aquatic species as they compete for scarce resources. Restoring natural habitat and stream connectivity will promote a supportive setting for native species to flourish. The San Juan Creek watershed is one of the very few stream systems in Southern California that does not have major municipal reservoirs and is one of only a few streams with potential for restoration of the endangered steelhead trout. In total, the Project is needed to achieve 145 acres of stream habitat restoration and will restore fish passage to 2 miles of stream, making these segments available for spawning.

The Project implements the Southern California Steelhead Recovery Plan (NMFS 2012) and the San Juan and Trabuco Creeks Steelhead Recovery Watershed Management Plan (TU and CDFW 2007) and the Cal State Water Action Plan (SWAP). One of the most closely aligned SWAP priority funding areas is #4: Protect and Restore Important Ecosystems.

Riparian habitat condition will also be improved through the removal of non-native weeds including Arundo and fig. Across the Cleveland National Forest (Forest), the Forest Service has been treating Arundo and other invasive weeds actively, as non-native invasives threaten and compete with native plants for resources. Invasive plant removal will enhance aquatic habitat and leave more water available for other resources. Non-native plants do not provide the essential habitat native fauna require. In 2012, the Forest Service treated a large patch of Arundo in Trabuco Canyon (downstream of the Project area). Treatment of fig, Arundo, and other invasives through this grant would further these efforts.

The Forest Service is already taking steps to address the aquatic organism passage and sediment issues in the San Juan Watershed. In 2014, the Forest removed 9 of the rock and mortar dams using a grant from US Fish and Wildlife Service. An undersized culvert/stream crossing that poses an eight-foot jump for fish, an aquatic passage barrier, and has historically been a chronic sediment source is planned for bridge replacement during summer of 2015. The stream crossing has washed out twice in the last 15 years and the bridge will ensure safe ingress/egress as well as allow aquatic passage. Building the bridge will save the public millions in repairs after big storm events and prevent large quantities of crossing related road fill from entering the stream system. In 2007, the Forest Service successfully replaced another crossing with a bridge in Holy Jim Canyon. CDFW and Trout Unlimited are working on projects to address the fish passage barriers at the I-5 and Metrolink crossings. Funding from the Prop 84 grant would allow continuation of the effort to improve beneficial uses, connectivity and health of aquatic ecosystems, and help reduce anthropogenic sedimentation in the San Juan Watershed.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the Project, 145 acres of habitat would not be improved. Other planned or completed actions include: replacement of a crossing with a bridge in Holy Jim Creek 2007, and removal of dams in Silverado Canyon and San Juan (mainstem) (2016-2019). The Forest also has an ongoing noxious weed removal program and has removed more than 20 acres of Arundo from streams in Orange County.

However, if the 16 dams, undersized culvert to bridge project and two crossings are not replaced or removed, and the invasive weeds are not addressed, the channel will still have aquatic organism barriers,

limiting the success of the Forest Service and regional aquatic organism passage efforts. Additionally, habitat will continue to be degraded due to invasive weeds.

Failure to remove the dams or replace the stream crossings will allow continued erosion, alteration of the natural hydrologic processes in the stream, and segmentation of aquatic habitat. As stated there are few streams left in Southern California that do not have major municipal reservoirs impounding the stream. With climate change and increasing water demands, restoring and preserving existing habitat is of the essence. Retaining the existing barriers will not only prevent migration of species but allow continued degradation and alteration of natural hydrologic processes and sediment transport.

Failure to treat the invasive fig and other invasive species will allow continued replacement of riparian vegetation by invasives, eliminating valuable habitat. In several locations the fig has completely replaced riparian vegetation and is so thick it has diverted stream flow out of the channel. Arundo has been shown to use 20 AFY/acre of water compared to riparian vegetation that only uses about 4 acre feet of water (California Invasive Plant Council, Arundo donax Distribution and Impact Report. March 2011). Removal of invasive species will protect water supplies for native flora and fauna dependent on riparian ecosystems. Removal of invasive species will help native ecosystems become more resilient during times of drought by reducing competition with high water users. Failure to remove invasive species will put increased stress on natives already stressed by long periods of drought.

Overall, failure to complete the Project would not only prevent restoration of 145 acres of riparian habitat and the opening of two miles of stream, but the increasing trend of invasive weed expansion and replacement of riparian vegetation would also continue. This would result in an even greater loss of native riparian acreage.

3. Description of methods used to estimate physical benefits.

The measure of riparian habitat acres improved is calculated based on miles of stream connectivity restored. Removal of aquatic barriers posed by stream crossings and dams (identified in the Forest Service stream assessment 2012) would restore connectivity for aquatic organisms in 2 miles of stream (upstream habitat made available to organisms migrating upstream). The adjacent habitat, stream corridor, and channel system would be improved as natural flow regimes and sediment transport fluxes would be re-established. The calculation of acres of habitat improved is based on the re-establishment of natural processes and a riparian habitat buffer. The Forest riparian buffer zone of 300 feet from a stream channel (300 ft from either side of the stream, or a 600ft total buffer) is the area the Forest Service specifically manages and protects in areas with steelhead trout habitat. The invasive weed treatment will also result in restoration of riparian habitat. In claiming acres of habitat restoration through invasive weed removal there is a one to one calculation (one acre of weeds equals one acre of restoration); however, the stream connectivity and weed removal are located in the same section of stream. There is no double counting of acres in the 145 acres of habitat restoration.

In 2015, 1 acre of habitat will be improved because a bridge will be constructed in place of a road and there is an 8 foot aquatic passage barrier that will be removed (no longer impacted by roadway). The 0.5 acre in 2016 will be improved due to the invasive plant removal. Currently, several dams and stream crossings are barriers for aquatic organisms (2012 Forest Service stream assessment). This Project is part of a greater effort to improve aquatic habitat and aquatic passage in the San Juan watershed headwaters. Removal of all the dams and the two stream crossings in Holy Jim Canyon will result in opening up 2 miles of habitat for aquatic organisms. The Project's habitat restoration is included in the San Juan Creek Watershed Plan, as well as the recovery plan for Southern California Steelhead. Assessments from the past decade confirm the ecological importance of providing passage to all native aquatic and riparian species through road-stream crossings and for all life stages of those species, particularly to provide for robust communities and for resilience to climate change (Hoffman, R. and J. Dunham. 2007. Fish movement ecology in high-gradient headwater streams: Its relevance to fish passage restoration through stream culvert barriers. USDI US Geological Survey report. Available online at http://fresc.usgs.gov/products/papers/1710_Hoffman.pdf). In 2012, the Forest Service treated a large patch of Arundo in Trabuco Canyon (downstream of the Project area). Treatment of fig, Arundo, and other invasives through this grant would further these efforts. Benefitting acres are included in the acreage provided for the fish passage part of Project. Estimates are based on the Forest Service's experience in invasive removal and aquatic habitat improvement. The Forest Service continues to address the aquatic organism passage and sediment issues in the San Juan Creek Watershed. In 2014, the Forest Service removed 9 of the rock and mortar dams using a grant from US Fish

and Wildlife Service. In 2015, an undersized culvert/stream crossing will be replaced with bridge in order to address issues with the crossing, which is an eight-foot jump for fish, an aquatic passage barrier, and has historically been a chronic sediment source (California Department of Fish and Wildlife (CDFW). 2013. Fish passage website. http://www.calfish.org/)

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

The Project requires construction of one large bridge to replace an undersized crossing, designs for two smaller concrete ford crossings to be replaced by two small bridges, and installation of one of the small bridges. All facilities would be located on Forest Service land. The Forest Service plans to replace the second crossing with a Federal grant concurrently. NEPA, CEQA (for dam removal and stream crossings), SHPO concurrence, 404 and 401 permits or notifications have been completed. CEQA for the invasive plant removal will be obtained in 2016.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

The Project will not result in any significant adverse physical effects; although there may be minor/insignificant increases in sediment related to the dam removal and stream crossing replacement. All minor/insignificant increases would be localized and short-term. To mitigate short-term increases in sediment, implementation would utilize best management practices (National Forest Service BMPs and Regional BMPs). The 401 and 404 permits for crossing replacements have been acquired. Although the dams do not have boards in place to retain water, some dams have accumulated small sediment wedges at the upstream side of the dam. The sediment accumulated behind the dams will help fill in the erosion downstream of the dams and restore the natural channel gradient. There will be some traffic delays along Holy Jim Creek road; potentially this road may be closed during part or all of the construction period and visitors may walk in from a nearby parking lot. Trabuco Road/Bridge construction will have vehicle bypass. The smaller Holy Jim crossings will not. Pedestrian access will be available. Lack of drivable access was discussed in the NEPA decision and available to the public during scoping, comment and objection periods of the project planning. Most visitors already walk in from the parking lot because there is limited parking at the end of the road. An additional road access behind the crossing will be minimal in size, approximately ¼ mile.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project addresses drought preparedness by achieving long-term reduction of water use and water conservation through re-establishment of native plant species following invasive species removal. Regional climate change projections of rising temperatures will increase stresses on native plant and aquatic species as they compete for scarce resources. Invasive plant removal will enhance aquatic habitat and leave more water available for other resources. Invasive plants such as Arundo have been shown to use more than 20 AFY/acre compared to riparian vegetation (California Invasive Plant Council, 2011). Restoring natural habitat and stream connectivity will promote a supportive setting for native species to become more sustainable and successful. Replacement of the undersized culverts and inadequate stream crossings will “storm-proof” the crossings, allowing them to pass larger flows that may result from more extreme weather or fires. Flows may also include debris flows such as those following major wildland fires, another disturbance projected to occur more frequently in the future and during periods of drought.

Secondary Benefit: Water quality through sediment reduction.

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The Project is needed to reduce 31 mg/L per year of sediment to address non-point source sediment related to erosion at the stream crossings, dams, and diversions created by the invasive fig. Although the sediment reduction is minor compared to the annual bedload, washouts have contributed significant amounts of sediment during large storms and degraded dams may trap debris and sediment causing flooding and increased erosion as flows create new erosion paths around barriers.

Sediment reductions would occur from a reduction in non-point source sediment sources, such as erosion related to the dams, stream crossings, and diversions created by the invasive fig. Most of the erosion sites are localized around structures/weeds and spread out through the stream system. The dams locally alter flow, channel conditions, and erosion and no longer function as originally intended. The dams were built for recreation and never intended for flood control. Since the dams have not been maintained for 30 years or more, many are currently storing sediment and debris, and during flood events may cause the stream to flow around the dam, creating increased flooding risk for adjacent roads and structures. Several dams have deep plunge pools that have resulted from channel erosion. Removal of the dams will allow more natural sediment transport and storage. Restoration of the sites impacted by invasive fig will allow the sites to regrow native riparian vegetation, provide habitat, and allow the stream to stay in the channel. The stream crossing that will be replaced with a bridge has washed out twice in the last 15 years. During each washout, approximately 90 cubic yards of road fill has washed directly into the stream system. Replacement of the stream crossings will reduce anthropogenic sedimentation. Roads are major contributors of sediment pollution to streams and stream crossings are a direct link. Replacement of the undersized culverts and inadequate stream crossings will “storm-proof” the crossings, allowing them to pass larger flows that may result from more extreme weather. Flows may also include debris flows such as those following major wildland fires, another disturbance projected to occur more frequently in the future due to drought and climate change.

By upgrading the three stream crossings, sediment related to washouts, road drainage, and flow restrictions will be minimized, improving water quality. Improving floodplains and channel conditions will benefit natural resources, which in turn contributes to healthy headwaters for downstream beneficial uses. Although it is difficult to measure reductions in non-point source sediment, using estimates of a blown out crossing gully dimensions, plunge pools, and diversions, the Project would result in a reduction of 145 cubic yards of sediment. This amount and the average annual discharge (USGS stream gage) were used to calculate 31 milligrams of sediment reduction per liter.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

If the Project is not implemented, erosion related to the dams, stream crossings, and diversions created by the invasive fig will continue and worsen. The dams pose barriers for debris and trap sediment, while causing erosion as water is forced out of the aggraded channel. Scouring around dams, under dams, and downstream of dams is common as the dams have altered natural sediment transport processes. Washing out or damage to structures is possible if dams trap enough debris and cause localized flooding. Therefore, without the Project there will be no reduction in sediment and no improvement to water quality.

3. Description of methods used to estimate physical benefits.

Sediment reduction will come from restoration of non-point sources of sediment. Several dams and crossings have deep plunge pools that have resulted from channel erosion. To estimate non-point source sediment, an estimate of 2 cubic yard of sediment for each dam (estimated diversion gully and plunge pool) and 1 cubic yard of sediment for each of 15 diversions created by the invasive fig (based on field observations and stream assessment surveys, Forest Service 2012). Actual diversions, gullies, and plunge pools vary in size and number. Erosion around the two smaller stream crossings is estimated based on the depth of the plunge pools and erosion around the banks (4 cubic yards each). The stream crossing that will be replaced with a bridge has washed out twice in the last 15 years. During each washout, approximately 90 cubic yards of road fill was washed to the stream system. Cubic yards of sediment and the annual average discharge were used to estimate milligrams of sediment per liter of discharge.

Replacement of the stream crossings will reduce anthropogenic sedimentation and will proactively prevent introduction of road fill. Replacement of the undersized culvert and inadequate stream crossings will “stormproof” the crossings, allowing them to pass larger flows that may result from more extreme weather. The following summarizes the assumptions: 1) Removal of 9 dams in Holy Jim Canyon resulting in a reduction of 18 cubic yards of sediment.2) Replacement of Forest Service crossing with a bridge resulting in a reduction of 90 cubic yards of sediment. 3) Partial treatment of invasive weeds resulting in a reduction of 4 cubic yards of sediment. 4) Replacement of one Forest Service crossing, removal of 7 dams, and remaining treatment of invasive weeds, resulting in a reduction of 33 cubic yards of sediment. 5) Total reduction of 145 cubic yards of sediment. The estimated cubic yards of sediment and the average annual discharge (USGS gage station 11047000) was used to estimate the decrease in milligrams of non-point

source sediment per liter of discharge. By upgrading the three stream crossings, sediment related to washouts, road drainage, and flow restrictions will be minimized, improving water quality. Improving floodplains and channel conditions will benefit natural resources, which in turn contributes to healthy headwaters for downstream beneficial uses. Although it is difficult to measure reductions in non-point source sediment, using estimates from a previous blown out crossing and site erosion, the Project would result in a reduction of 145 cubic yards of sediment or 31 mg of sediment/liter of discharge per year.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

The Project requires construction of one large bridge to replace an undersized crossing, designs for two smaller concrete ford crossings to be replaced by two small bridges, and installation of one of the small bridges. All facilities would be located on Forest Service land. The Forest Service plans to replace the second crossing with an additional grant concurrently. NEPA, CEQA (dam removal and stream crossings), SHPO concurrence, 404 and 401 permits or notifications have been completed. CEQA for invasive plant removal will be completed in 2016.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

The Project will not result in any significant adverse physical effects; although there may be temporary minor/insignificant increases in sediment related to the dam removal and stream crossing replacement. All minor/insignificant increases would be localized and short-term. To mitigate short-term increases in sediment, implementation would utilize best management practices (National NFS BMPs and Regional BMPs). The 401 and 404 permits for crossing replacements have been acquired. Although the dams do not have boards in place to retain water, some dams have accumulated small sediment wedges at the upstream side of the dam. The sediment accumulated behind the dams will help fill in the erosion (plunge pool) downstream of the dams and restore the natural channel gradient. There will be some traffic delays along Holy Jim Creek and Trabuco road, potentially this road may be closed during part or all of the construction period and visitors may walk in from a nearby parking lot. Trabuco Road/Bridge construction will have vehicle bypass. The smaller Holy Jim crossings will not. Pedestrian access will be available. Lack of drivable access was discussed in the NEPA decision and available to the public during scoping, comment and objection periods of the project planning. Most visitors already walk in from the parking lot because there is limited parking at the end of the road. An additional road access behind the crossing will be minimal in size, approximately about ¼ mile.

6. Description of whether the proposed project effectively addresses long-term drought preparedness

This Project addresses drought preparedness by achieving long term reduction of use and water conservation by riparian habitat restoration, which results in less water uptake through re-establishment of native species following invasive species removal. Regional climate change projections of rising temperatures will increase stresses on native plant and aquatic species as they compete for scarce resources. Invasive plant removal will enhance aquatic habitat and leave more water available for other resources. Invasive plants such as Arundo have been shown to use more than 20 AFY/acre of water compared to riparian vegetation (California Invasive Plant Council, Arundo donax Distribution and Impact Report. March 2011). Restoring natural habitat and stream connectivity will promote a supportive setting for native species to become more sustainable and successful. Replacement of the undersized culverts and inadequate stream crossings will “storm-proof” the crossings, allowing them to pass larger flows that may result from more extreme weather or fires. Flows may also include debris flows such as those following major wildland fires, another disturbance projected to occur more frequently in the future and during periods of drought. Removing weedy species may increase the amount of water available in the stream for wildlife.

3. Crown Valley Park Entry Channel Improvements

Primary Benefit: Water Quality - Reduce phosphorus concentration in dry-weather urban runoff

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The proposed Project is needed to provide pollutant removal capacity in the Sulphur Creek and Aliso Creek watersheds to protect designated beneficial uses (REC-1, REC-2 and WARM). The project will reduce 303 (d)-listed Total Phosphorus (TP) constituents as well as fecal coliform bacteria concentrations for Sulphur and Aliso Creeks as well as for the Sulphur Creek Lake downstream of the project site, which is used for flood control, fishing, boating and wading activities. As the Sulphur Creek watershed transitioned from pastoral to urbanized during the 1970s to 1990s, Sulphur Creek Lake experienced intermittent nutrient-driven algae blooms, disrupting fish populations and causing maintenance problems. Numerous water quality samples along Sulphur Creek and its tributaries since 2000 have shown chronically elevated TP concentrations relative to the San Diego Basin Plan Objective of 0.1 mg/L. Dry-weather samples taken at Crown Valley Park in 2013 (n=20) showed an average dry-weather TP concentration of 0.35 mg/L. One set of wet-weather samples taken in 2015 at the upstream end of the Project site showed a wet-weather concentration of 0.8 mg/L. The primary sources of dry and wet-weather TP in the contributory watershed include naturally-high-phosphorus soil/geological substrate, decomposing vegetative debris, pet/wildlife fecal material, landscape fertilizers, and irrigation runoff.

Crown Valley Community Park features extensive year-round active recreation facilities. As was typical in the 1960s and 1970s, the design of Crown Valley Park (as well as their hilly surrounding communities) was designed to channelize stream flow and to plant extensive areas of irrigated and well-fertilized turfgrass. This process of urbanization converted the runoff flow from ephemeral to constant, with a dry-weather flow rate averaging 0.5 CFS (2013 data); wet-weather flow may reach 2000 CFS. All this flow moves through the subsurface storm drain and daylights into Crown Valley Park at the partially grass-lined J03P01 flood control channel. The J03P01 Channel bisects the Park and outlets to Sulphur Creek downstream of the proposed Project site. Currently, runoff carrying TP and other pollutants flows from the entire 1,197-acre contributory drainage area upstream of the Park, into the J03P01 Channel, into Sulphur Creek and into the lake downstream.

Nutrient constituent concentrations measured in the channel are summarized as:

Constituent	J03P01 Channel Concentration	San Diego Region Basin Plan Water Quality Objective
Phosphorus	0.35 mg/L	0.1 mg/L
Total N	5.40 mg/L	1.0 mg/L

The Project is expected to reduce TP concentrations in dry weather discharge by approximately 41%, from 0.35 mg/L to 0.21 mg/L. The Project will also reduce phosphorus concentration in wet-weather runoff by an estimated 39%, from 0.8 mg/L down to 0.5 mg/L during small storms. As such, the water quality treatment component of this Project will incrementally help support the designated beneficial uses. To achieve this, the Project will implement capital-intensive best management practices based on natural (i.e. not energy-intensive) treatment mechanisms.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

The without-Project conditions are projected to include a continuation or worsening of current conditions, where 0.5 cubic feet/second (cfs) of dry-weather urban runoff is not effectively treated; and the levels of nutrients continue unabated. The contributing watershed is already fully built out. The average dry weather flow rate might trend somewhat downward in the future in response to actions that may be taken by individual businesses and residents upstream, either in response to ongoing drought conditions or to reflect BMP improvements driven by NPDES permit requirements for land use redevelopment. However, it is anticipated that increasing regional utilization of recycled water for landscape irrigation, as a drought response approach, may actually drive up the nutrient concentrations in urban runoff, due to high nutrient

concentrations in the local recycled water supply; this increase would not be buffered by the treatment system and habitat restoration proposed in this Project; and impacts on the downstream lake might worsen.

3. Description of methods used to estimate physical benefits.

The Project will help reduce nutrient concentrations (Total Phosphorus (TP), including both dissolved and particulate phosphorus, as well as nitrogen compounds) in dry and wet weather discharges from the 1,197-acre contributory drainage area within the Sulphur Creek watershed, which is 303(d) listed for nutrients impairment. Primary sources of TP in the contributory watershed include naturally-high-phosphorus soil/geological substrate, decomposing vegetative debris, pet/wildlife fecal material, landscape fertilizers, and irrigation runoff by recycled water. TP concentration (n=20) was measured on-site at an average of 0.35 mg/L in 2013; i.e. 3.5 times higher than the San Diego Basin Plan Water Quality Objective (WQO) for Total Phosphorus, which is 0.1 mg/L. Dry weather urban runoff flow rate in 2013 averaged 0.5 CFS, or 352 AFY, of which 2/3 would be treated through the constructed treatment wetland, with a hydraulic retention time (HRT) of 12 hours.

For particulate phosphorus, the dry-weather and wet-weather treatment mechanisms in the proposed sediment forebay, treatment wetlands and bioswales are through depositional and biofiltration processes that remove sediments and fine organic particulates. Removal mechanisms for dissolved phosphorus compounds are primarily effective for lower, slower dry-weather flows; they include uptake by wetland plants and microbiota; sorption to wetland soils; fixation and precipitation. Although the 12-hour HRT is less-than-optimal for phosphorus reduction even for dry weather, local research at the nearby Narco Channel Restoration Project (also tributary to Sulphur Creek) showed a reduction of up to 41% in phosphorus concentration through a restored wetlands that was not specifically designed for treatment, with only a 6-hour retention time. Given the doubled HRT and 1/3 of dry-weather flow that will evade the wetland, the project is estimated to achieve, on average, between 41% and 54% phosphorus reduction under dry weather conditions. Based on the 35mg/L measured in the dry-weather influent), a 41% reduction would produce a dry-weather effluent value of 0.21 mg/L. For wet weather, measured TP value at the upstream end of the site (n=1 in 2015) was 0.8 mg/L, which would be consistent with an increase in particulate TP as turbulent storm waters discharge from this watershed, which has naturally high-phosphorus soils. If a storm were small enough not to overwhelm the proposed system, the combined sediment forebay, treatment wetland and bioswales are estimated to perform as well during wet weather as predicted by the International Stormwater BMP Database's "wetland" phosphorus removal rate, which would be -39%. Based on an average influent value of 0.8 mg/L, the wet-weather effluent concentration, assuming 39% reduction, would be estimated to be around 0.5 mg/L.

<u>References:</u> 1) Bacteria and phosphorus data collected by City of Laguna Niguel in Summer 2013, n = 20; 2) Final Report for Wetland Capture And Treatment (WetCAT) Network, Agreement No. 01-122-259-0, March 2004, prepared for the San Diego Regional Water Quality Control Board by the City of Laguna Niguel. 3) Findings from follow-up summary of 2012 treatment performance, PowerPoint presented by the OC Watersheds, County of Orange in 1/30/2013 for The Sulphur Solution: Prevent, Control Restore Project, under Agreement No. 04-066-559-0, March 2008, prepared for the San Diego Regional Water Quality Control Board by the City of Laguna Niguel.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits

To improve water quality the Project will implement the following new facilities: a multi-process treatment train including a sediment forebay, a constructed treatment wetland for dry-weather flows, and vegetated bioswales for filtering storm flows. These components will be constructed between the J03P01 outfall at the upstream end of the channel, and an existing pedestrian bridge that crosses the channel approximately 700' downstream of the existing dip crossing.

Design of the water quality treatment components is generally based on the design parameters described under TC-21 (Constructed Wetlands) and TC-30 (Vegetated Swales) of the California Stormwater Quality Association (CASQA) Stormwater New Development/Redevelopment BMP Handbook (California Stormwater Quality Association, January 2003). However, due to space and jurisdictional constraints, both the dry-weather and the wet-weather treatment components of the Project were designed/sized to the "maximum extent practicable" standard for average dry- and wet-weather, rather than sized for the optimal treatment capacity or peak flow rates, which would have required more space (which is unavailable) to fully

treat regional flows from the large 1,197-acre contributory drainage area. To achieve the proposed water quality benefits, the key components of the Project's water quality improvement treatment train will include the following, from upstream to downstream:

Sediment Forebay and Trash Boom: At the outfall upstream of the open J03P01 channel (channel), there is an existing grouted-riprap apron for energy dissipation. Immediately downstream of the existing apron, the channel is soft-bottom, unvegetated, and collects coarse sediments which need to be removed by the City prior to the rainy season to maintain flood-handling capacity and positive flow under dry-weather conditions.

Under the proposed Project, a 1,909 sq. ft. concrete-lined sediment forebay will be constructed below the outfall, with a depth of 4' and volume of approximately 6,372 cubic feet. The sediment forebay will encourage deposition of coarse sediments during both dry weather and small storms. A floating trash boom in the forebay will capture trash from the first flush of storm flows, which will be removed after each storm and whenever it accumulates during the dry season. A maintenance access ramp will be constructed to facilitate routine and intermittent maintenance activity, including vector control, as well as trash and sediment removal. General public access will be constrained by perimeter fencing and signage.

Average hydraulic retention time of the forebay would range from 3.5 hours for dry weather flows (0.5 cfs) to 20 minutes for a 'first flush' storm (5.1 cfs) to 5 minutes for the 85th percentile storm (21 cfs). At these flow rates, deposition of coarse particulates will occur for the average storm flows, and of both coarser and finer sediments under dry weather conditions. The trash boom will be effective to capture floatables at all evaluated flow rates.

Low-flow Channels: Outflow from the sediment forebay flows into two existing earthen low-flow channels that pass under an existing well-established riparian canopy. Under the proposed Project, a third low-flow channel, would be cut, sized and controlled to divert 2/3 of the average 0.4-0.6 cfs low flow from the existing channels (at the most downstream point feasible consistent with the need for gravity flow), into the upstream end of the constructed treatment wetland. One-third of the average low flow would continue to flow through the existing channels, to support existing riparian canopy trees. The diversion channel will be designed to convey an additional 5.1 cfs, representing the <0.2" precipitation event that is defined under the Bacteria TMDL as a "dry weather day". At flow rates over about 21 cfs (i.e. the 85th percentile design storm), all three low-flow channels would begin to overtop and spread across the wider J03P01 channel bed, with decreasing treatment effectiveness. No added water quality benefit is being claimed for the Project from the low-flow channel(s); however, the diversion channel is essential for the operation of the constructed treatment wetland during regional dry weather flows.

A constructed treatment wetland will be developed just upstream of the existing dip crossing, outside of the RWQCB/USACE jurisdictional area of the J03P01 channel bed. The permanent pool will have an area of approximately 10,147 square feet and volume of 14,088 cubic feet. Another 12" of depth will be provided above the permanent-pool water surface, providing a total capacity of 24,779 cubic feet. Emergent vegetation planted in the wetland will provide multiple pollutant removal benefits: *Scirpus* (bulrush) will provide nitrification, plant uptake, and sedimentation, removing targeted pollutants such as organics and pesticides, with supplemental removal of nitrate, phosphorus and metals. *Typha* (cattails) will provide the additional benefit of filtration, providing removal of nitrate, phosphorus, metals and pathogens, as well as some organics. Sedimentation, solar radiation, and biological predation will also occur in the treatment wetland during dry weather.

The wetland will have an average HRT of 12 hours with a flow rate of 0.33 cfs (i.e. two-thirds of the 0.5 cfs for dry weather flows), and a permanent pool volume of 14,088 cubic feet. This HRT is substantially less than the 2+ days generally recommended for optimal performance for phosphorus removal; however, the Project prevents further water quality degradation downstream to the Maximum Extent Practicable (MEP) for the constituent given site constraints and the significant, contributory drainage area. Phosphorus removal in studies has been variable, but research at another site in the Sulphur Creek watershed – Narco Channel – showed a TP reduction of 41% with a 6-hour HRT and a starting concentration of 0.39 mg/L. Given the analogous pre-Project conditions between the two sites (0.35 mg/L and 0.39 mg/L), similar TP removal results are anticipated for the Project. At the 5.43 cfs dry-weather flow rate (i.e. 2/3 of the <0.2" precipitation event), the full storage capacity would be engaged, utilizing the total volume of 24,779 cubic feet, providing an HRT of approximately 1.25 hours. Effectiveness at this retention rate has not been statistically confirmed locally; however, storm flows typically carry higher loads of sediments and

particulates; such that it is expected (based on International Stormwater BMP Database findings) that phosphorus bound to coarser sediment particles would drop out, reducing TP to a similar percentage as for dry-weather flows. At storm flow rates over 21 cfs (the 85th-percentile storm), the low-flow channels and treatment wetland would not provide TP treatment at a predictable rate.

Arched Culvert Crossing and Energy Dissipator/Grade Transition Structure: An arched culvert crossing structure will be retrofitted in-channel, allowing high flood flows up to 5' in depth for a 100-year storm to pass unimpeded underneath. This crossing would replace the existing dip crossing, steep grouted-rock berm slopes and grouted-rock channel aprons that currently flood during storms. Just upstream of the arched culvert crossing, a wide non-grouted rock transition spillway (15% slope) will provide clearance under the culvert crossing, providing a gentle transition and energy dissipation for floodwaters moving between the upstream and the downstream channels. Erosion from floodwater turbulence would be further abated via an additional 100'-long apron of non-grouted rock. To handle the much-lower flows during dry weather conditions, a shallow rock-lined low-flow channel within the broader rock transition spillway surface will create a narrow, gentle cascade for year-round low flows coming from the e treatment wetland effluent. Native riparian vegetation interspersed among the non-grouted rock areas will emulate the appearance and ecological function of a natural stream floodplain, promoting habitat connectivity. The rock with interspersed native plantings will directly connect the riparian habitat area upstream of the culvert crossing to habitat downstream, and the arched culvert crossing will allow aquatic and terrestrial wildlife to pass freely between up and downstream, without obstruction by the existing dam-like berm and vertical low-flow pipes. Additionally, the culvert crossing replaces impervious surface in the channel bed, enabling treatment of regional dry weather flows and to dissipate energy and aerate regional storm flows.

Vegetated Bioswales: Downstream of the arched culvert crossing and apron, a 74'-wide swath of mown-turfgrass in the bed of the J03P01 channel will be stripped of the existing sod, and modified to create a set of 5 parallel, gently meandering, 10'-wide bioswales, varying in length from 252 to 310 linear feet. The bioswales will be planted with native *Carex* and *Juncus* species that provide biofiltration capacity, as well as foraging habitat for wildlife. Flow controls will be established along the base of the ungrouted rock apron to distribute any flows over 1 cfs across the top end of the bioswales. The 5 swales would be capable of treating any low flow that is not treated in the constructed wetlands, and storm flow up to 6.15 cfs (equivalent to 4" depth or less). According to the International BMP Database, a moderate removal of sediments, including phosphorus components, may be expected. The biofiltration mechanism would be principally depositional, and most effective for particulates to which Phosphorus may adhere.

The vegetated bioswale portion of the Project will also include a temporary irrigation system that will function for approximately two years post-construction to establish the plantings, after which it is expected that the plants will survive on the natural channel-bed moisture replenished by low-level precipitation events and winter storm flows. The frequent turfgrass fertilization added phosphorus to the channel bed and will be discontinued. The new *Carex* and *Juncus* vegetation, once established, will have habitat value for red-winged blackbirds and other foraging species that nest in the adjacent riparian habitat. Additional TP inputs will also be eliminated with cessation of landscape chemical/fertilizer applications to maintain the J03P01 flood control channel. The bioswales will provide treatment to the maximum extent practicable for regional storm flows and elevated dry weather flows.

Policies and actions required to implement the new facilities include applying for and securing a 404 Nationwide Permit 14 from the US Army Corps of Engineers, a 401 Water Quality Certification from the Regional Water Quality Control Board, and a 1602 Streambed Alteration Agreement from the California Department of Fish & Wildlife. . A long-term maintenance agreement for the treatment facilities will be negotiated with the applicable resource agencies, as required. Prior to implementing Phase 2 construction, a Statewide Construction General Permit WDID will be needed from the State Water Resources Control Board. An existing easement for Moulton Niguel Water District will also need to be modified to reflect the relocation of existing wet utility lines when the new channel crossing structure is put into place.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

Potential adverse physical effects from implementing the Project's BMP components are minimal as some existing natural components will be protected in place and the new BMPs are designed to minimize impacts. "Natural" water quality treatment BMP components, which will have much of the appearance and ecological functionality of a stream habitat restoration, were designed to restore beneficial use for aquatic/riparian

habitat to the maximum extent practicable, consistent with the primary public safety function and maintenance requirements for the critical continued use of the channel for flood control. The water quality components of the Project were designed to minimize or avoid impacts. A long-term maintenance agreement for the treatment facilities will be negotiated with the applicable resource agencies, as required. Park users may be inconvenienced temporarily during the construction period.

The existing low-flow channel adjacent to the bioswales has well-established native vegetation, a native riparian canopy and shrub understory on its banks. The vegetation and flow-line of the existing low-flow vegetated channel are regularly maintained by the City, as outlined in a Routine Maintenance Agreement with California Fish & Wildlife that was developed in 2006. The low-flow channel bed incorporates a series of small concrete weirs that encourage shallow ponding and reduce bacteria; this system can also effectively reduce phosphorous. Routine maintenance of this channel will be continued to retain pollutant removal capabilities and positive flow to control mosquitos. The existing low-flow vegetated channel and habitat area will be protected in place, with the exception of 20' that will be affected by culvert crossing construction, and 40' affected by the downstream extent of the non-grouted rock apron. To the extent feasible, the existing riparian trees along the affected portion of the vegetated low-flow channel will be protected in place, and understory plantings and emergent vegetation will be restored after construction to retain existing water quality improvement potential and habitat in the low flow vegetated channel.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project will promote water conservation, reuse and recycling by supplying the Niguel Botanical Preserve with recycled water in place of potable water for irrigation, directly offsetting the Preserve's annual water demand of 32.7 AFY. Switching the water source for the Botanical Preserve to recycled water will effectively decrease the amount of potable water supply that will need to be imported regionally by32.7 AFY. As such, the Project effectively makes potable supply available for more critical uses in the region during periods of long-term drought.

Outside the Botanical Preserve, the Project will also convert 2.3 acres of turfgrass to low-water-use landscaping and non-irrigated surfaces, saving approximately7 AFY of recycled water supply for regional use. The low-water-use landscaping will also require less fertilizer than the turfgrass reducing the phosphorus applied to the environment, where it could potentially be washed into the channel by rainfall.

Secondary Benefit: Restore Riparian Habitat

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

Historically (prior to development), the southerly tributary to Sulphur Creek was an ephemeral stream with very limited riparian woodland overstory, surrounded by native grasslands and coastal sage scrub. The J03P01 channel was engineered along the streambed in the 1970s to accept dry weather nuisance runoff and storm flow from 1,197 acres of planned residential and commercial land uses (subsequently constructed 1980-1990s). A feasibility study prepared by the US Army Corps of Engineers in the late 1990s estimated that 97% of the ecosystem value of the Sulphur Creek system had been substantially damaged by urban development and channelization. The Project is needed to repair the Sulphur Creek ecosystem through habitat connectivity, restoration of riparian areas, and restoration of stream beds to eliminate impediments to upstream movement of aquatic species and to reduce flooding and safety threats to the public.

The existing dip crossing is a barrier to upstream movement of aquatic fauna and disconnects the 4-acre riparian willow canopy area upstream from the 15 acres of riparian habitat (emergent marsh vegetation, willow woodland and sycamore floodplains) in the Sulphur Creek watershed downstream and 40 acres of habitat at Sulphur Creek Lake. Healthy riparian areas improve water quality, reduce erosion, attract beneficial insects, and enhance a variety of recreational opportunities. The Project will re-connect both aquatic and riparian habitat.

Construction of Crown Valley Community Park displaced native scrubland vegetation and channelized the ephemeral southerly tributary to Sulphur Creek. The park is now bisected by the J03P01 flood control channel, which flows continuously and outlets to Sulphur Creek within the park's boundaries. Currently, channel storm flows, multiplied by urbanization in the surrounding hilly watershed, reach a flow rate up to 2,000 CFS, flooding the existing 'dip crossing' entry, which will be removed under the proposed Project.

By removing the dip crossing, the Project will enable restoration of riparian habitat, unimpeded water flow and direct habitat connectivity between the 4 acres of existing riparian vegetation immediately upstream of the crossing, to 700'of riparian habitat immediately downstream, and another 15 acres of existing riparian habitat along the Sulphur Creek mainstem. The Project will provide critical habitat restoration for 4.4 acres and create 1.55 acres of new riparian habitat, resulting in a total of 5.95 acres of restored habitat in the Sulpher Creek watershed. Riparian habitat areas created as a result of the Project will provide open-water habitat in the wetland, native vegetation in and immediately surrounding the channel banks, and native floodplain reeds and sedges in the bioswales.

The dip crossing is currently an impediment to upstream travel by native species. The Project will remove the dip crossing aligned perpendicular to the trapezoidal channel which floods during peak storm flows, and the low point of which is elevated several feet above the upstream channel bed, on a grouted-rock-berm structure that effectively separates the upstream channel from the downstream channel. The Project is needed to eliminate this barrier for aquatic fauna and to re-connect riparian habitat on each side of the stream crossing.

Upstream of the dip crossing, an existing well-established riparian canopy, consisting of 4 acres almost entirely of Arroyo Willow, was planted when the J03P01 channel was completed in 1979. Through this canopy vegetation run low-flow channels, which are downcut approximately 2' from the surface through sediment layers laid down by storms over the last 35 years. The willow canopy area is almost entirely devoid of understory vegetation, due to heavy shading and ongoing routine flow-line and canopy maintenance activity that maintains overflow flood capacity for the wider J03P01 flood channel. The City's consulting biologist has identified these low-flow channels as conveying the waters of the Ordinary High Water Mark that delineates the limit of US Army Corps and Regional Water Quality Control Board jurisdiction.

Downstream of the dip crossing and its grouted-rock aprons, a 100'-wide swath of ornamental mown-turfgrass covers most of the bed and embankments of the J03P01 channel. The lawn area serves as an overflow floodplain during significant storms. The Project is needed for removal and revegetation of the existing turfgrass areas with native species to improve water quality and the ecosystem in the Sulphur Creek Watershed.

Sulphur Creek, downstream of the confluence with J03P01 channel, is in a predominantly natural condition, with significant well-developed riparian habitats. Approximately ¾ mile downstream of the J03P01 confluence with the creek, Sulphur Creek flows through Sulphur Creek Lake (a flood control reservoir within County-owned Laguna Niguel Regional Park), and then continues another mile to merge into Aliso Creek within Aliso &Woods Canyon Regional Park at a point approximately 3 miles from Aliso Beach and the Pacific Ocean. Sulphur Creek Lake intermittently exhibits algae blooms, indicating excessive nutrient concentrations in the water. Through revegetation of native plant species, removal of the dam-like dip crossing, and reconnecting riparian habitat, the Project is needed to restore riparian habitat to native vegetation, reduce flooding and safety threats to the public, eliminate impediments to movement of fish and other aquatic species, and reduce nutrient discharges that promote algae blooms that aggravate anoxic conditions that harm fish and other aquatic life in the lake.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the Project, riparian communities will remain limited to the 4 acres of willow canopy in the channel upstream of the existing dip crossing, and the ¼-acre of emergent vegetation and sycamore trees alongside the low-flow channel downstream of the dip crossing. No other projects are planned for habitat restoration in the Project area at this time. The 1.55 acres of riparian habitat would not be restored to native vegetation and the benefits of native vegetation, reduced flooding and safety threats to the public, reduction in algae blooms and eliminating impediments to movement of fish and other aquatic species would not be realized.

3. Description of methods used to estimate physical benefits.

Physical benefits, expressed as acres of existing compared to restored habitat area, are measured from aerial photography in the City's GPS database and field-verified by the Project Biologist Glenn Lukos Associates for existing conditions; and from Project engineering plans being prepared by the City's engineering design consultant, Hunsaker & Associates for proposed conditions. Native vegetation communities established within the channel and subject to resource agency permit requirements will be monitored for vegetative coverage, species mix, etc. that will be defined in the permits and associated documents.

Existing riparian habitats within the Project limits, as measured from maps, include a riparian willow canopy area of 4 acres, disconnected from downstream habitat by the existing dip crossing and grouted rock aprons; and an 18' wide x700' long (0.4 acres) low-flow stream with emergent marsh vegetation, sycamores and alders. After completion, the constructed treatment wetland would add 0.25 acres of open-water pond and emergent marsh vegetation; the bioswales with native reed and sedge vegetation will add 0.4 acres; and riparian transitional vegetation of 0.5 acres would be added to the east channel embankment and 0.4 acres at the rocky channel grade transition. Total acres of restored riparian would include 4.4 acres of existing riparian plus the 1.55 acres of restored riparian habitat with the Project, or 5.95 acres. The total additional acreage benefits of 1.55 acres are consistent each year after Project completion, and will be maintained in accordance with long-term routine maintenance agreements to be negotiated with the resource agencies. Removal of the existing dip crossing will also remove a barrier to habitat connectivity of the 4 acres of willow canopy upstream, to the 15 acres of natural habitat along Sulphur Creek downstream, as well as to the 40 acres of Sulphur Creek Lake.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

New facilities that will be constructed to achieve habitat restoration benefits include a treatment wetland, non-grouted rock spillway including native vegetation, and vegetated bioswales. "Natural" water quality treatment BMP components, which will have much of the appearance and ecological functionality of a stream habitat restoration project, were designed to restore beneficial use for aquatic/riparian habitat, to the maximum extent practicable consistent with the primary public safety function and maintenance requirements for the critical continued use of the channel for flood control.

The proposed constructed treatment wetland, which will be approximately 11,186 square feet in area (1/4-acre) and with a permanent pool depth averaging 18" deep, will be developed within and just upstream of the footprint of the existing dip crossing, partially within the area that is currently occupied by the existing grouted-rock apron of the dip crossing, and outside of the Regional Water Quality Control Board (RWQCB)/United States Army Corps of Engineers (USACE) jurisdictional area of the J03P01 channel bed. The proposed constructed treatment wetland will be planted with emergent vegetation, including *Typha* (cattails) and *Scirpus* (bulrush) species, ringing the open-water habitat in the center.

Downstream of the proposed treatment wetland and just upstream of the proposed arched culvert crossing, a wide non-grouted rock transition spillway will be installed to allow dry-weather and stormwater to flow under the culvert crossing. A 100'-long apron of non-grouted rock will also extend from the rock transition. Native riparian vegetation will be interspersed among all the non-grouted rock areas to emulate the appearance and ecological function of a natural stream floodplain, and to achieve and promote habitat connectivity. The rock with interspersed native plantings will directly connect the riparian habitat area upstream of the culvert crossing to habitat downstream. The arched culvert crossing will allow aquatic and terrestrial wildlife to pass freely between up and downstream, without obstruction by the existing dam-like berm and vertical low-flow pipes. The upstream and downstream edges and the side flanks of the rock aprons will be visually transitioned with more widely-spaced rock, randomly distributed to better mimic the appearance and function of a natural floodplain.

Downstream of the non-grouted rock area, the channel floodplain and embankments will be stripped of the existing turfgrass, and re-shaped and re-planted into a total area of about 17,200 square feet (0.4 ac) of vegetated bioswales. The vegetated bioswales will be planted with native *Carex* and *Juncus* species that provide stormwater biofiltration capacity, as well as foraging habitat for wildlife.

Policies and actions required to implement the new facilities include: applying for and securing a 404 Nationwide Permit 14 from the USACOE, a 401 Water Quality Certification from RWQCB, and a 1602 Streambed Alteration Agreement from the CDFW. A long-term maintenance agreement for the new habitat

areas, to preserve their function for water quality treatment while maintaining habitat value, will be negotiated with the applicable resource agencies, as required.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

There are no potential adverse physical effects from the Project. The water quality components were designed to minimize or avoid impacts. The constructed treatment wetlands, for example, will be developed within and just upstream of the footprint of the existing dip crossing, partially within the area that is currently occupied by the existing grouted-rock apron of the dip crossing, and outside of the RWQCB/USACE jurisdictional area of the J03P01 channel bed. It is anticipated that additional specific conditions for Project construction will be incorporated in conjunction with the procurement and negotiation of permit terms for the Project. All permit applications relating to the Project construction were submitted to the 3 resource agencies identified above in spring 2015. An additional application proposing appropriate protections for long-term routine maintenance operations is being prepared for submittal targeted in summer 2015.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

In addition to the conversion to recycled-water irrigation at the Niguel Botanical Preserve that will occur as Phase 1 of the Project and effectively increase the regional availability of potable water supply, Phase 2 of the Project will reduce long term water demand for recycled water. The local water retailer, Moulton Niguel Water District, currently runs short of recycled water supply during peak summer heat conditions, and therefore intermittently needs to draw upon potable supplies to supplement the recycled-water supply to its customers. Any on-site reduction in peak recycled water demand therefore helps incrementally to reduce the regional need to import potable water.

The Project will achieve long-term reduction of water use by replacing water-intensive turfgrass with low-water demanding native species such as sedges and reeds for the bioswale area, and sycamore trees (*Platanus)*, *Rosa californica* and/or *Ribes* (wild currant)next to the low-flow channel. These plantings will also benefit habitat complexity as a beneficial use. Temporary irrigation will be required to establish the transitional plantings, but at a much lower level than needed for the turfgrass.

In addition to the channel embankment plantings and the bioswale area within the channel, there will also be other areas of turfgrass converted to drought-tolerant species, on the slope to the west above the intersection of the arched culvert crossing with the maintenance road/bikeway; and on the slope below the south parking lot. These turf conversion areas total approximately 0.8 acres.

An important aspect of the turfgrass conversions to low-water plantings is that the existing high-precipitation rate irrigation system will be replaced with low-precipitation rate systems, which should eliminate any runoff from the high-clay soil surface. After the new plants are established, the frequency of watering during dry weather will be reduced by roughly 5/6 (i.e. to semi-weekly compared to 3 times per week for turf), and the overall annual watering precipitation will be reduced from 39” to 15”, or about by about 5.25 AFY. Just south of the box culvert outfall at the upstream end of the park, approximately 1 additional acre of existing irrigated ornamental turfgrass will be replaced with new parking areas and walkways to serve the park’s sports fields. These improvements will completely eliminate 3.4 AFY of landscape irrigation, as well as seasonal applications of fertilizers to these areas, so they no longer contribute to dry-weather runoff flows or pollutant constituent concentrations in dry weather.

4. Strategic Turfgrass Removal & Design Assistance Program

Primary Benefit: Water Use Efficiency and Water Supply Saved

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The Project is needed to conserve 252 AFY of water used for irrigation through turf removal and conversion to native or California-friendly landscape. The South Orange County WMA (WMA) relies on two distinct water supply sources: 1) The imported water supply upon which the South Orange County WMA is dependent; and 2) the local water supply including groundwater, surface water, recycled water and desalted water, which improves the WMA's water supply and system reliability. The imported water supply accounts for more than 90% of the South Orange County WMA's potable water supply, and is obtained through the wholesaler, Municipal Water District of Orange County (MWDOC), which receives imported water supply from the Colorado River and Northern California through the state water project (SWP) contractor Metropolitan Water District of Southern California (MWD). The local water supply, though smaller in amount, is in many ways much more critical in that it involves not only developing a usable supply to improve overall water supply reliability, but also requires maintaining and protecting the area's ecological functions dependent on the availability of high quality surface water and groundwater.

The current drought conditions pose significant threat to MWDOC due to its reliance on imported water supply. On April 7, Governor Brown issued an executive order requiring a mandatory 24% potable water reduction. The negative impacts of not implementing the proposed Program include the following: A reduced ability to respond to the drought; A lower reliability of water supply; A reduced ability to meet the Governor's call for a 20% reduction in urban water use by 2020 (The Water Conservation Act of 2009, SBX7-7); a continued negative impact to the local creeks and Pacific Ocean due to dry-weather runoff and non-point source pollution; a missed opportunity to educate local residents and property owners about environmentally friendly landscaping techniques.

Due to recent drought conditions, conversion of landscapes from predominately high water-using plant material (turfgrass) to a climate appropriate (California-friendly) landscape palette will result in long-term sustainable water use efficiency. The proposed Program is needed to improve water supply reliability by being more efficient with existing supplies, thereby availing imported water for more critical potable uses. Both of these benefits will minimize or forestall shortages due to drought.

The Project will enhance MWDOC's current Turf Removal Program by reducing landscape water consumption, reducing irrigation runoff, increasing onsite infiltration, and increasing market transformation towards sustainable landscapes. MWDOC will administer this Project as the lead agency on behalf of the cities and retail water agencies within the South Orange County WMA. The proposed Project will target the voluntary removal of 1,796,330 square-feet of ornamental turfgrass and installation of California-friendly landscapes with climate appropriate greenscape and permeable hardscape. The Project will save 252 AFY of water supply used for irrigation and convert approximately 42 acres of turf grass to California-friendly landscape. Landscape water use accounts for 50% of Orange County water use and is a critical component to ensure domestic water use efficiency. California-friendly plantings require less than half the irrigation required by turfgrass. Turfgrass requires more irrigation than any other ornamental plant and is often over-irrigated. The turfgrass removal component of the Project will be available to both residential, commercial, and public properties. MWDOC proposes to facilitate the removal of turfgrass, providing incentives through a rebate-style format to residential and commercial property owners. Rebates will be provided to property owners for qualifying Projects. The technical assistance component of the Project will be offered as a pilot to approximately 4,000 residential, commercial, and public sites as a means to promote landscape renovations yielding optimum benefits.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the Project, the region risks shortfalls in supply and the 252 AFY of water savings will not occur. Shortfalls in supply are two-fold. First, the region is experiencing four years of below average rainfall, which is inhibiting MWDOC's ability to access surplus water and could lead to mandatory water rationing this

summer. Second, the State Water Project is experiencing the same dry years and pumping restrictions due to drought impacts to endangered species. Due to these ongoing reductions of imported water supply, water agencies have, in some years, been forced to draw from emergency storage to meet demand. These emergency storage levels are all at critical low levels and could be significantly lower if dry conditions continue throughout 2015. These events would force all regional water agencies to ration there supplies and force heavy fines for retail agencies that do not comply. Following the Governor's drought declaration water agencies continue to enforce mandatory water use restrictions, including irrigation time of day and days of the week, washing of hard surfaces, runoff, etc.

3. Description of methods used to estimate physical benefits.

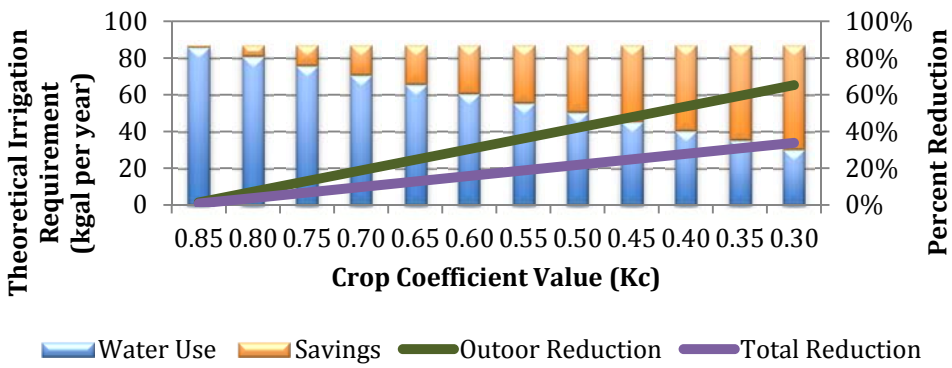
This Program has been collecting data for the past several years. The method used to estimate water supply savings includes the theoretical irrigation requirement, as described: The average annual water saving was initially calculated utilizing the theoretical irrigation requirement (TIR) water need taking local evapotranspiration (ETo) and rainfall (Pe) into consideration. As part of this analysis, the crop coefficients (Kc) varies from turfgrass (0.8) versus a California-friendly landscape, comprised of low water need plants (0.3).

$$TIR = (ETo \times Kc - Pe) / IE$$

$$WS = (TIR\ final - TIR\ initial) / TIR\ final$$

where, WS = Water Savings (%)
IE = Irrigation Efficiency (%)

The graph below depicts the general relationship between the theoretical irrigation requirement and potential reduction of water for various Kc values (Baum-Haley, 2014).



For the Orange County area, this results in the following:

Annual Average		Assumptions		Theoretical Irrigation Requirement TIR (gallons per ft² per year)		Potential Savings based on TIR	
P (in/yr)	**ETo (in/yr)**	**Pe (in/yr)**	**IE (%)**	**Turfgrass Landscape Kc = 0.8**	**CA Friendly Plantings Kc = 0.3**	**Gallons per ft² per year**	**Percent**
12	47	3.8	60-70	56	14	42	75%

From the data previously collected from onsite inspections at Turf Removal sites within Orange County, the average removal area is 2,000 square feet. This would result in an annual use prior to the conversion from 112,000 to 28,000 gallons per year, in this case a savings of 84,000 gallon per year. On a per square foot basis, this is a savings of approximately 42 gallons per year per ft² or 0.12 gallons per day per ft². This analysis also concurs with the water savings observed using actual meter data. Following the theoretical analysis, actual water use at sites was evaluated, utilizing historic water use data as well as the water use data following the turf removal landscape conversion. Metropolitan Water District of Southern California looked at their regional turf removal program and found water savings of approximately 44 to 49 gallons per year per square foot.

$$Project\ Savings\ Rate = (Conversion\ Area) \times (Water\ Savings\ Rate)$$

$$252\frac{AF}{year} = (1{,}796{,}330\ sqft) \times \left(44\frac{gallons}{year\ per\ sqft}\right) \div 325{,}851\frac{gallons}{AF}$$

The 44 to 49 gallons per year per square foot savings rate is the conversion for the acre foot savings that is listed.

Total Square footage = 1,796,330
Water saving rate = 45.6 gal/yr or 0.125 gallons per day (gpd)
Total water savings = 1,796,330 x 0.125 gpd = 224,541 gpd
Lifetime water savings rate = 224,541 gpd x 365 days/yr x 10 yrs = 819,575,563 gallons per life
Lifetime acre foot = 819,575,563 gallons per life / 325,866 gal/ acre-feet per year (AFY)
Annual water savings = 252 AFY

The annual water savings is associated with the square feet of turf converted per year. Implementation of the Project's 4,000 sites will occur from 2015 through 2019, with 10 year life expectancy of the sites beginning in the year of implementation. As the program ramps up, the annual water savings increases, plateaus, and then decreases as the program activity ramps down. The last year of implementation will be in 2019, therefore the benefits in Table 5a are shown through year 2029.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

All actions needed to ensure the benefits associated with this landscape conversion rebate incentive program, are outlined in the Program's application terms and conditions. Namely, the completed Project must meet the following guidelines to achieve water savings:

a. The Project area cannot include any live turf or turf-looking plantings.
b. Final Project area(s) must include some plants, unless synthetic turf is installed.
c. The watering system, if remaining, must be a low flow system (drip or high efficiency rotating nozzles). If part of a lawn is converted, the sprinkler system must be properly modified to provide adequate coverage to the remaining lawn without spraying the converted area.
d. No invasive plant species are permitted. A helpful website can be found at http://cal-ipc.org/landscaping/

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

The proposed Program will not negatively impact the surrounding environment. The Program focuses on landscape and irrigation system improvements to existing urban landscape. It is anticipated that these improvements will result in water conservation and reduced dry-weather runoff and non-point source pollution leaving the Program area and entering the natural environment, including local streams and creeks leading to the Pacific Ocean. There are no known endangered or threatened species or wetlands that will be negatively impacted by the Program or directly impacted within the area.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The proposed Program will effectively address long-term drought by promoting water conservation, improving landscape efficiencies, and achieving long-term reduction of water use by conserving 252 AFY of water. This Program was identified in MWDOC's 2013 Water Use Efficiency Master Plan. Program design work is complete and includes a standard consumer rebate implementation framework. Rebate applications, to be completed by consumers, are established, and rebate administration vendors are in place. The proposed Program is included in the 5-year portfolio of programs identified for implementation in the Master Plan. The proposed Program conforms to California's SBx 7-7, the 2009 Water Conservation Act that calls for a 20% reduction in urban water demand by 2020. This Program represents a key strategy, landscape water use efficiency, which will assist Orange County water agencies to meet their reduction goals. The Project will significantly increase the awareness of water conservation in Orange County. The Program will be promoted through water bill stuffers, water bill messages, newsletters, websites, radio spots, and social media channels. The Program will serve as an example of efficiency that can be replicated not only from user to user, but also by water agency to water agency, thereby increasing the capability of future water conservation and efficiency efforts beyond Orange County.

Secondary Benefit: Habitat Restoration

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The Project is needed to reduce degradation of water quality and habitat of waterways by providing pockets of habitat in a highly urbanized area. Further degradation through habitat fragmentation and limited availability of drought-tolerant and native habitat will reduce available habitat for native fauna and flora and will allow easier access for invasive species such as arundo donax to take root in more of the region's riparian corridors. The Project is needed to replace 42 acres of turfgrass which provides little to no habitat for native species with California-friendly landscaping that provides greater habitat variability and reduces water demand on natural systems. The Project will also provide technical resources to enhance the landscape conversion process, which was a need identified in the results of MWDOC's previous incentive based water conservation programs. Plant palates will be appropriately selected, irrigation will be better managed, and superfluous use will be reduced. The new landscape will provide: increased soil function, health, and biodiversity; stormwater retention including runoff prevention and erosion control; ecosystem services such as habitat creation, fire control, and cooling; and greenhouse gas (GHG) emissions and waste generation reduction (California Urban Water Conservation Council (CUWCC), 2015). As a specific criterial of the program terms, no invasive species are permitted within the landscape conversion area.

The Project is needed to address long-term drought preparedness by achieving water conservation and long-term reduction of water use through removing high water- consuming plants and replacing them with low water-consuming California-friendly species; thereby increasing the total amount of water in the creek system. The removal of existing and prevention of the spreading of water demanding non-native and/or invasive species from the area will contribute to overall drought preparedness by replacing high-water demand landscaping with low-water need plants that are California-friendly and non-invasive. The presence of high water demanding non-native and invasive plants decreases the amount of water which successfully infiltrates into groundwater.

Prolonged droughts on the State Water Project and/or Colorado River Aqueduct imported water systems reduces available imported water supply and increases salinity of imported water supply. Also, as a result of the drought, there is a decreased availability of imported water for drinking water and other potable uses. The imported water supply accounts for more than 90% of the South Orange County WMA's potable water supply, and is supplied by MWDOC, which receives imported water supply from Metropolitan Water District of Southern California (MWD). Nearly 50% of the region's water demand comes from outdoor use and irrigation. The Project would directly reduce the amount of water used for irrigation by planting 42 acres of low water-demanding, California-friendly landscape, which requires much less water than turf as well as providing pockets of habitat for native species. The U.S. Drought Monitor declared the County of Orange, California, as in the extreme category for the 2014 Drought on April 1, 2014. Since the South Orange County WMA's water supply originates predominately from imported sources, the region is subject to drought conditions and agencies outside of the region. In the case of emergency shutdowns or outages of facilities, such as MWD's Diemer Water Filtration Plant or major supply pipelines, the region is under serious threat of not receiving any imported water supply. The South Orange County WMA is vulnerable to drought or emergency outages of the import system; therefore the drought has directly affected the local water supply. For example, all of Santa Margarita Water District's (SMWD) domestic water supply is imported water purchased from MWDOC, which purchases the water from MWD, which delivers water to the region from Northern California via State Water Project and from the Colorado River via the Colorado River Aqueduct. The proposed Project would conserve 252 AFY of imported water used for irrigation to reduce the demand on imported water for the region. The decreased availability of imported water increases the need for local water supply reliability.

The landscape conversions will reduce dry weather runoff and pollution from existing landscapes. Irrigation runoff carries pollutants which denudes native habitat and allows non-native species to invade. Additionally, the Project indirectly protects surface, groundwater, and ocean water quality. The Project promotes state-wide and region-wide utilization of BMPs that are appropriate to non-point source (NPS) pollutants to prevent potential pollutants from entering municipal storm drain systems and aquatic ecosystems during wet/dry weather. In addition to habitat restoration, it is anticipated that 0.11 million gallons per day of NPS will be reduced as a direct benefit of this Project. Reductions in urban runoff will also have considerable

benefits on water quality within Orange County's creeks and streams, an important local issue. Reduced urban runoff also benefits water quality within local creeks and streams (Source: Residential Runoff Reduction (R3) Study, 2004, MWDOC and Irvine Ranch Water District). Funding is needed for significant enhancement of habitat restoration and associated water supply benefits.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without this Project, the proposed 42 acres of landscape transformation to include low water-demanding plants would not be implemented. Following the Governor's drought declaration water agencies continue to enforce mandatory water use restrictions, including irrigation time of day and days of the week, washing of hard surfaces, runoff, etc. As irrigation is reduced, high water-consuming non-native and/or invasive species will use up the limited irrigation water available, decreasing the amount of water which successfully infiltrates into groundwater. Without this Project, the 42 acres of habitat restoration within the urban landscape would not be achieved.

3. Description of methods used to estimate physical benefits.

The Project includes converting approximately 1,796,330 square-feet (or approximately 42 acres) of turfgrass to California-friendly landscapes. Implementation of the Project's 4,000 sites will occur from 2015 through 2019, with 10 year life expectancy of the sites beginning in the year of implementation. The last year of implementation will be in 2019, therefore the benefits are shown through year 2029 and the anticipated useful life of the Project is 14 years. This estimate is based on previous results from implementing the program, including customer participation, marketing/promotional efforts, rebate incentives, and implementing water conservation measures. MWDOC's service area encompasses all of the South Orange County WMA and it is anticipated that users will be dispersed throughout the WMA. MWDOC's Residential Runoff Reduction Study (July 2004) and SmarTimer and Edgescape Evaluation Study (October 2008) have each focused on the conversion of the urban landscape from turf intensive to climate appropriate focusing on climate appropriate California-friendly and native vegetation. While implementation of the California-friendly landscapes is expected to be permanent, a 10 year life of the conversion is utilized for planning purposes. However, the total 42 acres converted to California-friendly landscapes may remain in place from year 2029 on.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

All actions needed to ensure the benefits associated with this landscape conversion rebate incentive program, are outlined in the Program's application terms and conditions. Namely, the completed Project must meet the following guidelines to achieve turf removal and replacement with California-friendly landscapes:

a. Any new vegetation planted within the turf removal area must be either native or climate appropriate species. No invasive species are permitted within the landscape conversion area.
b. All exposed soil must be covered with a 2-3 inch layer of mulch, except in areas planted with creeping or rooting groundcovers or directly seeded.
c. The Project will implement Low Impact Development (LID) strategies targeting anthropogenic pollutants through landscape conversion. The converted area must be permeable to air and water. Weed barriers must be permeable. Concrete, plastic sheeting, or other impermeable surfaces will not be eligible for rebate funding. Grout and/or mortar used with pavers are not considered permeable and will disqualify the site from the rebate program if installed. Pavers or bricks that are sand filled and/or spaced sufficiently to allow air and water to pass through can be included in your conversion area so long as all program requirements have been met. Installing drains does not make the area permeable.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

The proposed Program will not negatively impact the surrounding environment. The Program focuses on landscape and irrigation system improvements to existing urban landscape. It is anticipated that these improvements will result in water conservation and habitat restoration within the urban landscape. There are no known endangered or threatened species or wetlands that will be negatively impacted by the Program or directly impacted within the area.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project effectively addresses drought preparedness by achieving long-term reduction of water use and water conservation through the replacement of non-functional turf grass with native and California-friendly plants in approximately 42 acres of urban landscapes. The Project will incentivize the replacement of high-volume irrigation technologies used on turfgrass, with low-volume irrigation technologies or no irrigation utilized after the conversion. Native and California-friendly plants contribute to long-term drought preparedness because native plant species will allow more water to infiltrate into the soil and groundwater, replenishing supplies. Regional climate change projections of rising temperatures will increase stresses on native plant and aquatic species as they compete for scarce resources. Turf removal and replacement with California-friendly landscapes will leave more water available for other uses. The Project will significantly increase the awareness of water conservation in Orange County. The Program will be promoted through water bill stuffers, water bill messages, newsletters, websites, radio spots, and social media channels. The Program will serve as an example of efficiency that can be replicated not only from user to user, but also by water agency to water agency, thereby increasing the capability of future water conservation and efficiency efforts beyond Orange County. The Program will improve landscape efficiencies by providing specific tools to help sites reduce their water use with to goal of at least a 20% reduction and elimination of runoff due to landscape irrigation. Lastly, the Project will achieve long-terms reduction of water use by saving up to 252 AFY through 42 acres of landscape conversion to water savings alternatives.

Also, as a result of the drought, there is a decreased availability of imported water for drinking water and other potable uses. The imported water supply accounts for more than 90% of the South Orange County WMA's potable water supply, and is supplied by MWDOC, which receives imported water supply from MWD. Nearly 50% of the region's water demand comes from outdoor use and irrigation. The Project would directly reduce the amount of water used for irrigation by planting 42 acres of native and California-friendly plant species, which require much less water than turf. The U.S. Drought Monitor declared the County of Orange, California, as in the extreme category for the 2014 Drought on April 1, 2014. Since the South Orange County WMA's water supply originates predominately from imported sources, the region is subject to drought conditions and agencies outside of the region. In the case of emergency shutdowns or outages of facilities, such as MWD's Diemer Water Filtration Plant or major supply pipelines, the region is under serious threat of not receiving any imported water supply. The South Orange County WMA is vulnerable to drought or emergency outages of the import system; therefore the drought has directly affected the local water supply. The proposed Project would conserve 252 AFY of imported water used for irrigation to reduce the demand on imported water for the region. The decreased availability of imported water increases the need for local water conservation measures, as proposed by the Project.

5. 3A Water Recycling Plant Tertiary Expansion

Primary Benefit: Increase Recycled Water Supply

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

Santa Margarita Water District (SMWD) is Orange County's second-largest water district, providing water and wastewater treatment services to more than 155,000 residents and businesses, and encompassing approximately 52,000 acres, with a total water demand of approximately 35,000 AFY. All of SMWD's water supply is purchased through Municipal Water District of Orange County (MWDOC) from the Metropolitan Water District of Southern California (MWD), which delivers water to the region from Northern California via the State Water Project (SWP) and from the Colorado River via the Colorado River Aqueduct. Due to the drought, this imported water supply is at risk. SMWD currently serves approximately 28,000 AFY of potable water. SMWD's recycled water system provides one-fifth of SMWD's annual water demand and further utilizing the available recycled water is necessary to reduce the demand on imported water supplies from MWD. In an effort to provide a more reliable and locally sustainable water supply, SMWD's Project will increase the amount of recycled water available. The proposed Project would provide at least 3,000 AFY of additional recycled water to reduce the demand on imported water for the region. The 3,000 AFY that will be produced by this Project will be a 100% offset of the amount of potable water that must be imported which reflects more than 10% of the SMWD's water supply. The 3,000 AFY of recycled water would make that same amount of domestic water available to service areas that are short on supply as a result of the state's drought. The percentage of total outdoor water use is roughly 55% of SMWD's total domestic demand. Using recycled water in place of potable water for irrigation supply reduces the total domestic water demand for SMWD. Increasing the recycled water usage for irrigation purposes increases the domestic water reliability, thereby making high quality drinking water available for potable uses rather than non-potable uses. The Project helps decrease the reliance on imported water for the delivery of safe drinking water by providing recycled water for non-potable uses. Implementing recycled water will ensure there is adequate supply for irrigation and agricultural uses, including Rancho Mission Viejo's ranching and agricultural operations and 17,000 acres of natural open space. The ability to continue to irrigate landscaping upstream of the natural ecosystems allows for the groundwater levels to stay at a relatively constant level which will support the ground surface habitats. Providing 3,000 AFY of recycled water for irrigation supply will also reduce the amount of wastewater released into the ocean. The Project's recycled water supply helps to reduce the drought's threat to residents, agriculture, and businesses in the local economy.

The California Department of Water Resources (DWR) reduced the anticipated SWP water supply deliveries to contractors to zero percent in 2014 which greatly impacted the water reliability of the Region because the South Orange County WMA relies on imported water for 90% of its supply. The Project will increase both the local water supply reliability and the ability to deliver safe drinking water by supplying recycled water for irrigation to the region. Irrigating with recycled water allows an equal amount of high quality drinking water to become available for potable uses instead of non-potable uses. The Project will also result in energy saved and greenhouse gases avoided. The current drought conditions pose significant threat to the District due to its reliance on imported water supply. In 2015, the SMWD moved to a level 2 water supply warning following Governor Brown issuing an executive order requiring a mandatory 24% potable water reduction.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the Project, 3,000 AFY of imported water will continue to be supplied to meet the irrigation demands of the service area. The limited availability of imported water supplies makes the without-Project conditions unreliable in terms of dependency on SWP and Colorado River Water. Other planned water conservation projects will continue to contribute to reducing water demand, however customers in the service area have already implemented aggressive conservation measures and increasing local recycled water supply is needed. There will be zero benefits to the amount of recycled water used, the amount of domestic water saved, the amount of energy used and the amount of greenhouse gasses reduced if the Project is not constructed.

3. Description of methods used to estimate physical benefits.

The estimated physical benefits will be the actual physical benefits due to the direct offset that each AFY of recycled water will provide for the existing potable water use. Using the District's existing recycled water distribution system it will be possible to connect existing potable water irrigation users to the recycled water system. The additional recycled water will also be used within the Moulton Niguel Water District (MNWD) for additional recycled water customers that they have developed in response to the water shortage conditions. The 3,000 AFY produced will be the result of expanding the tertiary treatment capacity of the 3A Water Recycling Plant (WRP) by 3.0 million gallons per day (MGD). The 3.0 MGD is the equivalent of 3,360 AFY and allowing for a 90% capture rate due to losses associated to solids dewatering, filter backwash and other in-plant uses results in 3,000 AFY.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

The new facilities will include the modification of existing secondary treatment components and the expansion of the existing tertiary treatment facilities. Additionally, new effluent pumps will be required to transfer the larger volume of water into the distribution system. No new policies will need to be established as both SMWD and MNWD have mandatory recycled water use policies in place. The final design of the facility must be completed along with the CEQA documentation associated with the Project. The District's Board of Directors must approve the award of the construction contract. The District's portion of the Project funds have been budgeted for FY 2015-2016.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

No potential adverse physical effects are anticipated due to the expansion of the existing 3A WRP. There is adequate space available on the existing site to accommodate the modifications/expansion that are proposed for this Project.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project provides immediate and long-term reduction of water use by providing 3,000 AFY of recycled water to the region for irrigation, thereby promoting potable water conservation, conjunctive use, reuse and recycling. The Project promotes water recycling by expanding the existing 3A WRP to produce at least 3,000 AFY of new recycled water. Using recycled water in place of potable water for irrigation supply reduces the total domestic water demand for SMWD. The Project helps decrease the reliance on imported water for the delivery of safe drinking water by providing recycled water for non-potable uses.

The Project will improve landscape and agricultural irrigation efficiencies by providing 3,000 AFY of recycled water for these users. It is anticipated that the current landscape irrigation efficiencies will improve due to more diligence in monitoring the irrigation system to meet recycled water use regulations. Increasing the recycled water usage for irrigation purposes increases the domestic water reliability, thereby making high quality drinking water available for potable uses rather than non-potable uses. Implementing recycled water will ensure there is adequate supply for irrigation and agricultural uses, including Rancho Mission Viejo's ranching and agricultural operations and 17,000 acres of natural open space. Providing 3,000 AFY of recycled water for irrigation supply will reduce the amount of wastewater released into the ocean. The Project's recycled water supply helps to reduce the drought's threat to residents, agriculture, and businesses in the local economy.

The Project provides immediate and long-term reduction of water use by providing 3,000 AFY of recycled water to the region for irrigation. The Project would be very successful in meeting long-term drought preparedness by producing recycled water that will be used to be a direct offset to imported potable water use. The state's July 15, 2014 news release, State Water Board Approves Emergency Regulation to Ensure Agencies and State Residents Increase Water Conservation, asks water agencies to increase recycled water projects. This recycled water Project will utilize approximately 3,000 AFY of local recycled water to offset imported water demand, contributing to sustainable water supply and reliability during water shortages. The 3,000 AFY of recycled water will be readily available The Project addresses long-term drought preparedness in that it is a permanent increase in recycled water supply. With the direct offset of

the potable water use there will be an immediate and permanent reduction in water use for the specific irrigation users.

The Project will establish system interties by connection with MNWD's system. The Project is located at the boundary of the SMWD and MNWD service areas and encourages the joint beneficial use of the additional recycled water that will be produced.

Secondary Benefit: Reduced amount of electrical energy required to import potable water to Santa Margarita Water District.

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

SMWD currently serves approximately 28,000 AFY of potable water. All of this water is imported from either northern California or the Colorado River. In an effort to provide a more reliable and locally sustainable water supply, the District is proposing to increase the amount of recycled water available. The 3,000 AFY that will be produced by this Project will be a 100% offset of the amount of potable water and its required energy to distribute it that must be imported. There is a great need for reducing energy usage and greenhouse gas emissions. The amount of greenhouse gas, or carbon dioxide, is based on the statistical analysis of data collected by the United States Environmental Protection Agency. The total energy savings that will result from the Project is 5,653,000 kWh per year and the carbon emissions saved equal 3,448,330 lbs of CO_2 per year.

The energy required to recycle water is less than the energy required to import potable water. Climate change has resulted in more extreme temperatures, requiring a greater usage of energy for cooling and heating systems. The University of California, Los Angeles (UCLA) Fielding School of Public Health, in partnership with the Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC), recently published several studies that found if greenhouse gas emissions continue to increase globally, climate change could impact Southern California in the following ways: increasing temperatures, decreased snowfall, and more extreme weather. Energy usage results in greenhouse gases that contribute to climate change. The Project is needed to reduce energy usage and greenhouse gases required to import water from northern California to Southern California by producing recycled water locally.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the Project the District will be required to import the 3,000 AFY from out of the area or a significant reduction in water usage from its customers. Continuing to supply 3,000 AFY imported water will result in an additional power consumption of 5,653,000 kWh/year along with the associated increase in greenhouse gas emissions. Although water conservation efforts have been and will continue to be aggressively implemented throughout SMWD's service area, they will not achieve the same level of 3,000 AFY benefit in the same period of time.

3. Description of methods used to estimate physical benefits.

The amount of energy that is saved is directly related to the amount of recycled water that is produced and used in the area. The savings are approximately 1,880 kWh/af which can be directly measured using the plant's effluent meters (5,653,000 kWh/year/3,000 AF/year = 1,884 kwh/AF). Based on the publication "California's Water – Energy Relationship" prepared by the California Energy Commission (November 2005, page 51), the amount of electrical energy required to transfer 1 acre-foot of water from northern California to an area just north of the District requires 3,000 kWh. The same publication also identifies 2,000 kWh for each acre-foot of water that is imported from the Colorado River to southern California. Using an assumed 50-50 split of water sources the amount of power per AF required to transfer the water is 2,500 kWh for a total of 7,500,000 kWh/year. The amount of power required to produce the tertiary water from secondary effluent and to pump the water into the recycled water system is approximately 1,847,000 kWh/year. This value is generated by calculating the power associated with 400 feet of pumping head and the additional in-plant energy required for (3) 5-hp motors and a minor amount of backwash water being used on the filters. The effective reduction in energy required to supply the 3,000 AFY is the difference between the

7,500,000 kWh/year associated to the potable water delivery and the 1,847,000 kWh/year for the tertiary production or 5,653,000 kWh/year. There is a great need for reducing energy usage and greenhouse gas emissions. The amount of greenhouse gas savings, or carbon dioxide (CO_2), is based on the statistical analysis of data collected by the United States Environmental Protection Agency. From the data collected on the amount of CO_2 produced for the generation of electricity, CO_2 generation factors were determined as a way of estimating the total CO_2 that will be emitted based on a given energy consumption. The most current factor applicable in the state of California, released in 2014, was used to determine this Secondary Physical Benefit. The carbon emission estimates of 0.61 lbs of CO_2 /kWh are based on the United States Environmental Protection Agency's 9th edition of eGrid, "Year 2010 eGRID Subregion Emissions - Greenhouse Gases". The calculation for emissions saved: .61 lbs of CO_2/kWh * 5,653,000 kWh = 3,448,330 lbs of CO_2.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

The new facilities will include the modification of some of the existing secondary treatment components and the expansion of the existing tertiary treatment facilities. Additionally, new effluent pumps will be required to transfer the larger volume of water into the distribution system. No new policies will need to be established as both SMWD and MNWD have mandatory recycled water use policies in place. The final design of the facility must be completed along with the CEQA documentation associated to the Project. The District's Board of Directors must approve the award of the construction contract. The District's portion of the Project funds have been budgeted for FY 2015-2016.

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

No potential adverse physical effects are anticipated due to the expansion of the existing 3A WRP. There is adequate space available on the existing site to accommodate the modifications/expansion that is proposed for this Project.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project provides immediate and long-term reduction of water use by providing 3,000 AFY of recycled water to the region for irrigation, which results in associated energy savings of 5,653,000 kWh per year and 3,448,330 lbs of CO_2 saved per year. DWR reduced the anticipated SWP water supply deliveries to contractors to zero percent which greatly impacts the water reliability of the Region because the South Orange County WMA relies on imported water for 90% of its supply. The Project will increase both the local water supply reliability and the ability to deliver safe drinking water by supplying recycled water for irrigation to the region. Irrigating with recycled water allows an equal amount of high quality drinking water to become available for potable uses instead of non-potable uses. The Project will also result in energy saved and greenhouse gases avoided.

The Project promotes water recycling by expanding the existing 3A WRP to produce at least 3,000 AFY of new recycled water and reducing associated energy use. Using recycled water in place of potable water for irrigation supply reduces the total domestic water demand for SMWD. The Project helps decrease the reliance on imported water for the delivery of safe drinking water by providing recycled water for non-potable uses.

The Project would be very successful in meeting long-term drought preparedness by producing recycled water that will be a direct offset to imported potable water use. The state's July 15, 2014 news release, State Water Board Approves Emergency Regulation to Ensure Agencies and State Residents Increase Water Conservation, asks water agencies to increase recycled water projects. This recycled water Project will utilize approximately 3,000 AFY of local recycled water to offset imported water demand, contributing to sustainable water supply and reliability during water shortages. The 3,000 AFY of recycled water will be readily available. The Project addresses long-term drought preparedness in that it is a permanent increase in recycled water supply. With the direct offset of the potable water use there will be an immediate and permanent reduction in water use for the specific irrigation users.

6. Recycled Water Distribution Upgrade

Primary Benefit: **Increased Delivery of Recycled Water**

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The Project is needed to eliminate a bottleneck in recycled water supply distribution and provide 850 AFY of recycled water to South Coast Water District's (SCWD) service area. The existing recycled water transmission main in Pacific Coast Highway (PCH) supplies recycled water from the Coastal Treatment Plant (with additional treatment to Title 22 standards by the South Orange County Wastewater Authority's Advanced Water Treatment (AWT) facility) to the entire SCWD service area. The Coastal Treatment Plant/AWT is the sole source of recycled water to the District. An existing 6,600 foot reach of 10-inch pipeline is a bottleneck in the PCH transmission main and restricts recycled water supply to the District service area. Replacement of the existing 10-inch pipeline with a new 16-inch pipeline will eliminate the bottleneck and allow SCWD to add users to meet up to 850 AFY of additional recycled water demand. Conversion of existing customers to recycled water will result in a corresponding reduction in potable water consumption.

SCWD's total water demand is approximately 7,000 AFY, with 80% of the supply required for SCWD's service area imported from the Colorado River and northern California through MWD. The balance of the water comes from two local sources: 1) The District's Groundwater Recovery Facility in the City of Dana Point near San Juan Creek pumps raw well-water from the San Juan Groundwater Basin, which uses reverse osmosis technology to produce potable water for local drinking water, representing about 10% of the District's total water supply; and 2) The AWT facility in Laguna Canyon near Aliso Creek that takes treated wastewater from the Coastal Treatment Plant and further disinfects it to produce recycled water for local irrigation, representing about 10% of the District's total water supply. The current drought conditions pose significant threat to the District due to its reliance on imported water supply. On April 7, the District moved to a level 2 water supply warning following Governor Brown issuing an executive order requiring a mandatory 24% potable water reduction. The District is an existing recycled water provider to over 300 acres of land irrigated with recycled water. The Project will help alleviate drought impacts by reducing imported potable water used for landscape irrigation by up to 850 AFY. This irrigation demand will be met by local recycled water, which will reduce the required potable supply for irrigation by up to 850 AFY and make that potable water available for other uses, including drinking water demands throughout the state. Implementing recycled water will ensure there is adequate supply for irrigation and agricultural uses. Providing this additional recycled water supply for irrigation will reduce the amount of wastewater released into the ocean. The Project's recycled water supply helps to reduce the drought's threat to residents, agriculture, and businesses in the local economy.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the Project, the District would import up to an additional 850 AFY from the Metropolitan Water District of Southern California (MWD), who obtains their source water primarily from the State Water Project and Colorado River Aqueduct; which are both currently experiencing drought conditions. The District already implements an aggressive water use efficiency program and, with this in place, still has the need for recycled water for irrigation. Without the Project, SCWD would continue to supply users with imported potable drinking water for irrigation uses. Thus there would not be a benefit of additional usage of up to 850 AFY of recycled water.

3. Description of methods used to estimate physical benefits.

The Project's physical benefits were determined via hydraulic modeling conducted during the 2008 Infrastructure Master Plan (South Coast Water District 2008 Infrastructure Master Plan, November 2008. PBS&J), along with calculations conducted as part of the Project's Preliminary Design Report, completed by PSOMAS on February 17, 2015. SCWD's customer service data (e.g., dedicated irrigation meter information, etc.), along with information obtained as part of the SCWD 2015 Infrastructure Master Plan Update (est. completion date of September 2015) were also utilized.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

New facilities to be constructed include 6,600 feet of 16-inch HDPE pipe, construction of a new motor-operated ball valve in a vault and abandonment of 6,600 feet of the existing 10-inch pipeline. Conversion of existing customers to the recycled water system is also required. CEQA tasks and documents for the PCH Bottleneck Replacement Project are complete. The following permits will be required to implement the Project and obtain the physical benefits: Encroachment Permit from Caltrans for geotechnical borings; Encroachment Permit from Caltrans for project construction; Encroachment Permit from the City of Laguna Beach; Storm Water Pollution Prevention Plan (SWPPP); and Courtesy review submittal to the County of Orange (the project is near the Aliso Creek Beach Parking Lot, which is County of Orange property).

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

There are no potential adverse physical impacts because the Project is replacing an existing 10-inch pipeline with a larger 16-inch pipeline for recycled water. The required permits to ensure potential adverse physical impacts during construction are mitigated include obtaining encroachment permits from Caltrans and the City of Laguna Beach. The District's contractor will be required to comply with all construction standards specified by Caltrans and the City of Laguna Beach.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project will achieve long-term drought preparedness by promoting water reuse and recycling through expanding recycled water use for irrigation of landscapes of up to 850 AFY, as identified in the 2008 Master Plan and subsequent SCWD staff research (pursuant to the 2015 Infrastructure Master Plan Update, currently in progress). Conversion of these existing customers to recycled water will result in a corresponding reduction in potable water consumption.

During the conversion process to recycled water, customers will be required to upgrade existing irrigation systems to meet current District standards for recycled water irrigation. The Project will help alleviate drought impacts by reducing imported potable water used for landscape irrigation by up to 850 AFY. This irrigation demand will be met by local recycled water, which will reduce the required potable supply for irrigation by up to 850 AFY and make that potable water available for other uses, including drinking water demands throughout the state. Implementing recycled water will ensure there is adequate supply for irrigation and agricultural uses. As shown in Table 5A, the District estimates an annual increase in recycled water usage by up to 850 AFY from 2017 through 2066. Based on these projections, the total reduction of water use is 42,500 acre-feet over the 50-year Project life.

The Project will help alleviate drought impacts by reducing imported potable water used for landscape irrigation by up to 850 AFY. The District is an existing recycled water provider to over 300 acres of land irrigated with recycled water. A District Ordinance requires users to convert to recycled water once distribution system is available, and the Project will make the distribution immediately available to potential recycled water end users identified in the District's 2008 Infrastructure Master Plan, along with those identified in the 2015 Infrastructure Master Plan Update (scheduled for completion in September 2015). The Project's recycled water supply helps to reduce the drought's threat to residents, agriculture, and businesses in the local economy.

Providing up to 850 AFY of recycled water for irrigation supply will reduce the amount of wastewater treated and released into the ocean. This increased usage of recycled water will also result in a corresponding reduction in potable water consumption.

Secondary Benefit: Reduced Energy Usage and Greenhouse Gases Avoided

1. Explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The energy required to recycle water is less than the energy required to import potable water. Climate change has resulted in more extreme temperatures, requiring a greater usage of energy for cooling and

heating systems. The University of California, Los Angeles (UCLA) Fielding School of Public Health, in partnership with the Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC), recently published several studies that found if greenhouse gas emissions continue to increase globally, climate change could impact Southern California in the following ways: increasing temperatures, decreased snowfall, and more extreme weather. Energy usage results in greenhouse gases that contribute to climate change. The Project is needed to reduce energy usage and greenhouse gases required to import water from northern California to Southern California by producing recycled water locally.

2. Estimates of without-project conditions (e.g., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the Project, 850 AFY will continue to be imported and 1,700,000 kWh/year of energy and 1,037,000 lbs of CO_2 will continue to be required and emitted. There are no other projects planned to expand the existing recycled water distribution pipeline to eliminate the bottleneck. This Project is a critical project identified in the SCWD's Master Plan to increase total recycled water distribution to its service area and to reduce overall imported water supply and its associated energy usage and associated greenhouse gases.

3. Description of methods used to estimate physical benefits.

The Project's physical benefits were determined via hydraulic modeling conducted during the 2008 Infrastructure Master Plan (South Coast Water District 2008 Infrastructure Master Plan, November 2008. PBS&J), along with calculations conducted as part of the Project's Preliminary Design Report, completed by PSOMAS. SCWD's customer service data (e.g., dedicated irrigation meter information, etc.), along with information obtained as part of the SCWD 2015 Infrastructure Master Plan Update (est. completion date of August 2015) were also utilized.

The referenced documents provide estimated energy requirements for both imported drinking water and locally produced recycled water. The difference in energy required to supply these two sources, 2,000kWh/AF, is the physical benefit to the Project. At 850 AFY, the result amounts to an annual benefit of 1,700,000 kWh of energy saved. The power required to import one acre-foot (AF) of water is 2,500 kWh (3,000 kwh/AF for State Water Project water and 2,000 kwh/AF for Colorado River water). One acre-foot of recycled water requires 500 kWh of energy to produce and deliver. Imported Water Calculation for Total Energy: 850 AFY X 2,500 kWh/AF = 2,125,000 kWh. Recycled Water Calculation for Total Energy: 850 AFY X 500 kWh/AF = 425,000 kWh. The benefits are equal to the power savings: 2,125,000 kWh - 425,000kWh= 1,700,000 kWh. Therefore, the annual energy savings would be 1,700,000 kWh. The benefits are consistently 1,700,000 kWh each year from 2017 thru 2066 because the Project will replace existing imported water supply with recycled water supply to meet the existing demand for the identified irrigation meters and customers; thereby using the same amount of energy each year.

Reduced energy usage results in reduced greenhouse gas emissions. The amount of greenhouse gas, or carbon dioxide, is based on the statistical analysis of data collected by the United States Environmental Protection Agency. From the data collected on the amount of CO_2 produced for the generation of electricity, CO_2 generation factors were determined as a way of estimating the total CO_2 that will be emitted based on a given energy consumption. The most current factor applicable in the state of California, released in 2014, was used to determine this Secondary Physical Benefit. The carbon emission estimates of 0.61 lbs of CO_2/kWh are based on the United States Environmental Protection Agency's 9th edition of eGrid, "Year 2010 eGRID Subregion Emissions - Greenhouse Gases". The calculation for emissions saved: .61 lbs of CO_2/kWh * 1,700,000 kWh = 1,037,000 lbs of CO_2.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits.

New facilities to be constructed include 6,600 feet of 16-inch HDPE pipe, construction of a new motor-operated ball valve in a vault and abandonment of 6,600 feet of the existing 10-inch pipeline. Conversion of existing customers to the recycled water system is also required. CEQA tasks and documents for the PCH Bottleneck Replacement Project are complete. The following permits will be required to implement the Project and obtain the physical benefits: Encroachment Permit from Caltrans for geotechnical borings; Encroachment Permit from Caltrans for project construction; Encroachment Permit from the City of Laguna Beach; Storm Water Pollution Prevention Plan (SWPPP); and Courtesy review submittal to the County of Orange (the project is near the Aliso Creek Beach Parking Lot, which is County of Orange property).

5. Description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

There are no potential adverse physical impacts because the Project is replacing an existing 10-inch pipeline with a larger 16-inch pipeline for recycled water. The required permits to ensure potential adverse physical impacts during construction are mitigated include obtaining encroachment permits from Caltrans and the City of Laguna Beach. The District's contractor will be required to comply with all construction standards specified by Caltrans and the City of Laguna Beach.

6. Description of whether the proposed project effectively addresses long-term drought preparedness:

The Project will achieve long-term drought preparedness by promoting water reuse and recycling through expanding recycled water use for irrigation of landscapes of up to 850 AFY, as identified in the 2008 Master Plan and subsequent SCWD staff research (pursuant to the 2015 Infrastructure Master Plan Update, currently in progress). Conversion of these existing customers to recycled water will result in a corresponding reduction in potable water consumption.

The Project will improve landscape irrigation efficiencies by providing up to 850 AFY of recycled water for irrigation supply in place of imported water supply, which results in associated energy savings of 1,700,000 kWh/year of energy and 1,037,000 lbs of CO_2 saved per year. During the conversion process to recycled water, customers will be required to upgrade existing irrigation systems to meet current District standards for recycled water irrigation. The Project will help alleviate drought impacts by reducing imported potable water used for landscape irrigation by up to 850 AFY. This irrigation demand will be met by local recycled water, which will reduce the required potable supply for irrigation by up to 850 AFY and make that potable water available for other uses, including drinking water demands throughout the state. Implementing recycled water will ensure there is adequate supply for irrigation and agricultural uses.

The Project will achieve long term reduction of water use by reducing imported potable water used for landscape irrigation by up to 850 AFY. The California Department of Water Resources (DWR) reduced the anticipated SWP water supply deliveries to contractors to zero percent which greatly impacts the water reliability of the Region because the South Orange County Watershed Management Area (SOCWMA) relies on imported water for 90% of its supply. The Project will increase both the local water supply reliability and the ability to deliver safe drinking water by supplying recycled water for irrigation to the region. Irrigating with recycled water allows an equal amount of high quality drinking water to become available for potable uses instead of non-potable uses. The Project will also result in energy saved and greenhouse gases avoided.

As shown in Table 5A, the District estimates an annual increase in recycled water usage by up to 850 AFY from 2017 through 2066. Based on these projections, the total reduction of water use is 42,500 acre-feet over the 50-year Project life. The District is an existing recycled water provider to over 300 acres of land irrigated with recycled water. A District Ordinance requires users to convert to recycled water once distribution system is available, and the Project will make the distribution immediately available to potential recycled water end users identified in the District's 2008 Infrastructure Master Plan, along with those identified in the 2015 Infrastructure Master Plan Update (scheduled for completion in August 2015). The Project's recycled water supply helps to reduce the drought's threat to residents, agriculture, and businesses in the local economy.

VI. DIRECT WATER-RELATED BENEFIT TO A DAC

1. Dairy Fork Wetland - Dairy Fork Wetland Project will serve disadvantaged community (DAC) members in the City of Laguna Woods. Approximately 25% of the Project area is considered DAC (Laguna Woods). Urban runoff from the DAC will be treated for water quality improvement and habitat restoration. Removal of invasive, non-native *Arundo donax* (Arundo) will increase water supply available in Aliso Creek to support native habitat and to infiltrate as groundwater. The Project addresses long-term drought preparedness for DACs by replacing high water-consuming invasive species with low water-consuming native species; thereby increasing the total amount of surface water in the creek system. The removal of existing and prevention of spreading of invasive species such as Arundo from the area will contribute to overall drought preparedness in that the Arundo absorbs large amounts of water and crowds out other bank stabilizing plants which are native to California. The presence of the invasive plants decreases the amount of water which successfully infiltrates into groundwater, and will put the riparian area at a higher risk of erosion which increases turbidity and decreases water quality while increasing reproduction rates for bacteria that flourish in turbid environments.

2. San Juan Aquatic Passage and Habitat Improvement - This Project is not expected to provide substantial direct water-related benefit to a DAC.

3. Crown Valley Park Entry Channel Improvements - This Project is not expected to provide substantial direct water-related benefit to a DAC.

4. Strategic Turfgrass Removal & Design Assistance Program - The Strategic Turfgrass Removal and Design Assistance Program may also provide direct water-related benefits to members of DACs; however, the Project area does not include 25% DACs. The Project's boundary encompasses all the South Orange County WMA, as it is a region-wide rebate-based incentive program open to all members of the community, including DACs located in the City of Laguna Woods. Offering rebates as well as technical design assistance to implement turfgrass removal and replacing it with native, drought-tolerant species will benefit DACs by providing them with reduced water charges (due to reduced water usage) and technical assistance for designing and installing the native plants. The Project will provide up to 252 AFY of water savings. MWDOC is a wholesaler of imported water for the region. By saving 252 AFY in irrigation water through the program, more potable water supply is made available for drinking water uses that meet the needs of DACs.

5. 3A Water Recycling Plant Tertiary Expansion - This Project is not expected to provide substantial direct water-related benefit to a DAC.

6. Recycled Water Distribution Upgrade - This Project is not expected to provide substantial direct water-related benefit to a DAC.

VII. PROJECT PERFORMANCE MONITORING PLAN

1. Dairy Fork Wetland

Table 6 – Project Performance Monitoring Plan
Project: Dairy Fork Wetland

Proposed Physical Benefits	Targets	Measurement tools and methods
Total Suspended Solids (TSS) Reduction	90% Removal	Sampling at Inlet and Outlet of Project Area
Habitat Restoration	Removal of Invasive and Planting Native species for 2 acres around the wetland and 9 acres of riparian area	Field and Visual Observation

Describe measurement tools and methods to effectively track performance.

- State where the data will be collected and the types of analyses used:

Water quality data to illustrate wetland pollutant removal efficiency will be collected at two different points, the inlet to the Project above the ponds, and at the outlet of the Project area below the ponds. Data will be collected by taking water samples and sending them to an independent laboratory for testing and data collection. This allows the city to track on a consistent basis the change in bacterial concentration from the beginning of the treatment to the end of the treatment. This data can then be used to measure performance of the treatment and apply it to the 95% bacterial removal goal.

Visual documentation of Arundo removal process will be tracked via photographs and written reports.

- Explain how the monitoring tools and targets are appropriate for the benefits claimed:

The Dairy Fork Wetland Project will be monitored to quantify the performance of Project in achieving the physical benefits described in previous sections. The primary and secondary objectives will be evaluated using different metrics. Similar to the methods outlined in the "Wood Canyon Emergent Wetland Project Report", by the City of Aliso Viejo, monitoring will occur monthly so as to track the progress of achieving the outlined goals. For the wetland phase of the project, the monitoring tools and targets utilized are appropriate for the benefits claimed because sampling at the inlet and outlet of the Project Area will accurately measure bacteria load reduction. Field and visual observations recorded during the habitat restoration and Arundo removal portions of the Project will verify the amount and extent of invasive species removed.

- Discuss how monitoring data will be used to measure performance:

Monitoring data will be used to track the primary objective of improving water quality by looking at concentrations of pollutants found within water, specifically reducing bacterial loads. Monitoring data will be used to track the secondary objective of the program, to restore habitat in and around the Project area. This will be tracked by routine field and visual observations, which will be performed on the wetland site. These consistent observations will be used to identify certain changes in the biodiversity of the wetland area, and identify flora and fauna health. These data can be used to measure the progress of removing all invasive plants as they are found, and by sustaining a habitat for native species. Visual inspections are useful to identify invasive species and target them for removal. Visual observations of Arundo stands and throughout the process will provide verification of removal efficiency to prevent regrowth.

2. San Juan Aquatic Passage and Habitat Improvement

Table 6 – Project Performance Monitoring Plan

Project: San Juan Aquatic Passage and Riparian Habitat Improvement

Proposed Physical Benefits	Targets	Measurement tools and methods
145 acres of habitat restored	Improve streamside habitat in Project areas	Monitoring restoration sites through photo points, BMPEP, PFC
31 milligrams of sediment per liter of discharge	Stabilize channel at dam and crossing sites	Monitoring restoration sites through photo points, BMPEP, PFC

BMPEP = Best Management Practices Evaluation Program
PFC = Proper Functioning Condition

Describe measurement tools and methods to effectively track performance.

- State where the data will be collected and the types of analyses used:

Monitoring will occur in the immediate vicinity of the dams that are removed, the bridge, and the road crossing that were replaced to evaluate stream response and reduction in sedimentation. Monitoring of the weed removal Project will occur in the same area. As described in the 401 and 404 permit, Forest Service

will measure fines (sediment) from the Project. Three characteristics will be measured at each selected site from a sampling pool and will include pre- and post-measurements. These characteristics are percent pool tail fines, cobble embeddedness, and streambank stability. From the sampling pool, percent pool tail fines at selected sites will be monitored using a fines grid. Sampling at each site will include three samples, one pool upstream of treatment and two pools directly downstream of treatment. The sampling method is taken from the Stream Condition Inventory Manual used by the Forest Service to assess habitat and stream conditions. At each selected site, cobble embeddedness would also be sampled. Sampling at each site will include a "random walk" across the reach and evaluation of 25 cobbles for percent embeddedness. Method for evaluation cobble embeddedness is taken from the SWAMP Bioassessment Procedures, 2007. The third component to measure non-point source erosion reduction, is assessing streambank stability. Stream bank stability will be determined as described in the USFS Stream Condition Inventory Manual with some alterations. Three transects will be used at each site selected for monitoring.

- Explain how the monitoring tools and targets are appropriate for the benefits claimed:

Monitoring tools and targets are appropriate because the 145 acres of habitat restored and 31 mg of sediment per liter of discharge will be measured by TSS and monitored through photo documentation to visually show the physical changes in the habitat, Best Management Practices Evaluation Program (BMPEP) monitoring will reflect best management practices, and Proper Functioning Condition (PFC) will evaluate the habitat as a whole for a sustainable ecosystem.

- Discuss how monitoring data will be used to measure performance:

In the 401 permit for dam removal and crossing replacement, the Forest Service stipulates that the BMPEP will be conducted, sections of the stream channel will have PFC monitoring, and photo documentation will be provided. The monitoring report will be submitted to the State Water Resources Control Board, as a part of the 401 permit. BMPEP monitoring will be included in the annual BMPEP report that is submitted to the Regional Water Quality Control Board.

Proper Functioning Condition is designed to look at the habitat as a whole which is the intent of habitat restoration. The goal of the habitat and aquatic organism passage restoration is to create a sustainable ecosystem.

Aquatic passage and habitat restoration effectiveness will be monitored through photo documentation of treated sites, measuring jump height at treated channel sites, and assessing particle size/channel characteristics up and downstream of the rehabilitated sites. If sites fail to revegetate to levels greater than 50% cover, do not meet jump height requirements, or have excess fines, the site will be re-evaluated and the Forest Service will adapt the treatment methods (re-treat or alter methods) to meet those goals.

3. Crown Valley Park Entry Channel Improvements

Table 6 – Project Performance Monitoring Plan
Project: Crown Valley Park Channel Entry Improvements

Proposed Physical Benefits	Targets	Measurement tools and methods
Decrease phosphorus (TP) and fecal coliform bacteria concentrations and loads	Up to 41% decrease in phosphorus (TP) concentration and load with additional fecal coliform concentration/load reduction (70%)	Flow rate and water quality sampling and laboratory analysis at influent and effluent points of system, pre- and post-Project
Increase riparian habitat acres	Increase of 1.55 acres of riparian habitats	Measurements from aerial photography and construction plans and manual vegetative transects

Describe measurement tools and methods to effectively track performance.

- State where the data will be collected and the types of analyses used:

Performance monitoring data for water quality will be collected pre- and post-Project at four locations: 1) at the outfall of the J03P01 storm drain pipe structure at the upstream end of the Project; 2) at the downstream effluent point of the constructed treatment wetland; 3) at the base of the grade transition structure upstream of the bioswales; and 4) downstream of the bioswales. At each location, dry weather flow rate will be measured in cubic feet per second; and grab samples will be taken for laboratory analysis of nutrients – Total Phosphorus and Total Nitrogen as well as total and fecal coliform, E. coli, and Enterococcus indicator bacteria concentrations.

- Explain how the monitoring tools and targets are appropriate for the benefits claimed:

These monitoring constituents are appropriate targets because their concentrations are used as Water Quality Objectives by the Regional Water Quality Control Board, indicating the suitability of surface waters for beneficial recreational and aquatic habitat uses.

- Discuss how monitoring data will be used to measure performance:

The flow rate will be used in combination with the concentration data, to estimate load reductions of these constituents from the contributory drainage area, relative to load reduction requirements expressed in the Water Quality Improvement Plan and the Bacteria TMDL applicable to the watershed. The post-Project and downstream data will be compared with the pre-Project and upstream outfall data to determine whether the target percent reduction effectiveness has been achieved. Project performance data will continue to be collected and evaluated for 10 years to confirm the sustainability of the water quality benefits, and summarized in annual Post-Performance Reports.

Performance monitoring for increase in riparian habitat acreage will be accomplished using measurements from pre-Project aerial photography, post-Project construction plans, and manual vegetative coverage transects anticipated to be required for 5 years after construction, under the terms of the Mitigation Monitoring Plans that will be required to secure the resource agency permits.

4. Strategic Turfgrass Removal & Design Assistance Program

Table 6 – Project Performance Monitoring Plan
Project Name: Strategic Turfgrass Removal & Design Assistance Program

Proposed Physical Benefits	Targets	Measurement tools and methods
Water Supply Savings	Reduction of landscape water use resulting in 252 AFY savings	On-site measurement of landscape conversion.
Habitat Restoration	42 acres of converted landscape	On-site measurement of landscape conversion.

Describe measurement tools and methods to effectively track performance.

- State where the data will be collected and the types of analyses used:

Data will be collected onsite to measure water use. The average annual water saving will be calculated utilizing the theoretical irrigation requirement water need taking local evapotranspiration (ETo) and rainfall (Pe) into consideration. As part of this analysis, the crop coefficients (Kc) varies from turfgrass (0.8) versus a California-friendly landscape, comprised of low water need plants (0.3). Following the theoretical analysis, actual water use at sites will be evaluated, utilizing historic water use data as well as the water use data following the turf removal landscape conversion. Metropolitan Water District of Southern California documented a water savings of approximately 44 to 49 gallons per day per square foot for the turf removal

program. Baum-Haley, Melissa. (2014). "Turf Removal as a Potential Best Management Practice." Prepared for the California Urban Water Conservation Council. Sacramento, CA.

- Explain how the monitoring tools and targets are appropriate for the benefits claimed:

The monitoring tools of on-site measurement of landscape conversion and targets identified in Table 6 are appropriate because turf removal and conversion to native habitat can be quantified by estimating the water supply savings and habitat converted based on the amount of landscape converted. Estimates are based on MWDOC's successful implementation of the Rebate Program over several years and is based on actual data. Actual onsite measurements of total acres of land conversion will allow estimates of total water supply saved and total habitat re-established within the urban landscape.

- Discuss how monitoring data will be used to measure performance:

Monitoring data will be used to measure performance of the program by a robust, regression-based, statistical water savings evaluation of pre- and post-participation water use information. This evaluation will include weather normalization of pre- and post-landscape conversion water use. Acreage measurements of converted turf areas will be taken before and after the landscape improvements. This will give the water industry another opportunity to quantify actual water savings associated with this Program. This analysis will include a statistically significant population of Program participants and will maintain 95% confidence. Participant water use data before and after participating in the Program will be used to determine changes in water use associated with the site improvements. The analysis will also normalize the pre- and post-retrofit water use data (e.g. weather). A written report describing the statistical methods used and evaluation results will be submitted as the final report for the Program. Results from this Program will be shared with DWR, the County of Orange, Metropolitan, and MWDOC retail water agencies.

5. 3A Water Recycling Plant Tertiary Expansion

Table 6 – Project Performance Monitoring Plan
Project: 3A WRP Tertiary Treatment Expansion

Proposed Physical Benefits	Targets	Measurement tools and methods
Reduce amount of potable water needed to be imported into the District	Up to 3,000 AFY produced.	Measuring the amount of recycled water introduced into the recycled water distribution system. Use effluent flow meter.
Reduce the amount of electrical energy required to supply water demands	Up to 5,653,000 kWh saved.	Measuring the amount of recycled water introduced into the recycled water distribution system. Use effluent flow meter. This can then be equated to the offset in energy required to transfer an equal quantity of water to the District from the other water supply sources.

Describe measurement tools and methods to effectively track performance.

- State where the data will be collected and the types of analyses used:

The amount of recycled water produced will be measured using the recycled water flow meter that is located on the discharge to the recycled water pumps. This can then be equated to the offset in energy required to transfer an equal quantity of water to the District from the other water supply sources.

- Explain how the monitoring tools and targets are appropriate for the benefits claimed:

The meter will provide both instantaneous and cumulative flow rates for the recycled water being introduced into the recycled water distribution system. The flow rates will be in gallons per minute and gallons per day

with the information being stored on the plant's SCADA system for retrieval and reporting purposes. These values can be translated into acre-feet through simple mathematics.

- Discuss how monitoring data will be used to measure performance:

The data that is provided through the flow metering activities will be a direct measure of the quantity of recycled water that is introduced into the system. These values will be tracked over the course of a year and will be a direct measure of the amount of recycled water that is put into the distribution system for use in both SMWD's and MNWD's recycled water system.

6. Recycled Water Distribution Upgrade

Table 6 – Project Performance Monitoring Plan Project: Recycled Water Distribution Upgrade		
Proposed Physical Benefits	**Targets**	**Measurement tools and methods**
Reduce Potable Water Use	up to 850 AFY recycled water produced	Monitoring recycled water meter reads.
Reduce Energy Usage	up to 1,700,000 kWh	Monitoring recycled water meter reads.

Describe measurement tools and methods to effectively track performance.

- State where the data will be collected and the types of analyses used:

SCWD staff will track the number of recycled water conversions. Recycled meter information (i.e., meter sizes and meter readings) is collected and maintained by the SCWD Customer Service division. Energy data will be collected by measuring the amount of recycled water introduced into the recycled water distribution system via the effluent flow meter. The savings can then be equated to the offset in energy required to transfer an equal quantity of water to the District from the other water supply sources.

- Explain how the monitoring tools and targets are appropriate for the benefits claimed:

The Project's physical benefits were determined through analysis conducted during completion of the SCWD 2008 Infrastructure Master Plan and 2015 Update in progress. SCWD mandates that customers who are located adjacent to the District's recycled water infrastructure receive recycled water for irrigation. SCWD staff have identified a minimum of over 1,000 AFY of potential, viable recycled water customers (i.e., new and enhanced uses). The Project, upon completion, will provide up to 850 AFY to help meet these potential uses. Measuring the amount of recycled water introduced into the recycled water distribution system using the effluent flow meter is appropriate to measure the total energy used for recycled water. This can then be equated to the offset in energy required to transfer an equal quantity of water to the District from the other water supply sources.

- Discuss how monitoring data will be used to measure performance:

Monitoring data would include comparisons of actual recycled water usage to an appropriate time period prior to the completion of the Project. Recycled Water meter usage for the entire SCWD service area will be utilized, since the Project will allow additional recycled water to be served to the entire service area. Monitoring data will be used to measure the overall energy savings of using recycled water distributed locally compared to using the same amount of imported water from Colorado River (since SWP allocations have been limited).

VIII. COST EFFECTIVE ANALYSIS

1. Dairy Fork Wetland

Table 7 – Cost Effective Analysis **Project name: Dairy Fork Wetland**	
Question 1	*Types of benefits provided as shown in Table 5:* Water Quality Improvement (TSS reduction) and Habitat Restoration
Question 2	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes for the constructed wetland, and no for the Arundo removal component of the Project.
	If no, why? There is not an alternative method for removing Arundo.
	If yes, list the methods (including the proposed project) and estimated costs. This Project will collect and treat the entire sub-watershed runoff (325 AFY) in the constructed wetland then release it to Aliso Creek. The alternative of the proposed Project would be to capture and treat runoff at ten identified sites which discharge into Aliso Creek via outfalls that connect the MS4 to the Dairy Fork sub-watershed. This alternative method would be comparable to creating treatment wetlands at each of these sites which would be infeasible for multiple reasons, including lack of space for treatment, as well as cost of treatment per acre foot which contractors have estimated at $1,415 per acre foot of water. The total alternative cost would be the combined cost of each of the ten outfalls multiplied by the total sub-watershed dry weather flow of 325 acre feet per year, which is approximately 32.5 acre feet per year per outfall, for a total cost of $46,000 per year per outfall (1,415 dollars per acre foot x32.5 acre feet per year per outfall = $46,000 per year per outfall), resulting in a total alternative cost of $460,000 per year. Over the 20 year life of the Project, this amounts to $9,200,000. The proposed Project wetland will treat 325 AFY of dry weather flow (based on a flow of 0.45 cfs) with an estimated cost of $3,289 per AF. The total Project cost of $1,068,000 over the 20 year life of the Project amounts to $53,400 per year. The proposed Project cost of $53,400 per year compared to the alternative cost of $460,000 per year results in an annual cost savings of $406,600, showing that the proposed Project is the most cost effective alternative.
Question 3	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* The proposed Project is the least cost alternative and the preferred alternative.

2. San Juan Aquatic Passage and Habitat Improvement

Table 7 – Cost Effective Analysis **Project name: San Juan Aquatic Passage and Riparian Habitat Improvement**	
Question 1	*Types of benefits provided as shown in Table 5:* 145 acres of riparian habitat restored, reduction of 31 milligrams of non-point source sediment (TSS) per liter of discharge
Question 2	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why?
	If yes, list the methods (including the proposed project) and estimated cost: The proposed Project includes removal of 16 dams, improvements to three stream crossings, and invasive weed removal along 2 miles of stream (Project area). 9 of the rock and mortar dams were removed in 2014. Therefore, the remaining 7 dams will be removed as part of the proposed Project. Of the three stream crossings, the proposed Project includes improving one stream by replacing an undersized culvert with a large bridge. The proposed Project also includes the design of both of the other two stream crossings; however, only one stream crossing will be replaced with a bridge as part of the proposed project. The other bridge for the stream crossing is not included in the proposed project cost, but will be funded by federal grant funds. The dam removals and stream improvements will connect 2 miles of stream that are currently disconnected by the dams, thereby improving 145 acres of riparian habitat. Sediment reduction is estimated to be about 31 mg/liter. The following summarizes the Project Components: 1) 16 dams removed: 9 already removed in 2014, 7 proposed. 2) 3 Stream crossings: a) 1 larger bridge for larger stream crossing: An undersized culvert will be replaced with a large bridge. b) 2 smaller bridges for smaller stream crossings: Design of both of the smaller stream crossings; implementation of bridge to replace one stream crossing. The other bridge for the stream crossing is not included in the proposed project cost, but will be funded by federal grant funds. 3) Invasive weed removal will occur along the 2 miles of stream for riparian habitat restoration. The total Project cost of the Project is $1,518,194 with a 50 year life. Other options were considered to address the dams in the NEPA process. One alternative was to install fish ladders to go around barriers. Fish ladders are extremely expensive to construct and are difficult for fish to traverse. Although adult trout and steelhead could use a fish ladder, resident native fish such as Arroyo Chub do not have the ability to jump and use this type of structure. Construction of fish ladders in the Project area would cost an average of $90,000 per dam for ladder construction (which would include studies, designs and implementation), not including the additional cost for annual maintenance or additional repair and maintenance needed due to subsequent storm damage. For this alternative, a total of 16 dams would cost $1.44 million for ladder construction only, compared to the proposed Project cost of $1,399,694 for construction phase. The second alternative considered maintenance of the dams to restore intended function. This alternative would not permit the stream gradient to be restored, nor would it permit the stream to return to its proper functioning condition. Dam repair and maintenance would be very costly. Repairing and maintaining dams would not be consistent with Forest Plan direction regarding management of Riparian Conservation Areas, and would not implement the recovery plan objectives for steelhead. Over the projected 50 year life of the Project, this would result in a cost of $211,200 per year, compared to the cost of $30,363.88 per year of the proposed Project.
Question 3	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* The proposed Project is the least cost alternative.
Comments:	

3. Crown Valley Park Entry Channel Improvements

Table 7 – Cost Effective Analysis Project name: Crown Valley Park Channel Entry Improvements Project	
Question 1	*Types of benefits provided as shown in Table 5:* Reduction in phosphorus and fecal coliform bacteria concentrations in inland surface water; and increase in acreage of riparian habitats
Question 2	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs. The proposed Project elements that will achieve the water quality benefit of reducing the phosphorus and bacteria concentration, as well as the increase in acreage of riparian habitats, will cost approximately $2.9 million to construct and approximately $16,500 annually to operate and maintain over the 40-year lifecycle, for a (non-inflated) lifecycle cost of $3.56 million, or $89,000 annually, to treat flow at a rate of 0.5 cfs from 1,197 acres of contributory drainage area. Alternatives to the Project's centralized, natural-systems approach to reducing bacteria concentrations for MS4 discharge from a large contributory drainage area are a) decentralized treatment facilities or preventative measures at many locations within the contributory drainage area, most of which is not under direct City control and which cannot be counted on to produce a reliable result; and 2) more technological approaches such as multi-step filtration units, ultraviolet radiation and/or ozonation systems; or 3) diversion of low flows to the sewage treatment system. The City experimented with all 3 approaches in 2001-2003 in a smaller, 640-acre drainage area (J03P02) in the same watershed that produced runoff at 0.1 to 0.2 cfs. The decentralized approach was found to be generally ineffective or highly variable in reducing phosphorus or bacteria concentrations in runoff. The diversion to sewer for 0.1 cfs cost $132,000 annually in sewage treatment fees and pumping costs, and another $50,000 annually in facility operational maintenance, which if scaled up to 0.5 cfs (which from a practical standpoint is not feasible due to limitations on available sewage treatment plant capacity) would cost approximately $910,000 annually, or $36.4 million (uninflated) over a 40-year lifecycle. The diversion of urban runoff to a sewage treatment plant, or the implementation of an on-site centralized technological system, would also negatively impact energy resources and CO_2 footprint, and would not produce the habitat acreage increase of the proposed Project. The proposed Project cost of $3.56 million compared to the alternative cost of $36.4 million reflects that the proposed Project is the least cost alternative and the preferred alternative.
Question 3	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* The proposed Project is the least cost alternative.
Comments:	

4. Strategic Turfgrass Removal & Design Assistance Program

Table 7 – Cost Effective Analysis **Project Name: Strategic Turfgrass Removal & Design Assistance Program**	
Question 1	*Types of benefits provided as shown in Table 5:* 252 AFY of water savings; 42 acres of landscape conversion (habitat restoration)
Question 2	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* No.
	If no, why? The combination of water savings and runoff reduction can only be achieved through a landscape conversion. The total Program cost is estimated at $2,927,155.72. This investment will result in 3,528 acre feet of water savings over a 14-year period or 252 AFY. The cost per acre foot saved is approximately $830/AF. This is less than the MWD avoided cost for imported water, including the Readiness to Serve and other fees at $1,067/AF. The Project is considered a vital program within the portfolio of water saving opportunities for end-users. As part of our diverse water supply portfolio, water use efficiency is a sound investment. This water savings will also result in reductions in both runoff and non-point source pollution. The Project will also result in 42 acres of landscape conversion to drought tolerant plant species. Habitat restoration within urban spaces would not occur without this Project, thereby it adds value to the overall Project cost.
	If yes, list the methods (including the proposed project) and estimated costs.
Question 3	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods*: The proposed Project is the least cost alternative and the preferred alternative.
Comments:	

5. 3A Water Recycling Plant Tertiary Expansion

Table 7 – Cost Effective Analysis **Project name: __3A Water Recycling Plant Tertiary Treatment Expansion**	
Question 1	*Types of benefits provided as shown in Table 5* - 3,000 AFY of Recycled Water used for irrigation; 5,653,000 kWh/yr savings in energy; and 3,448,330 lbs of CO_2 emissions eliminated.
Question 2	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs. The alternative to the Project would be to not convert the domestic irrigation accounts to recycled water service and continue serving the customers with imported domestic water. The cost to continue serving these irrigation customers with imported water is the purchase price of the imported water, which is $947 per AF. The total cost to purchase imported water for those irrigation customers that can be switched to recycled water, based on the total annual demand of 3,000 AF, would be approximately $2,836,000 per year. In comparison, if the service life of the proposed Project is 20 years, the annualized cost (not factoring in the cost to finance the Project), at a total estimated Project cost of $4,000,000, would be $200,000 per year. Implementing the Project, allowing for a cost to treat and pump the recycled water of $250/AF compared to continuing to purchase imported water would save approximately $1,886,000 in year 2015. The cost savings of using recycled water instead of imported water would continue throughout the life of the Project as both imported water and Project costs escalate. In this analysis, the cost of the proposed recycled water system extension is much more cost effective versus the use of 3,000 AFY of imported water supply for irrigation demand. There are additional cost savings that will be realized due to the 5,653,000 kWh/Yr energy saved.
Question 3	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods*. The proposed Project is the least cost alternative and the preferred alternative.
Comments:	

6. Recycled Water Distribution Upgrade

Table 7 – Cost Effective Analysis **Project name: South Coast Water District Recycled Water Distribution Upgrade**	
Question 1	*Types of benefits provided as shown in Table 5:* 850 AFY of recycled water for irrigation; 1,700,000 kWh per year savings in energy; 1,037,000 lbs of CO_2 emissions per year eliminated.
Question 2	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs. The alternative to the Project would be to not convert the domestic irrigation accounts to recycled water service and continue serving the customers with imported domestic water. The cost to continue serving these irrigation customers with imported water is the purchase price of the imported water, which is approximately $1,000 per AF. The total cost to purchase imported water for the total annual demand of 850 AF, would be approximately $850,000 for year 2015. In comparison, if the service life of the proposed Project is 50 years, the annualized cost at a total estimated Project cost of $2,250,000, would be $67,500 in year 2015 (note: interest rate=3%). Also applying a 3% escalation rate to the cost of increased recycled source water for the Project, the cost of 850 AFY of increased recycled water would equal $442,300 by year 2065. Applying a 3% escalation rate to the annual price of imported water, the cost of 850 AFY of imported water would equal $3,726,300 by year 2065. Implementing the Project compared to continuing to purchase imported water would save approximately $340,200 in year 2015 and $1,719,600 in 2065. Factoring in a present worth value of approximately $25.729, implementing the Project would save the District approximately $8.75 million in 2015 dollars over the 50 years. In this cost analysis, the cost of the proposed recycled water system extension is much more cost effective versus the use of 850 AFY of imported water supply for irrigation demand. The District pays an average of $0.15/kWh for energy and applying a cost of living increase factor to the unit cost. At a cost of $0.15/kWh, the total annual energy cost of implementing 2,125,000 kWh of imported water is $318,750, while the total annual energy cost of implementing 425,000 kWh of recycled water is $63,750, resulting in cost savings of $255,000.
Question 3	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods*. The proposed Project is the least cost alternative and the preferred alternative.
Comments:	