Attachment 3

San Diego Integrated Regional Water Management

2014 IRWM Drought Solicitation Implementation Grant Proposal
Project Justification

Attachment 3 consists of the following items:

✓ **Project Justification.** This attachment includes a summary of the proposed projects, including the purpose and how each project meets the needs created by the drought, which are explained in Attachment 2. This attachment also includes a technical justification of each project, describes how each project can achieve the claimed level of benefits, explains how the benefits will be attained through the least cost alternative, and identifies a plan to monitor project performance.

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Project Summary Table

Table 3-1 includes information about how each of the seven projects included in the Proposal meet applicable Drought Elements and IRWM Program Elements stipulated in Table 4 of the Proposal Solicitation Package (PSP).

Table 3-1: Project Summary Table

		Reynolds Groundwater Desalination Facility Expansion	Fallbrook Plant Nurseries Recycled Water Distribution System Expansion	Carlsbad Recycled Water Plant and Distribution System Expansion	Regional Demand Management Program Expansion	San Diego Water Use Reduction Program	Rincon Customer-Driven Demand Management Program	Regional Emergency Storage and Conveyance System Intertie
Drought Project Element								
D.1	Provide immediate regional drought preparedness	✓	✓	✓	✓	✓	✓	✓
D.2	Increase local water supply reliability and the delivery of safe drinking water	✓						✓
D.3	Assist water suppliers and regions to implement conservation programs and measures that are not locally cost-effective							
D.4	Reduce water quality conflicts or ecosystem conflicts created by the drought	✓	✓	✓	✓	✓	✓	✓
IRWM Project Element								
IR.1	Water supply reliability, water conservation, and water use efficiency	✓	✓	✓	✓	✓	✓	✓
IR.2	Stormwater capture, storage, clean-up, treatment, and management							
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							
IR.4	Non-point source pollution reduction, management, and monitoring		✓	✓	✓	✓	✓	✓
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	✓	✓	✓		✓		
IR.7	Water banking, exchange, reclamation, and improvement of water quality							
IR.8	Planning and implementation of multipurpose flood management programs							
IR.9	Watershed protection and management							✓
IR.10	Drinking water treatment and distribution	✓						✓
IR.11	Ecosystem and fisheries restoration and protection							✓

Regional Map

Figure 3-1 includes the San Diego IRWM regional boundary and a marker identifying the location of each project contained in the Proposal. **Figures 3-2** through **3-18** provided below include the project maps as required by the California Department of Water Resources (DWR) in the PSP along with additional project-specific maps that provide back-up and supporting information for the benefits claimed herein.

Project 1: Reynolds Groundwater Desalination Facility Expansion

Local Project Sponsor: Sweetwater Authority (Sweetwater)
Partner: City of San Diego

The following sections of this application include project-specific information for the *Reynolds Groundwater Desalination Facility Expansion* project, and include the following information pursuant to the PSP:

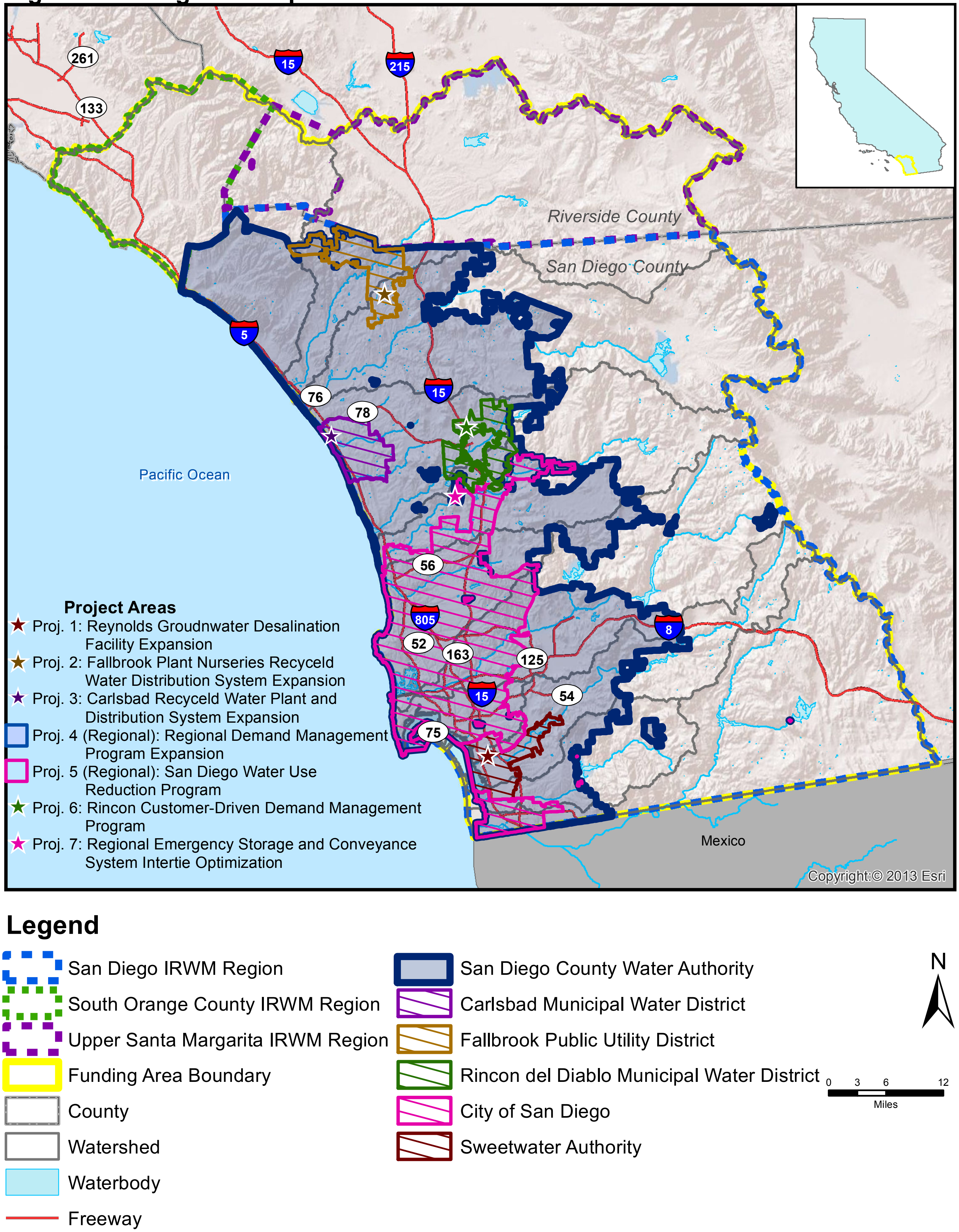
1. Project Description
2. Project Map
3. Project Physical Benefits
4. Technical Analysis of Physical Benefits Claimed, which includes the following sub-sections:
    - Technical Basis of the Project
    - Background for Benefits Claimed (Recent and Historical Conditions)
    - Without-Project Baseline (Estimates of Without-Project Conditions)
    - Methods Used to Estimate Physical Benefits
5. New Facilities, Policies, and Actions Required to Obtain Physical Benefits
6. Potential Physical Effects of the Project
7. Cost Effectiveness Analysis

Project Map: Reynolds Groundwater Desalination Facility Expansion

Figure 3-2 shows the *Reynolds Groundwater Desalination Facility Expansion* project area, the service areas of the project sponsor, and the project's relation to groundwater basins and disadvantaged communities (DACs). **Figure 3-3** shows imported water infrastructure within the San Diego IRWM Region and **Figure 3-4** shows a detailed map of the project area; information provided within these figures is used to explain the benefits claimed for the *Reynolds Groundwater Desalination Facility Expansion* project.

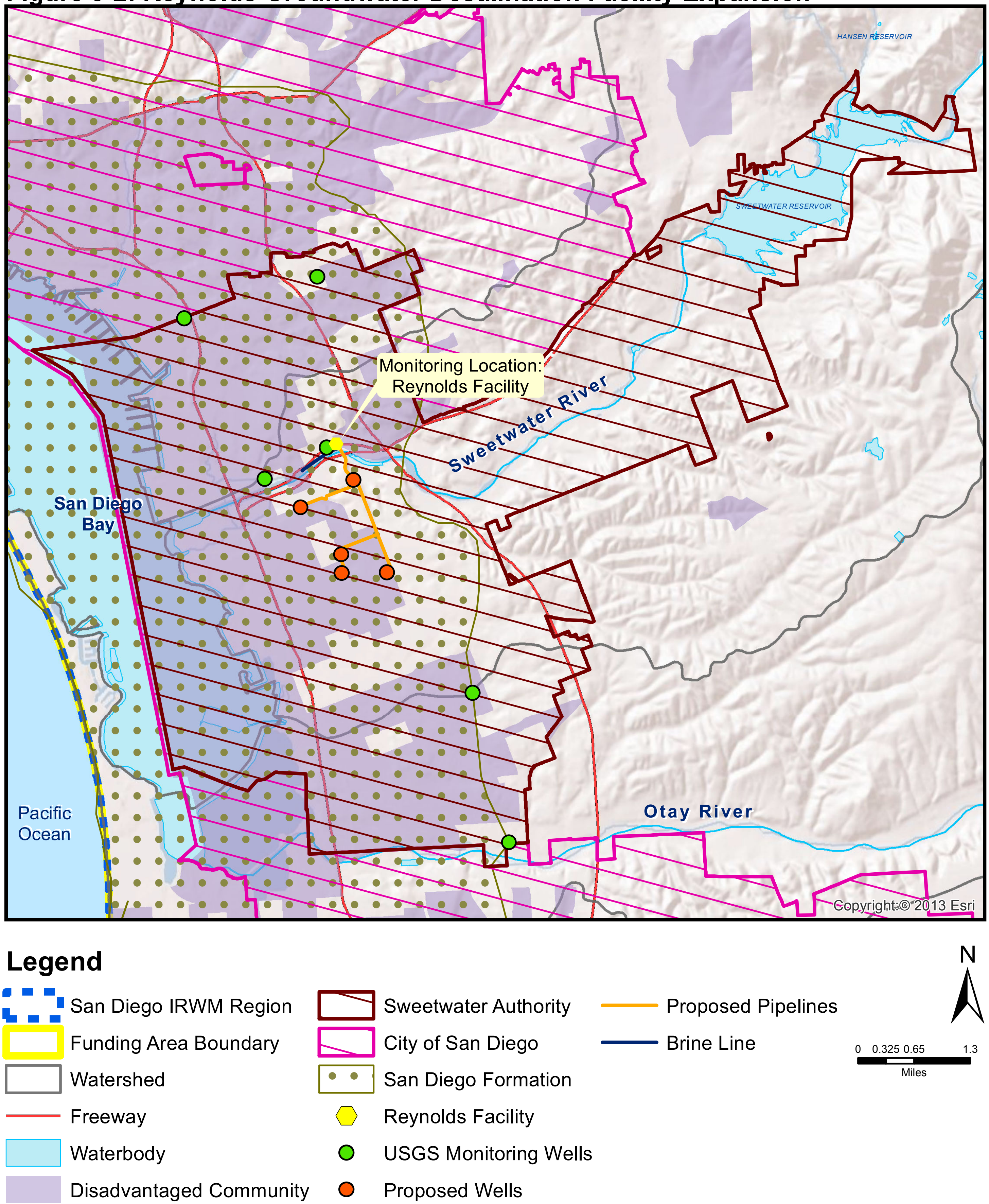
Existing Reynolds Groundwater Desalination Facility

Figure 3-1: Regional Map



Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\1-1_PriorityGWBasins_15Jul14.mxd

Figure 3-2: Reynolds Groundwater Desalination Facility Expansion

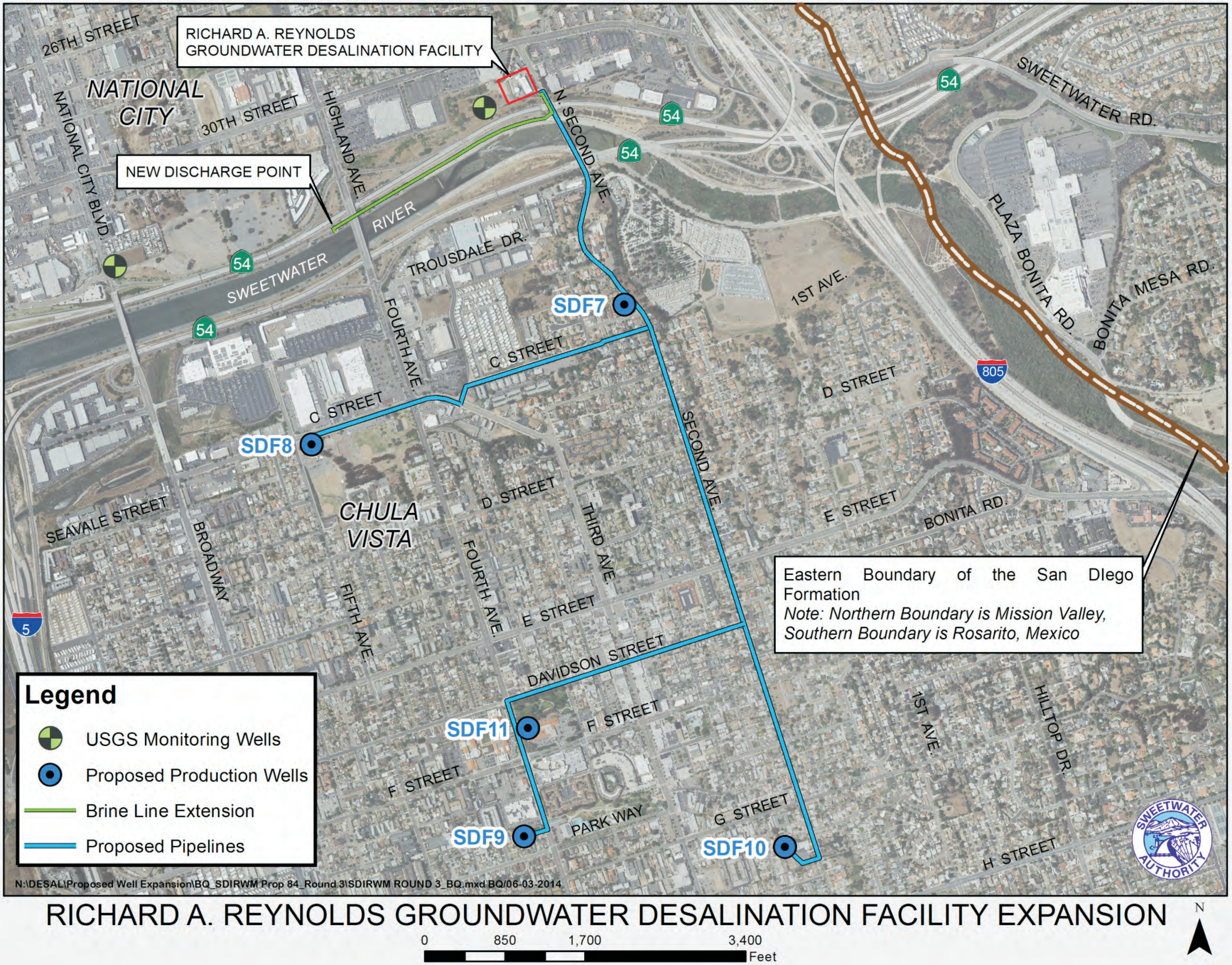


Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-2_Proj1_Reynolds_15Jul14.mxd

Figure 3-3: Regional Water Supply Infrastructure

Source: San Diego Association of Governments (SANDAG) - GIS Data Warehouse, Metropolitan Water District
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-3_ImportedWaterInfra_15Jul14.mxd

Figure 3-4



RICHARD A. REYNOLDS GROUNDWATER DESALINATION FACILITY EXPANSION

Project Description: Reynolds Groundwater Desalination Facility Expansion

Project will reduce dependence on imported water by treating and distributing 5,200 AFY of locally-produced desalinated brackish groundwater to create a reliable, drought-proof water supply.

Project Nexus to Drought Impacts

The *Reynolds Groundwater Desalination Facility Expansion* meets three of the Drought Project Elements defined by DWR (**Table 3-1**). The project provides drought preparedness through efficient groundwater basin management and establishment of system interties between Sweetwater's and the City of San Diego's potable water distribution systems. The project increases local water supply reliability and the delivery of safe drinking water by increasing production of 5,200 acre-feet per year (AFY) of potable water through brackish groundwater desalination. It also helps to reduce ecosystem conflicts created by the drought by reducing demands from the Sacramento-San Joaquin Delta (Bay-Delta), which is subject to pumping restrictions to protect water levels for sensitive ecosystems, reducing demands for local potable water that can result in additional reservoir draw-down, and increasing brackish water flows to the Lower Sweetwater River and a downstream protected wildlife area.

The *Reynolds Groundwater Desalination Facility Expansion* project addresses six of the drought impacts identified in Attachment 2:

- Ability to Meet Drinking Water Demands: The project will supply an additional 5,200 AFY of potable water for use by customers in the Sweetwater and City of San Diego service areas. This project will reduce reliance on imported water, thereby helping the Region meet drinking water demands that are threatened by drought restrictions. As a local, sustainable water supply, the water produced by this project is not vulnerable to restrictions on imported water deliveries and utilizes available brackish groundwater supplies.
- Ability to Meet Agricultural Water Demands: Any cutbacks on imported water supplies from MWD could result in local water restrictions to agricultural users. Local, drought-proof supplies such as those supplied by the project provide a local water supply buffer that allows the Region to avoid severe water use restrictions to agricultural users even in times of drought.
- Ability to Meet Ecosystem Demands: Provision of desalinated groundwater reduces demands on imported water that is largely stored in local reservoirs, thereby reducing reservoir drawdown. Reservoir drawdown can impact ecosystems by decreasing water availability and reducing water quality (pollutant concentrations increase as water in the reservoir is reduced). Therefore, by helping to avoid reservoir drawdown, the project will reduce drought impacts associated with meeting riparian and aquatic ecosystem demands.
- Drinking Water MCL Violations: Poor water quality in reservoirs increases the risk of drinking water MCL violations, particularly secondary MCLs for color, taste, and odor. Reduced drawdown of reservoirs, which would occur as a result of the project, reduces this risk.
- Increased Wildfire Risk and Water Quality Impacts: The project reduces wildfire risk by reducing contribution to the causes of climate change (greenhouse gas [GHG] emissions) and associated wildfire risk. Improved supply reliability also allows water to be available to fight wildfires with a reduced impact on supplies needed to meet existing demands.
- Economic Impacts: Increasing water supply reliability will help to ensure that demands associated with the regional economy – including manufacturing, tourism, military, and agriculture – can be met. This project provides a substantial new water source and buffer against prolonged drought.

The project was selected for inclusion in this funding application because it is a multi-benefit project that addresses drought impacts and is able to be implemented and provide benefits within an expedited timeline. Expedited funding is needed for this high-priority project because it provides additional local potable water supplies that are critical in times of drought.

Project Physical Benefits: Reynolds Groundwater Desalination Facility Expansion

Tables 3-3 through **3-9** provide summaries of the primary and secondary physical benefits anticipated to be achieved through implementation of the *Reynolds Groundwater Desalination Facility Expansion* project. The primary physical benefit of the project is an increase in brackish groundwater desalination to create an additional 5,200 AFY of new potable water supplies. As shown in **Table 3-2**, this project would result in six quantifiable secondary physical benefits and one qualitative benefit (designated with letters). Benefits are quantified over the useful life of the project, which is expected to be 30 years, with benefits beginning to accrue in October 2016 when project construction is complete. Benefits are therefore phased in and out in accordance with this anticipated schedule (refer to Attachment 6 and see the Project Phasing section below for justification). **Appendix 3-1** includes detailed spreadsheets that show how the quantified benefits were calculated.

Table 3-2: Physical Benefits Summary
Reynolds Groundwater Desalination Facility Expansion

Primary Physical Benefit	Secondary Physical Benefit		Annual Quantification of Benefit (cumulative quantification)
Increase brackish groundwater desalination for potable use (5,200 AFY)	A	Avoid Imported Water Supply Purchases	5,200 AFY (156,000 AF)
	B	Reduce Demand for Net Diversions from the Bay-Delta	3,467 AFY (104,000 AF)
	C	Local Supply Development to Decrease Vulnerabilities	5,200 AFY (156,000 AF)
	D	Reduce Net Production of Greenhouse Gases	2,394 MT CO_2/year (71,815 MT CO2)
	E	Avoid Social Costs of Greenhouse Gases	$58,768/year ($1,763,048)
	G	Reduce Water Costs to Customers, Including DACs	Variable ($243,622,167)
	K	Improve Habitat in Protected Wildlife Area	Qualitative

Table 3-3: Primary Physical Benefit – Increase Brackish Groundwater Desalination for Potable Use
Reynolds Groundwater Desalination Facility Expansion

Project Name: *Reynolds Groundwater Desalination Facility Expansion*
Type of Benefit Claimed: Increase Brackish Groundwater Desalination for Potable Use
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2016	3,600 AF	4,900 AF	1,300 AF
2017	3,600 AF	8,800 AF	5,200 AF
2018-2045	3,600 AFY (100,800 AF)	8,800 AFY (246,400 AF)	5,200 AFY (145,600 AF)
2046	3,600 AF	7,500 AF	3,900 AF
Total*	**118,800 AF**	**267,600 AF**	**156,000 AF**

Comments: The Annual Without Project benefit would accrue from the existing 3,600 AFY Reynolds Facility. The proposed expansion would produce an additional 5,200 AFY water supply, for a total facility production of 8,800 AFY. Benefits would be phased in by 1,300 AFY in 2016 because the upgraded facility would begin to deliver water in September of that year (refer to Attachment 6), providing 25% of annual benefit in 2016. The Reynolds Facility would be operating at 5,200 AFY in 2017, the first full year of total benefits.

Sources: (project description) Sweetwater Authority. 2010. Sweetwater Authority Brackish Groundwater Desalination Project Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 1-2 of the Draft EIR, which was not revised in the Final EIR.; (revision of project description to current, proposed project) Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Pg. 13

*Some differences may occur due to rounding

Table 3-4: Physical Benefit A-Avoid Imported Water Supply Purchases
Reynolds Groundwater Desalination Facility Expansion

Project Name: *Reynolds Groundwater Desalination Facility Expansion*
Type of Benefit Claimed: Avoid Imported Water Supply Purchases
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2016	3,600 AF	4,900 AF	1,300 AF
2017	3,600 AF	8,800 AF	5,200 AF
2018-2045	3,600 AFY (100,800 AF)	8,800 AFY (246,400 AF)	5,200 AFY (145,600 AF)
2046	3,600 AF	7,500 AF	3,900 AF
Total*	**118,800 AF**	**267,600 AF**	**156,000 AF**

Comments: Within the San Diego IRWM Region, local water supplies are used before purchasing imported water to meet demand deficits. Because the Reynolds Facility will be producing an additional 5,200 AFY local supply from desalinated groundwater, this will directly offset the purchase of imported water. This benefit will begin to accrue when water deliveries from the expanded Reynolds Facility begins, in September 2016 (see Attachment 6). 25% of the annual benefits will therefore be accrued in 2016 (1,300 AF avoided imported water purchases), with full benefits realized the following year (5,200 AFY avoided imported water purchases).

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13.

*Some differences may occur due to rounding

Table 3-5: Physical Benefit B-Reduce Demand for Net Diversions from the Bay-Delta
Reynolds Groundwater Desalination Facility Expansion

Project Name: *Reynolds Groundwater Desalination Facility Expansion* **Type of Benefit Claimed:** Reduce Demand for Net Diversions from the Bay-Delta **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2016	0 AF	867 AF	867 AF
2017	0 AF	3,467 AF	3,467 AF
2018-2045	0 AFY (0 AF)	3,467 AFY (97,067 AF)	3,467 AFY (97,067 AF)
2046	0 AF	2,600 AF	2,600 AF
Total*	**0 AF**	**104,000 AF**	**104,000 AF**

Comments: The San Diego County Water Authority (SDCWA) is the sole imported water wholesaler in the San Diego IRWM Region. Although SDCWA supplies include a mix of sources, local supplies are used first, and imported water purchased only to satisfy unmet demand once local supplies are exhausted. SDCWA's imported supply mix includes water from the State Water Project (SWP), which comes from the Sacramento-San Joaquin Delta (Bay-Delta), and the Colorado River. During normal years, SDCWA's imported supply mix is 2/3 SWP and 1/3 Colorado River. Under drought conditions in 2014 and 2015, SWP is 15% of SDCWA's imported supply. This analysis assumes 15% imported water is from the SWP during 2014 and 2015, and 2/3 from SWP during other years. This proportion was applied to the offset imported water calculated under Benefit A, above.

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13; (SDCWA supply mix) Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8; (imported mix during drought) Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

*Some differences may occur due to rounding

Table 3-6: Physical Benefit C-Local Supply Development to Decrease Vulnerabilities
Reynolds Groundwater Desalination Facility Expansion

Project Name: *Reynolds Groundwater Desalination Facility Expansion* **Type of Benefit Claimed:** Local Supply Development to Decrease Vulnerabilities **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2016	3,600 AF	4,900 AF	1,300 AF
2017	3,600 AF	8,800 AF	5,200 AF
2018-2045	3,600 AFY (100,800 AF)	8,800 AFY (246,400 AF)	5,200 AFY (145,600 AF)
2046	3,600 AF	7,500 AF	3,900 AF
Total*	**118,800 AF**	**267,600 AF**	**156,000 AF**

Comments: The Region's high reliance on imported water supplies increases its vulnerability to water shortages (see Attachment 2). Local supply development is a key regional strategy to address this issue. The Reynolds Facility will produce drought-proof local supply, implementing this strategy to decrease vulnerabilities. The amount of water produced by the project at the Reynolds Facility is calculated under the Primary Physical Benefit (**Table 3-3**), above, as an additional 5,200 AFY, bringing the total amount of local supply produced at the Reynolds Facility to 8,800 AFY, up from 3,600 AFY.

Source: (strategy to reduce vulnerabilities) SDCWA. 2008. Strategic Plan. April. Pg. 9

*Some differences may occur due to rounding

Table 3-7: Physical Benefit D-Reduce Net Production of Greenhouse Gases
Reynolds Groundwater Desalination Facility Expansion

Project Name: *Reynolds Groundwater Desalination Facility Expansion*
Type of Benefit Claimed: Reduce Net Production of Greenhouse Gases
Units of the Benefit Claimed: Mega tons of CO2e

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2016	1,175 MT CO2e	576 MT CO2e	598 MT CO2e
2017	4,699 MT CO2e	2,305 MT CO2e	2,394 MT CO2e
2018-2045	4,699 MT CO2e/yr (131571 MT CO2e)	2,305 MT CO2e/yr (64,544 MT CO2e)	2,394 MT CO2e/yr (67,027 MT CO2e)
2046	3,524 MT CO2e	1,729 MT CO2e	1,795 MT CO2e
Total*	**140,696 MT CO2e**	**69,155 MT CO2e**	**71,815 MT CO2e**

Comments: Importing water is more energy intensive than the desalination process used at the Reynolds Facility, using 2.65 MWh/AF to import water to the Region compared to 1.3 MWh/AF at the Reynolds Facility. California produces 70% of its energy with a carbon dioxide equivalent (CO2e) emissions factor of 613.28 lbs/MWH. 10% of California's energy is imported from the Pacific Northwest, with a CO2e emissions factor of 846.97 lbs/MWH, and 20% imported from the Pacific Southwest, with a CO2e emissions factor of 1,182.89 lbs/MWh. Using a weighted average, CO2e emissions from California's energy is 750.57 lbs/MWh, or 0.341 MT/MWh. This was applied to the energy intensity of imported water offset by the project (see Benefit A, **Table 3-4**), and the energy intensity of water produced by the Reynolds Facility from the project (see Primary Physical Benefit, **Table 3-3**).

Sources: (energy intensity of imported water) Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10); (energy intensity of brackish groundwater desalination) WateReuse. 2011. *Seawater Desalination Power Consumption White Paper*. November. Table 2 (pg. 15); (California energy mix) CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html; (CO2e emissions factors) U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

*Some differences may occur due to rounding

Table 3-8: Physical Benefit E-Avoid Social Costs of Greenhouse Gases
Reynolds Groundwater Desalination Facility Expansion

Project Name: *Reynolds Groundwater Desalination Facility Expansion*
Type of Benefit Claimed: Avoid Social Costs of Greenhouse Gases
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2016	$0	$14,692	$14,692
2017	$0	$58,768	$58,768
2018-2045	$0/yr ($0)	$58,768/yr ($1,645,512)	$58,768/yr ($1,645,512)
2046	$0	$44,076	$44,076
Total*	**$0**	**$1,763,048**	**$1,763,048**

Comments: There are social costs associated with GHG emissions, which were estimated at $21.40/MT CO2e in 2007 dollars. This is converted to $24.55/MT CO2e in 2014 dollars. This value is applied to the reduced GHG emission calculated under Benefit D, above (**Table 3-7**).

Sources: (social cost of GHGs) Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28); (conversion from 2012 to 2014 dollars) U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm.

*Some differences may occur due to rounding

Table 3-9: Physical Benefit G-Reduce Water Costs to Customers, Including DACs
Reynolds Groundwater Desalination Facility Expansion

Project Name: *Reynolds Groundwater Desalination Facility Expansion*
Type of Benefit Claimed: Reduce Water Costs to Customers, Including DACs
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2016	$1,887,392	$394,333	$1,493,059
2017	$7,814,560	$2,113,019	$5,701,541
2018-2045	Variable ($289,452,384)	Variable ($61,008,157)	Variable ($228,444,227)
2046	$9,568,104	$1,584,764	$7,983,340
Total*	**$308,722,440**	**$65,100,272**	**$243,622,167**

Comments: Imported water costs are based on the projected average costs to member agencies from the SDCWA, the sole imported water wholesaler in the Region. The project will offset imported water supply purchases (Benefit A, **Table 3-4**), avoiding the cost of imported water. Water produced by the Reynolds Facility are based on the operations and maintenance costs of the current facility to calculate a per-acre-foot cost of desalinated brackish groundwater for potable use. These costs are applied to the water produced by the project, calculated in the Primary Physical Benefit (**Table 3-3**).

Sources: (imported water costs) Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44); (Reynolds Facility water costs) Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-17 (pg. 43).

*Some differences may occur due to rounding

Technical Analysis of Physical Benefits Claimed: Reynolds Groundwater Desalination Facility Expansion

Technical Basis of the Project

The *Reynolds Groundwater Desalination Facility Expansion* project will increase the capacity of the existing Reynolds Groundwater Desalination Facility (Reynolds Facility), drill additional wells to supply desalinated brackish groundwater to the expanded facility, and produce and deliver an additional 5,200 AFY of potable water produced by the expanded facility to customers. The existing Reynolds Facility already produces 3,600 AFY of potable water from brackish groundwater; the expansion included within this project will expand production to 8,800 AFY. The proposed expansion of the Reynolds Facility is described in the *Sweetwater Authority Brackish Groundwater Desalination Project EIR*[1], and in Sweetwater Authority's *Title XVI Project Technical Report*.[2] Per a settlement agreement between Sweetwater and the City of San Diego (City), the water produced by the Reynolds Facility expansion will be evenly split between the two parties – 2,600 AFY to each.[3]

To achieve the 5,200 AFY expansion provided through the *Reynolds Groundwater Desalination Facility Expansion* project, an additional five groundwater wells will be built, for a total of eleven wells drawing from the San Diego Formation (SDF). The new wells, identified as SDF-7 through SDF-11, will be located to the south and west of the existing facility, and further from the Sweetwater River than the existing wells (see **Figure 3-4**).

Equipment that will be installed for the expansion include a new reverse osmosis system for the new wells, updated controls to accommodate the increased capacity and new equipment, modification of the clean-in-place system, and automation of some parts of the existing and new groundwater wells. The pre-treatment system will be upgraded from the existing three cartridge filters to four larger-capacity filters. An additional iron and manganese treatment system will be installed and will use a direct high-rate pressure vessel filtration process. An additional three reverse osmosis treatment trains will be installed with a treatment capacity of 1.67 million gallons per day (MGD) each, for a total of 5 MGD new treatment capacity at the Reynolds Facility; the existing Reynolds Facility has a treatment capacity of 4 MGD. The reverse osmosis bypass system will provide up to 2 MGD raw water to bypass the RO train that will be treated for iron and manganese removal. Details about the design of the expanded Reynolds Facility can be found in **Appendix 3-2**, which includes the 90% design drawings for the project that were completed in July 2014. Design specifications for the project that accompany the design drawings are included in the compact disc that is provided in support of the application and are not provided in the reference documents due to their size.

Construction of an additional 13,400 linear feet of new pipeline is required to connect the new groundwater wells to the Reynolds Facility. These pipelines will be constructed along existing roadways, with longer segments along C Street, 2nd Avenue, Park Way, and G Street (refer to **Figure 3-4**). The pipeline will cross underneath the Sweetwater River to reach the Reynolds Facility. No additional pipeline construction is required as part of the project, because pipelines are already in place to distribute potable water produced at the Reynolds Facility to customers.

To accommodate additional brine that will be produced by the expanded Reynolds Facility, the brineline discharge point that discharges to the Sweetwater River was recently relocated approximately 2,000 feet west of the previous discharge point (see **Figure 3-4**). Construction of the brineline discharge was completed in February 2014; the brineline was moved in accordance with permits obtained by the San

[1] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 1-2 of the Draft EIR, which was not revised in the Final EIR.
[2] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Pg. 13
[3] Sweetwater Authority and City of San Diego. 2013. Settlement Agreement Between Sweetwater Authority and City of San Diego Regarding Joint Expansion of Richard A. Reynolds Desalination Facility. August 28. Pg. 10

Diego Regional Water Quality Control Board (Regional Board) for additional discharges associated with the Reynolds Facility expansion project.[4]

Project Phasing

As shown in Attachment 6, the project will be constructed from February 2015 through September of 2016, with construction and testing of the facility expansion and pipelines completed in September 2016. Desalinated water production and delivery will begin after this date, and benefits are assumed to begin accruing immediately. Benefits can be immediately accrued upon completion of the facility expansion, because all pipelines and infrastructure necessary to deliver the water to customers from the existing Reynolds Facility are already in place. In 2016, benefits will accrue for 3 months (October – December), or 25% of the year. For this analysis, it is assumed that 25% of the annual benefit upon full operation of the system will be realized in 2016, full annual benefits will be realized from 2017 through 2045, and 75% of the annual benefits will be realized in the final year of the project life, 2046. Because benefits have been phased in during the first year of operation, they must also be phased out in the final year of the project (i.e., in the final year, the benefit accrued is 100% less the % benefit realized in the first year). The project life is anticipated to be 30 years, based on agency planning horizons and as reported in the *Title XVI Project Technical Report*.[5] Details about the phasing schedule and associated benefit accrual are shown in the spreadsheets provided in **Appendix 3-1**.

The primary physical benefit of the project is an additional 5,200 AFY new potable water supply through brackish groundwater desalination. **Table 3-3** shows the primary physical benefit as it accrues over the 30-year life of the project. As described below, there are many other benefits that are achieved by the project as a result of this primary physical benefit.

Background for Benefits Claimed

The primary physical benefit associated with the *Reynolds Groundwater Desalination Facility Expansion* project of producing an additional 5,200 AFY of desalinated groundwater will result in many other benefits. The information provided below is organized by each benefit that will be provided by the project and includes background information about the Region as well as specific information about the project that explains the basis for each of the benefits claimed for the project.

Primary Physical Benefit – Production of New Potable Water Supply

After the severe drought that took place in California from 1987-1992 the Metropolitan Water District of Southern California (MWD) and the San Diego County Water Authority (SDCWA) began offering financial incentives for agencies to complete projects that would diversify local supplies and increase new sources of local, drought-proof supplies. In response to this available funding, the Sweetwater Authority began exploration of local groundwater supplies, which had previously supplied drinking water to the local area.[6] After completing groundwater studies to evaluate the basin and other requisite environmental documentation, Sweetwater constructed the Reynolds Facility (originally called the Lower Sweetwater River Demineralization Facility) to treat local brackish groundwater to potable levels. The existing Reynolds Facility began operation in January 2000 and has a treatment capacity of 4 MGD; however, the facility was constructed to accommodate a larger capacity (10 MGD) in anticipation of a potential future expansion.[7]

The existing Reynolds Facility utilizes water that is pumped from the Sweetwater River area of the San Diego Formation; the San Diego Formation is a large brackish aquifer that underlies several coastal

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[4] San Diego Regional Water Quality Control Board. 2010. Waste Discharge Requirements for the Sweetwater Authority Richard A. Reynolds Desalination Facility Discharge to the Lower Sweetwater River Basin, San Diego County (Order No. R9-2010-0012 [NPDES No. CA0108952]). Pg. 7.

[5] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. pg. 41

[6] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 1-2 of the Draft EIR, which was not revised in the Final EIR. Pg. 1-1, Project Background.

[7] Sweetwater Authority. 2011. 2010 Urban Water Management Plan. June. Pg. 25.

alluvial aquifers and extends north to the San Diego River Valley and south to the United States/Mexico border.[8] Since construction of the existing Reynolds Facility, Sweetwater has been working with the United States Geological Survey (USGS) to evaluate the San Diego Formation and to determine the safe yield that could be available to expand the Reynolds Facility. Findings from this research calculated that average recharge to the San Diego Formation within the Sweetwater River area is nearly 12,000 AFY and also found that the larger San Diego Formation, including the San Diego, Sweetwater, and Otay River areas had an average recharge of 40,000 AFY.[9] At a maximum the entire Reynolds Facility (existing and proposed expansion) will extract 8,800 AFY from the San Diego Formation, demonstrating that the project is within the safe yield of the aquifer, because extractions are less than annual average recharge to the basin.

As explained above, the *Reynolds Groundwater Desalination Facility Expansion* project includes expansion of an existing 4 MGD facility by 5 MGD (for a total of 9 MGD); construction of the expansion will take place entirely within the existing facility site, which already has the capacity to accommodate additional equipment because it was designed for a maximum capacity of 10 MGD.[10] Because the Reynolds Facility is an existing facility that produces water for potable purposes, additional pipelines and delivery infrastructure beyond what is included to deliver additional brackish groundwater to the facility are not necessary because they are already in place.

The City of San Diego filed a CEQA lawsuit in 2010 regarding the proposed Reynolds Desalination Facility expansion. In 2013, a settlement agreement was reached between the City and Sweetwater to resolve the lawsuit.[11] As part of this settlement, the two parties agreed to split the additional potable water produced by the *Reynolds Groundwater Desalination Facility Expansion* project as described here. That is, Sweetwater will continue to receive the first 3,600 AFY produced at the existing facility (current production capacity), and the water created by the expansion (5,200 AFY) will be split evenly between the two parties.[12]

The Environmental Impact Report for the Reynolds Facility found that there could be potential environmental impacts associated with brine discharges to the Sweetwater River.[13] In response to these potential impacts and in coordination with recommendations from the Regional Board, Sweetwater agreed to move the brineline discharge point 2,000 feet west of the previous discharge point.[14] Upon moving the brineline location, Sweetwater is now permitted (under Order No. R9-2010-0012 from the Regional Board) to increase brine discharges to 2.5 MGD, which is within the proposed operating plans of the expanded Reynolds Facility (refer to **Appendix 3-2** that includes design drawings for the project; specifications that accompany these drawings are included in the accompanying compact disc).

Given the existing infrastructure in place, the extensive research that has been conducted on the SDF, legal agreements that have been reached between applicable parties, and permitting that is in place, it is fully certain that the *Reynolds Groundwater Desalination Facility Expansion* project will result in an additional provision of 5,200 AFY of a potable water supply in a sustainable manner that will not result in groundwater overdraft conditions. Further, due to existing infrastructure and the fact that the Reynolds Facility is able to treat brackish water to potable levels, it is certain that the specific project components

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[8] MWD. 2007. Groundwater Assessment Study: A Status Report on the Use of Groundwater in the Service Area of the Metropolitan Water District of Southern California. Report Number 1308. September. Chapter 4: San Diego County Basins – South San Diego County Basins. Pg. iv-23-2.

[9] Flint et al. 2012. A Basin-Scale Approach for Assessing Water Resources in a Semiarid Environment: San Diego Region, California and Mexico. February. Pg. 3825.

[10] Sweetwater Authority. 2011. 2010 Urban Water Management Plan. June. Pg. 25.

[11] Sweetwater Authority and City of San Diego. 2013. Settlement Agreement Between Sweetwater Authority and City of San Diego Regarding Joint Expansion of Richard A. Reynolds Desalination Facility. August 28. Pg. 1.

[12] Sweetwater Authority and City of San Diego. 2013. Settlement Agreement Between Sweetwater Authority and City of San Diego Regarding Joint Expansion of Richard A. Reynolds Desalination Facility. August 28. Pg. 4.

[13] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. ES-11 of the Draft EIR, which was not revised in the Final EIR.

[14] San Diego Regional Water Quality Control Board. 2010. Waste Discharge Requirements for the Sweetwater Authority Richard A. Reynolds Desalination Facility Discharge to the Lower Sweetwater River Basin, San Diego County (Order No. R9-2010-0012 [NPDES No. CA0108952]). Pg. 7.

discussed herein will be sufficient to produce and deliver potable water to local customers. Finally, because Sweetwater Authority has already received permits to discharge additional brine to the Sweetwater River and has resolved potential legal issues with applicable parties, it is certain that the project will be able to deliver water and will not face any additional permitting or legal hurdles.

Benefit A-Avoid Imported Water Supply Purchases and Benefit C-Local Supply Development to Decrease Vulnerabilities

One of the secondary benefits of the project is avoided purchase of imported water supply. The SDCWA is the sole imported water wholesaler to 24 member agencies within San Diego County[15]. SDCWA supplies include a mix of surface water and imported water supplied through water transfers from Imperial Irrigation District, canal lining projects, and purchases from MWD.[16] As shown in SDCWA's *2010 Urban Water Management Plan* (UWMP), during dry years, imported water will constitute a larger proportion of SDCWA's supplies due to reduced surface water flows.[17] SDCWA supplies are purchased only to meet demand that cannot be met with local supplies by member agencies, per SDCWA's demand projection methods described in its UWMP.[18] Although SDCWA and its member agencies use a mix of imported water and local sources to supply their customers, imported water is more expensive to provide and is considered to be the marginal water source.[19] Thus, any new supplies that are available in the Region (such as brackish groundwater) will be used to offset purchase of imported water supplies.

SDCWA purchases the majority of the Region's imported water (sourced from the State Water Project (SWP) and the Colorado River Aqueduct (CRA)) from the MWD, and receives additional imported supplies from the Colorado River through a conservation and transfer agreement with the Imperial Irrigation District (IID).[20] SDCWA, as the only water wholesaler within the Region, distributes the aforementioned supply to its 24 member agencies, which include all major water agencies in the San Diego Region. The amount of water imported into the Region varies depending on hydrologic conditions, but in recent years the Region's water supply has consisted of between 79% and 93% imported water (refer to **Figure 3-3** for an overview of the Region's imported water infrastructure).[21] By 2010, SDCWA had decreased reliance on MWD imports to 59% (331,825 AF), with increased use of IID transfers (13% or 70,000 AF), canal lining transfers (14% or 80,200 AF), and member agency local sources (14% or 76,100 AF).[22] The member agency local sources in the Region currently consist of conservation, recycled water, local surface water, and groundwater.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

The Bay-Delta is the source of water supplied by the SWP. Conflict over management of the Bay-Delta system has been ongoing for decades, and stems from the challenge of balancing the needs and demands of people and ecosystems.[23] The CALFED Bay-Delta Program (now managed by the Delta Stewardship council) established four objectives[24] for the Bay-Delta system:

- *Water Quality*: to invest in projects that improve the State's water quality from source to tap.
- *Water Supply*: comprised of five critical elements: conveyance, storage, environmental water account, water use efficiency and water transfer.
- *Ecosystem Restoration*: aims at restoring habitats, ecosystem functions, and native species.

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[15] SDCWA. 2011. 2010 Urban Water Management Plan. June Pg. 1-8 and 3-1.
[16] SDCWA. 2011. 2010 Urban Water Management Plan. June Pg. 9-2.
[17] SDCWA. 2011. 2010 Urban Water Management Plan. June Pp. 9-3 to 9-7.
[18] SDCWA. 2011. 2010 Urban Water Management Plan. June Pg. 2-13.
[19] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10. Note that despite desalinated water's high cost, the San Diego IRWM region's priority is to reduce dependence on imported water (IRWM Plan, 2007).
[20] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 1-8.
[21] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-26.
[22] San Diego County Water Authority. 2011. 2010 Urban Water Management Plan. June. Pg. 4-4, 4-6, and 6-1.
[23] Delta Stewardship Council. 2013. The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value. Pp. 10-11.
[24] CALFED Bay-Delta Program Archived Website. CALFED Objectives. Accessed 28 June 2014. Available: http://calwater.ca.gov/

- *Levee Integrity*: to protect water supplies by reducing the threat of levee failures.

As described in Attachment 7, reduced pumping from the Bay-Delta will help to reduce the conflicts surrounding management of Bay-Delta supplies by allowing more water to be available to help meet water-based needs of all users, including people and ecosystems.

Benefit D-Reduce Net Production of Greenhouse Gases and Benefit E-Avoid Social Costs of Greenhouse Gases

Imported water is known to be an energy intensive supply of water, as explained below under Benefit D. The energy required to move and treat imported water supplies results in GHG emissions, which contribute to climate change. The *2013 San Diego IRWM Plan* incorporated the results of a Climate Change Planning Study for the Region. This planning study demonstrated that climate change is anticipated to increase temperature between 1.5˚F and 4.5˚F, increase variability in rainfall, decrease imported water supplies, increase water demand, increase wildfires, and cause sea level rise.[25] A vulnerability analysis of the effects of climate change on the Region found that the highest priority to help the Region reduce its vulnerability to climate change impacts is to decrease imported water supply, followed by supply impacts from higher drought potential, water quality issues from increased concentration of pollutants, increased in flooding from extreme weather, decrease in habitat, inundation of storm and sewer systems from sea level rise, and a decrease in ecosystem services.[26] Each of these impacts has a cascading effect on the Region including costs associated with mitigating the effects of climate change and economic impacts to industry and businesses.

Benefit G-Reduce Water Costs to Customers, Including DACs

The project area lies along the San Diego Bay, and residents served by the project are vulnerable to climate change impacts, notably supply vulnerabilities and sea level rise. The areas of the project near the Bay are nearly all classified as DACs (refer to **Figure 3-2**). DACs have fewer resources to accommodate the potential impacts of climate change. Because the *Reynolds Groundwater Desalination Facility Expansion* will reduce GHG emissions and offset imported water, DACs will benefit from cost savings associated with avoided water costs and avoided social costs from GHGs. Imported water, as described in Benefit A, is expensive compared to water produced by the Reynolds Facility. Costs of water production and delivery are passed along to customers in the form of water rates and fees. By reducing water costs through offsetting imported water, the project will help to protect Sweetwater Authority and City of San Diego customers from price escalations and fluctuations associated with imported water. Reducing supply vulnerabilities also protects customers from high water rates by reducing the need for water use restrictions, which are often accompanied by fees and higher rates for excessive water use.

Benefit K-Improve Habitat in Protected Wildlife Area

In addition the benefits to people within the project area, the *Reynolds Groundwater Desalination Facility Expansion* will also provide habitat benefits. Reduced pumping from the Bay-Delta will provide habitat benefits to species of concern in the Bay-Delta, including the endangered Delta Smelt. The project will also directly provide benefits to native habitat associated with the Lower Sweetwater River. As noted in the biological report for the project's Environmental Impact Report (EIR), the Reynolds Facility is located upstream of the San Diego Bay National Wildlife Refuge, which supports numerous native species, along with threatened and endangered species, including the Least tern, Belding's savannah sparrow, and Western snowy plover [27], among other species of concern. By adding brine discharges to the Lower Sweetwater River, the project will help to maintain brackish conditions within the Wildlife Refuge and therefore support habitat for the native and sensitive species that reside within the Wildlife Refuge.

[25] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-15 (pg. 7-38).
[26] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-16 (pg. 7-39).
[27] ESA. 2008. Draft Final Biological Resources Background Report for the Phase II Richard A. Reynolds Desalination Facility Expansion Project. Appendix E to the Sweetwater Authority Brackish Groundwater Desalination Project Draft EIR. January. Pg. 35-42

Without Project Baseline

Without the project, the Reynolds Facility would not be expanded. As such, the facility would continue to produce 3,600 AFY of potable desalinated groundwater which would be distributed to customers solely within the Sweetwater service area. The project sponsors would continue to purchase imported water to supplement local supplies to meet existing demands, and as costs of imported water increase as predicted (see Benefit G), costs will be passed along to customers, including DACs. GHG emissions associated with imported water would continue, and impacts from climate change felt sooner, and potentially more intensely. Further, the partnership between Sweetwater Authority and the City of San Diego would dissolve, potentially opening the door to future litigation between the two agencies over use of SDF groundwater in the future if other groundwater projects are pursued.

Further, without the project, the drought impacts described in Attachment 2 would not be addressed. The original Reynolds Facility was conceptualized in 1992 following a prolonged drought period, and has been a source of local, drought-proof water since 2000.[28] Without the project, the Reynolds Facility would continue to provide drought relief to the Region, but at a lower magnitude than with the project (3,600 AFY vs. 8,800 AFY). The importance of local drought-proof supplies continues to be a priority for the Region, and without this project the Region would continue to face drought-related water supply issues that can have serious social, environmental, and economic consequences.

Methods Used to Estimate the Physical Benefits

Methods used to estimate the primary physical benefit – namely via reference to technical documentation – were described above under Technical Basis of the Project.

Benefit A-Avoid Imported Water Supply Purchases

Local supplies, such as surface water, groundwater, and recycled water, will always be used first to meet demands, because imported water supplies are considered to be a marginal water source. Imported water is purchased by Sweetwater Authority or the City of San Diego to meet demands that cannot be met with local supplies. SDCWA is the imported water purveyor for the Region, and its projected water demands (sales) are based on total demands minus local supplies from its 24 member agencies,[29] including Sweetwater Authority and the City of San Diego. Due to the prioritization of water sources in the Region, all of the water produced by the project will be used to offset imported water supply purchases. **Table 3-4** shows the avoided imported water supply purchases from the production of desalinated groundwater at the Reynolds Facility, as described in the *Sweetwater Authority Brackish Groundwater Desalination Project EIR* and revised in Sweetwater Authority's *Title XVI Project Technical Report*.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described in Benefit A, all of the water produced and delivered by the *Reynolds Groundwater Desalination Facility Expansion* project will offset imported water purchases. Sweetwater Authority and the City of San Diego purchase imported water from SDCWA. SDCWA's supply mix includes imported water, surface water, and recycled water. During a normal year, SDCWA's imported water supply consists of two-thirds SWP supplies and one-third Colorado River supplies.[30] As described in Attachment 2, SWP deliveries have been reduced to 5% of allotments for 2014, and are anticipated to decrease to 0% if drought conditions continue into 2015. During drought years, assumed to be 2014 and 2015, the SWP portion of SDCWA's imported water mix is 15%[31] while the average year two-thirds proportion is used for other years, assuming drought conditions cease.

For this analysis, it is assumed that drought conditions continue through 2015, but that normal water conditions continue after that time; however, this assumption is considered highly conservative given the

[28] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 1-2 of the Draft EIR, which was not revised in the Final EIR. Pg. 1-1, Project Background.
[29] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[30] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8
[31] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

probability of the Region experiencing another drought between 2016 and 2046. Given that the project will begin water deliveries in 2016, it is assumed that over the lifetime of the project, the project will reduce demand for net diversions from the Bay-Delta by two-thirds (average year conditions) of the amount of water supplied by the project. Therefore, beginning in October 2016 when the project is completed and continuing in 2017 when the project is able to produce an additional 5,200 AFY of desalinated brackish groundwater, the project will reduce net diversions from the Bay-Delta by 3,467 AFY (2/3 of 5,200 AFY) or 104,000 AF over the project life (see **Table 3-5**).

Benefit C-Local Supply Development to Decrease Vulnerabilities

As described in SDCWA's 2010 UWMP, supply diversification is a key strategy to improve long-term reliability of supplies.[32] Specifically, the Region has a goal to improve the reliability and sustainability of regional water supplies, with part of the associated supply diversification objective to encourage the development of local water supplies.[33] Imported water and surface water used as regional water supplies are both vulnerable to reduced deliveries during drought. Further, the Region is located at the end of both of its imported water systems, increasing the risk of delivery interruptions from accidents, natural disasters, such as seismic events or weather events exacerbated by climate change, or other events. Any new local supply development or conservation effort would reduce the Region's vulnerability to these and other supply interruptions. The *Reynolds Groundwater Desalination Facility Expansion* project creates new local supply, as well as new drought-proof supply. The water produced by this project is therefore only at risk for interruptions if something affects production at the Reynolds Facility, the associated delivery pipelines, or wells. As such, all water produced by this project, as described under Benefit A, constitutes local supply development that will decrease vulnerabilities by 156,000 AF over the project life, shown in **Table 3-6.**

Benefit D-Reduce Net Production of Greenhouse Gases

As described under Benefit A, the potable water produced by the Reynolds Facility under the *Reynolds Groundwater Desalination Facility Expansion* project would directly offset imported water purchases by Sweetwater Authority and the City of San Diego. GHG reduction from this imported water offset can be calculated as the difference of GHG emissions between treated imported water in the Region and water produced at the Reynolds Facility. Potable water from imported supplies is an energy intensive water supply. For delivery to the Region, imported water requires pumping over large distances, in addition to the treatment of raw water to potable standards. A 2010 report produced by a San Diego-based think-tank (Equinox Center) estimates energy required to convey and treat imported water delivered to the customers in the Region is 2.65 mega-watt hours per acre-feet (MWh/AF).[34] Brackish water desalination has a calculated energy intensity between 980 kilo-watt hours per acre-feet (kWh/AF) and 1,630 kWh/AF, or an average of 1.3 MWh/AF.[35] Therefore, every AF of imported water that is offset by desalinated brackish groundwater from the Reynolds Facility results in 1.35 MWh of energy savings. These assumptions are presented in the bullets below:

- Energy intensity of desalinated brackish groundwater: 1.3 MWh/AF
- Energy intensity of imported water: 2.65 MWh/AF
- Energy savings resulting from the project: 1.35 MWh/AF

To translate energy savings into net reduction of GHG emissions, California energy mix and associated GHG emissions were used from the California Energy Commission (CEC) and U.S. Environmental Protection Agency's (USEPA) eGRID. Per the CEC's Energy Almanac, California produces 70% of its energy and imports 10% from the Pacific Northwest, and 20% from the Pacific Southwest.[36] USEPA eGRID data provides information about the GHGs associated with each of the energy supplies

[32] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.
[33] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (available in this application as Appendix 1-5)
[34] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[35] WateReuse. 2011. *Seawater Desalination Power Consumption White Paper*. November. Table 2 (pg. 15).
[36] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html

(calculated as carbon dioxide equivalent units or CO2e) as 613.28 pounds of CO2e per MWH (lbs/MWh), 846.97 lbs/MWh, and 1,182 lbs/MWh, respectively.[37] Averaging each of these CO2e emissions factors shows that California energy supplies have a combined CO2e emissions factor of 750.57 lbs/MWh, or 0.341 metric tons (MT) of CO2e per MWh. Applying this number to the energy intensity of imported water, Reynolds Facility water, and the difference between the two, finds GHG reduction of 71,815 MT CO2e over the life of the project. These benefits are provided by year in **Table 3-7** and summarized in the bullets below:

- Energy savings resulting from the project: 1.35 MWh/AF
- Average GHG in California energy grid: 0.341 MT/MWh
- Resulting GHG reductions resulting from the project: 0.460 MT of CO2e/AF
- Annual GHG reductions resulting from the project (assuming 5,200 AFY of desalinated groundwater produced by the project): 2,394 MT CO2e /Year
- Cumulative GHG reductions over project lifetime: 71,815 MT CO2e

Benefit E-Avoid Social Costs of Greenhouse Gases

There are social costs associated with increased GHG emissions related to air quality impacts and climate change. The social cost of GHGs (reported as CO2e) is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present day.[38] Such costs include, but are not limited to, impacts to agricultural productivity, human health, increased flood risk and associated damages, and ecosystem services and their values.[39] The recommended mean estimate of the social cost of one MT of CO2e in 2014 is $24.55. This is updated from the 2007 value of $21.40 reported by the Interagency Working Group on Social Cost of Carbon[40], using the CPI Inflation Calculator.[41] An estimate of the social costs of GHGs avoided by the project can be calculated by applying this $24.55/MT CO2e to the emissions savings from Benefit D. **Table 3-8** shows the avoided social costs of GHGs from the *Reynolds Groundwater Desalination Facility Expansion* project and summarized in the bullets below:

- Annual GHG reductions resulting from the project (assuming 5,200 AFY of desalinated groundwater produced by the project): 2,394 MT CO2e/Year
- Social cost of CO2e: $24.55 per MT CO2e
- Annual avoided social costs of GHG emissions from the project (assuming 5,200 AFY of desalinated groundwater produced by the project): $58,768 per year
- Cumulative avoided social costs of GHG emissions over project lifetime: $1,763,048

Benefit G-Reduce Water Costs to Customers, Including DACs

Water produced at the Reynolds Facility is less costly than imported water. Based on an analysis by Sweetwater, the cost to produce water at the Reynolds Facility is $303/AF (in 2014 dollars) compared to $1,452/AF (in 2014 dollars) for treated imported water.[42] The *Title XVI Technical Project Report* for the Reynolds Facility reports the cost of producing water at the Reynolds Facility as a function of operations

[37] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

[38] IPCC. 2007. Summary for policymakers. In Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. ML Perry, OF Canziani, JP Palutikof, PJ van der Linden, and CE Hanson (eds.). Cambridge University Press. Cambridge, UK. Pg. 17.

[39] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 1

[40] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28).

[41] U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm

[42] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-17 (pg. 43).

and maintenance (O&M) costs per AF water produced. This value ranges from $292/AF to $482/AF with an average of $329/AF in 2012 dollars over the life of the project.[43] Costs are also reported over the life of the project for imported water, ranging from $675/AF to $2,359/AF, with an average of $1,544/AF in 2012 dollars.[44] A conversion factor of 1.04 from the CPI Cost Index[45] was applied to these values to convert 2012 dollars to 2014 dollars (accounting for discounting). **Table 3-9** summarizes the cost savings of using Reynolds Water in place of imported water, a detailed table is provided in **Appendix 3-1**. These cost savings of $243,622,167 over the project life will be passed along to customers through protection of water rates. As described in Attachment 8, this project will serve DACs in both Sweetwater's service area and the City of San Diego's service area. Therefore the water cost savings from the project that benefit all customers within the project sponsors' service areas will also benefit DACs.

Benefit K-Improve Habitat in Protected Wildlife Area

The Reynolds Facility discharges brine to the Sweetwater River via the Upper Paradise Creek Flood Control Channel. The Upper Paradise Creek Flood Control Channel is a concrete-lined channel that ultimately discharges to the Lower Sweetwater River Channel. At the mouth of the Lower Sweetwater River Channel there is a regionally significant wildlife area known as the San Diego Bay National Wildlife Refuge. This refuge has habitat for many special-status species and is classified as a subtidal and intertidal habitat area due to its location adjacent to the San Diego Bay.[46] A biological report completed to support the EIR for the Phase II Richard A. Reynolds Desalination Facility Expansion Project found that increasing brine discharge from the expanded Reynolds Facility would increase flow of brackish water to habitats located downstream of the discharge point (including the Wildlife Refuge), which would help maintain the salinity necessary to support local salt-tolerant plants and reduce the invasion opportunity for non-native plants.[47] Supporting conditions favored by salt marsh would provide benefits to native habitat and associated species that reside within the Wildlife Refuge; however, these benefits have not been quantified as part of this analysis.

New Facilities, Policies, and Actions Required to Obtain Physical Benefits

The physical benefits of the *Reynolds Groundwater Desalination Facility Expansion* will require construction of all the project components described in Attachment 4. These components include five new groundwater wells, 13,400 feet of new pipeline to connect the wells to the Reynolds Facility, an extension of the brineline by approximately 2,000 feet west of the original discharge location, and additional treatment equipment to increase the capacity at the Reynolds Facility. The brineline extension, as required by the Regional Board permit for the expanded Reynolds Facility, was completed in 2014. Water produced by the project will be distributed to customers through Sweetwater's and the City of San Diego's existing potable water system, and will not require any additional facilities to provide benefits. All agreements and policies are in place for the water use agreements between Sweetwater Authority and the City of San Diego[48], and the Regional Water Quality Control Board has already issued the discharge permit for the increased brine discharges from the expanded Reynolds Facility.[49]

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[43] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-17 (pg. 43).

[44] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44).

[45] Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 24 June 2014. Available: http://www.bls.gov/data/inflation_calculator.htm

[46] U.S. Fish and Wildlife Service. 2014. *South San Diego Bay Unit*. Available: http://www.fws.gov/refuge/San_Diego_Bay/wildlife_and_habitat/South_San_Diego_Bay_Unit.html

[47] ESA. 2008. Draft Final Biological Resources Background Report for the Phase II Richard A. Reynolds Desalination Facility Expansion Project. Appendix E to the Sweetwater Authority Brackish Groundwater Desalination Project Draft EIR. January. Pg. 48.

[48] Sweetwater Authority and City of San Diego. 2013. Settlement Agreement Between Sweetwater Authority and City of San Diego Regarding Joint Expansion of Richard A. Reynolds Desalination Facility. August 28.

[49] San Diego Regional Water Quality Control Board. 2010. Waste Discharge Requirements for the Sweetwater Authority Richard A. Reynolds Desalination Facility Discharge to the Lower Sweetwater River Basin, San Diego County (Order No. R9-2010-0012 [NPDES No. CA0108952]).

Potential Physical Effects of the Project

There may be temporary environmental impacts during construction, and ongoing noise and vibration from operation of the five new groundwater wells. There is potential for groundwater overdraft if the drought continues and groundwater inflow and recharge decreases beyond that anticipated for the basin. Monitoring is ongoing for the basin, so pumping can be adjusted if ongoing studies indicate overdraft is beginning to occur. Mitigation measures included in the project EIR address all of these impacts potential impacts and ensure that the project will not have a significant impact on the environment.

Cost Effectiveness Analysis: Reynolds Groundwater Desalination Facility Expansion

The *Reynolds Groundwater Desalination Facility Expansion* project will achieve six quantifiable physical benefits and one qualitative benefit, described in detail in the sections above, and summarized in **Table 3-2**. These benefits will be realized as a result of the project's primary physical benefit, which is to desalinate and distribute brackish groundwater for potable use. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 3-10** provides a brief overview of the alternatives and reasons the preferred alternative was selected as the project. Details on each of the alternatives and considerations for selecting the preferred alternative are provided below.

Table 3-10: Project Analysis
Reynolds Groundwater Desalination Facility Expansion

Project Name: ***Reynolds Groundwater Desalination Facility Expansion***	
Question 1 Physical Benefits Summary	The project will increase potable water supplies through increased desalinated groundwater. This will achieve the benefits summarized in **Table 3-2**. These benefits include: avoid imported water supply purchases, reduce demand for net diversions from the Bay-Delta, local supply development to decrease vulnerabilities, reduce GHG emissions, avoid social costs of GHGs, reduce water costs to customers, and improve habitat in a protected wildlife area.
Question 2 Alternatives Considered	A total of ten alternatives were considered for the project. Of these, only five provide the same types and amounts of benefits as the proposed project.
	The alternative methods that were considered and estimated costs for the alternatives are provided below: The alternatives were considered within the EIR for the project. Of the five alternatives that provide the same types and amounts of benefits as the project, one was found to be infeasible due to lack of space to accommodate required pipeline. The remaining four alternatives are presented here briefly, and described in more detail in the discussion following this table. <u>Alternative Well Site – SDF Well #7</u> This alternative would move one of the production wells (SDF Well #7) to a different location. This alternative would involve moving the well down a hill, and would require conveyance pipeline construction on the hillside, which would increase the cost of the pipeline. Additional pipeline costs have not been quantified. <u>Alternative Well Site – SDF Well #9A</u> This alternative would move one of the production wells (SDF Well #9) to a local park, Memorial Park. Because this alternative would involve use of land on a publicly-owned park, it would require a 4(f) analysis, which is a lengthy, costly, and complex process. The potential additional costs associated with this alternative have not been quantified. <u>Alternative Well Site – SDF Well #9B</u> This alternative would move one of the production wells (SDF Well #9) to a different location. This alternative site would require costly soil amendment on 25% of the site prior to construction due to uneven terrain, and the purchase price of the site is unknown. The potential additional costs associated with this alternative have not been quantified. <u>Brineline Alternatives</u> Several brineline alternatives were evaluated for the project. The potential additional costs associated with the alternatives have not been quantified. <u>Preferred Alternative</u> The preferred alternative identified in the EIR was the one selected as the proposed project presented in this Proposal. The project would not incur any of the potential additional costs described for the alternatives; therefore it is the most cost-effective of the alternatives.
Question 3 Preferred Alternative	The proposed project is the least cost feasible alternative that achieves the same type and amount of benefits described herein.

Q1: Types of Benefits Achieved by Project

The *Reynolds Groundwater Desalination Facility Expansion* project would achieve six quantifiable physical benefits and one qualitative benefit as a result of its primary physical benefit of increasing brackish groundwater desalination for potable use by 5,200 AFY. These benefits and how they were calculated are discussed in detail in the sections above, and summarized in **Table 3-2**. Benefits from the project include:

- Avoid imported water supply purchases – 5,200 AFY
- Reduce demand for net diversions from the Bay-Delta – 3,467 AFY
- Local supply development to decrease vulnerabilities – 5,200 AFY
- Reduce net production of GHGs – 2,394 MT CO2e per year
- Avoid social costs of GHGs - $58,768 per year
- Reduce water costs to customers, including DACs – $243,622,167 (over 30-year project life)

Improve habitat in a protected wildlife area (qualitative) Q2: Discussion of Project Alternatives

The *Reynolds Groundwater Desalination Facility Expansion* project will expand the treatment capacity of the Reynolds Facility, drill five new wells into the SDF, and construct pipelines to convey the raw brackish water to the Reynolds Facility for treatment. Sweetwater considered a series of project alternatives before selecting the final well locations and pipeline alignments. The project's EIR considered a total of ten alternatives[50]. Please note that while the EIR included ten alternatives, only nine alternatives are presented below. One of the EIR alternatives for the brineline (the Box Model Alternative that would move the brineline discharge point approximately 2,000 feet west of the original location) was ultimately incorporated into the project design in order to receive permitting approval for the project from the Regional Board.

- No project alternative
- 3 alternative well sites
- 1 alternative pipeline alignments
- 4 brineline alternatives

These alternatives were selected because they would be able to generally meet the objectives of the project. When considering the alternatives, Sweetwater considered the potential environmental impacts that would be generated by each alternative, the feasibility of each alternative, whether the alternative could be considered within a "reasonable range" of alternatives as defined by the California Environmental Quality Act (CEQA), and CEQA's required "no project" alternative.[51] Given that the Reynolds Facility has already been built and the expansion can be achieved on-site, no alternative location was considered for the facility itself. Further, because the Reynolds Facility already treats brackish groundwater from the SDF to potable levels, no alternative treatment train was considered.

No Project

The "No Project Alternative" would be equivalent to the "Without Project Baseline" discussed above, and would result in the Reynolds Facility remaining at its current capacity, which would result in no additional desalinated groundwater being added to the potable water supplies for Sweetwater or the City of San Diego. Without creating this new additional potable supply, both agencies would continue to purchase imported water to meet demands. Therefore none of the secondary benefits of the project would be realized. This alternative would not provide the same type or amounts of benefits of the project.

[50] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. ES-4 through ES-9 of the Draft EIR.
[51] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-1 of the Draft EIR.

Alternative Well Site – SDF Well #7

SDF Well #7 could have been located at the San Diego Metro Kampgrounds of America (KOA) campground located within Chula Vista. This alternative was considered because it could reduce the visual and cultural impacts associated with SDF Well #7, though it would increase the hydrology and water impacts of SDF Well #7.[52] This alternative is not preferred because there are access issues with the site, and increased costs associated with constructing the associated conveyance pipeline on a hillside. Although not quantified, it is anticipated that the alternative location of conveyance pipeline associated with this alternative would be more costly, because construction would be more complicated and require grading and other construction activities.

Alternative Well Site – SDF Well #9A

An alternative location for SDF Well #9 was considered at Memorial Park, which is a public park. The alternative would have increased environmental impacts related to aesthetics because of its location in a park where it could be easily viewed from a busier street than the original location.[53] However, it would also reduce environmental impacts of the project on biological resources because it would be constructed in an open grassy area.[54] This location is not preferred because it would require a 4(f) compliance analysis, which can be long and complex. A 4(f) compliance is required for federally-funded projects that involve parks, recreation areas, wildlife and waterfowl refuges, or historic property.[55]

Alternative Well Site – SDF Well #9B

Another alternative well site for SDF Well #9 was considered for the project. This second alternative to SDF Well #9 would be located on the corner of 4th Ave. and Park Way, near the proposed well location and across the street from Memorial Park. This alternative would reduce impacts to biological resources and hydrology and water quality by moving the well away from an existing drainage, but would have aesthetic impacts that could be mitigated.[56] This is not the preferred alternative for SDF Well #9 because the cost of the site is unknown, and approximately 25% of the site would require soil amendment to create a level construction area. The smaller size of the lot on which this alternative would have been constructed also makes it less attractive than the proposed location for the well.[57]

Alternative Pipeline Alignment – Sweetwater River Crossing

The raw water conveyance pipeline of the selected project alternative crosses under the Sweetwater River using directional boring. This alternative pipeline would cross over the river using the 2nd Ave. Bridge utility corridor. This would also involve installing a fiber optic cable along the same utility corridor.[58] Although the environmental impacts of this alternative are less than those of the preferred alternative, this alternative is not feasible because there is not enough room in the utility corridor for both an 18-inch conveyance pipeline and its associated fiber optic cables.[59] As such, this alternative is considered infeasible.

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[52] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pp. 7-8 to 7-9 of the Draft EIR.

[53] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-9 of the Draft EIR.

[54] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-11 of the Draft EIR.

[55] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-9 of the Draft EIR.

[56] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pp. 7-12 to 7-14 of the Draft EIR.

[57] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-15 of the Draft EIR.

[58] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-15 of the Draft EIR.

[59] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-17 of the Draft EIR.

Brineline Alternative – Regional Concentrate Conveyance

This alternative would construct a Regional Concentrate Conveyance System that would be able to accommodate additional increased capacity of desalination, as well discharges from industrial facilities. Brine conveyed by this alternative would be discharged to the South Bay Ocean Outfall.[60] Although this alternative would reduce environmental impacts, at the time of the EIR, this alternative had only been considered for feasibility by SDCWA, and no work had been completed on design, permitting, scheduling, or funding such an effort.[61] As such, this alternative was considered infeasible due to the many unknown aspects that could potentially increase project costs. This alternative would not have the same benefits as the proposed project, because it would not increase brine discharge flows to help support native habitats.

Brineline Alternative – Sanitary Sewer

This alternative would replace brine discharge to the Sweetwater River with discharge into the sanitary sewer system owned and operated by neighboring National City. To connect to the sewer system, Sweetwater would need to upsize the existing sewer line near the Reynolds Facility, install a sewer meter, purchase capacity for the increased flow, obtain permits, and confirm that the treatment facility that serves National City is able and willing to accept and treat the brine discharge from the Reynolds Facility.[62] There would be some temporary construction-related environmental impacts, but in general, this alternative would have fewer environmental impacts than the selected alternative.[63] This alternative is costly because of the expenses involved in connecting to the sewer system, and has a number of uncertainties related to regional wastewater management due to unknown factors about the treatment facility's ability to accept and treat the brine discharge. This alternative could also have impacts on potential future recycling opportunities.[64] This alternative would not have the same benefits as the proposed project, because it would not increase brine discharge flows to help support native habitats.

Brineline Alternative – Deep Well Injection

This alternative would replace discharge of brine concentrate to the Sweetwater River with injection into the deep aquifer near San Diego Bay. This would be achieved through two 1,200 foot deep injection wells, and would require 6,000 feet of new pipeline from the Reynolds Facility to the wells.[65] In general, this alternative has fewer environmental impacts than the preferred alternative, though there would be temporary impacts related to construction. This alternative would require a test well for the deep aquifer, additional testing for feasibility, and permitting from the California Department of Public Health.[66] The uncertainties associated with the feasibility of this alternative make it less desirable than the preferred alternative.

Brineline Alternative – Evaporation Ponds

Instead of discharging brine concentrate to the Sweetwater River, this alternative proposes to discharge the brine to evaporation ponds. This alternative would require construction of evaporation ponds on approximately 300 acres of land, in addition to increasing the feed water recovery rate at the Reynolds Facility. To reduce the volume of brine concentrate, an additional reverse osmosis membrane train would

[60] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-20 of the Draft EIR.
[61] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-22 of the Draft EIR.
[62] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-24 of the Draft EIR.
[63] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pp. 7-24 to 7-26 of the Draft EIR.
[64] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-27 of the Draft EIR.
[65] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-27 of the Draft EIR.
[66] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-29 of the Draft EIR.

be required to increase recovery rate from 82% to 90%.[67] To implement this alternative, land must be available to house the evaporation ponds; no suitable land is available for this alternative. Further, the inclusion of the additional reverse osmosis treatment train is costly.[68]

Q3: Preferred Project Alternative

A quantifiable cost-effectiveness analysis was not conducted for each of the project alternatives. The *Reynolds Groundwater Desalination Facility Expansion* is the second phase of Sweetwater's groundwater desalination for potable supply project, the first phase of which was initial construction of the Reynolds Facility and the existing SDF groundwater wells. The Reynolds Facility was sized to accommodate the eventual expansion proposed in this project, and the project was designed to achieve the full expansion to produce 8,800 AFY of potable water at the Reynolds Facility. For these reasons, considerations for alternatives were limited to the discussion contained in the project's EIR. As described above, each of the alternatives considered would meet the project goal of increasing the Reynolds facility's capacity by 5,200 AFY but would either be infeasible or more costly than the proposed project. **Table 3-11** shows each of the considered alternatives and why they were not the preferred alternative, as described above.

As noted in **Table 3-11**, some of the alternatives were found to be infeasible or not enough information was available to assess the feasibility of the alternative. For those alternatives that were found to be feasible strictly from a technical perspective, costs were a primary concern. While a cost effectiveness analysis was not conducted, there are additional costs associated with any additional pipelines, treatment requirements, and construction. For these reasons, the project as described in this Proposal is the most cost-effective feasible alternative that achieves all of the same amount and types of benefits of the project.

Table 3-11: Project Alternatives

Alternative	Reason for Rejection
No project	Does not meet the objectives of the project.
Alternative Well Site – SDF Well #7	Higher costs for construction on hillside and access issues at site.
Alternative Well Site – SDF Well #9A	Requires 4(f) compliance (costly and time consuming) and impacts park use.
Alternative Well Site – SDF Well #9B	Unknown costs to acquire site, additional costs of soil amendment, and construction difficulties associated with small lot size of site.
Alternative Pipeline Alignment – Sweetwater River Crossing	Not feasible – utility corridor lacks room for conveyance pipeline
Brineline Alternative – Regional Concentrate Conveyance	Feasibility unknown, requires coordination with SDCWA. Does not provide the "Improve Habitat in Protected Wildlife Area benefit".
Brineline Alternative – Sanitary Sewer	High costs to connect to sewer system and uncertainties over future impacts to recycling treatment and regional waste water management decisions. Does not provide the "Improve Habitat in Protected Wildlife Area benefit".
Brineline Alternative – Deep Well Injection	Feasibility unknown, lack of adequate knowledge about deep aquifer to implement alternative. Does not provide the "Improve Habitat in Protected Wildlife Area benefit".
Brineline Alternative – Evaporation Ponds	No suitable site, high costs associated with necessary additional reverse osmosis treatment train. Does not provide the "Improve Habitat in Protected Wildlife Area benefit".

[67] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-29 of the Draft EIR.
[68] Sweetwater Authority. 2010. Richard Reynolds Brackish Groundwater Desalination Facility – Phase II Expansion Final Environmental Impact Report (SCH No. 2007101055). February. Pg. 7-31 of the Draft EIR.

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Project 2: Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Local Project Sponsor: Fallbrook Public Utility District (Fallbrook)
Partners: Mission Resources Conservation District (MRCD) and San Diego County Farm Bureau

The following sections of this application include project-specific information for the *Fallbrook Plant Nurseries Recycled Water Distribution System* project, and include the following information pursuant to the PSP:

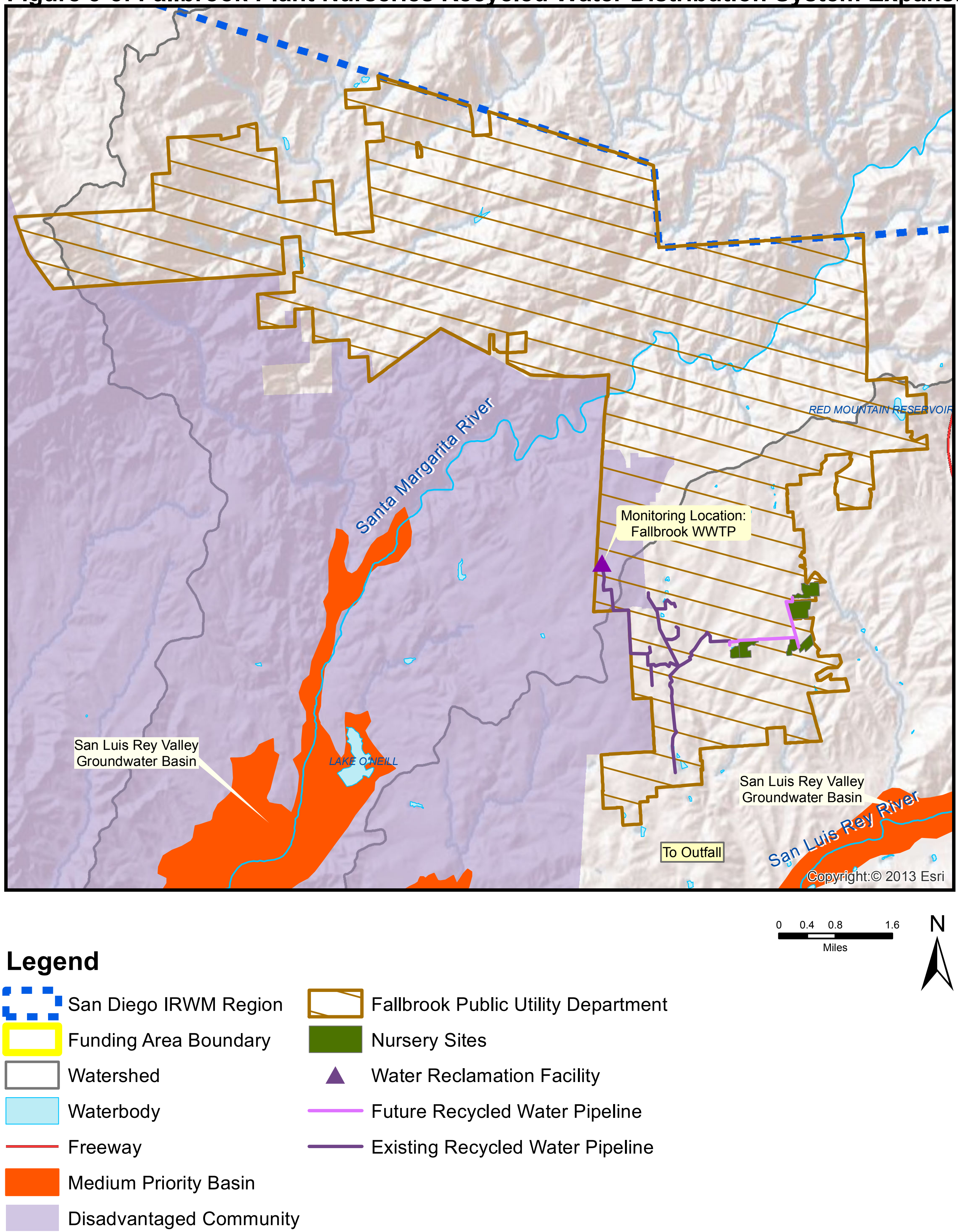
1. Project Description
2. Project Map
3. Project Physical Benefits
4. Technical Analysis of Physical Benefits Claimed, which includes the following sub-sections:
5. Technical Basis of the Project
   - Background for Benefits Claimed (Recent and Historical Conditions)
   - Without-Project Baseline (Estimates of Without-Project Conditions)
   - Methods Used to Estimate Physical Benefits
   - New Facilities, Policies, and Actions Required to Obtain Physical Benefits
   - Potential Physical Effects of the Project
6. Cost Effectiveness Analysis

Project Map: Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Figure 3-5 shows the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project area, the service are of the project sponsor (Fallbrook), and the project's relation to groundwater basins and DACs. **Figure 3-6** shows sewersheds associated with the Region's outfalls and recycled water systems within the San Diego IRWM Region; information provided within this figure is used to explain the benefits claimed for the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project. **Figure 3-7** shows detailed project information from the Project Preliminary Design Drawings, which have been completed for the project.

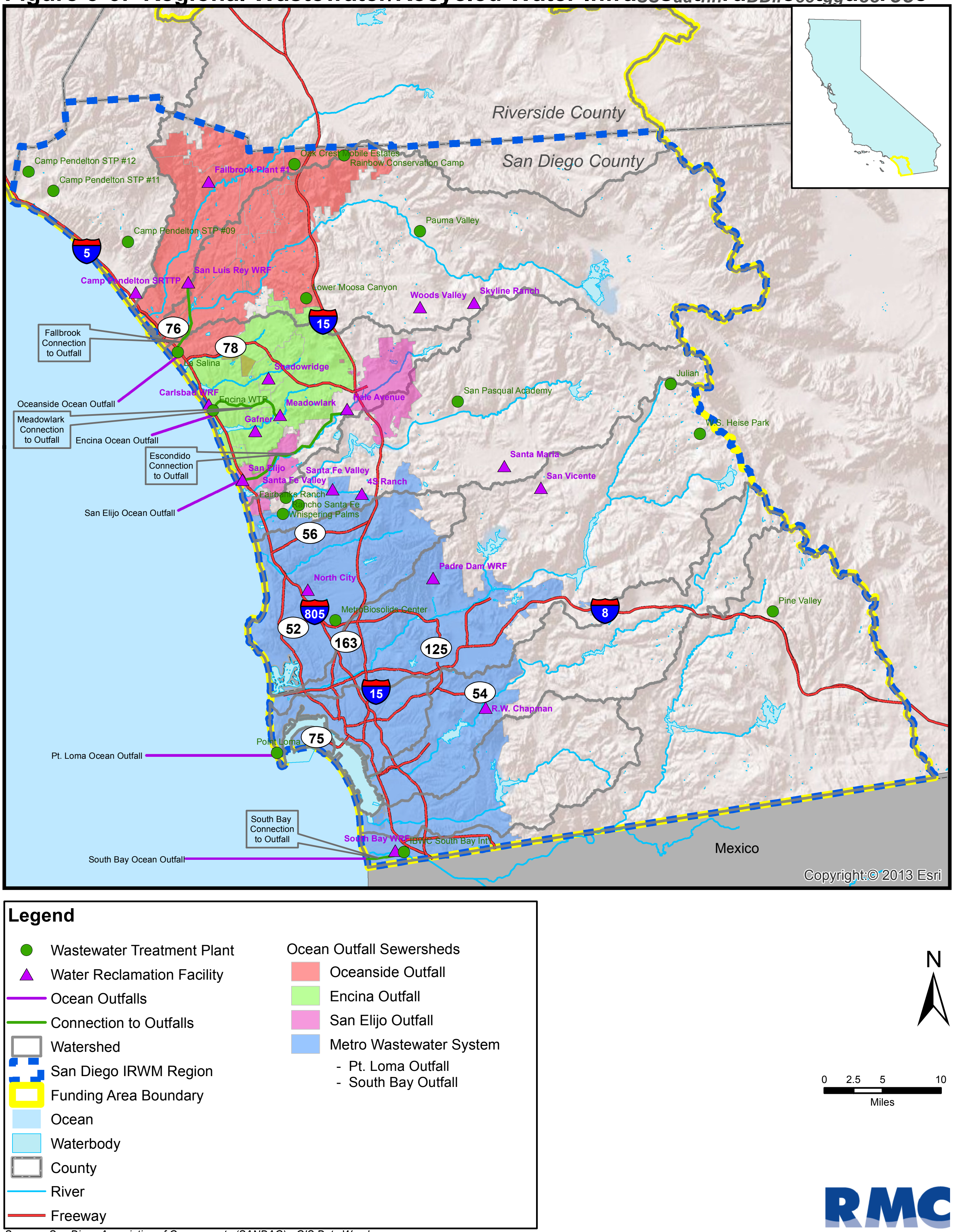
Agricultural Nursery

Figure 3-5: Fallbrook Plant Nurseries Recycled Water Distribution System Expansion



Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-4_Proj2_Fallbrook_11Jul14.mxd

Figure 3-6: Regional Wastewater/Recycled Water Infrastructure



Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
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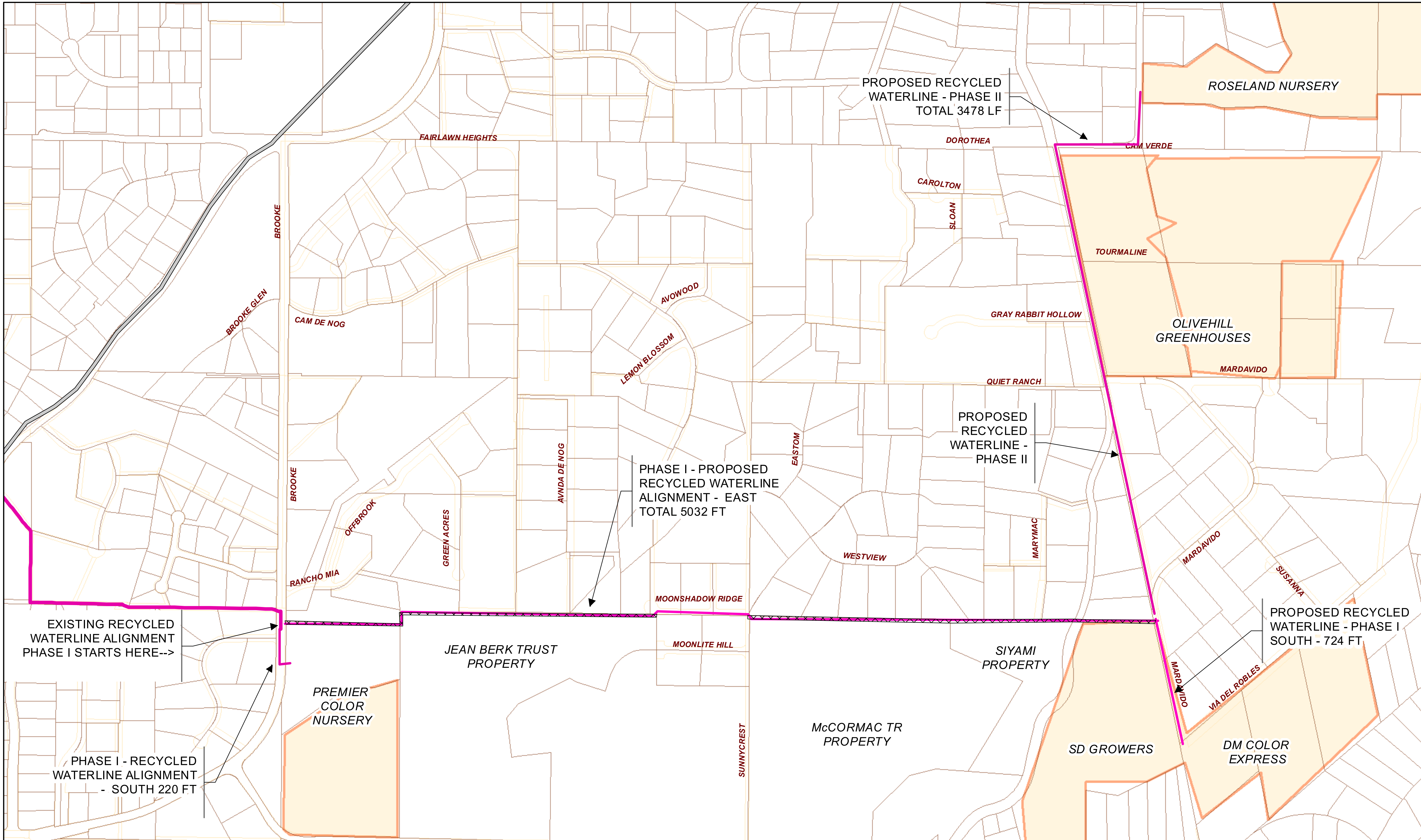
Figure 3-7



PROPOSED ALIGNMENT OF RECYCLED WATERLINE EXTENSTION: EAST PHASE I: 5,976 FEET EAST AND SOUTH, AND NORTH PHASE II: 3,478 FT NORTH. TOTAL: 9,454 LF 8" RECYCLED WATERLINE,

MAP BY SOLEIL DEVELLE 4/30/2014
X:\JOB FILES\2000 - District\2949 - Recycled Water Line Extension_East\Drawings\RECYCLED WATERLINE_EXTENSION_MAP_PHASES

WATERLINE
PRES. ZONE_
Existing Recycled Waterline
PARCELS
EASEMENT
Proposed Recycled Irrigated Areas

0 250 500 1,000 1,500 Feet

1 inch = 500 feet

Project Description: Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project extends the existing Fallbrook recycled water system to serve plant nurseries with 642 AFY of recycled water that is currently discharged to the ocean.

Project Nexus to Drought Impacts

The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project meets two of the Drought Project Elements defined by DWR (**Table 3-1**). The project provides regional drought preparedness by increasing distribution of locally-produced, recycled water. The project will also reduce water quality or ecosystem conflicts by reducing demand for imported water, thereby reducing demand for water from the Bay-Delta and reducing reservoir drawdown locally.

The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will address seven of the drought impacts identified in Attachment 2:

- Ability to Meet Drinking Water Demands: The project reduces potable water demands, thereby preserving potable supplies for drinking water purposes. High reliance on imported water puts drinking water supplies at risk during drought, because during droughts there may be imported water restrictions. This project maximizes use of local water supplies, providing an additional local water source and a water supply buffer that will help to reduce water restrictions that could jeopardize the Region's ability to meet drinking water demands.
- Ability to Meet Agricultural Water Demands: The project will include all facilities required to supply existing recycled water to agricultural users (nurseries). Any cutbacks on imported water could result in water restrictions to agricultural water users. By supplying recycled water, which is not subject to the cutbacks discussed in Attachment 2, the project will ensure that water supplies are available to meet agricultural water demands in the Fallbrook area.
- Ability to Meet Ecosystem Demands: Provision and use of recycled water reduces demands on imported water that is largely stored in reservoirs, thereby reducing reservoir drawdown. The project helps to meet ecosystem water demands by reducing demand from imported water from local reservoirs serving as critical riparian and aquatic habitats.
- Drinking Water MCL Violations: Impairments to water quality related to the drought result from a combination of lower reservoir levels and an increase in the proportion of inflow sourced from the high TDS Colorado River water. Reduced demand for imported water and associated drawdown of reservoirs from the project helps to address these issues that contribute to the potential for MCL violations.
- Groundwater Basin Overdraft: The project protects water supplies by utilizing what was previously a waste stream and turning it into a resource. Providing additional local water supplies reduces the need to use other local water sources such as groundwater to meet demands, thereby reducing the potential for groundwater basin overdraft.
- Increased Wildfire Risk and Water Quality Impacts: Wildfire risks increase with climate change, which is caused by GHG emissions. The project reduces GHG emissions by replacing demands with a less energy intensive water supply than imported water. It also protects water supplies, such that more water is available to fight wildfires in the event of an incident. Decreasing wildfire risks also provides protection from water quality impacts related to wildfires.
- Economic Impacts: Increasing water supply reliability will help to ensure that demands associated with the regional economy can be met. Specifically, reduced water costs (via access to recycled water) for plant nurseries will help ensure the sustainability of this agricultural subsector.

The project was selected for inclusion in this funding application because it addresses the drought impacts in the Region and can be implemented in an expedited timeline. Expedited funding is needed for this high-priority project because it creates local, drought-proof water supplies that are critical during droughts. Funding support for this project will help to maintain recycled water rates and ensure that agricultural water users will remain in the Fallbrook area and support the local economy.

Project Physical Benefits: Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

The primary physical benefit of the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project is reduced potable water demand through increased provision of recycled water for local use by agricultural water users. This primary physical benefit is 642 AFY of reduced potable demand through recycled water use, and results in many secondary benefits that are summarized in **Table 3-12**. As described under Technical Analysis of Physical Benefits Claimed, the project has an anticipated 75-year life. **Tables 3-13** through **3-22** show the benefits that would accrue as a result of the project over the 75-year project life, with benefits phased in and out in accordance with the project schedule provided in Attachment 6, and as explained in the Technical Analysis of Physical Benefits Claimed, below. **Appendix 3-1** includes detailed spreadsheets that show how the quantified benefits were calculated.

Table 3-12: Physical Benefits Summary
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Physical Benefit	Result of Physical Benefit		Annual Quantification of Benefits (cumulative quantification)
Increase recycled water use and reduce imported water (642 AFY)	A	Avoid Imported Water Supply Purchases	642 AFY (48,150 AF)
	B	Reduce Demand for Net Diversions from the Bay-Delta	428 AFY (32,059 AF)
	C	Local Supply Development to Decrease Vulnerabilities	642 AFY (48,150 AF)
	D	Reduce Net Production of Greenhouse Gases	580 MT/CO2e/year (43,511 MT CO2)
	E	Avoid Social Costs of Greenhouse Gas Emissions	$14,243/year ($1,068,189)
	F	Contribute to 20x2020 Goals	17% by 2020
	G	Reduced Water Costs for Agricultural Users	14.5%
	H	Reduce Discharge to Outfall and Increase Available Capacity	642 AFY (48,150 AF)
	I	Reduce Stormwater Loading of Pollutants	Qualitative
	J	Reduce Need for Fertilizer Application	96,894 lbs/yr (7,267,025 lbs)

Table 3-13: Primary Physical Benefit – Increase Recycled Water Use and Reduce Imported Water
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*
Type of Benefit Claimed: Increase Recycled Water Use and Reduce Imported Water
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	8 AF	8 AF
2015	0 AF	72 AF	72 AF
2016	0 AF	642 AF	642 AF
2017-2088	0 AFY (0 AF)	642 AFY (46,224 AF)	642 AFY (46,224 AF)
2089	0 AF	634	634
2090	0 AF	571	571
TOTAL*	**0 AF**	**48,150 AF**	**48,150 AF**

Comments: The Primary Physical Benefit described here is to increase recycled water use and reduce imported water. Without the project, there will be no increase in recycled water use, and no reduction in imported water. The project will increase recycled water demand by 642 AFY, based on demand calculations for the identified customers. 2000 AFY recycled water is produced by Fallbrook, but only 600 AFY delivered to customers – the remaining 1,400 AFY is discharged to the Fallbrook Outfall, which conveys water to the Oceanside Ocean Outfall. Therefore there is sufficient existing supply to meet the additional recycled water demands from the project, and customers will be phased in as they can be connected. Premier Color will begin receiving recycled water in November 2014, SD Growers and DM Color will begin receiving recycled water in June 2015, and the remaining three customers will begin receiving recycled water in January 2016. A proportion of the annual recycled water demand commensurate with the percentage of months in a year when the benefit will be provided. Full annual benefits will be realized the year following connection. Premier Color will receive 17% benefits in 2014, SD Growers and DM Color will each receive 58% benefits in 2015. The remaining three customers will receive full benefits the first year of deliveries. Benefits are phased out accordingly at the end of the project life for each customer.

Sources: (projected customer demand) Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Table 3 (pg. 3); (current recycled water supplies and demand) Fallbrook Public Utility District. 2012. Recycled Water Master Plan. Chapter 2, pg. 2
*Some differences may occur due to rounding

Table 3-14: Physical Benefit A-Avoid Imported Water Supply Purchases
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*
Type of Benefit Claimed: Avoid Imported Water Supply Purchases
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	8 AF	8 AF
2015	0 AF	72 AF	72 AF
2016	0 AF	642 AF	642 AF
2017-2088	0 AFY (0 AF)	642 AFY (46,224 AF)	642 AFY (46,224 AF)
2089	0 AF	634	634
2090	0 AF	571	571
TOTAL*	**0 AF**	**48,150 AF**	**48,150 AF**

Comments: Within the San Diego IRWM Region, local water supplies are used before purchasing imported water to meet demand deficits. Because the project will be deliver an additional 642 AFY local supply (as recycled water), this will directly offset the purchase of imported water. This benefit will begin to accrue when recycled water deliveries to the five identified customers begin, as shown in the Primary Physical Benefit (**Table 3-**14).

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13.

*Some differences may occur due to rounding

Table 3-15: Physical Benefit B-Reduce Demand for Net Diversions from the Bay-Delta
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*
Type of Benefit Claimed: Reduce Demand for Net Diversions from the Bay-Delta
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	1 AF	1 AF
2015	0 AF	11 AF	11 AF
2016	0 AF	428 AF	428 AF
2017 – 2088	0 AFY (0 AF)	428 AFY (30,816 AF)	428 AFY (30,816 AF)
2089	0AF	423 AF	423 AF
2090	0 AF	380 AF	380 AF
TOTAL*	**0 AF**	**32,059 AF**	**32,059 AF**

Comments: The San Diego County Water Authority (SDCWA) is the sole imported water wholesaler in the San Diego IRWM Region. Although SDCWA supplies include a mix of sources, local supplies are used first, and imported water purchased only to satisfy unmet demand once local supplies are exhausted. SDCWA's imported supply mix includes water from the State Water Project (SWP), which comes from the Sacramento-San Joaquin Delta (Bay-Delta), and the Colorado River. During normal years, SDCWA's imported supply mix is 2/3 SWP and 1/3 Colorado River. Under drought conditions in 2014 and 2015, SWP is 15% of SDCWA's imported supply. This analysis assumes 15% imported water is from the SWP during 2014 and 2015, and 2/3 from SWP during other years. This proportion was applied to the offset imported water calculated under Benefit A, above.

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13; (SDCWA supply mix) Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8; (imported mix during drought) Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

*Some differences may occur due to rounding

Table 3-16: Physical Benefit C-Local Supply Development to Reduce Vulnerabilities
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*
Type of Benefit Claimed: Local Supply Development to Reduce Vulnerabilities
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	8 AF	8 AF
2015	0 AF	72 AF	72 AF
2016	0 AF	642 AF	642 AF
2017-2088	0 AFY (0 AF)	642 AFY (46,224 AF)	642 AFY (46,224 AF)
2089	0 AF	634	634
2090	0 AF	571	571
TOTAL*	**0 AF**	**48,150 AF**	**48,150 AF**

Comments: The Region's high reliance on imported water supplies increases its vulnerability to water shortages (see Attachment 2). Local supply development is a key regional strategy to address this issue. Recycled water delivered by the project is a local supply; the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project implements this local supply strategy to decrease vulnerabilities. The amount of recycled water delivered by the project is calculated under the Primary Physical Benefit (**Table 3-15**), above, as an additional 642 AFY over the current deliveries of 600 AFY.

Source: (strategy to reduce vulnerabilities) SDCWA. 2008. Strategic Plan. April. Pg. 9

*Some differences may occur due to rounding

Table 3-17: Physical Benefit D-Reduce Net Production of Greenhouse Gases
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*
Type of Benefit Claimed: Reduce Net Production of Greenhouse Gases
Units of the Benefit Claimed: MT CO2e

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	7 MT CO2e	0 MT CO2e	7 MT CO2e
2015	65 MT CO2e	0 MT CO2e	65 MT CO2e
2016	580 MT CO2e	0 MT CO2e	580 MT CO2e
2017-2088	580 MT CO2e/yr (41,770 MT CO2e)	0 MT CO2e/yr (0 MT CO2e)	580 MT CO2e/yr (41,770 MT CO2e)
2089	573 MT CO2e	0 MT CO2e	573 MT CO2e
2090	516 MT CO2e	0 MT CO2e	516 MT CO2e
TOTAL*	**43,511 MT CO2e**	**0 MT CO2e**	**43,511 MT CO2e**

Comments: Importing water is more energy intensive than producing and delivering recycled water, using 2.65 MWh/AF to import water to the Region compared to 0.8 MWh/AF for recycled water. Because Fallbrook already produces the recycled water that will be delivered to customers, and currently disposes of it to the outfall, the offset GHG emissions from the project is equal to the GHG emissions of the avoided imported water (Benefit A, **Table 3-16**). California produces 70% of its energy with a CO2e emissions factor of 613.28 lbs/MWH. 10% of California's energy is imported from the Pacific Northwest, with a CO2e emissions factor of 846.97 lbs/MWH, and 20% imported from the Pacific Southwest, with a CO2e emissions factor of 1,182.89 lbs/MWh. Using a weighted average, CO2e emissions from California's energy is 750.57 lbs/MWh, or 0.341 MT/MWh. This was applied to the energy intensity of imported water offset by the project (see Benefit A, **Table 3-16**).

Sources: (energy intensity of imported water) Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10); (California energy mix) CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html; (CO2e emissions factors) U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/
*Some differences may occur due to rounding

Table 3-18: Physical Benefit E-Avoid Social Costs of Greenhouse Gas Emissions
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* **Type of Benefit Claimed:** Avoid Social Costs of Greenhouse Gas Emissions **Units of the Benefit Claimed:** $			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$179	$179
2015	$0	$1,586	$1,586
2016	$0	$14,243	$14,243
2017-2088	$0/yr ($0)	$14,243/yr ($1,025,461)	$14,243/yr ($1,025,461)
2089	$0	$14,064	$14,064
2090	$0	$12,656	$12,656
TOTAL*	**$0**	**$1,068,189**	**$1,068,189**

Comments: There are social costs associated with GHG emissions, which were estimated at $21.40/MT CO2e in 2007 dollars. This is converted to $24.55/MT CO2e in 2014 dollars. This value is applied to the reduced GHG emission calculated under Benefit D, above (**Table 3-19**).

Sources: (social cost of GHGs) Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28); (conversion from 2012 to 2014 dollars) U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm.

*Some differences may occur due to rounding

Table 3-19: Physical Benefit F-Contribute to 20x2020 Goals
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* **Type of Benefit Claimed:** Contribute to 20x2020 Goals **Units of the Benefit Claimed:** %			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2020	0%	17%	17%

Comments: Fallbrook’s 20x2020 goal is 374 gpcd. Their baseline is therefore 467.5 gpcd (374 gpcd/80%). This is a reduction of 93.5 gpcd from the baseline to 2020. Fallbrook’s population is projected to be 35,917 people in 2020. In 2020, the project will deliver 642 AFY recycled water. This is 573,141 gallons per day, or 15.96 gpcd (573,141 gallons/35,917 people). 15.96 gpcd is 17% of the total reduction of 93.5 gpcd from the baseline to the 20x2020 goal.

Sources: (20x2020 goal) FPUD. 2011. 2010 Urban Water Management Plan. Pg. 19; (2020 population) FPUD. 2011. 2010 Urban Water Management Plan. Table 2 (pg. 5).

Table 3-20: Physical Benefit G-Reduce Water Costs for Agricultural Users
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*			
Type of Benefit Claimed: Reduce Water Costs for Agricultural Users			
Units of the Benefit Claimed: %			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	100%	85.5%	14.5%
2015-2090	100%	85.5%	14.5%
TOTAL	100%	85.5%	14.5%

Comments: Recycled water is cheaper than potable water as both an incentive for customers to use recycled water, and because it is cheaper to produced recycled water than purchase imported water for potable supplies. Projected potable and recycled water rates for Fallbrook are not available. Current potable water rates are $4.06 for commercial agricultural customers, and $3.47 for recycled water (all customers). In general, recycled water rates are based on a percentage of potable water rates, for Fallbrook, this is 85.5%. This analysis assumes that this proportion remains constant over the project life, and this benefit is presented as the percentage in water costs savings that commercial agricultural customers can expect to receive by converting from potable to recycled water.

Sources: (Fallbrook water rates) Fallbrook Public Utility District. 2013. Customer Billing Information. July 1. Refer to Recycled Water and Com Ag (CA) rates.

Table 3-21: Physical Benefit H-Reduce Discharge to Outfall and Increase Available Capacity
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*			
Type of Benefit Claimed: Reduce Discharge to Outfall and Increase Available Capacity			
Units of the Benefit Claimed: AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	1,400 AF	1,392 AF	8 AF
2015	1,400 AF	1,329 AF	72 AF
2016	1,400 AF	758 AF	642 AF
2017-2088	1,400 AFY (100,800 AF)	758 AFY (54,576 AF)	642 AFY (46,224 AF)
2089	1,400 AF	766 AF	634 AF
2090	1,400 AF	830 AF	571 AF
TOTAL*	**107,800 AF**	**59,650 AF**	**48,150 AF**

Comments: Fallbrook currently produces 2,000 AFY recycled water but only has demands for 600 AFY. The remaining 1,400 AFY is discharged to the outfall. Water delivered by this project would increase us of the recycled water already produced by Fallbrook, thereby directly reducing the volume of recycled water discharged to the outfall by an amount equal to the water deliveries from the project. Total water deliveries from the project are calculated under the Primary Physical Benefit (see **Table 3-15**), above.

Sources: (current recycled water production and use) Fallbrook Public Utility District. 2012. Recycled Water Master Plan. Chapter 2, pg. 2; (discharge of excess recycled water to outfall) California Regional Water Quality Control Board, San Diego Region. 2012. Waste Discharge Requirements for the Fallbrook Public Utility District Wastewater Treatment Plant No. 1 Discharge to the Pacific Ocean via the Oceanside Ocean Outfall (Order No. R9-2012-0004 [NPDES No. CA0108031]). August 8. Pp. 4-5.

*Some differences may occur due to rounding

Table 3-22: Physical Benefit J-Reduce Need for Fertilizer Application
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* **Type of Benefit Claimed:** Reduce Need for Fertilizer Application **Units of the Benefit Claimed:** lbs/year			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 lbs	1,217 lbs	1,217 lbs
2015	0 lbs	10,791 lbs	10,791 lbs
2016	0 lbs	96,894 lbs	96,894 lbs
2017-2088	0 lbs (0 lbs)	96,894 lbs/yr (6,976,344 lbs)	96,894 lbs/yr (6,976,344 lbs)
2089	0 lbs	95,676 lbs	95,676 lbs
2090	0 lbs	86,103 lbs	86,103 lbs
TOTAL*	**0 lbs**	**7,267,025 lbs**	**7,267,025 lbs**

Comments: Recycled water delivered by Fallbrook is permitted to contain up to 55.5 mg/L of nitrate, or 151 lbs/AF. Potable water is assumed to have negligible nitrate concentration (0 mg/L or 0 mg/AF). The project will serve commercial nurseries, which are assumed to monitor nutrient delivery to their stock; customers served by the project will reduce fertilizer application commensurate with the increase in nutrient level of water used for irrigation. When full benefits are realized (642 AFY, see Primary Physical Benefit, **Table 3-15**), this project will deliver 96,894 lbs/year nitrate, resulting in an equal amount of fertilizer offset by the project.

Source: (nitrate in Fallbrook recycled water) California Regional Water Quality Control Board San Diego Region. Waste Discharge Requirements for the Fallbrook Public Utility District Plant No. 1 and 2 Reclamation Projects, San Diego County (Order No. 91-93), as amended. Pg. 5 (of original permit).

*Some differences may occur due to rounding

Technical Analysis of Physical Benefits Claimed: Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Technical Basis of the Project

The primary physical benefit of the *Fallbrook Plant Nurseries Recycled Water Distribution System* project is the increased use of recycled water. As described in the *Preliminary Assessment Report Technical Memorandum*, the project will deliver 642 AFY recycled water to nurseries that represent some of the largest potential recycled users identified within Fallbrook's *Recycled Water Master Plan*.[69] The recycled water to be served by the project is currently being produced at Fallbrook's Wastewater Treatment Plant (WWTP) and discharged to an ocean outfall, because there is no infrastructure to deliver produced recycled water to customers. Because the recycled water to be delivered by the project is already being produced, recycled water deliveries would begin as soon as customers are connected (when construction is complete), and the associated benefits would begin to accrue immediately. As shown in Attachment 6, the project will be constructed in phases, and recycled water deliveries will begin by phase (upon construction of each phase). Further, Fallbrook will provide labor time to end-users (nurseries) to assist with design, implementation, and permitting for the onsite recycled water systems to ensure that users connect within the timeline shown in Attachment 6.

Fallbrook's *Recycled Water Master Plan* was adopted in 2012 and included a review of potential recycled water demands and the infrastructure and delivery system that would be required to connect to potential users.[70] The *Recycled Water Master Plan* focused on delivery of recycled water to additional users as a means for beneficially reusing recycled water that is produced by the WWTP and discharged through an ocean outfall.[71] From the recommendations of the *Recycled Water Master Plan* and additional analysis completed by Fallbrook, five potential sites were identified for recycled water connections.[72] In 2014 Fallbrook initiated environmental review and acquisition of property easements required to expand recycled water infrastructure to the five identified sites, all of which are considered easterly sites, because they would extend east from existing recycled water infrastructure. The sites to which recycled water would be provided as part of the project are existing nurseries that currently receive potable water from Fallbrook for irrigation purposes, including: Premier Color, SD Growers, DM Color, Olive Hill Greenhouses, and Roseland Nursery.[73] Fallbrook's existing recycled water infrastructure (pipelines) ends at a nursery located on Brooke Road; the nursery sites to which infrastructure would be extended are located to the east and north of this site (see **Figure 3-7**). Therefore, recycled water deliveries would involve extension of the existing recycled water infrastructure as well as onsite retrofits to connect the five nurseries to the existing recycled water system. Delivery of recycled water to these sites is already permitted under an existing Waste Discharge Requirement Permit from the Regional Board.[74] The useful life for pipelines in the western United States ranges from 60 years to 130 years based on pipe material and size, with typical range of 75-100 years.[75] To be conservative, this analysis assumes a 75-year useful life for the *Fallbrook Plant Nurseries Recycled Water Distribution System.*

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[69] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.

[70] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.

[71] California Regional Water Quality Control Board, San Diego Region. 2012. Waste Discharge Requirements for the Fallbrook Public Utility District Wastewater Treatment Plant No. 1 Discharge to the Pacific Ocean via the Oceanside Ocean Outfall (Order No. R9-2012-0004 [NPDES No. CA0108031]). August 8. Pp. 4-5.

[72] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.

[73] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.

[74] California Regional Water Quality Control Board, San Diego Region. 1991. Waste Discharge Requirements for Fallbrook PUD, Plant No. 1 and 2 Reclamation Projects, San Diego County (Order No. 91-39).

[75] American Water Works Association. 2013. Buried No Longer: Confronting America's Water Infrastructure Challenge. Pg. 8.

Project Phasing

As described above, the project will begin to deliver recycled water to customers as soon as customers are connected to the distribution system, and construction of the delivery system will occur in phases. Immediate delivery of recycled water is possible because the recycled water to be delivered is already being produced by Fallbrook. Attachment 6 shows the construction and connection schedule for the project as a whole and includes details about construction of each phase of the project. **Table 3-23** shows how the annual benefits will be accrued by each customer over the life of the project. Because benefits have been phased in during the first year of operation, they must also be phased out in the final year of the project (i.e., in the final year, the benefit accrued is 100% less the % benefit realized in the first year). The first customer to be connected is located adjacent to the existing recycled water pipeline (refer to **Figure 3-7**), and requires simple retrofitting and permitting to begin receiving recycled water, assistance which will be provided by Fallbrook as described above. The other customers will be connected based on anticipated construction schedules for the project. Additional information about project phasing as it relates to benefit accrual associated with the project is provided in **Appendix 3-1**.

Table 3-13 shows the delivery of recycled water from the project over its 75-year life, including the phasing in and subsequent phasing out at 75 years of customers as they are connected to the pipeline. The project's primary physical benefit of recycled water delivery produces a number of secondary benefits, each of which is described below. **Table 3-12** provides a summary of these benefits, and **Tables 3-13** through **3-22** shows the accrual of each of these benefits over the project life.

Table 3-23: Timing of Customer Connections for *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*

Customer	Date Connected	% Annual Benefit Realized in Year 1	% Annual Benefit Realized in Years 2-75	% Annual Benefit Realized in Year 76 (100% - % Year 1)
Premier Color	November 2014	17%	100%	83%
SD Growers	June 2015	58%	100%	42%
DM Color	June 2015	58%	100%	42%
Rosalyn Nursery	January 2016	100%	100%	0%
Olivehill Greenhouses	January 2016	100%	100%	0%
Property Conversion	January 2016	100%	100%	0%
Notes: 75-year project life for each of the customers connected. For customers that receive partial annual benefits for Year 1 of their component, the benefit phases out in Year 76, for a total project life of 900 months (75 years x 12 months/year).				

Background for Benefits Claimed

As described previously, the primary physical benefit associated with the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project of providing for the use of an additional 642 AFY of recycled water will result in many other benefits. The information provided below is organized by each benefit that will be provided by the project and includes background information about the Region as well as specific information about the project that explains the basis for each of the benefits claimed for the project.

Primary Physical Benefit – Increase Recycled Water Use

As described in the *2012 Recycled Water Master Plan*, the WWTP treats all influent to tertiary levels that are suitable for use as recycled water (meets standards set in Title 22 of the California Code of Regulations), but Fallbrook only has recycled water infrastructure to meet 600 AFY in existing recycled water demands and therefore discharges all excess recycled water that is produced but not used to the ocean.[76] According to Fallbrook's *Recycled Water Master Plan,* total recycled water produced by Fallbrook's WWTP is 2,000 AFY.[77] Given the 600 AFY of current recycled water usage, total discharge to

[76] Fallbrook Public Utility District. 2012. Recycled Water Master Plan - Chapter 2 Recycled Water. Pg. 2.
[77] Fallbrook Public Utility District. 2012. Recycled Water Master Plan - Chapter 2 Recycled Water. Pg. 2

the ocean from Fallbrook's WWTP, which is sent through the Oceanside Ocean Outfall (refer to **Figure 3-6**), is currently 1,400 AFY.

The *2010 Urban Water Management Plan* for Fallbrook indicated that treating all effluent to tertiary levels and discharging this effluent eighteen miles west to the Oceanside Ocean Outfall is not economical for the district; however, this practice has taken place because of operational issues at the WWTP that resulted in summer demands exceeding available recycled water supplies.[78] Since 2010 Fallbrook has upgraded the WWTP to increase storage for recycled water and allow for production and storage of recycled water in low-demand months (winter months) so that supplies will be available to serve additional users in the high-demand summer months.[79] To date, a one million gallon reservoir for recycled water storage at the WWTP has been completed, and additional improvements are underway.[80]

In response to the upgrades at the WWTP that would allow for delivery of recycled water to additional users, Fallbrook completed work in 2014 to identify potential additional connections that would be economically and technically feasible. This analysis found that there are five agricultural users (nurseries) to which recycled water lines could be extended. Based upon historical usage data and calculations from Fallbrook, the feasible nearby users have a cumulative irrigation demand of 642 AFY.

A Draft Negative Declaration for a project that would extend recycled water infrastructure in an easterly direction to the five additional users was completed in April 2014. This document found that there are no significant environmental impacts associated with extending recycled water infrastructure. [81] Further, an assessment of the properties was conducted to determine property easements and other legal considerations such as permitting that would be required for the recycled water extension. The assessment determined that four easements would be required to connect to three sites (Premier Color, SD Growers, and DM Color); as of April 2014 Fallbrook has secured all but one of these easements. [82]

During development of the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project for this Proposal, Fallbrook determined that no additional recycled water permitting would be required for the recycled water expansion, because recycled water use could occur through Fallbrook's existing Waste Discharge Requirement. [83] However, onsite recycled water users will be required to conduct onsite connections and secure permits to use recycled water that will be provided by the project. Recognizing the importance of connecting to the agricultural users and ensuring that these users utilize recycled water that will be provided by the project, Fallbrook will dedicate staff time to facilitate construction of the onsite systems and assist users with obtaining necessary permits (refer to Attachments 4 and 5).

Given the existing infrastructure in place, the technical and environmental documentation that has been completed by Fallbrook, permitting that is in place, and the support Fallbrook will provide to facilitate design and construction of the onsite connections, it is fully certain that the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will result in beneficial reuse of 642 AFY of recycled water that is currently produced but discharged to the ocean.

Benefit A-Avoid Imported Water Supply Purchases and Benefit C-Local Supply Development to Decrease Vulnerabilities

One of the secondary benefits of the project is avoided purchase of imported water supply. The SDCWA is the sole imported water wholesaler to 24 member agencies within San Diego County[84]. SDCWA

[78] Fallbrook Public Utility District. 2011. 2010. Urban Water Management Plan. Pp. 41 and 42
[79] Fallbrook Public Utility District. 2014. Initial Study and Negative Declaration: Recycled Waterline Extension – East. April. Pg. 1.
[80] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.
[81] Fallbrook Public Utility District. 2014. Initial Study and Negative Declaration: Recycled Waterline Extension – East. April 22. Pg. 3.
[82] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 3.
[83] California Regional Water Quality Control Board, San Diego Region. 1991. Waste Discharge Requirements for Fallbrook PUD, Plant No. 1 and 2 Reclamation Projects, San Diego County (Order No. 91-39).
[84] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 1-8 and 3-1.

supplies include a mix of surface water and imported water supplied through water transfers from Imperial Irrigation District, canal lining projects, and purchases from MWD.[85] As shown in SDCWA's 2010 UWMP, during dry years, imported water will constitute a larger proportion of SDCWA's supplies due to reduced surface water flows.[86] SDCWA only purchases enough imported water to meet demands that cannot be met with local supplies by member agencies, per SDCWA's demand projection methods described in its UWMP.[87] Although SDCWA and its member agencies use a mix of imported water and local sources to supply their customers, imported water is more expensive to provide and is considered to be the marginal water source.[88] Thus, any new supplies that are available in the Region (such as recycled water) will be used to offset purchase of imported water supplies. As such, it is assumed for this analysis that the project will directly offset 642 AFY of imported water purchases.

The increased use of recycled water and utilization of what has traditionally been a waste (wastewater) into a resource (recycled water) supports the Region's goal of supply diversification. SDCWA's Strategic Plan identifies water supply diversification as a key to assuring water supply reliability.[89] Over a five-year average of supply sources, 83% of the Region's water was imported.[90] This dependence upon imported water makes the Region highly vulnerable to changes in the availability of imported water. In addition to restrictions on imported water deliveries as a result of drought conditions, the Region is vulnerable to disruption in deliveries because of its location at the end of the imported water distribution system. The Region's location from source water supplies means that there is a higher probability of supply disruptions due to infrastructure failures or natural disasters such as seismic events. The goal of increased water supply diversity is very important to the Region and is included in the 2013 San Diego IRWM Plan as Objective E[91], further, during scoring and ranking of projects for inclusion within this Proposal, the Region decided to weight the value of this objective substantially over the other objectives to ensure that each project included in the Proposal would meet Objective E (refer to Attachment 1 and **Appendix 1-5**).

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

Reduced demand for imported water reduces pumping from the Bay-Delta, which supplies the SWP. In a normal year, approximately two-thirds of SDCWA's imported supplies (and therefore the Region's imported supplies) are sourced from the Bay-Delta.[92] Management of the Bay-Delta water system is controversial, and challenges arise from the need to balance water supplies to meet the needs of people, and water supplies to meet the needs of ecosystems and sensitive species.[93] The CALFED Bay-Delta Program (now managed by the Delta Stewardship council) established four objectives[94]:

- *Water Quality*: to invest in projects that improve the State's water quality from source to tap.
- *Water Supply*: comprised of five critical elements: conveyance, storage, environmental water account, water use efficiency and water transfer.
- *Ecosystem Restoration*: aims at restoring habitats, ecosystem functions, and native species.
- *Levee Integrity*: to protect water supplies by reducing the threat of levee failures.

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85 SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-2.
86 SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 9-3 to 9-7.
87 SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
88 Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10. Note that despite desalinated water's high cost, the San Diego IRWM region's priority is to reduce dependence on imported water (IRWM Plan, 2007).
89 SDCWA. 2008. Strategic Plan. April. Pg. 9.
90 Pers. Comm. Dana Friehauf, SDCWA, Acting Water Resources Manager. June 18, 2014. Available: 858-522-6749. (Attachment 2.)
91 RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (excerpted in this application in Appendix 1-5).
92 Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8
93 Delta Stewardship Council. 2013. The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value. Pp. 10-11.
94 CALFED Bay-Delta Program Archived Website. CALFED Objectives. Accessed 28 June 2014. Available: http://calwater.ca.gov/

Reduced demand for imported water will reduce demand for pumping from the Bay-Delta, allowing more water to be available to help meet these needs (refer to Attachment 7).

Benefit D-Reduce Net Production of Greenhouse Gases and Benefit E-Avoid Social Costs of Greenhouse Gases

Reducing purchases of imported water will reduce the amount of imported water that is pumped to the Region and will therefore also help to reduce GHG emissions due to the amount of energy required to treat and deliver imported water to the Region. GHGs are the cause of climate change, which is anticipated to have a strong impact on the Region. During development of the 2013 San Diego IRWM Plan, the Region conducted a Climate Change Planning Study to assess the Region's climate change vulnerabilities and concerns. Within the San Diego Region, climate change is anticipated to raise temperatures, increase rainfall variability, decrease availability of imported water supplies, increase drought and flooding potential, increase water quality issues, decreases habitat and ecosystem services, and inundate storm and sewer systems from sea level rise.[95]

The high priority climate change issues of the Region that are likely to have the greatest impact within Fallbrook's service area is water supply concerns related to decreased imported supply and higher drought potential.[96] The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will address this climate change issue by reducing contribution to climate change through reduced GHG emissions, and by increasing the use of a local, drought-proof water supply. Further, the risk of wildfires increases from climate change (see Attachment 2 for more information), which is particularly important to the Fallbrook area, which is in a high wildfire risk area. Fallbrook's service area was threatened by wildfires in 2014, with the Tomahawk Fire originating at the Naval Weapons Station in western Fallbrook, and the Highway Fire south of Fallbrook near Deer Springs.

Benefit F-Contribute to 20x2020 Goals

Senate Bill X7-7 (SBX7-7) was passed as legislation in California in 2009 and included provisions for reducing per capita water use by 20% by the year 2020. These provisions are referred to as the 20x2020 Water Conservation Plan or 20x2020 Plan. The 20x2020 Plan acknowledges that water resources are limited in California and therefore need to be managed sustainably by reducing per capita water use. The baseline for the 20x2020 Plan for California as a whole is 192 gallons per capita per day (gpcd), which must be reduced to 154 gpcd by 2020.[97] 20x2020 only applies to potable water use, so recycled water can be used to reduce gpcd. However, creation of new potable supplies from non-potable sources, such as desalination or stormwater capture, does not contribute to reduced gpcd because they constitute a new potable supply.[98] As noted in the 20x2020 Plan, the water use reduction is designed to protect the Bay-Delta but will also have a number of secondary benefits such as reduced energy consumption, because approximately one-fifth of the electricity used in California goes towards water delivery, treatment, and use, and one-third of natural gas not used in power plants is used for the same purpose.[99]

Benefit G – Reduced Water Costs for Agricultural Users

Reducing reliance on imported water will also help to protect against high water costs in the Region. Imported water is costly compared to recycled water and tends to have greater price fluctuations. Over time, imported water is projected to increase from $1,355 in 2014 to $2,453 in 2046.[100] It can be presumed that imported water costs will further increase through the end of the life of the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project in 2090. The cost savings to Fallbrook associated with purchasing less imported water will be passed along to customers in the form of lower

[95] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 7-38.
[96] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 7-39.
[97] DWR, et al., 2010. 20x2020 Water Conservation Plan. February. Pg. ix.
[98] DWR, et al., 2010. 20x2020 Water Conservation Plan. February. Pg. 3.
[99] DWR, et al., 2010. 20x2020 Water Conservation Plan. February. Pg. 1.
[100] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44). Converted from 2012 dollars to 2014 dollars using factor of 1.04 from the Consumer Price Index Calculator (Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 24 June 2014. Available: http://www.bls.gov/data/inflation_calculator.htm)

rates for recycled water compared to potable water, and reduced risk of price fluctuations. As calculated under Benefit G, currently in the Fallbrook service area recycled water is 14.5% less expensive than potable water. Cost savings associated with recycled water vs. potable water are anticipated to increase as imported water prices increase over time.

High costs of water have been a factor in the conversion of farmland to non-agricultural uses in San Diego as farmers are no longer able to afford agricultural operation costs, including the cost of water. Farmers in the Region have indicated that water price increases can significantly impact the cost of agricultural operations and may force them to shut down their operations.[101] In the City of Escondido, which is located within close proximity to Fallbrook, it is estimated that annual irrigation demand is 5 AF per acre for avocados,[102] which are valued at approximately $5,000 per acre.[103] Therefore, when water costs exceed $1,000 per acre, water costs alone are enough to make avocado growing unprofitable not accounting for other costs for the operation of the farm. While Fallbrook is not serving avocado growers, and their rates may be different from those in Escondido, this local information about the agricultural industry demonstrates that water costs are a significant factor in the successful continuation of agriculture in the Region. Protecting water costs to agricultural growers with the Fallbrook service area is of particular importance not only for the local economy but also statewide, because the customers to be served by the project are located on Prime Farmland and Farmland of Statewide Importance, as identified by the California Department of Conservation.[104]

Benefit H - Reduce Discharge to Outfall and Increase Available Capacity

Fallbrook's WWTP (also referred to as Plant No. 1), which produces the recycled water that will be used by the project, is permitted under the Regional Board Order No. R9-2012-0004 (NPDES No. CA0108031), and the Regional Board's Order No. 91-93, as amended. Order No. R9-2012-0004 permits the discharge from Plant No. 1 to the Oceanside Ocean Outfall (Oceanside OO), and sets the maximum discharge of secondary effluent at 2.7 MGD.[105] The permit also notes that recycled water produced by the plant is regulated by Order No. 91-93, and any treated wastewater from the plant that is not distributed as recycled water is discharged to the Oceanside OO. Fallbrook is currently allowed to discharge up to 2.4 MGD to the Oceanside OO.[106] The Preliminary Assessment Report (Recycled Water System East Expansion Planning) states that Fallbrook produces 2,000 AFY recycled water, but only uses 600 AFY.[107] **Table 3-24** shows the recycled water production and distribution by Fallbrook before and after the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*.

[101] City of Escondido. 2011. Escondido City Council Meeting Minutes. December 14.
[102] City of Escondido. 2012. Easterly Recycled Water Main Extension Preliminary Design Report. August 2012. Pg. 2-1.
[103] Bender, G. 2012.Avocado Farming with High-Priced Water. Can It Remain Profitable? Tropics in Subtropics – ANR Blogs.
[104] California Department of Conservation – Farmland Mapping and Monitoring Program. 2013. San Diego County Important Farmland 2010. Sheet 1 of 2. March.
[105] California Regional Water Quality Control Board, San Diego Region. 2012. Waste Discharge Requirements for the Fallbrook Public Utility District Wastewater Treatment Plant No. 1 Discharge to the Pacific Ocean via the Oceanside Ocean Outfall (Order No. R9-2012-0004 [NPDES No. CA0108031]). August 8. Pg. 4.
[106] California Regional Water Quality Control Board, San Diego Region. 2012. Waste Discharge Requirements for the Fallbrook Public Utility District Wastewater Treatment Plant No. 1 Discharge to the Pacific Ocean via the Oceanside Ocean Outfall (Order No. R9-2012-0004 [NPDES No. CA0108031]). August 8. Pp. 4-5.
[107] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.

Table 3-24: Use of Recycled Water Produced by Fallbrook
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

	Recycled Water Production at Fallbrook Plant No. 1	Recycled Water Use	Recycled Water Discharged to Oceanside OO
Current Distribution System (Without Project Conditions)	2,000 AFY	600 AFY	1,400 AFY
Expanded Distribution System (Post-Project Conditions)	2,000 AFY	1,242 AFY	758 AFY

The Oceanside OO serves a large area of northern San Diego County, as shown on **Figure 3-6**, including Oceanside, Fallbrook, and Camp Pendleton. In recent years there have been concerted efforts made by water and wastewater agencies in northern San Diego County to create a regional recycled water system that maximizes the use of recycled water and minimizes water waste. The Facilities Plan for the North San Diego County Regional Recycled Water Project identified potential opportunities to optimize and regionalize recycled water systems throughout northern San Diego County. Participating agencies, also referred to as the North San Diego Water Reuse Coalition (Coalition), are the Carlsbad Municipal Water District, City of Escondido, City of Oceanside, Leucadia Wastewater District, Olivenhain Municipal Water District, Rincon del Diablo Municipal Water District, San Elijo Joint Powers Authority, Santa Fe Irrigation District, Vallecitos Water District, and Vista Irrigation District. The Facilities Report evaluated potential opportunities based on the existing systems of the Coalitions, and the limitations presented by permits and treatment capacities. The Facilities Report also identified multiple long-term and short-term projects that could be implemented to help maximize recycled water use in the northern area of San Diego County.[108] As evidenced by the Facilities Report, there are a number of recycled water projects and water reuse projects (potable reuse projects) that are planned for the Region, and may require a sharing of facilities, including outfalls, brinelines, and other infrastructure. While Fallbrook is not a member of the Coalition, the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project contributes to the efforts of the Coalition by reducing discharges to the Oceanside OO; this reduction in discharges reduces current demands on the outfall and will allow other agencies to implement additional recycled water and reuse projects that require discharges.

Without Project Baseline

Without the project, Fallbrook will continue to produce 2,000 AFY recycled water at the Fallbrook WWTP, but will continue to discharge 1,400 AFY to the ocean via the Oceanside OO. Customers that would have been served by the pipeline expansion would continue to purchase 642 AFY imported water to serve agricultural demands. This continued use of potable water for agricultural uses means that none of the benefits of converting from potable to recycled water will be realized. Such benefits that will not be realized include offsetting imported water and reducing pumping from the Bay-Delta. There will also be continued high costs of water to agricultural users, continued high reliance on imported water and associated supply vulnerabilities, continued GHG emissions for importing 642 AFY water, and a need to find other ways to help meet 20x2020 goals.

Methods Used to Estimate the Physical Benefits

The methods used to calculate the Primary Physical Benefit is described above under Technical Basis of the Project. As described, this primary physical benefit results in the numerous secondary benefits summarized in **Table 3-12**. The sections below describe how these benefits as presented in **Tables 3-13** through **3-22** were calculated.

Benefit A-Avoid Imported Water Supply Purchases

The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will offset potable water use by delivery of recycled water to local nurseries that currently use potable water to satisfy

[108] RMC. 2012. North San Diego County Regional Recycled Water Project: Regional Recycled Water Facilities Plan. May. Revised February 2013.

irrigation demands. As described above, excess tertiary water produced by Fallbrook is currently produced but unused. The large majority of Fallbrook's potable supplies are purchased from SDCWA; in 2010 Fallbrook purchased 90% of its potable supplies from SDCWA.[109] Due to the high cost of imported water and its designation as a marginal water source, local water supplies are used before imported water sources, and SDCWA purchases enough imported water to supply additional demands that are not served by local sources. Therefore, any potable water offset will be used to directly offset imported supply purchases from SDCWA. The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will deliver 642 AFY recycled water[110], offsetting an equivalent amount of potable water, and thereby avoiding the purchase of 642 AFY imported water. **Table 3-14** shows the avoided water supply purchase benefit accrued by the project over its 75-year useful life, which totals 48,150 AF.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described above, Fallbrook purchases the large majority of its potable water from SDCWA. SDCWA's supplies consist of a mix of local surface water, recycled water, and imported water from both the Colorado River and the SWP. In normal years, SDCWA's imported water mix is approximately two-thirds SWP and one-third Colorado River water.[111] As noted in Attachment 2, however, SWP supplies have been curtailed due to the 2014 drought and a greater portion of SDCWA's imported supplies are sourced from the Colorado River. Per SDCWA, during the drought, 15%[112] of SDCWA's imported supplies are anticipated to be sourced from the SWP. It is assumed that the drought will continue through 2014 and 2015, and normal conditions will resume beginning in 2016 and continue through the life of the project. Using the avoided imported water supply purchases from Benefit A, the project's contribution to reducing demand for net diversions from the Bay-Delta (e.g., SWP share of avoided imported water) has been calculated as shown in **Table 3-15** for a total of 32,059 AF over the 75-year useful life of the project.

Benefit C-Local Supply Development to Reduce Vulnerabilities

As described in Attachment 2, imported water deliveries from SWP have been curtailed during the drought, and may be as low as 0% of allotted if the drought continues. Imported water is, therefore, considered relatively unreliable during times of drought. Surface water supplies are also unreliable during drought due to reduced precipitation. In addition to supply vulnerabilities related to the drought, imported supplies are considered vulnerable even in normal or wet years due to the Region's location at the end of both of its imported water supply systems and associated chance of system disruption. Local supply development helps to reduce supply vulnerabilities by reducing reliance on imported water systems and increasing supply diversification. Any local supply development or conservation project contributes towards reducing water supply vulnerabilities by an amount equal to the new supply or volume of conserved water. As described in Benefit A, because local supplies will be used before imported water sources, all water produced by the *Fallbrook Plant Nurseries Recycled Water System Expansion* project will offset imported water. Therefore, the volume of water from Benefit A is equal to the volume of water that will reduce vulnerabilities (Benefit C), as shown in **Table 3-16**.

Benefit D-Reduce Net Production of Greenhouse Gases

As described above, the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will deliver 642 AFY recycled water and offset an equivalent volume of imported water. Treating and conveying imported water is more energy intensive than treating and conveying recycled; the energy intensity of imported water is 2.65 MWh/AF while the energy intensity of recycled water is 0.8 MWh/AF.[113] Fallbrook already produces all of the recycled water that will be delivered by the project, and currently discharges it to the outfall. The energy to produce and convey recycled water is therefore already being expended prior to the project. For this reason, for every AF of imported water that is offset by recycled

[109] Fallbrook Public Utility District. 2011. 2010 Urban Water Management Plan. Pg. 10

[110] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Table 1 (pg. 2); Table 2 (pg. 2); and Table 3 (pg. 3).

[111] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8

[112] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

[113] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10.

water as a result of the project results in full energy savings of the offset imported water (2.65 MWh). These assumptions are presented in the bullets below:

- Energy intensity of imported water: 2.65 MWh/AF
- Energy savings resulting from the project: 2.65 MWh/AF

Converting from energy use to CO2e emissions requires a breakdown of California electricity sources. California uses a mix of energy sources, each of which produces a different amount of GHG emissions; these emissions are generally reported as carbon dioxide equivalence (CO2e) by the USEPA's.[114] California generates 70% of its electricity through a combination of hydroelectric, nuclear, coal, oil, natural gas, geothermal, biomass, wind, solar, and other. California also imports 30% of its energy from other regions; 10% of California's electricity is imported from the Pacific Northwest, and the remaining 20% imported from the Pacific Southwest.[115] Emission rates in lbs of CO2e per MWh will vary based on the energy source, but can be estimated across regions, per the EPA's eGRID. California production was eGRID subregion WECC California, the Pacific Northwest is WECC Northwest, and the Pacific Southwest is WECC Southwest. Each of these regions has a CO2e emission rate of 613.28, 846.97, and 1,182.89 lbs/MWh, respectively.[116] Taking a weighted emissions rate (using the percentage of electricity produced in each region), the average emissions for electricity in California is 750.57 lbs/MWh of CO_2e. With 2204.62 lbs per MT, a standard conversion rate for California can be calculated as 0.341 MT of CO_2e per MWh of electricity. Applying this number to the energy intensity of imported water, finds GHG reduction of 43,511 MT CO2e over the 75-year life of the project. These benefits are provided by year in **Table 3-17** and summarized in the bullets below:

- Energy savings resulting from the project: 2.65 MWh/AF
- Average GHG in California energy grid: 0.341 MT CO2e/MWh
- Resulting GHG reductions resulting from the project: 0.904 MT of CO2e/AF
- Annual GHG reductions resulting from the project (assuming 642 AFY of recycled water delivered by the project): 580 MT CO2e/year
- Cumulative GHG reductions over project lifetime: 43,511 MT CO2e

Benefit E-Avoid Social Costs of Greenhouse Gases

Greenhouse gas emissions create impacts that have costs to society. The social cost of greenhouse gases is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present.[117] Such costs include, but are not limited to, impacts to agricultural productivity, human health, increased flood risk and associated damages, and ecosystem services and their values.[118] The recommended mean estimate of the social cost of one MT of CO2e in 2014 is $24.55. This is updated from the 2007 value of $21.40 per MT CO2e reported by the Interagency Working Group on Social Cost of Carbon[119], using the CPI Inflation Calculator.[120] **Table 3-18** shows the benefit of avoided social costs of carbon, which was

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[114] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

[115] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html

[116] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

[117] IPCC. 2007. Summary for policymakers. In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* ML Perry, OF Canziani, JP Palutikof, PJ van der Linden, and CE Hanson (eds.). Cambridge University Press. Cambridge, UK. Pg. 17.

[118] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 1.

[119] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28).

[120] U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm

calculated based on the GHG emissions offset from Benefit D. The bullet points below summarize how the avoided social costs of greenhouse gas benefits was calculated for the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project:

- Annual GHG reductions resulting from the project (assuming 642 AFY of recycled water delivered by the project): 580 MT/Year
- Social cost of CO2e: $24.55 per MT CO2e
- Annual avoided social costs of GHG emissions from the project (assuming 642 AFY of recycled water delivered by the project): $14,243
- Cumulative avoided social costs of GHG emissions over project lifetime: $1,068,189

Benefit F-Contribute to 20x2020 Goals

SBX7-7, also known as 20x2020, is legislation that requires urban water suppliers to reduce their daily per capita water use by 20% by 2020. Fallbrook's 20x2020 goal is reported in its 2010 UWMP as 374 gpcd.[121] This is a reduction of 93.5 gpcd from the baseline gpcd value of 467.5 gpcd. The SBX7-7 legislation allows recycled water to contribute towards 20x2020 goals. The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will offset potable water use with recycled water, thereby contributing to Fallbrook's 20x2020 goals. Contribution to these 20x2020 goal was calculated by converting the recycled water provided by the project (presented in AF in Benefit A) to gpcd using the 2020 population estimates (35,917 people[122]) found in Fallbrook's 2010 UWMP. The project's contribution to meeting 20x2020 goals was calculated as the relative gpcd contribution from the project as a percentage of Fallbrook's overall gpcd reduction goal (93.5 gpcd), as shown in **Table 3-19.** Because the 20x2020 goals must be met by 2020, the benefit is only calculated for the year 2020, rather than through the full life of the project. Further details about this calculation are provided below:

- Fallbrook's 2020 gpcd reduction target: 93.5 gpcd
- Amount of water from the project that will contribute to 20x2020 goals (amount of recycled delivered in 2020): 642 AFY or 573,141 gallons per day
- GPCD reduction provided by the project in 2020 (573,141 gallons per day/35,917 people): 16 gpcd
- Percent contribution towards 20x2020 goals (15.96 gpcd/93.5gpcd): 17%

Benefit G-Reduce Water Costs for Agricultural Users

The water delivered by the project will serve agricultural users, as identified in the Preliminary Assessment Report Technical Memorandum.[123] The agricultural users (nurseries) that would receive water from the project currently purchase potable water from Fallbrook for their irrigation needs. As described above, the project will offset an amount of potable water use equal to the amount of recycled water delivered by the project, or 642 AFY. Recycled water rates for Fallbrook customers are lower than potable water, as shown in Fallbrook's customer billing information. Recycled water costs $3.47 per 1,000 gallons, while potable water costs $4.06 per 1,000 gallons for commercial agriculture customers.[124] Converting from potable water to recycled water for the nurseries (which are commercial agriculture customers) is a savings or $0.59 per 1,000 gallons of water purchased. Assuming that the cost ratio between potable and recycled water remains constant to incentivize recycled water use even through fluctuations in cost, the cost of recycled water would remain at 85.5% the cost of imported water for customers over time. Water costs to the nurseries converting from potable to recycled water as a result of the project would therefore be reduced by 14.5% per year throughout the 75-year lifetime of the project (see **Table 3-20**). Given that both imported water rates and recycled water rates fluctuate over time, this

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[121] Fallbrook Public Utility District. 2011. 2010 Urban Water Management Plan. Pg. 19.
[122] Fallbrook Public Utility District. 2011. 2010 Urban Water Management Plan. Table 2 (pg. 5).
[123] Fallbrook Public Utility DistrictUtility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.
[124] Fallbrook Public Utility District. 2013. Customer Billing Information. July 1. Refer to Recycled Water and Com Ag (CA) rates.

benefit was quantified as the percent reduction in water costs that would be borne by agricultural water users over time.

Reducing water costs directly decreases operational expenses for agricultural water customers, which in turn makes conducting agricultural business in Fallbrook more cost-effective for these users compared to existing conditions. By improving the cost-effectiveness of conducting agricultural business in Fallbrook for these users, this project will help to support the local economy through the jobs provided by these businesses.

Benefit H-Reduce Discharge to Outfall and Increase Available Capacity

As described above, Fallbrook's WWTP produces 2,000 AFY of recycled water that meets Title 22 standards for recycled water use but currently uses 600 AFY of this water. The remaining 1,400 AFY of unused recycled water is discharged to the ocean via the Oceanside OO. The project will increase recycled water use by 642 AFY, directly reducing the volume of water sent to the Oceanside OO from Fallbrook's WWTP. Reducing discharge to the outfall increases the available capacity of the outfall for other potential uses, which is especially important because the outfall is shared by several agencies that are involved in a unified effort to increase water reuse in the San Diego IRWM Region.

Per the Preliminary Assessment Report Technical Memorandum, 1,400 AFY unused recycled water is currently discharged to the outfall from Fallbrook's WWTP.[125] The project will use 642 AFY of this unused recycled water, reducing excess recycled water discharged to the outfall to 758 AFY as shown in **Table 3-21**.

Benefit I-Reduce Stormwater Loading of Pollutants

Recycled water use has more constraints than potable water use for irrigation application. Per the permit for Fallbrook's Plant Nos.1 and 2, recycled water must comply with the Rules and Regulations for Reclaimed Water developed by Fallbrook Sanitation District (the original owner/operator of the recycled water plants). These rules must be in compliance with Title 22 of the California Code of Regulations and meet the California Department of Public Health's guidelines for reclaimed water use.[126] Further, the permit itself prohibits "discharges of wastes, including windblown spray and runoff of effluent applied for irrigation, to lands which have not been specifically described in the report of waste discharges and for which valid waste discharge requirements are not in force…"[127] These restrictions result in the prohibition of irrigation runoff when using recycled water, which in turn will reduce stormwater loading of pollutants.

There is not accurately reportable information about existing stormwater runoff from the nursery sites that would receive recycled water as a result of the project. As such, this benefit has not been quantified, because the net change as a result of the project is unknown. However, due to the stringent requirements for recycled water vs. potable water application, it is certain that the project will result in the benefit of reducing stormwater loading of pollutants compared to existing conditions.

Benefit J-Reduce Need for Fertilizer Application

Compounds that are used to fertilize plants are commonly present in recycled water (e.g., nitrogen, phosphorus, potassium), but are not typically found in potable water at levels of significance. Thus, the use of recycled water for irrigation at the nurseries that will receive water as a result of the project will reduce fertilizer application and associated costs for these customers. The nutrient concentration in recycled water varies between treatment plants, seasonally, and from other factors such as the composition of source water supplies. These variations in nutrient concentrations of recycled water makes it difficult to quantify how much fertilizer use may be offset by the use of recycled water vs. potable

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[125] Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.

[126] California Regional Water Quality Control Board San Diego Region. Waste Discharge Requirements for the Fallbrook Public Utility District Plant No. 1 and 2 Reclamation Projects, San Diego County (Order No. 91-39), as amended. Pp. 20-21 (of original permit).

[127] California Regional Water Quality Control Board San Diego Region. Waste Discharge Requirements for the Fallbrook Public Utility District Plant No. 1 and 2 Reclamation Projects, San Diego County (Order No. 91-39), as amended. Pg. 12 (of original permit).

water for irrigation purposes. However, all recycled water must meet certain standards to legally be used for various purposes, per the California Code of Regulations.[128] The Waste Discharge Requirements for Fallbrook Public Utility District permit states that recycled water from the Fallbrook WWTP has a concentration of 55.5 milligrams per liter (mg/L) of nitrate.[129] Converting to pounds of nitrates per acre-foot of water (lbs/AF), Fallbrook's recycled water contains 150.9 lbs/AF of nitrate. Given that potable water does not include a significant amount of nutrients, it is assumed that the nitrate level in potable water supplies that would be offset by the project is 0 lbs/AF.

It is anticipated that because the users of the recycled water are agricultural growers, they will reduce their fertilizer application commensurate with the increased nutrient content of their irrigation water – now recycled instead of potable. Over the life of the project, 7,267,025 pounds of fertilizer will be offset by the use of recycled water, or 96,894 lbs/yr, as shown in **Table 3-22** and shown in the bullet points below:

- Nitrate content of existing potable water supply: 0 lbs/AF
- Nitrate content of recycled water supply provided by the project: 150.9 lbs/AF
- Recycled water to offset potable water as a result of the project: 642 AFY
- Nitrate that would be used to offset fertilizer use as a result of the project: 96,894 lbs/yr

New Facilities, Policies, and Actions Required to Obtain Physical Benefits

Customers receiving recycled water from the *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will need to complete on-site retrofits and permitting in order to connect to the recycled water system. Fallbrook does not charge a connection fee for recycled water, and will provide staff support to help offset costs of permitting and on-site retrofits. Such on-site retrofits include small PVC pipe, fittings, and recycled water signage. Labor and construction costs for on-site retrofits are anticipated to be approximately $5,000 per nursery.

Potential Physical Effects of the Project

There could be temporary adverse physical effects during construction of the pipelines required for implementation of the project. However, the project falls under a Mitigated Negative Declaration (MND) for CEQA, and would not have any significant impacts. There could also be additional localized water quality impacts from the use of recycled water over imported water due to the high concentration of nutrients. As nurseries are able to adjust irrigation practices to accommodate the nutrient levels of recycled water, it is anticipated that these impacts would no long occur. Any impacts associated with the project are anticipated to be short-term in nature and mitigated to less-than-significant levels if necessary. There are no anticipated long-term, significant adverse effects.

[128] California Code of Regulations. Title 22. Division 4. Chapter 3. Water Recycling Criteria.
[129] California Regional Water Quality Control Board San Diego Region. Waste Discharge Requirements for the Fallbrook Public Utility District Plant No. 1 and 2 Reclamation Projects, San Diego County (Order No. 91-39), as amended. Pg. 5 (of original permit).

Cost Effectiveness Analysis: Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project will achieve nine quantified physical benefits and one qualitative benefit, as described above. These benefits will be achieved through increased use of recycled water by agricultural customers. **Table 3-25** summarizes the consideration of alternatives during project development. A more detailed discussion of potential alternatives and their cost effectiveness is provided following the table.

Table 3-25: Project Analysis
Fallbrook Plant Nurseries Recycled Water Distribution System Expansion

Project Name: *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion*	
Question 1 Physical Benefits Summary	The project will achieve ten benefits, as described above and summarized in **Table 3-12**. These benefits include: avoid imported water supply purchases, reduce Bay-Delta demands, local supply development to decrease vulnerabilities, reduce GHG emissions, avoid social costs of GHGs, contribute to 20x2020 goals, reduce water costs to agricultural users, reduce discharge to outfall, reduce stormwater loading of pollutants, and reduce need for fertilizer.
Question 2 Alternatives Considered	No alternative were identified that would achieve the same types and amounts of benefits of the proposed project. Alternatives that could provide the same types but different amounts of benefits were considered.
	Of the considered alternatives, two are already included in development costs and are anticipated to be implemented regardless of this project. A third alternative was rejected due to uncertainties over whether sufficient customer demand was present to justify the extension. Two alternatives remain: South Extension and East Extension. Cost estimates for the alternatives as presented in the *Fallbrook Recycled Water Master Plan* were based on assumptions included in Appendix A. These assumptions included capital costs for pipeline extensions of $100 per linear foot (lf) in paved areas, and $40 per lf in unpaved areas. These estimates were based on Fallbrook's costs for pipeline installation. The O&M costs were estimated to increase only incrementally, at $100 per AF additional recycled water delivery.[130] <u>South Extension</u> This alternative would deliver 40 AFY recycled water at a capital cost of $520,000, or $13,000 per AF. <u>East Extension</u> This alternative would deliver 85 AFY recycled water at a capital cost of $780,000, or $9,200 per AF. <u>East Extension – Updated (proposed project)</u> The East Extension was updated during development of the project for the drought grant solicitation. The updated East Extension would deliver 642 AFY recycled water to five customers, for a total project cost (construction + other costs) of $1,233,136, or $1,921 per AF. Costs for the proposed project are based on the assumptions explained above, and incorporate costs for additional project components such as outreach, grant and project administration, permitting, and Fallbrook staff support to onsite users, as presented in Attachment 5. This expanded cost is more conservative than using just the construction costs as was done for the other alternatives as it takes into consideration full permitting, administration, and other costs not included within construction estimates.
Question 3 Preferred Alternative	The proposed project is the least cost alternative on a per-acre-foot basis. It achieves a significantly higher amount of the same types of benefits of the alternatives by delivering 16 times the amount of recycled water as the South Extension alternative, and 7.5 times the amount of recycled water as the original East Extension alternative.

[130] Fallbrook Public Utility District. 2012. Recycled Water Master Plan – Chapter 2 Recycled Water. Appendix A – Recycled Alternatives Cost Assumptions.

Q1: Types of Benefits Achieved by Project

The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* project would achieve ten physical benefits as a result of its primary physical benefit of reducing potable water demand through increased use of recycled water. These benefits summarized in **Table 3-12,** and details regarding how they were calculated are provided in in the sections above. Benefits from the project include:

- Avoid imported water supply purchases – 642 AFY
- Reduce demand for net diversions from the Bay-Delta – 428 AFY
- Local supply development to decrease vulnerabilities – 642 AFY
- Reduce net production of GHGs – 580 MT CO2e per year
- Avoid social costs of GHGs - $14,243 per year
- Contribute to 20x2020 goals – 17%
- Reduce water costs to agricultural users – 14.5%
- Reduce discharge to outfall – 642 AFY
- Reduce stormwater loading of pollutants – Qualitative
- Reduce need for fertilizer application – 96,894 lbs per year

Q2: Discussion of Project Alternatives

The *Fallbrook Plant Nurseries Recycled Water Distribution System Expansion* implements a modified version of the East Extension alternative identified in the *2012 Recycled Water Master Plan* (RWMP). The alternatives considered in the RWMP involve potential alternatives for wastewater disposal and reuse. The RWMP evaluated four alternatives:[131]

1. Eliminate the recycled water program
2. Develop additional recycled water demands
3. Develop potable recharge with aquifer storage and recovery
4. Develop potable recharge with reservoir augmentation

Of these four alternatives, the first would fail to achieve any of the benefits of the proposed project, and can be eliminated from further discussion. The potable recharge options (alternatives 3 and 4) would provide most of the same types of benefits as the proposed project, albeit likely with lower water production numbers given that additional treatment required for potable recharge results in more brine and less product water compared to recycled water. In addition, the potable recharge options would not contribute to 20x2020 goals (because potable water is included in gpcd calculations for the purposes of 20x2020), would not reduce stormwater loading of pollutants, and would not reduce need for fertilizer application. The potable recharge options also may not reduce GHG emissions or social costs of GHGs due to potentially high energy requirements for advanced treatment; however, a full analysis of these alternatives was not conducted for the benefits described in this funding application. This leaves option 2 as the only viable alternative for the proposed project, as it would produce the same benefits.

Alternative 2: Develop Additional Recycled Water Demands

As presented in the RWMP, six alternatives for additional recycled water demands were identified and considered. Of these alternatives, the East Extension (which formed the basis of the proposed project) was the most expensive in total cost, but also met the highest demand. On a per-acre-foot basis, East Extension cost $9,200 per AF, while the other alternatives ranged from $0 per AF to $13,000 per AF.[132] **Table 3-26** shows the cost evaluation as presented in the RWMP for each of the additional demand alternatives.

[131] Fallbrook Public Utility District. 2012. Recycled Water Master Plan – Chapter 2 Recycled Water. Pg. 6.
[132] Fallbrook Public Utility District. 2012. Recycled Water Master Plan – Chapter 2 Recycled Water. Pg. 7.

Table 3-26: Additional Recycled Water Demand Extension Alternatives[133]

Recycled Water Extension	Estimated Demand (AF)	Estimated Cost	Cost per AF
Peppertree Development Phase 7	14	$0*	$0/AF
Peppertree Development Phase 8 and 9	28	$0*	$0/AF
North Extension**	55	$475,000	$8,600/AF
East Extension	85	$780,000	$9,200/AF
South Extension	40	$520,000	$13,000/AF
Total	**222**	**$1,510,000**	**$8,900/AF**

*The costs to extend recycled water to these customers is already included in the cost of the development and therefore would not be directly borne by Fallbrook
**The North Extension is dependent on construction of the Army Reserve Base, which is uncertain

The RWMP notes that because the treatment plant already produces tertiary water that is suitable for use as recycled water, there are no additional capital or O&M costs associated with any of these alternatives with regards to the production of recycled water.[134] The costs included in **Table 3-26** are the capital costs for the pipeline extensions themselves. The RWMP removed North Extension from consideration because demand cannot sustain the extension if the construction of a proposed Army Reserve Center in the area does not move forward. At the time the RWMP was developed, the fate of the potential reserve center was uncertain.[135] The South Extension is therefore the only viable alternative to the East Extension.

When the RWMP was developed, additional recycled water storage and improvements at the treatment plant were required to improve recycled water reliability. These improvements are underway, and additional storage has been constructed.[136] The treatment plant improvements are scheduled to be completed prior to the anticipated completion of the proposed project, and Fallbrook is confident that recycled water can reliably be delivered as soon as customers are able to come online under the proposed project.

During development of the East Extension portion of the project, additional recycled water customers were identified adjacent to the proposed extension. Fallbrook's Preliminary Assessment Report (Recycled Water System East Expansion Planning) technical memorandum updates the proposed extension with additional users. As noted in this technical memorandum, although the full extension was shown in the RWMP, the customers at the end of the extension were not included in the RWMP analysis.[137] The updated proposed project identified three additional customers to the two already identified in the RWMP. The total recycled water demand that will be met by the East Extension, as revised in this project, is 642 AFY.[138] This is an increase of 557 AFY over the demands from the East Extension identified in the RWMP. Capital costs for the East Extension have also increased, with the total project budget increasing to $1,233,136 (see Attachment 5). Note that this total budget includes construction costs as well as design, permitting, outreach efforts, grant and project administration and other costs, while the costs presented above for the South Extension only includes construction capital costs. Even with the increased project cost, with the significant increase in recycled water deliveries, the East Extension's per-acre-foot cost is $1,921 per AF. **Table 3-27** shows the costs of the updated East Extension compared to the South Extension as presented in the RWMP.

133 Fallbrook Public Utility District. 2012. Recycled Water Master Plan – Chapter 2 Recycled Water. Pg. 7.
134 Fallbrook Public Utility District. 2012. Recycled Water Master Plan – Chapter 2 Recycled Water. Pg. 8.
135 Fallbrook Public Utility District. 2012. Recycled Water Master Plan – Chapter 2 Recycled Water. Pg. 7.
136 Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.
137 Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 1.
138 Fallbrook Public Utility District. 2014. Preliminary Assessment Report (Recycled Water System East Expansion Planning) Technical Memorandum. April 15. Pg. 3.

Table 3-27: Costs of the Updated East Extension and the South Extension Alternative

Recycled Water Extension	Estimated Demand (AF)	Estimated Cost	Cost per AF
East Extension	85	$780,000	$9,200/AF
Updated East Extension *(selected project)*	642	$1,233,136	$1,921/AF
South Extension	40	$520,000	$13,000/AF

Q3: Preferred Project Alternative

The analysis above clearly shows that the proposed project is the most cost effective of the alternatives considered for the project, $7,279 less costly than its original incarnation in the RWMP, and $11,079 less costly per AF than the South Extension Alternative. In addition to being the most cost effective of the expansion of the recycled water delivery system alternatives, the proposed project provides the greatest amount of benefits by delivering the most recycled water of the alternatives. Even if the East Extension had not been updated to include the three new customers, the original extension provided the greatest amount of benefits of the considered alternatives because it would offset the most imported water

Project 3: Carlsbad Recycled Water Plant and Distribution System Expansion

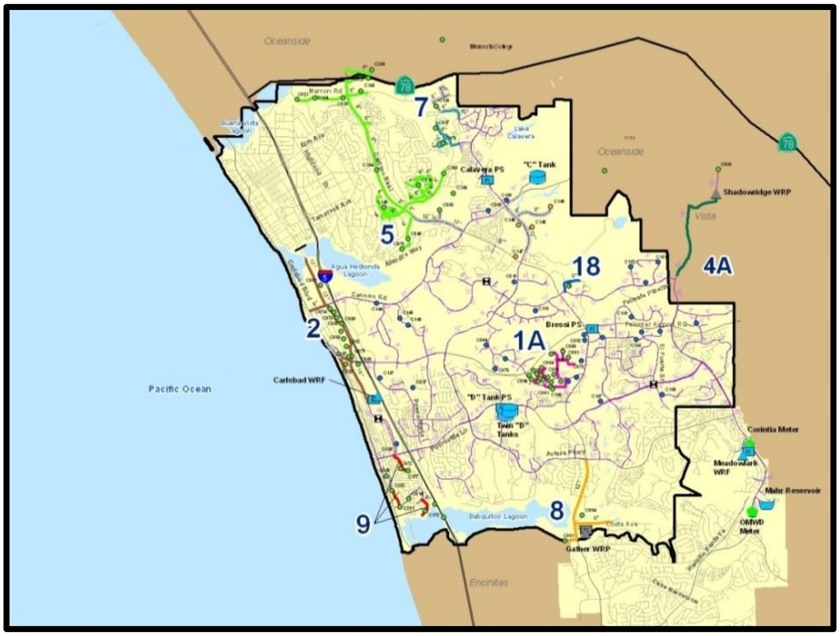
Local Project Sponsor: Carlsbad Municipal Water District (Carlsbad)
Partner: Olivenhain Municipal Water District (OMWD)

The following sections of this application include project-specific information for the *Carlsbad Recycled Water Plant and Distribution System Expansion* project, and include the following information pursuant to the PSP:

1. Project Description
2. Project Map
3. Project Physical Benefits
4. Technical Analysis of Physical Benefits Claimed, which includes the following sub-sections:
5. Technical Basis of the Project
    - Background for Benefits Claimed (Recent and Historical Conditions)
    - Without-Project Baseline (Estimates of Without-Project Conditions)
    - Methods Used to Estimate Physical Benefits
    - New Facilities, Policies, and Actions Required to Obtain Physical Benefits
    - Potential Physical Effects of the Project
6. Cost Effectiveness Analysis

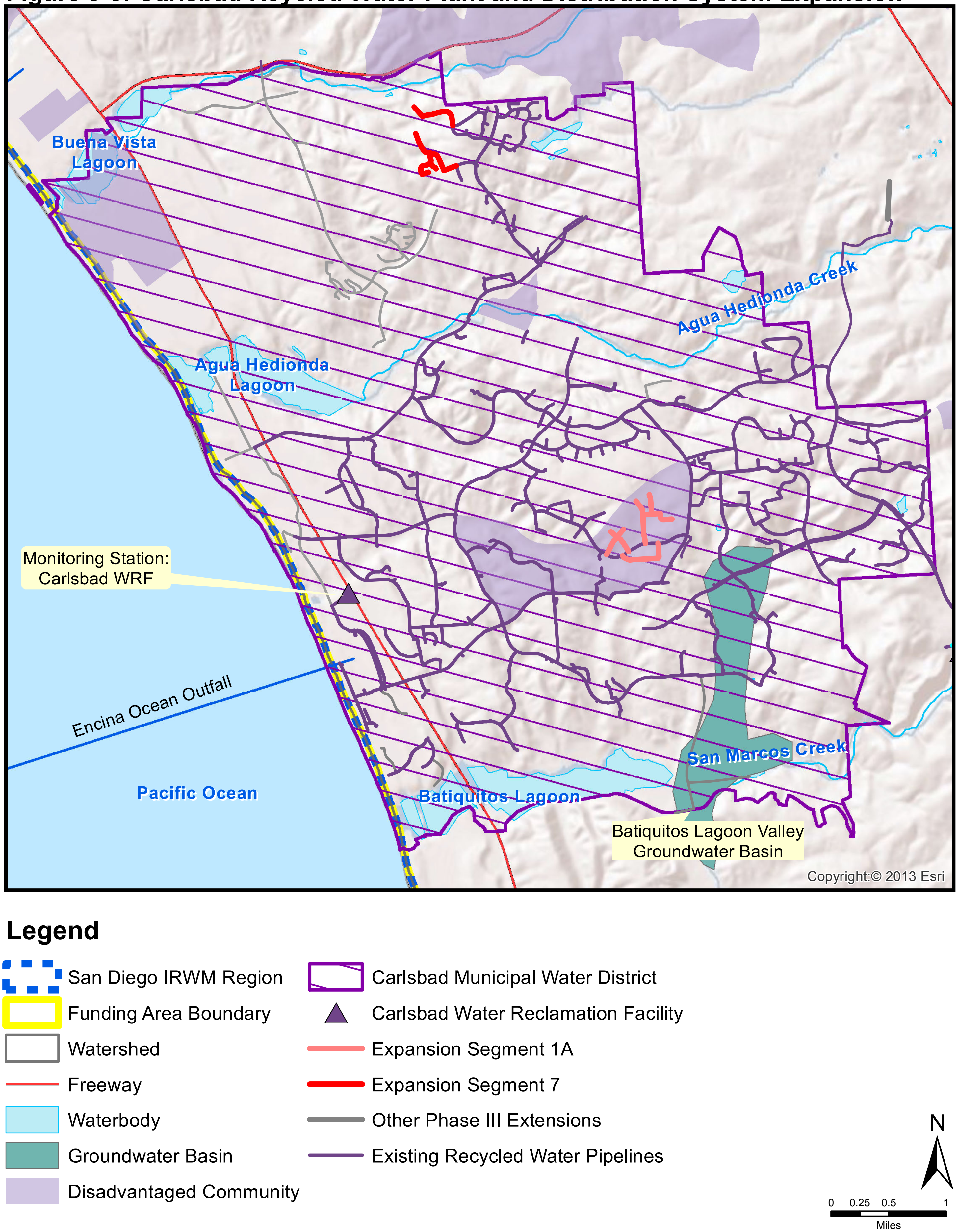
Project Map: Carlsbad Recycled Water Plant and Distribution System Expansion

Figure 3-8 shows the *Carlsbad Recycled Water Plant and Distribution System Expansion* project area, the service area of the project sponsor, and the project's relation to groundwater basins and DACs. **Figures 3-9** through **3-12** show detailed information about the project area and Carlsbad's recycled water system; information provided within these figures is used to explain the benefits claimed for the project.



Carlsbad Long-Term Recycled Water Distribution Plans

Figure 3-8: Carlsbad Reycled Water Plant and Distribution System Expansion



Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-6_Proj3_Carlsbad_15Jul14.mxd

Figure 3-9

Supply Source	Rated Capacity mgd	Processes
Carlsbad WRF	4.0	Tertiary
Carlsbad WRF Expansion	4.0	Tertiary
Meadowlark WRF	3.0 (summer) 2.0 (winter)	Primary, Secondary and Tertiary

Figure 3-10

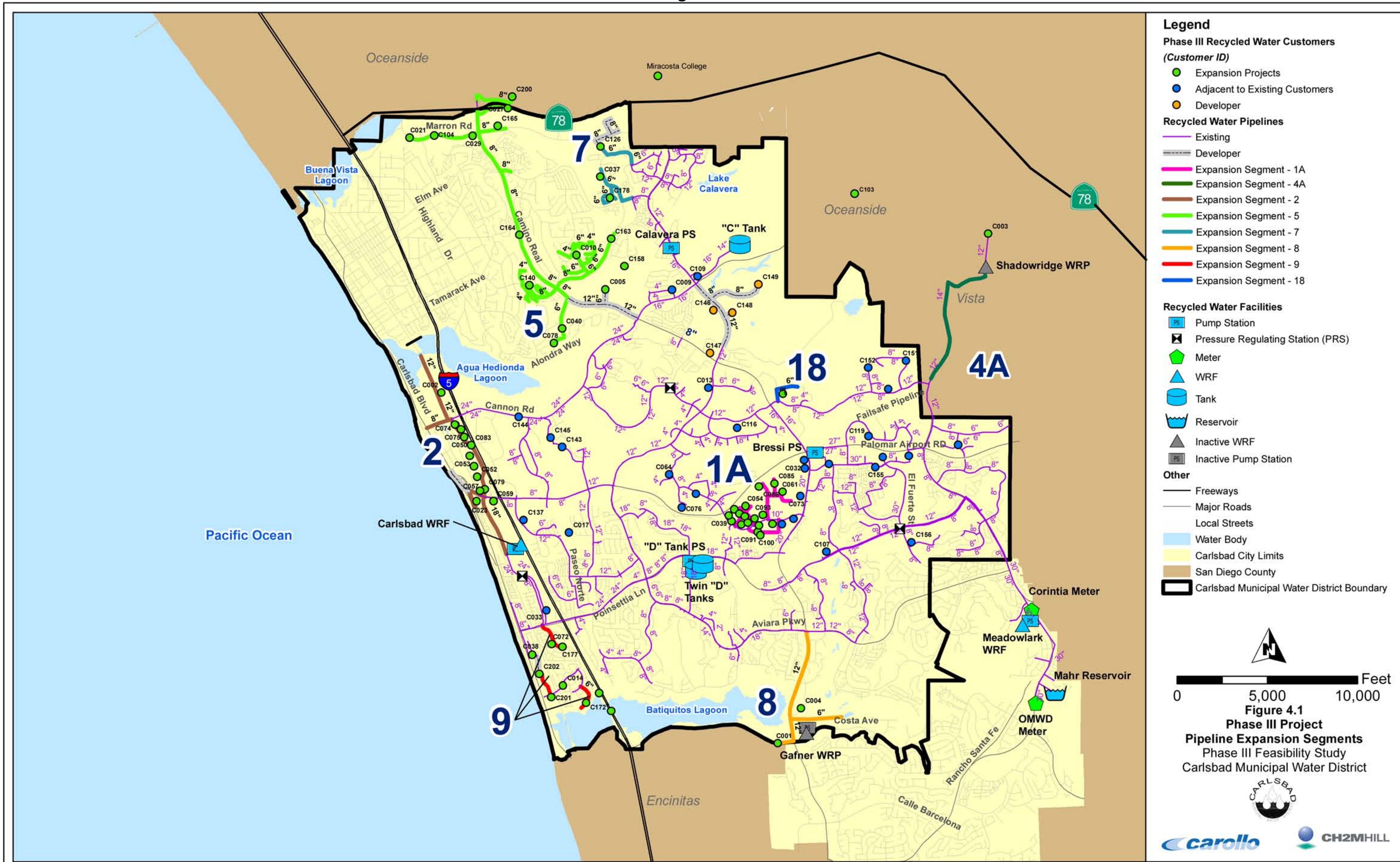


Figure 4.1
Phase III Project
Pipeline Expansion Segments
Phase III Feasibility Study
Carlsbad Municipal Water District

Figure 3-11

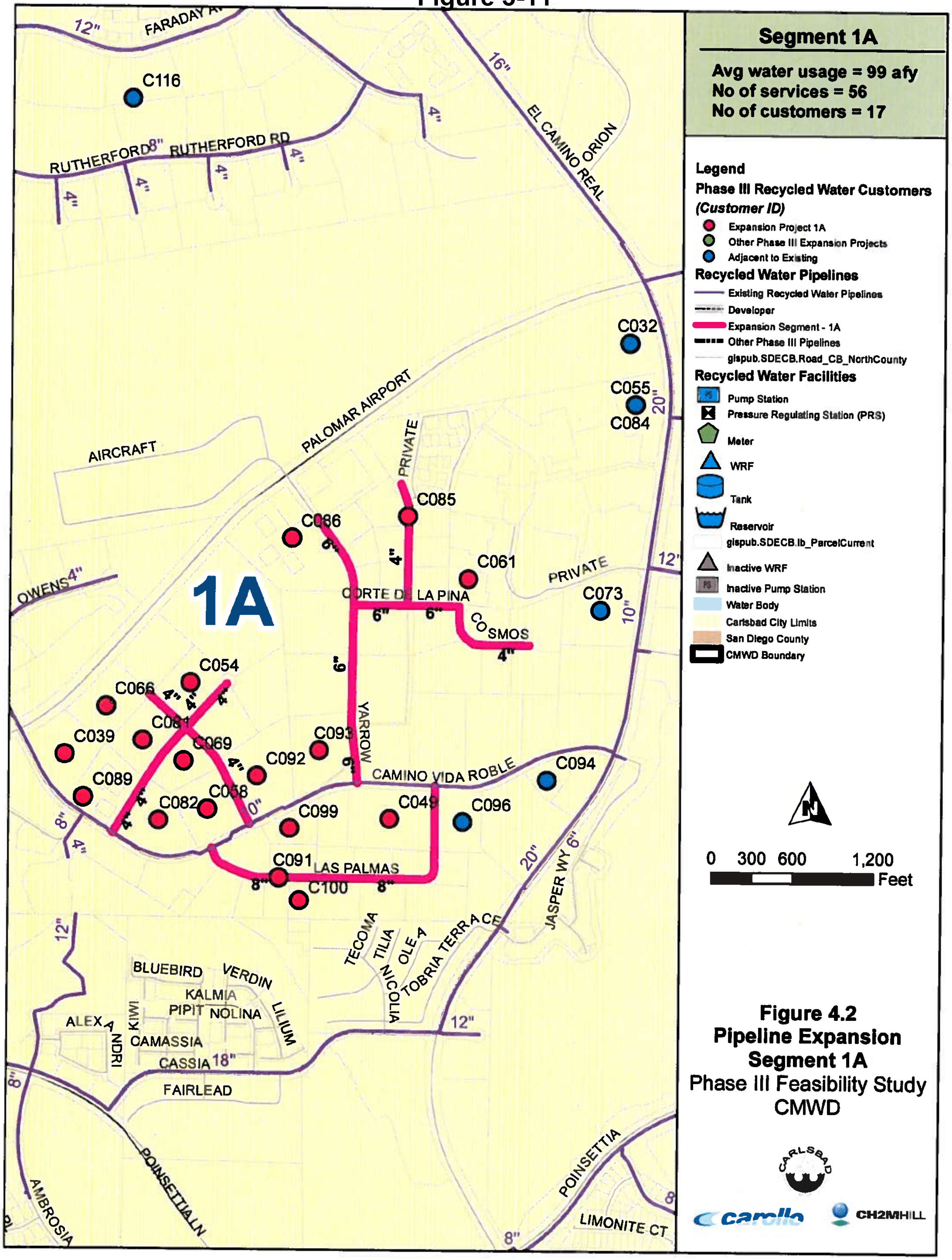
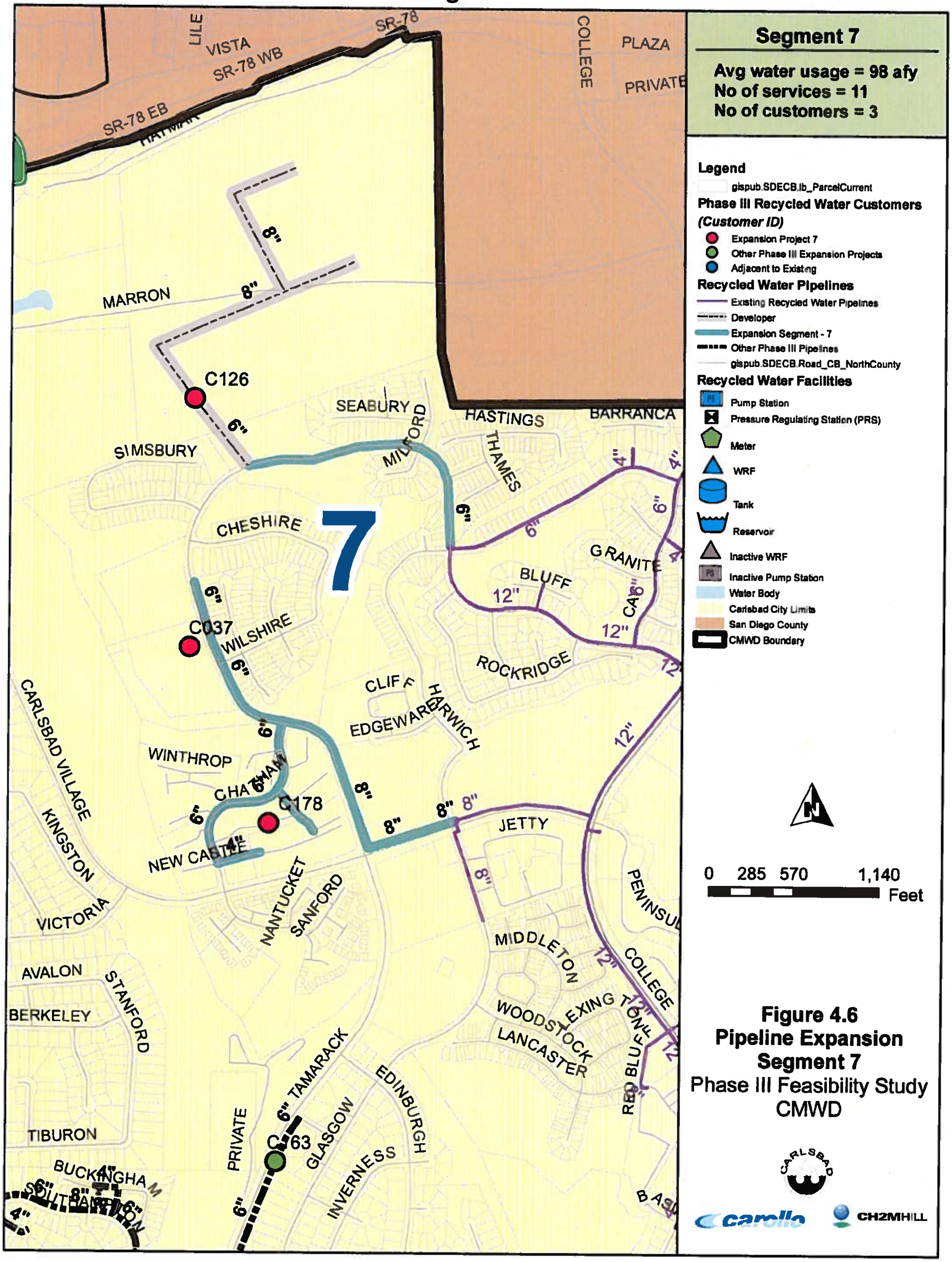

Segment 1A
Avg water usage = 99 afy
No of services = 56
No of customers = 17
Legend
Phase III Recycled Water Customers
(Customer ID)
Expansion Project 1A
Other Phase III Expansion Projects
Adjacent to Existing
Recycled Water Pipelines
Existing Recycled Water Pipelines
Developer
Expansion Segment - 1A
Other Phase III Pipelines
gispub.SDECB.Road_CB_NorthCounty
Recycled Water Facilities
Pump Station
Pressure Regulating Station (PRS)
Meter
WRF
Tank
Reservoir
gispub.SDECB.lb_ParcelCurrent
Inactive WRF
Inactive Pump Station
Water Body
Carlsbad City Limits
San Diego County
CMWD Boundary
0 300 600 1,200
Feet
Figure 4.2
Pipeline Expansion
Segment 1A
Phase III Feasibility Study
CMWD
1A
C116
C032
C055
C084
C085
C086
C061
C073
C054
C066
C081
C039
C069
C093
C092
C094
C089
C058
C082
C099
C049
C096
C091
C100
RUTHERFORD RD
FARADAY AV
EL CAMINO REAL
ORION
PALOMAR AIRPORT
AIRCRAFT
PRIVATE
OWENS
CORTE DE LA PINA
COSMOS
YARROW
CAMINO VIDA ROBLE
LAS PALMAS
JASPER WY
TECOMA
TILIA
OLEA
NICOLIA
TOBRIA TERRACE
BLUEBIRD
VERDIN
KALMIA
PIPIT
NOLINA
LILIUM
KIWI
ALEXANDRA
CAMASSIA
CASSIA
FAIRLEAD
POINSETTIA LN
POINSETTIA
AMBROSIA
LIMONITE CT
CH2MHILL

Figure 3-12


Segment 7
Avg water usage = 98 afy
No of services = 11
No of customers = 3
Legend
gispub.SDECB.lb_ParcelCurrent
Phase III Recycled Water Customers
(Customer ID)
Expansion Project 7
Other Phase III Expansion Projects
Adjacent to Existing
Recycled Water Pipelines
Existing Recycled Water Pipelines
Developer
Expansion Segment - 7
Other Phase III Pipelines
gispub.SDECB.Road_CB_NorthCounty
Recycled Water Facilities
Pump Station
Pressure Regulating Station (PRS)
Meter
WRF
Tank
Reservoir
Inactive WRF
Inactive Pump Station
Water Body
Carlsbad City Limits
San Diego County
CMWD Boundary
0 285 570 1,140
Feet
Figure 4.6
Pipeline Expansion
Segment 7
Phase III Feasibility Study
CMWD
7
C126
C037
C178
SR-78
SR-78 WB
SR-78 EB
VISTA
LILE
COLLEGE
PLAZA
PRIVATE
MARRON
SEABURY
SIMSBURY
MILFORD
HASTINGS
BARRANCA
THAMES
CHESHIRE
GRANITE
BLUFF
WILSHIRE
ROCKRIDGE
CLIFF
EDGEWARE
HARWICH
WINTHROP
CHATHAM
NEW CASTLE
JETTY
CARLSBAD VILLAGE
KINGSTON
VICTORIA
NANTUCKET
SANFORD
PENINSU
MIDDLETON
AVALON
STANFORD
BERKELEY
WOODSTOCK
LANCASTER
RED BLUFF
TAMARACK
EDINBURGH
GLASGOW
INVERNESS
TIBURON
BUCKINGHA
B ASI
CH2MHILL

Project Description: Carlsbad Recycled Water Plant and Distribution System Expansion

Project will expand existing water reclamation facility by 2 MGD, construct pipelines, and complete customer retrofits to deliver 353 AFY of recycled water.

Project Nexus to Drought Impacts

The *Carlsbad Recycled Water Plant and Distribution System Expansion* meets two of the Drought Project Elements defined by DWR (**Table 3-1**). The project will provide regional drought preparedness by increasing recycled water production and use and improving landscape irrigation efficiencies. The project also reduces ecosystem conflicts created by the drought through reduced demand for potable water, which reduces drawdown of local reservoirs and reduces demands for Bay-Delta supplies.

The project addresses seven of the drought impacts identified Attachment 2:

- Ability to Meet Drinking Water Demands: The project offsets 353 AFY of potable demand by increasing recycled water use. Offsetting potable water with recycled water increases the amount of potable water that is available to meet drinking water demands; this is especially important as continued drought will likely result in water use restrictions in the Region.
- Ability to Meet Agricultural Water Demands: Local supplies are necessary to buffer water use restrictions to agricultural users that are caused by reduced imported water supplies. The project produces and provides a local supply (recycled water) and will therefore help to buffer water use.
- Ability to Meet Ecosystem Demands: Reservoir drawdown as a result of drought and reduced inflows (imported water and surface water) contributes to water quality impacts and adversely impacts reservoir ecosystems. The project reduces potable demand, thereby reducing reservoir drawdown. The project also offsets Bay-Delta demands, and therefore allows more water to be available to meet the needs of Bay-Delta ecosystems.
- Drinking Water MCL Violations: Water quality in reservoirs is impacted by reduced water levels and high-TDS imported water from the Colorado River. Reducing potable water demands reduces demand for imported water, resulting in a smaller proportion of imported water coming into the Region from the Colorado River. Reducing potable demands also reduces drawdown from reservoirs, helping to protect against surface water quality impacts. Protection of water quality in the Region's reservoirs reduces the potential for drinking water MCL violations related to eutrophication that is worsened by the drought.
- Groundwater Basin Overdraft: Groundwater represents a potentially available local supply during times of drought, but is not always viable due to small size and low yields of local groundwater basins. Reduced potable demand makes potable supplies more available for other users, reducing the potential need for groundwater as an alternate supply. Reduced need for groundwater helps to protect groundwater basins from overdraft.
- Increased Wildfire Risk and Water Quality Impacts: Wildfire risks are anticipated to increase because of climate change. Reducing imported water demands reduces the Region's GHG emissions and contribution to climate change, thereby reducing wildfire risks. Further, the use of recycled water allows for more water to be available for firefighting purposes.
- Economic Impacts: Increasing water supply reliability will help to ensure that demands associated with the regional economy can be met. Specifically, reduced water costs (via access to recycled water) for business parks and manufacturing will help ensure the sustainability of this important commercial subsector.

This project was selected for inclusion in this funding application because it is an IRWM project that addresses drought impacts to the Region and is able to be implemented on an expedited timeline. Expedited funding is needed for this high-priority project because it would provide additional local water supplies and reduce demands for potable water, thereby freeing up available potable supplies to meet critical potable needs that may be jeopardized due to the current drought. Further, the project provides long-term drought preparedness and local water supply reliability by expanding a water reclamation plant in the Region for additional provision of recycled water.

Project Physical Benefits: Carlsbad Recycled Water Plant and Distribution System Expansion

The *Carlsbad Recycled Water Plant and Distribution System Expansion* project provides a number of physical benefits. The primary physical benefit of the project is reduced demand for potable water through 353 AFY of increased recycled water use. This primary physical benefit results in a number of secondary benefits, as summarized in **Table 3-28**. The project life is anticipated to be 60 years, as explained in the Project Phasing section, below. The benefits will be phased in (and subsequently out) over the project life, as shown in **Tables 3-29** through **3-39.** Detailed explanations of how these benefits were calculated are provided in the Technical Analysis of Physical Benefits Claimed section, below, along with the context for the importance and justification of these benefits. **Appendix 3-1** includes detailed spreadsheets that show how the quantified benefits were calculated.

Table 3-28: Physical Benefits Summary
Carlsbad Recycled Water Plant and Distribution System Expansion

Physical Benefit	Result of Physical Benefit		Annual Quantification of Benefits (cumulative quantification)
Reduce potable demand through recycled water use (353 AFY)	A	Avoid Imported Water Supply Purchases	353 AFY (21,180 AF)
	B	Reduce Demand for Net Diversions from the Bay Delta	235 AFY (14,120 AF)
	C	Local Supply Development to Decrease Vulnerabilities	353 AFY (21,180 AF)
	D	Reduce Net Production of Greenhouse Gases	223 MT/CO2e/yr (13,361 MT CO2)
	E	Avoid Social Costs of Greenhouse Gases	$5,467/yr ($328,022)
	F	Contribute to 20x2020 Goals	6.5% by 2020
	G	Reduce Water Costs to Customers	16.4%
	H	Reduce Discharge to Outfall	353 AFY (21,180 AF)
	I	Reduce Stormwater Loading of Pollutants	Qualitative
	J	Reduce Need for Fertilizer Application	15,455 lbs/yr (927,298 lbs)
	L	Increase Local Treatment Capacity for Future Recycled Water Delivery	1,887 AFY (113,237 AF)

Table 3-29: Primary Physical Benefit-Reduce Potable Demand through Recycled Water Use
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*
Type of Benefit Claimed: Reduce Potable Demand through Recycled Water Use
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	0 AF	0 AF
2016	0 AF	0 AF	0 AF
2017	0 AF	177 AF	177 AF
2018	0 AF	353 AF	353 AF
2019-2076	0 AFY (0 AF)	353 AFY (20,474 AF)	353 AFY (20,474 AF)
2077	0 AF	177 AF	177 AF
Total*	**0 AF**	**21,180 AF**	**21,180 AF**

Comments: Per Carlsbad's customer database for the Expansion Segments included in this project, total annual demand for recycled water that would be served by the project is 353 AFY. Expansion Segment 1A would serve 99 AFY, Expansion Segment 7 will serve 98 AFY, Adjacent-Existing customers will be served with 126 AFY (retrofit adjacent customers only), and 30 AFY would be used to replace the potable supplement currently necessary during summer months. Construction will be complete in June 2017, with benefits beginning to accrue immediately following construction. For 2017, this means that 50% of the full annual benefits will be realized, or 176.5 AFY recycled water. The full benefits would be accrued between 2018 and 2076, with the benefit phased out in 2077 (176.5 AFY), in accordance with how benefits were phased in.

Sources: (customer demands) CMWD. 2012. Phase II Recycled Water Project Feasibility Study. June. Pp. 48, 55, and 56; (potable supplement) CMWD. 2012. Recycled Water Master Plan. January. Table 4.2 (pg. 4-3)

*Some differences may occur due to rounding

Table 3-30: Physical Benefit A-Avoid Imported Water Supply Purchases
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*
Type of Benefit Claimed: Avoid Imported Water Supply Purchases
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	0 AF	0 AF
2016	0 AF	0 AF	0 AF
2017	0 AF	177 AF	177 AF
2018	0 AF	353 AF	353 AF
2019-2076	0 AFY (0 AF)	353 AFY (20,474 AF)	353 AFY (20,474 AF)
2077	0 AF	177 AF	177 AF
Total*	**0 AF**	**21,180 AF**	**21,180 AF**

Comments: Within the San Diego IRWM Region, local water supplies are used before purchasing imported water to meet demand deficits. Because the *Carlsbad Recycled Water Plant and Distribution System Expansion* will be delivering an additional 353 AFY local supply (recycled water), this will directly offset the purchase of imported water. This benefit will begin to accrue when water deliveries from the project begins, as phased in under the Primary Physical Benefit (**Table 3-31**).

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13.

*Some difference may occur due to rounding

Table 3-31: Physical Benefit B-Reduce Demand for Net Diversions from the Bay-Delta
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*
Type of Benefit Claimed: Reduce Demand for Net Diversions from the Bay-Delta
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	0 AF	0 AF
2016	0 AF	0 AF	0 AF
2017	0 AF	118 AF	118 AF
2018	0 AF	235 AF	235 AF
2019-2076	0 AFY (0 AF)	235 AF Y (13,649 AF)	235 AFY (13,649 AF)
2077	0 AF	118 AF	118 AF
Total	**0 AF**	**14,120 AF**	**14,120 AF**

Comments: The San Diego County Water Authority (SDCWA) is the sole imported water wholesaler in the San Diego IRWM Region. Although SDCWA supplies include a mix of sources, local supplies are used first, and imported water purchased only to satisfy unmet demand once local supplies are exhausted. SDCWA's imported supply mix includes water from the State Water Project (SWP), which comes from the Sacramento-San Joaquin Delta (Bay-Delta), and the Colorado River. During normal years, SDCWA's imported supply mix is 2/3 SWP and 1/3 Colorado River. Under drought conditions in 2014 and 2015, SWP is 15% of SDCWA's imported supply. This analysis assumes 15% imported water is from the SWP during 2014 and 2015, and 2/3 from SWP during other years. This proportion was applied to the offset imported water calculated under Benefit A, above (**Table 3-32**).

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13; (SDCWA supply mix) Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8; (imported mix during drought) Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

Table 3-32: Physical Benefit C-Local Supply Development to Decrease Vulnerabilities
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*
Type of Benefit Claimed: Local Supply Development to Decrease Vulnerabilities
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	0 AF	0 AF
2016	0 AF	0 AF	0 AF
2017	0 AF	177 AF	177 AF
2018	0 AF	353 AF	353 AF
2019-2076	0 AFY (0 AF)	353 AFY (20,474 AF)	353 AFY (20,474 AF)
2077	0 AF	177 AF	177 AF
Total*	**0 AF**	**21,180 AF**	**21,180 AF**

Comments: The Region's high reliance on imported water supplies increases its vulnerability to water shortages (see Attachment 2). Local supply development is a key regional strategy to address this issue. This project will produce 353 AFY drought-proof local supply, implementing this strategy to decrease vulnerabilities. The amount of recycled water delivered by the project is calculated under the Primary Physical Benefit (**Table 3-31**), above.

Source: (strategy to reduce vulnerabilities) SDCWA. 2008. Strategic Plan. April. Pg. 9

*Some differences may occur due to rounding

Table 3-33: Physical Benefit D-Reduce Net Production of Greenhouse Gases
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion* **Type of Benefit Claimed:** Reduce Net Production of Greenhouse Gases **Units of the Benefit Claimed:** MT CO2e			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 MT CO2e	0 MT CO2e	0 MT CO2e
2015	0 MT CO2e	0 MT CO2e	0 MT CO2e
2016	0 MT CO2e	0 MT CO2e	0 MT CO2e
2017	159 MT CO2e	48 MT CO2e	111 MT CO2e
2018	319 MT CO2e	96 MT CO2e	223 MT CO2e
2019-2076	319 MT CO2e/yr (18,501 MT CO2e)	96 MT CO2e/yr (5,585 MT CO2e)	223 MT CO2e/yr (12,916 MT CO2e)
2077	159 MT CO2e	48 MT CO2e	111 MT CO2e
Total*	19,139 MT CO2e	**5,778 MT CO2e**	**13,361 MT CO2e**

Comments: Importing water is more energy intensive than recycled water, using 2.65 MWh/AF to import water to the Region compared to 0.8 MWh/AF. California produces 70% of its energy with a CO2e emissions factor of 613.28 lbs/MWH. 10% of California's energy is imported from the Pacific Northwest, with a CO2e emissions factor of 846.97 lbs/MWH, and 20% imported from the Pacific Southwest, with a CO2e emissions factor of 1,182.89 lbs/MWh. Using a weighted average, CO2e emissions from California's energy is 750.57 lbs/MWh, or 0.341 MT/MWh. This was applied to the energy intensity of imported water offset by the project (see Benefit A, **Table 3-32**), and the energy intensity of recycled water from the project (see Primary Physical Benefit, **Table 3-31**).

Sources: (energy intensity of imported water and recycled water) Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10); (California energy mix) CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html; (CO2e emissions factors) U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

*Some difference may occur due to rounding

Table 3-34: Physical Benefit E-Avoid Social Costs of Greenhouse Gases
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion* **Type of Benefit Claimed:** Avoid Social Costs of Greenhouse Gases **Units of the Benefit Claimed:** $			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$0	$0
2015	$0	$0	$0
2016	$0	$0	$0
2017	$0	$2,734	$2,734
2018	$0	$5,467	$5,467
2019-2076	$0	$5,467/yr ($317,088)	$5,467/yr ($317,088)
2077	$0	$2,734	$2,734
Total*	**$0**	**$328,022**	**$328,022**

Comments: There are social costs associated with GHG emissions, which were estimated at $21.40/MT CO2e in 2007 dollars. This is converted to $24.55/MT CO2e in 2014 dollars. This value was applied to the reduced GHG emission calculated under Benefit D, above (**Table 3-35**).

Sources: (social cost of GHGs) Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28); (conversion from 2012 to 2014 dollars) U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm.

*Some difference may occur due to rounding

Table 3-35: Physical Benefit F-Contribute to 20x2020 Goals
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion* **Type of Benefit Claimed:** Contribute to 20x2020 Goals **Units of the Benefit Claimed:** %			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2020	0%	6.5%	6.5%

Comments: Carlsbad's 20x2020 goal is 207.1 gpcd. Their baseline is therefore 258.9 gpcd (207.1 gpcd/80%). This is a reduction of 51.8 gpcd from the baseline to 2020. Carlsbad's population is projected to be 94,101 people in 2020. In 2020, the project will deliver 353 AFY recycled water. This is 315,138 gallons per day, or 3.3 gpcd (315,138 gallons/94,101 people). 3.3 gpcd is 6% of the total reduction of 51.8 gpcd from the baseline to the 20x2020 goal.

Sources: (20x2020 goal) Carlsbad. 2011. 2010 Urban Water Management Plan. Pg. 3-9; (2020 population) Carlsbad. 2011. 2010 Urban Water Management Plan. Table 3-1 (pg. 3-1).

Table 3-36: Physical Benefit G-Reduce Water Costs to Customers
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*			
Type of Benefit Claimed: Reduce Water Costs to Customers			
Units of the Benefit Claimed: %			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	100%	83.6%	16.4%
2015-2077	100%	83.6%	16.4%
Total	**100%**	**83.6%**	**16.4%**

Comments: Recycled water is cheaper than potable water as both an incentive for customers to use recycled water, and because it is cheaper to produced recycled water than purchase imported water for potable supplies. Projected potable and recycled water rates for Carlsbad are not available. Current potable water rates are $4.22 for irrigation and $3.53 for recycled water (all customers). In general, recycled water rates are based on a percentage of potable water rates, for Carlsbad, this is 83.6%. This analysis assumes that this proportion remains constant over the project life, and this benefit is presented as the percentage in water costs savings that customers can expect to receive by converting from potable to recycled water.

Sources: (Carlsbad water rates) Carlsbad Municipal Water District. 2014. Water Rates. Refer to 2014 rates for Irrigation and for Recycled Water.

Table 3-37: Physical Benefit H-Reduce Discharge to Outfall
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*			
Type of Benefit Claimed: Reduce Discharge to Outfall			
Units of the Benefit Claimed: AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	0 AF	0 AF
2016	0 AF	0 AF	0 AF
2017	0 AF	177 AF	177 AF
2018	0 AF	353 AF	353 AF
2019-2076	0 AFY (0 AF)	353 AFY (20,474 AF)	353 AFY (20,474 AF)
2077	0 AF	177 AF	177 AF
Total*	**0 AF**	**21,180 AF**	**21,180 AF**

Comments: Influent for the Carlsbad WRF comes from effluent from the Encina Water Pollution Control Facility (EWPCF), which discharges waste to the Encina Ocean Outfall. Water delivered by this project would increase use of EWPCF effluent, thereby directly reducing the volume of wastewater discharged to the outfall by an amount equal to the water deliveries by the project. Total water deliveries from the project are calculated under the Primary Physical Benefit (see **Table 3-31**), above.

Sources: (influent source) CMWD. 2011. 2010 Urban Water Management Plan. Pg. 5-1; (discharge of EWPCF effluent to outfall) CMWD. 2011. 2010 Urban Water Management Plan. Pg. 5-1.

*Some difference may occur due to rounding

Table 3-38: Physical Benefit J-Reduce Need for Fertilizer Application
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*
Type of Benefit Claimed: Reduce Need for Fertilizer Application
Units of the Benefit Claimed: Lbs

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 lbs	0 lbs	0 lbs
2015	0 lbs	0 lbs	0 lbs
2016	0 lbs	0 lbs	0 lbs
2017	0 lbs	7,727 lbs	7,727 lbs
2018	0 lbs	15,455 lbs	15,455 lbs
2019-2076	0 lbs/yr (0 lbs)	15,455 lbs/yr (896,388 lbs)	15,455 lbs/yr (896,388 lbs)
2077	0 lbs	7,727 lbs	7,727 lbs
Total*	**0 lbs**	**927,298 lbs**	**927,298 lbs**

Comments: Carlsbad uses a mix of recycled water supplies to meet recycled water demands: Carlsbad WRF, Meadowlark WRF, and Gafner WRF. Of these three sources, Recycled water produced at the Carlsbad WRF is permitted to contain up to 45 mg/L of nitrate, but actual water quality from the Carlsbad WRF and Meadowlark WRF is not available. Gafner WRF water quality indicated nitrate levels of 16.1 mg/L (43.8 lb/AF). This was used as a conservative estimate of nitrate levels in all recycled water delivered by Carlsbad for the purposes of this benefit analysis. Potable water is assumed to have negligible nitrate concentration (0 mg/L or 0 mg/AF). This analysis assumes that the turf management workshops included in the project will cause customers served by the project to reduce fertilizer application commensurate with the increase in nutrient level of water used for irrigation. When full benefits are realized (353 AFY, see Primary Physical Benefit, **Table 3-15**), this project will deliver 15,455 lbs/year nitrate, resulting in an equal amount of fertilizer offset by the project.

<u>Source: (nitrate concentration of Carlsbad WRF water)</u> San Diego Regional Water Quality Control Board. 2012. Master Reclamation Permit with Waste Discharge Requirements for the Production and Purveyance of Recycled Water for Carlsbad Municipal Water District, Carlsbad Water Recycling Facility, San Diego County (Order No. 2001-352 as amended by Order R9-2012-0027). Pg. 3; (nitrate from Gafner WRF water) Carlsbad Municipal Water District. 2012. Recycled Water Master Plan. January. Table 4.3 (pg. 4-7).

*Some difference may occur due to rounding

Table 3-39: Physical Benefit L-Increase Local Treatment Capacity for Future Recycled Water Delivery
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*
Type of Benefit Claimed: Increase Local Treatment Capacity for Future Recycled Water Delivery
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	0 AF	0 AF
2016	0 AF	0 AF	0 AF
2017	0 AF	944 AF	944 AF
2018	0 AF	1,887 AF	1,887 AF
2019-2076	0 AFY (0 AF)	1,887 AFY (109,463 AF)	1,887 AFY (109,463 AF)
2077	0 AF	944 AF	944 AF
Total*	**0 AF**	**113,237 AF**	**113,237 AF**

Comments: This project will increase capacity at Carlsbad WRF from 4 MGD to 6 MGD, an increase of 2 MGD, or 2,240 AFY (see Attachment 4). This project will deliver 353 AFY of this to customers (see Primary Physical Benefit, **Table 3-31**), while the remaining capacity (1,887 AFY) is available for future recycled water delivery.

Source: (existing Carlsbad WRF capacity) CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pg. 71.

*Some difference may occur due to rounding

Technical Analysis of Physical Benefits Claimed: Carlsbad Recycled Water Plant and Distribution System Expansion

Technical Basis of the Project

The primary physical benefit of the *Carlsbad Recycled Water Plant and Distribution System Expansion* project is increasing recycled water production and delivery, thereby directly reducing potable water demands. The volume of recycled water delivered by the project was calculated as the sum of the water that will be delivered by each component of the project and the ability to meet these water deliveries on a year-round basis by increasing the capacity of the Carlsbad Water Reclamation Facility (WRF). Carlsbad's *Phase III Recycled Water Project Feasibility Study* (Feasibility Study) includes a detailed customer database for various proposed pipeline expansion segments and identifies customers that are located adjacent to existing recycled water pipelines (see **Figure 3-10**). The scope of work for the *Carlsbad Recycled Water Plant and Distribution System Expansion* project includes specific components of Carlsbad's Phase III Recycled Water Project (Phase III Project) defined in the Feasibility Study, including expanding the Carlsbad WRF by 2 MGD, completing pipeline expansion segments 1a and 7, delivering water to existing customers that are adjacent to the recycled water system but do not currently receive recycled water (adjacent-to-existing customers), and providing recycled water to existing recycled water users that receive potable water to supplement demands during dry months (see **Figures 3-11** and **3-12**).

Pipeline expansion segment 1a will deliver 99 AFY to seventeen new recycled water customers and require construction of 2,400 linear feet of 8-inch pipelines, 2,900 linear feet of 6-inch pipelines, 4,100 linear feet of 4-inch pipelines, and 56 service laterals.[139] Pipeline expansion segment 7 will deliver 98 AFY to three new recycled water customers and require construction of 1,800 linear feet of 8-inch pipelines, 5,000 linear feet of 6-inch pipelines, and 700 linear feet of 4-inch pipelines.[140] Deliveries to new adjacent-to-existing recycled water customers will be 126 AFY to serve thirty total customers.[141] Note that for the adjacent-to-existing customers, demands are only included for those customers that will be served through onsite retrofits, which is the only part of the adjacent-to-existing portion of the Phase III Project that is included in this grant application. In total, this project will provide 323 AFY of recycled water to new recycled water users within Carlsbad's service area.

Expansion of the Carlsbad WRF will involve increasing the total capacity of the facility from 4 MGD to 6 MGD. The expansion will require construction of granular media filtration feed pumps, granular media filtration, disinfection through a chlorine contact basin, plant controls, a flow equalization storage basin, and a recycled water pump station. [142]

Carlsbad's *Recycled Water Master Plan* shows that during dry months demands for recycled water are greater than supply, and Carlsbad must provide potable water to supplement recycled supply to meet existing demands. In 2010, 30 AFY of potable water was used to supplement Carlsbad's recycled supply.[143] However, because the proposed project includes expansion of the tertiary treatment capacity of the Carlsbad WRF, the project will provide an additional 30 AFY of recycled water to existing customers to eliminate the need to supplement their supplies with potable water. Therefore, the total volume of recycled water delivered by this project is 353 AFY, which is made possible through expansion of the Carlsbad WRF, expansion of the recycled water distribution system (segments 1a and 7), and connection of adjacent-to-existing users. **Table 3-40** shows the demands that will be met by each portion of the project.

[139] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pp. 44, 55, and 56.
[140] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pp. 44, 63, and 64.
[141] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pg. 44
[142] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pp. 71 and 72.
[143] CMWD. 2012. Recycled Water Master Plan. January. Table 4.2 (pg. 4-3)

Table 3-40: Demands met by Carlsbad Recycled Water Plant and Distribution System Expansion

Project Component	Recycled Water Demand
Expansion Segment 1A	99 AFY
Expansion Segment 7	98 AFY
Adjacent-to-Existing (Retrofits)	126 AFY
Existing Users	30 AFY
Total	**353 AFY**

Project Phasing

The project has an estimated 60-year life, and is expected to deliver 21,180 AF of recycled water over the course of its useful life. Due to the Carlsbad recycled water system's inability to meet current recycled water demand on a year-round basis, as evidenced by the need for supplemental potable water, it is assumed that no additional recycled water will be delivered until the Carlsbad WRF expansion is complete. As shown in Attachment 6, performance testing (Subtask 10.4) will be completed in June 2017. Recycled water deliveries will begin following this, in July 2017 for all customers. For 2017, this means that 50% of the annual benefit from the project will be realized (benefits accrued July-December, 2017 – 6 months – or 50% of the year). From 2018 through 2076, full annual benefits will be realized. Because benefits have been phased in during the first year of operation, they must also be phased out in the final year of the project (i.e., in the final year, the benefit accrued is 100% less the % benefit realized in the first year), therefore in the final year of the project, 2077, benefits will be 50% of the annual benefit. This works out to a total of 720 months of benefits over the project life, or 60 full years of benefit accrual. Additional details about project phasing as it relates to benefit accrual are provided in **Appendix 3-1**.

The primary physical benefit of increased recycled water production and use and reduced potable water demand is shown over the course of the project life in **Table 3-29**. There are a number of secondary benefits that will be realized as a result of this primary physical benefit. These secondary benefits are summarized in **Table 3-28**, and presented in greater detail in **Tables 3-30** through **3-39**.

Background for Benefits Claimed

As described previously, the primary physical benefit associated with the *Carlsbad Recycled Water Plant and Distribution System Expansion* project of increasing recycled water use by 353 AFY to offset potable water demand results in a number of additional benefits. The information presented below provides the background and context for the project, the Region, and the basis for each of the benefits that will accrue as a result of the project. Additional details about how each benefit was calculated are included in the Methods Used to Estimate the Physical Benefits section, below.

Primary Physical Benefit-Increased Recycled Water Use to Offset Potable Water Demand

The *Carlsbad Recycled Water Plant and Distribution System Expansion* is part of the Carlsbad Phase III Project and implements the Carlsbad WRF expansion, pipeline expansion segments 1a and 7, and deliveries to new adjacent-to-existing recycled water customers.[144] The Phase III Project is the latest phase of the Carlsbad *Recycled Water Master Plan*, an ongoing and updated plan to implement a recycled water program in Carlsbad's service area that began in 1990.[145] Carlsbad has served recycled water to its customers since 1993 and currently serves recycled water to its customers from three sources: Carlsbad WRF, Gafner WRF, and Meadowlark WRF. Refer to **Figure 3-9** for an overall map of the Carlsbad recycled water system, including connectivity between Carlsbad WRF, Gafner WRF, and Meadowlark WRF.

The Carlsbad WRF is owned by Carlsbad and operated by Encina Wastewater Authority and currently has a capacity of 4 MGD.[146] The Carlsbad WRF is located immediately south of the Encina Water

[144] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June.
[145] CMWD. 2012. Recycled Water Master Plan. January.
[146] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pg. 71.

Pollution Control Facility (EWPCF), which is owned and operated by the Encina Wastewater Authority. EWPCF is a 36 MGD facility that treats wastewater flows from members of the Encina Wastewater Authority to secondary levels.[147] Other members of the Encina Wastewater Authority include Vallecitos Water District, City of Vista, Buena Sanitation District, Leucadia Wastewater District, and the City of Encinitas; all members are responsible for their individual wastewater collection systems that feed EWPCF.[148] Carlsbad has ownership capacity of 10.26 MGD of secondary flows from EWPCF, a portion of these flows are sent to the Carlsbad WRF for additional treatment to tertiary levels, and any excess flows from EWPCF that are not treated to tertiary levels are disposed of in the ocean through the Encina Ocean Outfall.[149] Carlsbad WRF was master planned to be expanded to up to 16 MGD and must be expanded beyond its current 4 MGD capacity to beneficially reuse existing flows that are available from EWPCF and currently discharged to the ocean.[150]

Carlsbad also purchases recycled water from Gafner WRF (up to 0.75 MGD) and Meadowlark WRF (up to 3 MGD) through agreements with Leucadia Wastewater District and Vallecitos Water District, respectively.[151] Although these supplies are generally able to meet the demands of Carlsbad's current recycled water distribution system, during summer months, approximately 30 AFY of potable water must be used to supplement recycled supplies, indicating that additional supplies are not readily available for additional recycled water users within the Carlsbad service area.[152] The inability for the current recycled water supplies to meet current year-round demands indicates the need for additional recycled water supplies to expand water use within the Carlsbad service area in accordance with the Carlsbad Recycled Water Master Plan.

Phase I of Carlsbad's overall recycled water planning effort began in 1990 and Phase II of the overall effort was completed in 2008. Upon completion of the Phase II effort and recognizing the availability and demand for recycled water within the Carlsbad service area, in 2012 Carlsbad completed a Recycled Water Master Plan with the goal of evaluating the overall recycled water system to define the most cost-effective system expansions and develop a plan for build out of an additional Phase III system.[153] Following completion of the 2012 Recycled Water Master Plan, Carlsbad completed a Feasibility Report for Phase III, which further-defined supplies, demands, and overall build-out of the Phase III system, including expansion of the Carlsbad WRF. Overall, Phase III includes expansion of Carlsbad's recycled water system in eight separate extensions, which include segments 1A and 7 (see **Figure 3-10**). The recycled water projects included within the Phase III system were evaluated for their potential environmental impacts in a Mitigated Negative Declaration that was completed in November of 2012.

As part of Carlsbad's vision for recycled water use in its service area, Carlsbad issued a mandatory use ordinance, which requires recycled water to be used wherever it is "economically justified, financially and technically feasible, and consistent with legal requirements, preservation of public health, safety and welfare, and the environment."[154] The Phase III Project developed an extensive customer database of potential recycled water users, including existing sites that could be connected via retrofits, and planned sites that could be connected as new development. Water demands to be met by the *Carlsbad Recycled Water Plant and Distribution System Expansion* project are all found in the customer database in Appendix B of the *Phase III Feasibility Study*.[155]

Given the existing infrastructure in place, the technical and environmental documentation that has been completed by Carlsbad, permitting that is in place, and the mandatory use ordinance, it is fully certain that the *Carlsbad Recycled Water Plant and Distribution System Expansion* project will result in beneficial reuse of 353 AFY of recycled water that will be produced by the Carlsbad WRF.

[147] CMWD. 2012. Recycled Water Master Plan. January. Pg. 2-1 and Pg. 4-18.
[148] CMWD. 2012. Recycled Water Master Plan. January. Pp. 2-1 to 2-2.
[149] CMWD. 2011. 2010 Urban Water Management Plan. June. Pg. 5-1
[150] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pg. 71
[151] CMWD. 2012. Recycled Water Master Plan. January. Pg. 3.
[152] CMWD. 2012. Recycled Water Master Plan. January. Table 4.2 (Pg. 4-3).
[153] CMWD. 2012. Recycled Water Master Plan. January. Pg. 1.
[154] CMWD. 2005. Ordinance No. 43. June. Pg. 1. Note that this ordinance replaced Ordinance No. 31, which also mandated recycled water use.
[155] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Appendix B (pg. 124).

Benefit A-Avoid Imported Water Supply Purchases and Benefit C-Local Supply Development to Decrease Vulnerabilities

The entirety of Carlsbad's potable water supply is purchased from SDCWA, the imported water wholesaler for San Diego County.[156] SDCWA supplies include local surface water and imported water purchased from MWD and acquired through canal lining projects and transfers from IID.[157] MWD supplies include water from the SWP and the Colorado River, while water from IID is supplied from the Colorado River. The amount of water imported into the Region varies depending on hydrologic conditions, but in recent years the Region's water supply has consisted of between 79% and 93% imported water.[158] Using a 5-year average, approximately 83% of the Region's water was imported.[159] By 2010, the SDCWA had decreased reliance on MWD imports to 59% (331,825 AF), with increased use of IID transfers (13% or 70,000 AF), canal lining transfers (14% or 80,200 AF), and member agency local sources (14% or 76,100 AF).[160] As shown in SDCWA's 2010 UWMP, during dry years, imported water will constitute a larger proportion of SDCWA's supplies due to reduced surface water flows.[161] SDCWA supplies are purchased only to meet demand that cannot be met with local supplies by member agencies, per SDCWA's demand projection methods described in its UWMP.[162] Although SDCWA and its member agencies use a mix of imported water and local sources to supply their customers, imported water is more expensive to provide and is considered to be the marginal water source.[163] Thus, any new supplies that are available in the Region (such as recycled water) will be used to offset purchase of imported water supplies.

The Region's high reliance on imported water potentially jeopardizes the ability to meet local demands during times when imported water supply deliveries are interrupted or become too costly. As a result, SDCWA has identified supply diversification as a key strategy to improve water supply reliability.[164] This goal has been applied throughout the Region by its inclusion in the *2013 San Diego IRWM Plan* as Objective E, which was prioritized over other IRWM Objectives and weighted so heavily that projects needed to meet this objective in order to be successful in the project scoring process for inclusion in this expedited funding application.[165] The Region is located at the bottom of both of its imported water distribution systems, making it potentially vulnerable to disruptions anywhere along the imported water pipelines, which traverse a large part of the state. Increasing local supplies or otherwise offsetting imported water demand will help to reduce water supply vulnerabilities by increasing supply diversification and providing a buffer to potential changes in imported water supply availability.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

Reduced demand for imported water will also reduce demands for water from the Bay-Delta, which supplies water to the SWP. In a normal year, approximately two-thirds of SDCWA's imported supplies are SWP supplies.[166] As noted in Attachment 2, SWP deliveries are restricted during times of drought, due to reduced flows required to meet the needs of people and ecosystems. Management of the Bay-Delta system requires balancing supplies to meet the needs of people and the needs of sensitive

[156] CMWD. 2011. 2010 Urban Water Management Plan. June. Pg. 4-1.
[157] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 1-8
[158] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-26.
[159] Pers. Comm. Dana Friehauf, SDCWA, Acting Water Resources Manager. June 18, 2014. Available: 858-522-6749. (Attachment 2).
[160] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 4-4, 4-6, and 6-1.
[161] SDCWA. 2011. 2010. Urban Water Management Plan. June. Pp. 9-3 to 9-7.
[162] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[163] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10. Note that despite desalinated water's high cost, the San Diego IRWM region's priority is to reduce dependence on imported water (IRWM Plan, 2007).
[164] SDCWA. 2008. Strategic Plan. April. Pg. 9.
[165] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (excerpted in this application in Appendix 1-5).
[166] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8

ecosystems.[167] The CALFED Bay-Delta Program (now managed by the Delta Stewardship council) established four objectives[168]:

- *Water Quality*: to invest in projects that improve the State's water quality from source to tap.
- *Water Supply*: comprised of five critical elements: conveyance, storage, environmental water account, water use efficiency and water transfer.
- *Ecosystem Restoration*: aims at restoring habitats, ecosystem functions, and native species.
- *Levee Integrity*: to protect water supplies by reducing the threat of levee failures.

Reduced demand for imported water will reduce demand for pumping from the Bay-Delta, allowing more water to be available to help meet these needs (refer to Attachment 7).

Benefit D-Reduce Net Production of Greenhouse Gases and Benefit E-Avoid Social Costs of Greenhouse Gases

Imported water is an energy intensive water supply for the San Diego Region, requiring more than three times the energy required for recycled water on average.[169] Reduced demand for imported water through the use of recycled water therefore offsets the net production of GHGs. GHGs are the primary cause of climate change, which is anticipated to have impacts on the Region. The *2013 San Diego IRWM Plan* incorporated the results of a Climate Change Planning Study for the Region, which describes the Region's vulnerabilities and highest priorities related to climate change. Potential climate change-related impacts to the Region include temperature increases, increased variability in rainfall, decreased availability of imported water supplies, increased water demands, increased wildfires, and sea level rise.[170] A vulnerability analysis of the effects of climate change on the Region found that the highest priority to help the Region reduce its vulnerability to climate change impacts is to decrease imported water supply, followed by supply impacts from higher drought potential, water quality issues from increased concentration of pollutants, increased flooding from extreme weather, decrease in habitat, inundation of storm and sewer systems from sea level rise, and a decrease in ecosystem services.[171] These impacts have ongoing social cost impacts, such as public health, infrastructure improvements, and impacts to the economy.

Benefit H-Reduce Discharge to Outfall and Benefit L-Increase Local Treatment Capacity for Future Recycled Water Delivery

In addition to contributing to the Region's supply diversification goal, the *Carlsbad Recycled Water Plant and Distribution System Expansion* project supports local efforts in northern San Diego County to regionalize recycled water systems. The North San Diego Water Reuse Coalition (Coalition), comprising ten water and wastewater agencies in northern San Diego (including Carlsbad), has been working to develop an interconnected regional recycled water system to maximize recycled water resources. A North San Diego County Regional Recycled Water Project: Regional Recycled Water Facilities Plan (Facilities Plan) was developed in 2012 to identify existing recycled water resources, determine opportunities for connections, and develop a comprehensive understanding of the potential to optimize local recycled water systems.[172] As part of this local regionalization of recycled water systems, improved utilization of existing facilities, such as WRFs or outfalls, is required. The Carlsbad WRF expansion will be able to help support the demands projected by Carlsbad under the Phase III project and potentially could be used to support the larger regional vision for recycled water use in northern San Diego County. Further, the project will reduce discharges to the Encina Ocean Outfall (EOO) by increasing the use of water that is

[167] Delta Stewardship Council. 2013. The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value. Pp. 10-11.
[168] CALFED Bay-Delta Program Archived Website. CALFED Objectives. Accessed 28 June 2014. Available: http://calwater.ca.gov/
[169] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10
[170] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-15 (pg. 7-38).
[171] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-16 (pg. 7-39).
[172] RMC. 2012. North San Diego County Regional Recycled Water Project: Regional Recycled Water Facilities Plan. May. Revised February 2013.

currently discharged to the EOO.[173] Reducing wastewater discharges helps to maximize local water supplies and also frees up capacity at the EOO to support additional projects, potentially reducing the potential need to upsize the outfall – a costly endeavor.

Benefit F-Contribute to 20x2020 Goals

Recycled water also serves to meet 20x2020 goals, by offsetting potable demand. Senate Bill x7-7 (SBx7-7) was passed as part of plans to improve the Bay-Delta. The 20x2020 Water Conservation Plan (20x2020 Plan) was developed to define the goals of the SBx7-7 legislation and provide guidance for compliance for urban water suppliers affected by the legislation, which mandated a 20% reduction in California's per capita water use by 2020.[174] The 20x2020 Plan allows recycled water to be applied towards urban water suppliers' compliance with the 20x2020 goals, because recycled water offsets potable supply and does not constitute a new supply.[175] Each urban water supplier was required to set its 20x2020 goal in its 2010 UWMP. Carlsbad's 20x2020 goal is to reduce water use to 207.1 gpcd by 2020.[176] As noted in the 20x2020 Plan, the statewide mandated water use reductions are designed to protect the Bay-Delta, but will also have a number of secondary benefits. For example, the 20x2020 plan will help to reduce energy consumption, because approximately one-fifth of the electricity used in California is allocated to water delivery, treatment, and use, and one-third of natural gas not used in power plants is used for the same purpose.[177]

Benefit G-Reduce Water Costs to Customers

In addition to its high energy intensity, imported water has a greater cost to customers than recycled water. The costs of imported water incorporate costs related to pumping and treating supplies, maintaining and constructing infrastructure, and the costs of wheeling water through MWD and SDCWA. Conversely, because recycled water is locally-produced and not treated to potable levels, it often costs less than imported water to produce and use. For Carlsbad, potable water, which is purchased from SDCWA, that is used for irrigation costs $4.22 per hundred cubic feet (HCF), while recycled water costs customers only $3.53/HCF. [178] Converting to recycled water for irrigation, therefore, provides direct cost savings benefits to customers of $0.69/HCF in 2014. As such, in 2014, using recycled water for irrigation cost users approximately 84% of the cost of using potable water for irrigation. Projected increases in imported water costs show imported water costs continuing to increase over time.[179] Reduced reliance on imported water from the *Carlsbad Recycled Water Plant and Distribution System Expansion* project provides additional cost savings by providing a buffer against fluctuating costs associated with imported water.

Benefit J-Reduce Need for Fertilizer Application and Benefit I-Reduce Stormwater Loading of Pollutants

Additional cost savings to customers include the reduced need for fertilizer. Recycled water has a higher nutrient content than potable water. As described in the methodology for Benefit J, below, recycled water applied by customers in Carlsbad can have up to 45 mg/L nitrate concentrations, consistent with the Water Quality Control Plan for the San Diego Basin (Basin Plan). [180] While potable water supplies do not have a significant amount of nitrates. As described in Attachment 4, Work Summary, the *Carlsbad Recycled Water Plan and Distribution System Expansion* project will include outreach activities to recycled water users to provide information about nitrate concentrations and the reduced need to apply nitrates (fertilizer) as a result of using recycled water in lieu of potable water.

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[173] CMWD. 2012. Recycled Water Master Plan. January. Pg. 4-1.
[174] DWR et al., 2010. 20x2020 Water Conservation Plan. February. Pg. ix.
[175] DWR et al. 2010. 20x2020 Water Conservation Plan. February. Pg. 3.
[176] CMWD. 2011. 2010 Urban Water Management Plan. June. Pg. 3-8.
[177] DWR, et al., 2010. 20x2020 Water Conservation Plan. February. Pg. 1.
[178] CMWD. 2014. Water Rates. Refer to 2014 rates for Irrigation and for Recycled Water.
[179] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (Pg. 44).
[180] San Diego Regional Water Quality Control Board. 2012. Master Reclamation Permit with Waste Discharge Requirements for the Production and Purveyance of Recycled Water for Carlsbad Municipal Water District, Carlsbad Water Recycling Facility, San Diego County (Order No. 2001-352 as amended by Order R9-2012-0027). Pg. 3.

Because recycled water can have higher concentrations of constituents (nitrates, salts, etc.) compared to potable water, use of recycled water is more restrictive than use of potable water. Specifically, recycled water permits restrict water use to minimize runoff from irrigation.[181] Reducing runoff from irrigation is a substantial regional benefit as runoff is a substantial contributor to water quality issues and degradation in the Region.

Without Project Baseline

Without the *Carlsbad Recycled Water Plant and Distribution System Expansion* project, the Carlsbad WRF would remain at its current capacity of 4 MGD and Carlsbad would continue to use potable water to supplement recycled when supplies are inadequate to meet demand. Potential recycled water customers that would be served by pipeline extensions 1a and 7 as well as existing-to-adjacent users would continue to use potable water for irrigation, which in turn would continue Carlsbad's reliance on water purchases from SDCWA. Further, without the project there would be fewer local water supplies to offset potable water demands and imported water, if available, would continue to be purchased to meet the needs of the customers that would have been served by the project. As a result, all of the project-specific impacts related to offsetting imported water, such as GHG emissions, social costs of GHGs, and increased costs to customers would continue to be incurred. Without the Carlsbad WRF expansion, if the Phase III project is implemented, large amounts of potable water would need to be purchased to supplement recycled supplies, and the potential to realize the full benefits of participation in the North San Diego Water Reuse Coalition would be lost.

Methods Used to Estimate the Physical Benefits

Methods used to estimate the primary physical benefit – namely via reference to technical documentation – were described above under Technical Basis of the Project.

Benefit A-Avoid Imported Water Supply Purchases

Local supplies, such as surface water, groundwater, and recycled water, will always be used first to meet local demands per designation of imported water as a marginal water supply. Carlsbad and SDCWA purchase imported water to meet any demands that cannot be met with local supplies. SDCWA is the imported water purveyor for the Region, and its projected water demands (sales) are based on total demands minus local supplies from its 24 member agencies,[182] including Carlsbad. Increased local supplies result in an equivalent volume of avoided imported water purchases. Recycled water is a local supply, therefore the *Carlsbad Recycled Water Plant and Distribution System Expansion* will offset 353 AFY imported water, or a total of 21,180 AF over the 60-year life of the project, based on the total water delivered by the project, as described above. **Table 3-30** shows the avoided water purchases from the project over its life.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described in Benefit A, all of the water produced and delivered by the *Carlsbad Recycled Water Plant and Distribution Expansion* project will offset imported water purchases. Carlsbad purchases imported water from SDCWA, whose supply mix includes imported water, surface water, and recycled water. As described under Benefit A, local supplies, including surface water and recycled water, are used first, and any increase in local supplies will reduce imported water demand. During a normal year, SDCWA's imported water supply consists of two-thirds SWP supplies and one-third Colorado River supplies. As described in Attachment 2, SWP deliveries have been reduced to 5% of allotments for 2014, and are anticipated to decrease to 0% if drought conditions continue into 2015. During drought years, assumed to be 2014 and 2015, the SWP portion of SDCWA's imported water mix is 15%[183], while the normal two-thirds proportion is used for other years, assuming drought conditions cease. **Table 3-31** shows the

[181] San Diego Regional Water Quality Control Board. 2012. Master Reclamation Permit with Waste Discharge Requirements for the Production and Purveyance of Recycled Water for Carlsbad Municipal Water District, Carlsbad Water Recycling Facility, San Diego County (Order No. 2001-352 as amended by Order R9-2012-0027). Pg. 26.
[182] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[183] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

reduced demand for net diversions from the Bay-Delta resulting from this project's offset of imported water (14,120 AF over the 60-year life of the project). These reduced demands for net diversions from the Bay-Delta were calculated as the proportion of offset imported water (Benefit A) that would be sourced from the SWP in accordance with SDCWA's imported water mix.

Benefit C-Local Supply Development to Decrease Vulnerabilities

As described in SDCWA's 2010 UWMP, supply diversification is a key strategy to improve long-term reliability of supplies.[184] Specifically, the Region has a goal to improve the reliability and sustainability of regional water supplies, with part of the associated supply diversification objective to encourage the development of local water supplies.[185] As described in Attachment 2, imported water supplies and surface water supplies are vulnerable to reduced deliveries during drought. Further, the Region is located at the end of both of its imported water systems, increasing the risk of delivery interruptions from accidents, natural disasters, such as seismic events or weather events exacerbated by climate change, or other events.

Any new local supply development or conservation effort would reduce the Region's vulnerability to these and other supply interruptions. The *Carlsbad Recycled Water Plant and Distribution System Expansion* project will produce and deliver new local supply in the form of recycled water. Recycled water is a drought-proof supply, which reduces the Region's vulnerability to supply shortages during drought, as well as vulnerabilities inherent to the Region's reliance on imported water. The local supply development to decrease vulnerabilities that is attributable to the project is calculated as the amount of local supply produced and delivered by the project – 353 AFY, or 21,180 AF over the life of the project, as calculated above. Benefit C is shown in **Table 3-32** for the life of the project.

Benefit D-Reduce Net Production of Greenhouse Gases

As described under Benefit A, the recycled water delivered by the *Carlsbad Recycled Water Plant and Distribution System Expansion* project would directly offset imported water purchases by Carlsbad. GHG reduction from this imported water offset can be calculated as the difference of GHG emissions between imported water and recycled water in the Region. Potable water from imported supplies is an energy intensive water supply. For delivery to the Region, imported water requires pumping over large distances, in addition to the treatment of raw water to potable standards. The 2010 Equinox Report estimates energy required to convey and treat imported water delivered to the customers in the Region is between 2,000 kWh/AF and 3,300 kWh/AF,[186] or an average of 2.65 MWh/AF. In contrast, the 2010 Equinox Report estimates recycled water energy intensity is between 600 kWh/AF and 1,000 kWh/AF,[187] or an average of 0.8 MWh/AF. Every AF of imported water offset by recycled water results in 1.85 MWh energy savings.

These assumptions are presented in the bullets below:

- Energy intensity of recycled water: 0.8 MWh/AF
- Energy intensity of imported water: 2.65 MWh/AF
- Energy savings resulting from the project: 1.85 MWh/AF

Converting from energy use to CO2e emissions requires a breakdown of California electricity sources. California uses a mix of energy sources, each of which produces a different amount of GHG emissions; these emissions are generally reported as carbon dioxide equivalence (CO2e) by the USEPA.[188] California generates 70% of its electricity through a combination of hydroelectric, nuclear, coal, oil, natural gas, geothermal, biomass, wind, solar, and other. California also imports 30% of its energy from other regions; 10% of California's electricity is imported from the Pacific Northwest, and the remaining 20%

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[184] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.
[185] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (available in this application as Appendix 1-5)
[186] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[187] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[188] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

imported from the Pacific Southwest.[189] Emission rates in lbs of CO2e per MWh will vary based on the energy source, but can be estimated across regions, per the EPA's eGRID. California production was eGRID subregion WECC California, the Pacific Northwest is WECC Northwest, and the Pacific Southwest is WECC Southwest. Each of these regions has a CO2e emission rate of 613.28, 846.97, and 1,182.89 lbs/MWh, respectively.[190] Taking a weighted emissions rate (using the percentage of electricity produced in each region), the average emissions for electricity in California is 750.57 lbs/MWh of CO2e. With 2204.62 lbs per MT, a standard conversion rate for California can be calculated as 0.341 MT of CO2e per MWh of electricity. Applying this number to the energy intensity of imported water, recycled water, and the difference between the two, finds GHG reduction of 13,361 MT CO2e over the 60-year life of the project. These benefits are provided by year in **Table 3-33** and summarized in the bullets below:

- Energy savings resulting from the project: 1.85 MWh/AF
- Average GHG in California energy grid: 0.341 MT/MWh
- Resulting GHG reductions resulting from the project: 0.631 MT of CO2e/AF
- Annual GHG reductions resulting from the project (assuming 353 AFY of recycled water produced by the project): 223 MT CO2e/year
- Cumulative GHG reductions over project lifetime: 13,361 MT CO2e

Benefit E-Avoid Social Costs of Greenhouse Gases

There are social costs associated with increased GHG emissions related to air quality impacts and climate change. The social cost of carbon is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present.[191] Such costs include, but are not limited to, impacts to agricultural productivity, human health, increased flood risk and associated damages, and ecosystem services and their values.[192] The recommended mean estimate of the social cost of one MT of CO2 in 2014 is $24.55. This is updated from the 2007 value of $21.40 reported by the Interagency Working Group on Social Cost of Carbon[193], using the CPI Inflation Calculator.[194] An estimate of the social costs of carbon avoided by the project can be calculated by applying this $24.55/MT CO2 to the emissions savings from Benefit D. **Table 3-34** shows the avoided social costs of carbon from the *Carlsbad Recycled Water Plant and Distribution System Expansion* project.

Benefit F-Contribute to 20x2020 Goals

SBX7-7, also known as 20x2020, is legislation passed in 2000 that requires urban water suppliers to reduce their daily per capita water use by 20% by 2020. Carlsbad's 20x2020 goal is reported in its UWMP as 207.1 gpcd.[195] This is a reduction of 51.8 gpcd from the baseline value of 258.9 gpcd (207.1 gpcd = 80% of baseline value → baseline = 207.1 gpcd/0.8 →baseline = 258.9 gpcd). The legislation allows recycled water to contribute towards 20x2020 goals, because recycled water is not a new water supply source.[196] The *Carlsbad Recycled Water Plant and Distribution System Expansion* project will offset potable water use with recycled water, thereby contributing to Carlsbad's 20x2020 goals. Contribution to

[189] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html
[190] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/
[191] IPCC. 2007. Summary for policymakers. In Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. ML Perry, OF Canziani, JP Palutikof, PJ van der Linden, and CE Hanson (eds.). Cambridge University Press. Cambridge, UK. Pg. 17.
[192] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 1
[193] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28).
[194] U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm
[195] CMWD. 2011. 2010 Urban Water Management Plan. June. Pg. 3-8.
[196] DWR, et.al. 2010. 20x2020 Water Conservation Plan. February. Pg. 3.

these 20x2020 goals was calculated by converting the recycled water produced and used by the project (presented in AF in Benefit A) to gpcd using the 2020 population estimates (94,101 people[197]) found in Carlsbad's UWMP. Population estimates from 2020 were used because that is the year by which the 2020 goals must be met. The project's contribution to meeting 20x2020 goals is gpcd from the project (3.4 gpcd once full benefits realized) as a percentage of Carlsbad's overall gpcd reduction goal (51.8 gpcd) is 6.5% as shown in **Table 3-35**. Because the 20x2020 goals must be met by 2020, the benefit is only calculated to 2020, rather than through the full life of the project. The 20x2020 calculation for the *Carlsbad Recycled Wafer Plant and Distribution System Expansion* project is shown in **Table 3-35** and articulated below:

- Carlsbad's 2020 gpcd reduction target: 51.8 gpcd
- Amount of water from the project that will contribute to 20x2020 goals (amount of recycled produced and delivered in 2020): 353 AFY or 315,138 gallons per day
- GPCD reduction provided by the project in 2020 (315,138 gallons per day/94,101 people): 3.3 gpcd
- Percent contribution towards 20x2020 goals (3.3 gpcd/51.8 gpcd): 6.5%

Benefit G-Reduce Water Costs to Customers

The recycled water delivered by the project will serve customers who currently purchase potable water for their irrigation needs. As described above, the project will offset an amount of potable water use equal to the amount of recycled water delivered, or 353 AFY. Recycled water rates for Carlsbad customers are lower than potable water. Recycled water costs $3.53 per HCF. Potable water for irrigation costs $4.22/HCF.[198] Converting from potable water to recycled water is a savings or $0.69/HCF. Assuming that the cost ratio between potable and recycled water remains constant to incentivize recycled water use even through fluctuations in cost, the cost of recycled water is 83.6% the cost of imported water for customers. Water costs to the customers converting from potable to recycled water from this project would therefore be reduced 16.4% as shown in **Table 3-36**.

Benefit H-Reduce Discharge to Outfall

The Carlsbad WRF receives influent from the EWPCF.[199] The EWPCF produces more effluent to secondary than it currently sells to water recycling and water reclamation facilities for additional treatment to tertiary and use as recycled water. Excess secondary water from the EWPCF is discharged to the EOO. Increasing recycled water use in Carlsbad's service area means that the Carlsbad WRF will purchase more secondary water from EWPCF, reducing discharge to the outfall by an amount equal to the recycled water delivered by the project, or 353 AFY (see **Table 3-37**). Although it is not quantified here as part of the reduced discharge to the outfall, the expanded Carlsbad WRF will be able to reduce these discharges further, freeing additional capacity at the outfall for other uses. Carlsbad is a member of the North San Diego Water Reuse Coalition, a coalition of ten water and wastewater agencies seeking to increase water reuse and share resources. Freeing capacity in the outfall will allow greater flexibility for the Coalition to implement projects supporting this goal.

Benefit I-Reduce Stormwater Loading of Pollutants

Although recycled water is higher in nutrients and other constituents than potable water (see Benefit J, below), conversion from potable water to recycled water can lead to a reduction of stormwater loading of pollutants. Recycled water use is restricted by its permit to minimize runoff, misting, and ponding.[200] The turf management workshops that will be conducted by the project (see Work Plan) will improve understanding of proper landscaping care, reducing the amount of excess fertilizer or pesticides applied to the areas to be irrigated by the project, as well as reminding attendees about the proper use of

[197] CMWD. 2011. 2010 Urban Water Management Plan. June. Table 3-1 (pg. 3-1).
[198] CMWD. 2014. Water Rates. Refer to 2014 rates for Irrigation and for Recycled Water.
[199] CMWD. 2012. Recycled Water Master Plan. January. Pg. 4-1.
[200] San Diego Regional Water Quality Control Board. 2012. Master Reclamation Permit with Waste Discharge Requirements for the Production and Purveyance of Recycled Water for Carlsbad Municipal Water District, Carlsbad Water Recycling Facility, San Diego County (Order No. 2001-352 as amended by Order R9-2012-0027). Pg. 26.

recycled water for irrigation. The exact amount of pollutant loading avoided by the project is too difficult to quantify, and would require more and better data on current loading that can be associated with over irrigation and improper turf management. Therefore, reduced pollutant loading can only be discussed qualitatively.

Benefit J-Reduce Need for Fertilizer Application

Fertilizing compounds commonly present in recycled water (e.g., nitrogen, phosphorus, potassium) are typically not found in potable water at levels of significance. Thus, the use of recycled water for irrigation at the nurseries will reduce fertilizer costs for these customers. The nutrient concentration in recycled water varies from plant to plant, seasonally, and from other factors. This makes it difficult to quantify how much fertilizer use may be offset by the use of nutrient-rich recycled water for irrigation purposes. However, all recycled water must meet certain standards to legally be used for various purposes, per the California Code of Regulations (CCR).[201] The amount of nutrients (i.e., pounds of fertilizer) per AF of recycled water can be calculated from average (tertiary-treated) effluent values for Carlsbad WRF. The Carlsbad WRF permit mandates that recycled water produced by the plant meets the CCR regulations for recycled water. Water produced by the Carlsbad WRF must also stay within the water quality limits established in the Water Quality Control Plan for the Basin Plan for the hydrologic subregions within Carlsbad's service area. These subregions include El Salto (HAS 904.21), Los Monos (HAS 904.31), Encinas (HA 904.40), Batiquitos (904.51), and Richland (HAS 904.52).[202] Per the Basin Plan regulations as reported in Carlsbad's Master Reclamation Permit, the Carlsbad WRF's permit limitation for nitrate ($N0_3$ as N) is 45 mg/L.[203]

Carlsbad's Recycled Water Master Plan contains a summary of water quality for the three sources of recycled water used by Carlsbad – Carlsbad WRF, Meadowlark WRF, and Gafner WRF. This summary table does not report combined nitrogen values for Carlsbad WRF and Meadowlark WRF (marked N/A), but does report Gafner's combined nitrogen averaged 16.1 mg/L.[204] Because data on nitrogen content of water produced at Carlsbad WRF is unavailable, and Gafner WRF water is blended into Carlsbad's recycled water supply, we can use this 16.1 mg/L as a proxy for the potential amount of nitrogen in recycled water delivered to Carlsbad's customers. It also provides a more conservative estimate than using the permit limits. Thus, for every AF of recycled water used in lieu of potable water, recycled water customers will avoid the use of a total of 43.8 lbs of fertilizer (16.1 mg/L divided by 453,592 mg/lb times 1,233,481.8 L/AF = 43.8 lbs/AF).

All of the recycled water for this project will be used for irrigation purposes, offsetting a maximum of 15,455 lbs/year of fertilizer, or 927,298 lbs over the course of the 60-year project life (see **Table 3-38**). However, these estimates present a maximum amount of fertilizer avoided through a combination of maximum allowable nitrogen in recycled water, the use of recycled water exclusively for irrigation, and that irrigators will reduce fertilizer use in a 1:1 ratio with the increased nutrients in the recycled water.

Benefit L-Increase Local Treatment Capacity for Future Recycled Water

As described in Attachment 4, and above, the *Carlsbad Recycled Water Plant and Distribution System Expansion* will expand the Carlsbad WRF by 2 MGD, or 2,240 AFY. This is a key step to implementing the overarching Phase III Recycled Water Project, which implements Carlsbad's Recycled Water Master Plan and its recycled water goals. Of this 2,240 AFY, 353 AFY will be delivered as part of this project through the expanded pipelines, connecting adjacent-to-existing users, and the ability to meet recycled water demand year-round. The remaining 1,887 AFY capacity at the Carlsbad WRF will be used for future recycled water deliveries, which will be implemented in subsequent phases in accordance with the Phase III Recycled Water Project. This project, therefore, provides a benefit of increased local treatment capacity

201 California Code of Regulations. Title 22. Division 4. Chapter 3. Water Recycling Criteria.
202 San Diego Regional Water Quality Control Board. 2012. Master Reclamation Permit with Waste Discharge Requirements for the Production and Purveyance of Recycled Water for Carlsbad Municipal Water District, Carlsbad Water Recycling Facility, San Diego County (Order No. 2001-352 as amended by Order R9-2012-0027). Pg. 2.
203 San Diego Regional Water Quality Control Board. 2012. Master Reclamation Permit with Waste Discharge Requirements for the Production and Purveyance of Recycled Water for Carlsbad Municipal Water District, Carlsbad Water Recycling Facility, San Diego County (Order No. 2001-352 as amended by Order R9-2012-0027). Pg. 3.
204 CMWD. 2012. Recycled Water Master Plan. January. Table 4.3 (pg. 4-7).

for future recycled water delivery. This benefit is especially important in existing conditions where recycled water demands continue to increase as a result of the drought, as such, the project will provide capacity and ability to immediately produce recycled water and deliver it to customers as demands increase (anticipated to occur in the short-term).

New Facilities, Policies, and Actions Required to Obtain Physical Benefits

To provide recycled water to "adjacent to existing" customers requires on-site retrofits on private property. These on-site costs may include signage, on-site pipelines and other materials, planning costs, and labor. The Quarry Creek developer may also need to install a pressure regulator for the HOA served by Expansion Segment 7. Because of Carlsbad's mandatory use ordinance for recycled water, these facilities are guaranteed to be built; therefore it is fully certain that despite the need for additional facilities, the project benefits as described here will be realized.

Potential Physical Effects of the Project

There may be temporary adverse effects of the project during construction, such as noise, traffic, or air quality impacts. Any potential impacts would be mitigated with the mitigation measures included in the project MND. There may also be temporary overwatering or excessive fertilization as customers adjust to proper irrigation and turf management using recycled water. There are no anticipated long-term adverse physical effects of the *Carlsbad Recycled Water Plant and Distribution System Expansion.*

Cost Effectiveness Analysis: Carlsbad Recycled Water Plant and Distribution System Expansion

The *Carlsbad Recycled Water Plant and Distribution System Expansion* project would achieve eleven benefits by offsetting potable demand through expanded recycled water production and delivery. These benefits and details about how they were quantified, are discussed in the sections above, and summarized in **Table 3-28**. One alternative was considered for this project that would also have been feasible for this expedited drought solicitation funding opportunity, but was found to be more expensive and provide smaller amounts of the benefits provided by the proposed project. The analysis of this alternative and how it compares to the selected project is summarized in **Table 3-41**, and discussed in detail in the text following the table.

Table 3-41: Project Analysis
Carlsbad Recycled Water Plant and Distribution System Expansion

Project Name: *Carlsbad Recycled Water Plant and Distribution System Expansion*	
Question 1 Physical Benefits Summary	The project will achieve its many benefits by reducing potable demand through increased production and use of recycled water. The benefits provided by the project are summarized in **Table 3-28**, with ten of the eleven total benefits quantified. Anticipated benefits from the project include: avoid imported water supply purchases, reduce demand for net diversions from the Bay-Delta, local supply development to decrease vulnerabilities, reduce GHG emissions, reduce social costs of GHG emissions, contribute to 20x2020 goals, reduce water costs, reduce discharge to outfall, reduce stormwater loading of pollutants, reduce need for fertilizer, and increase local treatment capacity of future recycled water delivery.
Question 2 Alternatives Considered	Only one alternative to the proposed project was considered for this drought solicitation because it is the only other pipeline expansion segment that could be implemented in an expedited timeframe. This alternative does not provide the same amount of benefits as the proposed project because it does not offset as much imported water.
	The alternative that was considered for this project is Expansion Segment 2; the segments included in the selected projects are Expansion Segments 1A and 7. The Carlsbad WRF expansion would remain the same in both the alternative and the proposed project, and the cost included in estimates for both. <u>Expansion Segment 2</u> Expansion Segment 2 would serve 588 AFY recycled water to customers, but only offset 71 AFY imported water demands. The other 517 AFY would offset desalinated seawater. Based on design and construction estimates, the total cost to construct the Expansion Segment 2 alternative would be $12,208,080. <u>Proposed Project (Expansion Segments 1A and 7)</u> The proposed project would deliver 353 AFY recycled water, with all 353 AFY offsetting imported water demands. The proposed project is anticipated to cost $11,563,000 to complete, based on design and construction estimates as presented in Attachment 5.
Question 3 Preferred Alternative	The selected project is the least cost alternative ($645,080 less than the alternative) and provides greater benefits by offsetting a larger amount of imported water, thereby achieving a greater amount of associated benefits than the project alternative.

Q1: Types of Benefits Achieved by Project

The *Carlsbad Recycled Water Plant and Distribution System Expansion* project would achieve eleven physical benefits as a result of its primary physical benefit of reducing potable water demand through increased use of recycled water. These benefits are summarized in **Table 3-28,** and information about how they were calculated is provided in detail in the sections above. Benefits from the project include:

- Avoid imported water supply purchases – 353 AFY
- Reduce demand for net diversions from the Bay-Delta – 235 AFY
- Local supply development to decrease vulnerabilities – 353 AFY
- Reduce net production of GHGs – 223 MT CO2e per year
- Avoid social costs of GHGs - $5,467 per year

- Contribute to 20x2020 goals – 6.5%
- Reduce water costs to customers – 16.4%
- Reduce discharge to outfall – 353 AFY
- Reduce stormwater loading of pollutants – Qualitative
- Reduce need for fertilizer application – 15,455 lbs per year
- Increase local treatment capacity for future recycled water delivery – 1,887 AFY

Q2: Discussion of Project Alternatives

As described previously, the *Carlsbad Recycled Water Plant and Distribution System Expansion* project is part of Carlsbad's Phase III Recycled Water Project. The Phase III project includes eight pipeline expansion segments, in addition to increased capacity of the Carlsbad WRF. While any of the eight identified pipeline expansion segments could be considered a project alternative, only one other alternative expansion segment was considered for the *San Diego IRWM Drought Solicitation Implementation Grant Proposal*. The alternative that was considered includes the Carlsbad WRF expansion and construction of Expansion Segment 2.

Expansion Segment 2 would extend Carlsbad's recycled water delivery system northwest of the Carlsbad WRF to the Carlsbad Energy Center, adjacent to the Agua Hedionda Lagoon. Through analysis of its customer database, the Phase III Feasibility Study found that Expansion Segment 2 would serve 782 AFY recycled water.[205] This estimate was revised down to 517 AFY during project development for this funding application based on a letter of interest from NRG Energy, the parent company for the Carlsbad Energy Center, which indicated an anticipated recycled water demand of 168,300,000 gallons per year, or 517 AFY.[206] The Carlsbad Energy Center has the highest demand for Expansion Segment 2, representing approximately 88% of the total demand for water delivered by the pipeline. This alternative would cost $12,208,080.

Q3: Preferred Project Alternative

The preferred project alternative, which involves expansion of the Carlsbad WRF and construction of Expansion Segment 1A and Expansion Segment 7 instead of Expansion Segment 2, is the least cost alternative, with a total cost of $11,563,000 (see Attachment 5), compared to $12,208,080 for Expansion Segment 2.

As described above, the benefits associated with the *Carlsbad Recycled Water Plant and Distribution System Expansion* are based on the increased use of recycled water, which would offset demand for imported water. The assumed offset demand for imported water is based on the customers that would be served by Expansion Segments 1A and 7, which are customers who currently use potable water for irrigation purposes. This offset demand for imported water provides a host of benefits, such as reduced demand for Bay-Delta supplies, reduced GHG emissions and associated social costs, and reduced water costs to customers.

Although the alternative (Expansion Segment 2) would deliver more recycled water than the selected project (517 AFY vs. 353 AFY), it would offset less imported water. As described above, a majority of the recycled water demand from the project alternative would serve the Carlsbad Energy Center. The energy center would primarily use recycled water in its cooling towers.[207] The energy center's alternative supply for cooling tower water is desalinated seawater, not potable water.[208] Therefore, the alternative would not provide the same types and amounts of benefits as the selected project, because only 71 AFY of the recycled water demand would be used to offset imported water, compared to the 353 AFY recycled water that would offset imported water demand from the proposed project. This difference in the amount of

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[205] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pg. 58.
[206] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Appendix C – Letters of Interest. Request for Service for Water Supply & Sewer Interconnection – Proposed new Power Generation Equipment at the Encina Power Station. Pg. 2.
[207] CMWD. 2012. Phase III Recycled Water Project Feasibility Study. June. Pg. 51.
[208] California Energy Commission. 2012. Carlsbad Energy Center Project Commission Decision. CEC-800-2011-004-CMF. Docket No. 07-AFC-06. June. Pg. 1-2.

imported water offset by the project alternatives was the primary consideration for selecting the proposed project over its alternative.

Project 4: Regional Demand Management Program Expansion

Local Project Sponsor: San Diego County Water Authority
Partners: SDCWA Member Agencies, San Diego Gas & Electric (SDG&E), California Landscape Contractors Association

The following sections of this application include project-specific information for the *Regional Demand Management Program Expansion*, and include the following information pursuant to the PSP:

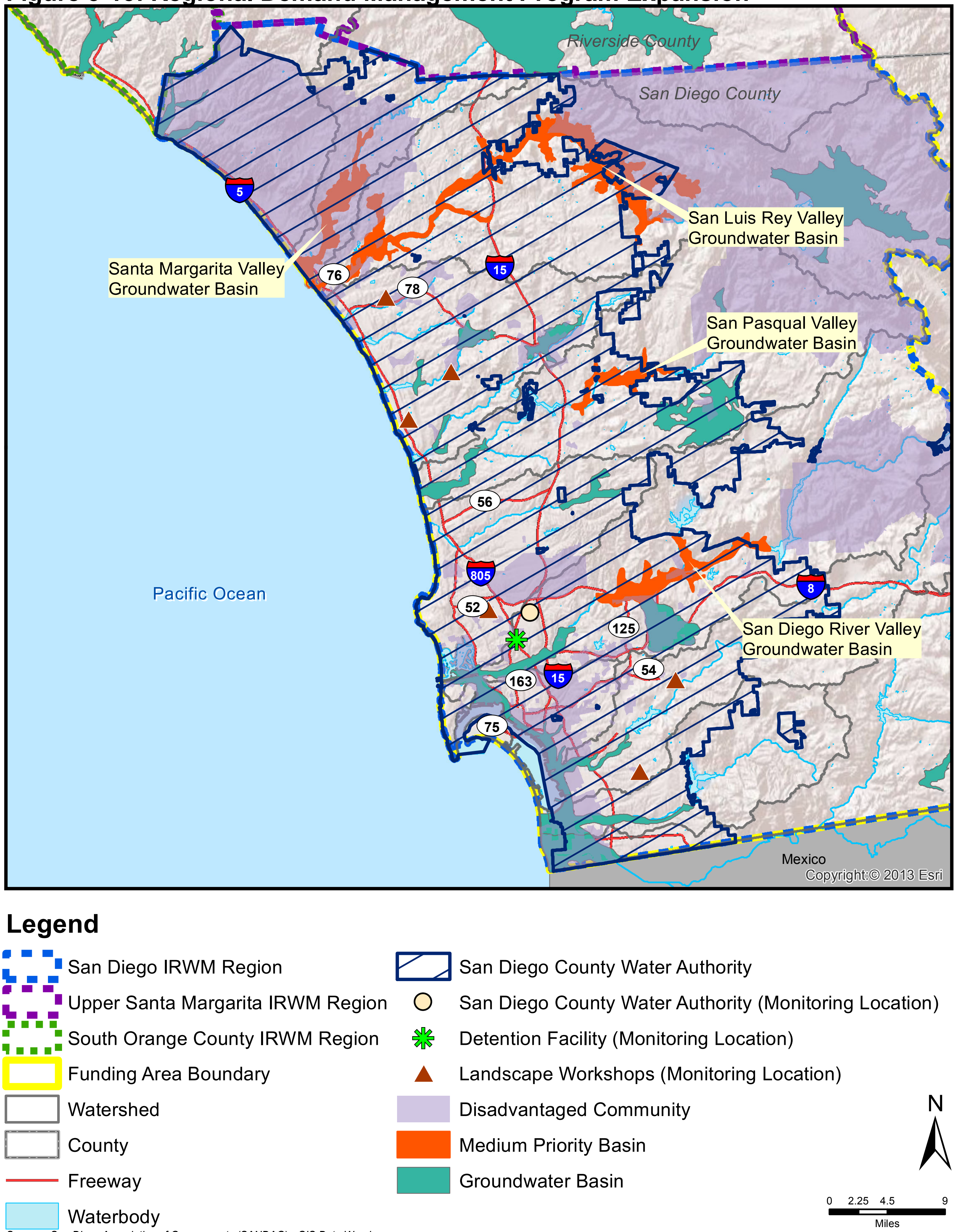
1. Project Description
2. Project Map
3. Project Physical Benefits
4. Technical Analysis of Physical Benefits Claimed, which includes the following sub-sections:
    - Technical Basis of the Project
    - Background for Benefits Claimed (Recent and Historical Conditions)
    - Without-Project Baseline (Estimates of Without-Project Conditions)
    - Methods Used to Estimate Physical Benefits
5. New Facilities, Policies, and Actions Required to Obtain Physical Benefits
6. Potential Physical Effects of the Project
7. Cost Effectiveness Analysis

Project Map: Regional Demand Management Program Expansion

Figure 3-13 shows the *Regional Demand Management Program Expansion* project area, the service area of the project sponsor, and the project's relation to groundwater basins and DACs. **Figure 3-14** shows additional details about the project area.

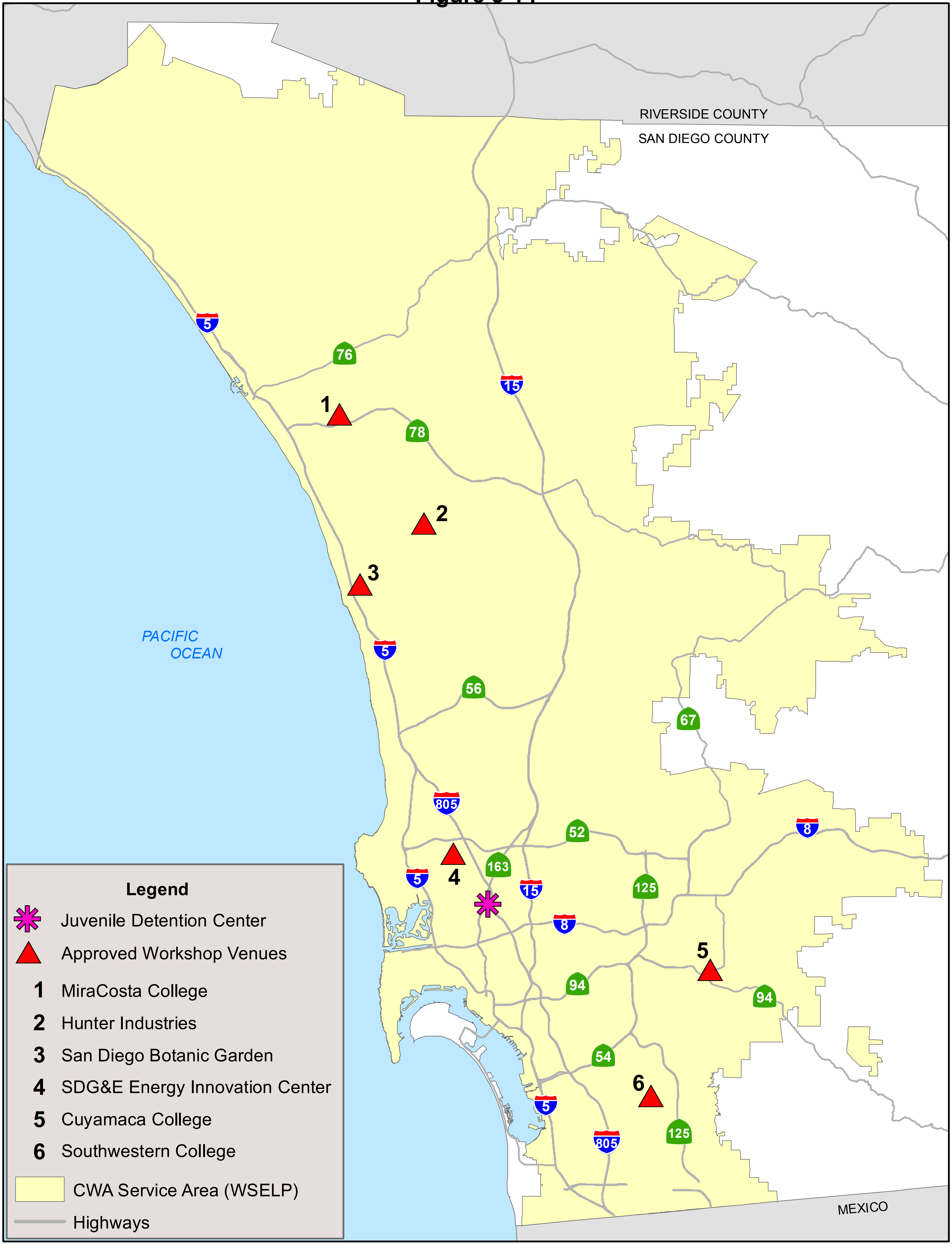
Outreach Flyers for the San Diego County Water Authority's Existing Demand Management Programs

Figure 3-13: Regional Demand Management Program Expansion



Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-7_Proj4_SDCWA_15Jul14.mxd

Figure 3-14



RIVERSIDE COUNTY
SAN DIEGO COUNTY
PACIFIC OCEAN
MEXICO
5
76
15
78
56
67
805
52
8
163
125
94
54
125
1
2
3
4
5
6
Legend
Juvenile Detention Center
Approved Workshop Venues
1 MiraCosta College
2 Hunter Industries
3 San Diego Botanic Garden
4 SDG&E Energy Innovation Center
5 Cuyamaca College
6 Southwestern College
CWA Service Area (WSELP)
Highways

Project Description: Regional Demand Management Program Expansion

Program is suite of regional water conservation programs, including irrigation controls, detention facility plumbing retrofits, turf rebates, and landscape workshops in response to current drought.

Project Nexus to Drought Impacts

The *Regional Demand Management Program Expansion* project meets two of the Drought Project Elements defined by DWR (**Table 3-1**). The project provides drought preparedness through water conservation The project also reduces water quality or ecosystem conflicts by reducing local demands for potable water that results in reservoir drawdown, and offsetting increased demand for imported water from the SWP, which allows more water to be available to meet sensitive ecosystem needs in the Bay-Delta system.

The *Regional Demand Management Program Expansion* project addresses seven drought impacts identified in Attachment 2:

- Ability to Meet Drinking Water Demands: The project offsets growing demand for potable water, reserving supplies to meet drinking water demands. Reliance on imported water is a critical vulnerability to the Region's ability to meet drinking water demands. This project reduces reliance on imported water, thereby protecting the Region's ability to meet drinking water demands.
- Ability to Meet Agricultural Water Demands: The Region's reliance on imported water makes it vulnerable to water supply shortages. Cutbacks to imported water, which is likely to occur if the drought continues, will result in cutbacks to agricultural users. Offsetting increasing demand for imported water will help contain and buffer the effects of potential cutbacks, thereby contributing to protecting the Region's ability to meet agricultural water demands.
- Ability to Meet Ecosystem Demands: The project reduces end use water demand, which means less demand for water stored in the Region's reservoirs. Reducing drawdown on reservoirs protects water levels, thereby protecting water quality impacted by drought. Local reservoirs provide habitat for many species, including sensitive species. Reducing imported water demand also helps reserve water in the Bay-Delta to meet the needs of sensitive ecosystems there.
- Drinking Water MCL Violations: Protecting reservoir levels by reducing water demands helps to protect water quality from algal blooms, eutrophication and increased concentration of pollutants. The project will conserve water, thereby reducing reservoir drawdown and the potential for drinking water MCL violations resulting from poor reservoir water quality.
- Groundwater Basin Overdraft: The project reduces water demands, which allows more water to be available to meet critical water supply needs in the Region. Protecting water supplies in this way reduces the potential for local agencies to turn to groundwater as an alternate supply. Because this project reduces the need to pump groundwater, local groundwater basins are less likely to experience overdraft.
- Increased Wildfire Risk and Water Quality Impacts: Wildfire risks increase as a result of climate change, which is caused by GHG emissions. The project reduces GHG emissions by offsetting energy-intensive water supplies. It also protects water supplies, meaning more water is available to fight fires that may occur.
- Economic Impacts: Increasing water supply reliability will help to ensure that demands associated with the regional economy can be adequately met.

This project was selected for inclusion this application because it is an IRWM project that addresses the Region's drought impacts and can be implemented to provide benefits in an expedited timeline. Further, the project was selected because it is an expansion of successful demand management programs in the Region, therefore ensuring that project-related benefits will accrue as a result of project implementation. Expedited funding is needed for this project because it is a high-priority project that increases water conservation, which is critical in times of drought.

Project Physical Benefits: Regional Demand Management Program Expansion

The primary physical benefit of the *Regional Demand Management Program Expansion* project is reduced water demand through conservation. This project will conserve a total of 1,089 AF of potable water, and provide numerous secondary benefits, as summarized in **Table 3-42**. The project has an anticipated project life of ten years, as described under Technical Analysis of Physical Benefits Claimed. **Tables 3-43** through **3-51** show the benefits that will accrue as a result of the project over the ten-year project life, with benefits phased in an out in accordance with the project schedule provided in Attachment 6, and described under Project Phasing, below. The technical basis for these benefits, methodology, and background are provided in the following sections. **Appendix 3-1** includes detailed spreadsheets that show how the quantified benefits were calculated.

Table 3-42: Physical Benefits Summary
Regional Demand Management Program Expansion

Physical Benefit	Result of Physical Benefit		Annual Quantification of Benefits (cumulative quantification)
Reduce potable water demand through conservation (1,089 AF total)	A	Avoid Imported Water Supply Purchases	Variable AFY (1,090 AF)
	B	Reduce Demand for Net Diversions from the Bay-Delta	Variable AFY (690 AF)
	C	Local Supply Development to Decrease Vulnerabilities	Variable AFY (1,090 AF)
	D	Reduce Net Production of Greenhouse Gases	Variable (985 MT CO2e)
	E	Avoid Social Costs of Greenhouse Gases	$24.55/MT CO2e ($24,172)
	F	Contribute to 20x2020 Goals	0.1%
	G	Reduce Water Costs to Customers, Including DACs	$1,724,160
	I	Reduced Stormwater Loading of Pollutants	Qualitative
	M	Reduce Production of Green Waste	45,707 lbs/yr (457,067 lbs)

Table 3-43: Primary Physical Benefit-Reduce Potable Water Demand through Conservation
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion*
Type of Benefit Claimed: Reduce Potable Water Demand through Conservation
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	70 AF	70 AF
2016	0 AF	160 AF	160 AF
2017	0 AF	171 AF	171 AF
2018	0 AF	179 AF	179 AF
2019	0 AF	179 AF	179 AF
2020	0 AF	109 AF	109 AF
2021-2024	0 AFY (0 AF)	39 AFY (156 AF)	39 AFY (156 AF)
2025	0 AF	39 AF	39 AF
2026	0 AF	19 AF	19 AF
2027	0 AF	8 AF	8 AF
Total*	**0 AF**	**1,090 AF**	**1,090 AF**

Comments: This program will conserve potable water through implementation of four conservation program components. The WaterSmart Landscape Efficiency Program (WSLEP) will conserve 140 AFY, based on a savings of 7 AFY/site, and 20 participating sites. The Detention Facility Retrofit component will conserve 16.3 AFY potable water, based on savings from installing 188 aerators and controlled flush toilets. The Turf Replacement Rebate Program component will conserve 22.8 AFY potable water, based on a pilot study by Metropolitan Water District of Southern California in a similar environment. The fourth program component – Landscape Workshops – is assumed to have no direct benefits, because there is no way to guarantee that benefits will not be double-counted between the Landscape Workshops and the Turf Rebate component (or the existing turf rebates that have been funded through previous rounds of IRWM Implementation Grants). Although there are no direct benefits being counted for the Landscape Workshops, they are a vital component for the success of the program by providing homeowners the tools for successful turf conversion project.

Benefits were calculated by component, with benefits phasing in and out as each component was implemented. For WSLEP, the program would begin implementation in March 2015. This analysis assumes that benefits from the WSLEP would begin to accrue four months later, in July 2015, to allow the program component to gain momentum. Therefore, for the WSLEP, 50% of the annual benefits would be accrued in 2015, with full benefits realized the following year. The Detention Facility Retrofit would be complete in March 2016, with benefits accruing immediately, for 75% of annual benefits realized in 2016 and full benefits realized the following year. The Turf Replacement Rebate Program would be implemented between March 2015 and the end of 2017. Benefits for this component were assumed to be realized evenly across 2016 through 2018, to allow for the individual turf replacement projects to be completed and begin accruing benefits. For this component, 33% of the annual benefits are assumed to be realized in 2-16, 67% in 2017, and 100% in 2018 and beyond. Benefits for each component are phased out at the end of the project life in accordance with how they were phased in. The WSLEP component has a 5-year project life, while the Detention Facility Retrofit and Turf Replacement Rebates components have 10-year project lives.

Sources: (WSLEP water savings) CPUC Energy Division. 2011. *Embedded Energy in Water Pilot programs Impact Evaluation Final Report*. March 9. Table ES-1 (pg. vi); (Detention Facility Retrofit water savings) Otay Water District. 2010. From Report to Reality; One Agency's Delayed Success Story. Presented at the WaterSmart Innovations Conference and Exposition. 6 October. Presented by Rhianna Pensa, Water Conservation Specialist. Slide 19; (Turf Replacement Rebate water savings) MWD. 2013. California Friendly Turf Replacement Incentive Program Southern California Final Project Report. September 30. Pg. 5.

*Some difference may occur due to rounding

Table 3-44: Physical Benefit A-Avoid Imported Water Supply Purchases
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion* **Type of Benefit Claimed:** Avoid Imported Water Supply Purchases **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project** **(cumulative without project)**	**Annual With Project** **(cumulative with project)**	**Annual Change Resulting from Project** **(cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	70 AF	70 AF
2016	0 AF	160 AF	160 AF
2017	0 AF	171 AF	171 AF
2018	0 AF	179 AF	179 AF
2019	0 AF	179 AF	179 AF
2020	0 AF	109 AF	109 AF
2021-2024	0 AFY (0 AF)	39 AFY (156 AF)	39 AFY (156 AF)
2025	0 AF	39 AF	39 AF
2026	0 AF	19 AF	19 AF
2027	0 AF	8 AF	8 AF
Total*	**0 AF**	**1,090 AF**	**1,090 AF**
Comments: Within the San Diego IRWM Region, local water supplies are used before purchasing imported water to meet demand deficits. Because the program will reduce potable demand , this will directly offset the purchase of imported water. This benefit will begin to accrue as each component begins to provide water demand reductions, as calculated in the Primary Physical Benefit (**Table 3-45**) Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13. *Some differences may occur due to rounding			

Table 3-45: Physical Benefit B-Reduce Demand for Net Diversions from the Bay-Delta
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion*
Type of Benefit Claimed: Reduce Demand for Net Diversions from the Bay-Delta
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	11 AF	11 AF
2016	0 AF	106 AF	106 AF
2017	0 AF	114 AF	114 AF
2018	0 AF	119 AF	119 AF
2019	0 AF	119 AF	119 AF
2020	0 AF	73 AF	73 AF
2021-2024	0 AFY (0 AF)	26 AFY (104 AF)	26 AFY (104 AF)
2025	0 AF	26 AF	26 AF
2026	0 AF	13 AF	13 AF
2027	0 AF	5 AF	5 AF
Total*	**0 AF**	**690 AF**	**690 AF**

Comments: The San Diego County Water Authority (SDCWA) is the sole imported water wholesaler in the San Diego IRWM Region. Although SDCWA supplies include a mix of sources, local supplies are used first, and imported water purchased only to satisfy unmet demand once local supplies are exhausted. SDCWA's imported supply mix includes water from the State Water Project (SWP), which comes from the Sacramento-San Joaquin Delta (Bay-Delta), and the Colorado River. During normal years, SDCWA's imported supply mix is 2/3 SWP and 1/3 Colorado River. Under drought conditions in 2014 and 2015, SWP is 15% of SDCWA's imported supply. This analysis assumes 15% imported water is from the SWP during 2014 and 2015, and 2/3 from SWP during other years. This proportion was applied to the offset imported water calculated under Benefit A, above (**Table 3-46**).

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13; (SDCWA supply mix) Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8; (imported mix during drought) Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

*Some differences may occur due to rounding

Table 3-46: Physical Benefit C-Local Supply Development to Decrease Vulnerabilities
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion*
Type of Benefit Claimed: Local Supply Development to Decrease Vulnerabilities
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	70 AF	70 AF
2016	0 AF	160 AF	160 AF
2017	0 AF	171 AF	171 AF
2018	0 AF	179 AF	179 AF
2019	0 AF	179 AF	179 AF
2020	0 AF	109 AF	109 AF
2021-2024	0 AFY (0 AF)	39 AFY (156 AF)	39 AFY (156 AF)
2025	0 AF	39 AF	39 AF
2026	0 AF	19 AF	19 AF
2027	0 AF	8 AF	8 AF
Total*	**0 AF**	**1,090 AF**	**1,090 AF**

Comments: The Region's high reliance on imported water supplies increases its vulnerability to water shortages (see Attachment 2). Local supply development is a key regional strategy to address this issue. As related to supply vulnerabilities, conservation is considered a local supply. The amount of water conserved by the project is calculated under the Primary Physical Benefit (**Table 3-45**), above.

Source: (strategy to reduce vulnerabilities) SDCWA. 2008. Strategic Plan. April. Pg. 9

*Some differences may occur due to rounding

Table 3-47: Physical Benefit D-Reduce Net Production of Greenhouse Gases
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion* **Type of Benefit Claimed:** Reduce Net Production of Greenhouse Gases **Units of the Benefit Claimed:** MT CO2e			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 MT CO2e	0 MT CO2e	0 MT CO2e
2015	0 MT CO2e	63 MT CO2e	63 MT CO2e
2016	0 MT CO2e	144 MT CO2e	144 MT CO2e
2017	0 MT CO2e	155 MT CO2e	155 MT CO2e
2018	0 MT CO2e	162 MT CO2e	162 MT CO2e
2019	0 MT CO2e	162 MT CO2e	162 MT CO2e
2020	0 MT CO2e	98 MT CO2e	98 MT CO2e
2021-2024	0 MT CO2e/yr (0 MT CO2e)	35 MT CO2e/yr (141 MT CO2e)	35 MT CO2e/yr (141 MT CO2e)
2025	0 MT CO2e	35 MT CO2e	35 MT CO2e
2026	0 MT CO2e	17 MT CO2e	17 MT CO2e
2027	0 MT CO2e	7 MT CO2e	7 MT CO2e
Total*	**0 MT CO2e**	**985 MT CO2e**	**985 MT CO2e**

Comments: Importing water is energy intensive, using 2.65 MWh/AF to import water to the Region. California produces 70% of its energy with a CO2e emissions factor of 613.28 lbs/MWH. 10% of California's energy is imported from the Pacific Northwest, with a CO2e emissions factor of 846.97 lbs/MWH, and 20% imported from the Pacific Southwest, with a CO2e emissions factor of 1,182.89 lbs/MWh. Using a weighted average, CO2e emissions from California's energy is 750.57 lbs/MWh, or 0.341 MT/MWh. This was applied to the energy intensity of imported water offset by the project (see Benefit A, **Table 3-46**) to get a total energy savings of 256 MT CO2e/year.

Sources: (energy intensity of imported water) Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10); (California energy mix) CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html; (CO2e emissions factors) U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

*Some differences may occur due to rounding

Table 3-48: Physical Benefit E-Avoid Social Costs of Greenhouse Gases
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion*
Type of Benefit Claimed: Avoid Social Costs of Greenhouse Gases
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$0	$0
2015	$0	$1,549	$1,549
2016	$0	$3,539	$3,539
2017	$0	$3,798	$3,798
2018	$0	$3,697	$3,697
2019	$0	$3,697	$3,697
2020	$0	$2,417	$2,417
2021-2024	$0/yr ($0)	$868/yr ($3,471)	$868/yr ($3,471)
2025	$0	$868	$868
2026	$0	$428	$428
2027	$0	$169	$169
Total*	**$0**	**$24,172**	**$24,172**

Comments: There are social costs associated with GHG emissions, which were estimated at $21.40/MT CO2e in 2007 dollars. This is converted to $24.55/MT CO2e in 2014 dollars. This value is applied to the reduced GHG emission calculated under Benefit D, above (**Table 3-49**).

Sources: (social cost of GHGs) Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28); (conversion from 2012 to 2014 dollars) U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm.

*Some differences may occur due to rounding

Table 3-49: Physical Benefit F-Contribute to 20x2020 Goals
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion*
Type of Benefit Claimed: Contribute to 20x2020 Goals
Units of the Benefit Claimed: %

(a)	(b)	(c)	(d)
Year	**Without Project**	**With Project**	**Change Resulting from Project**
2020	0%	0.1%	0.1%

Comments: SDCWA's 20x2020 goal is 167 gpcd. Their baseline is therefore 209 gpcd (167 gpcd/80%). This is a reduction of 42 gpcd from the baseline to 2020. SDCWA's population is projected to be 3,438,837 people in 2020. In 2020, the project will deliver 109 AFY recycled water. This is 97,236 gallons per day, or 0.03 gpcd (97,236 gallons/3,438,837 people). 0.03 gpcd is 0.1% of the total reduction of 42 gpcd from the baseline to the 20x2020 goal.

Sources: (20x2020 goal) SDCWA. 2011. 2010 Urban Water Management Plan. Pg. 2-10; (2020 population) SDCWA. 2011. 2010 Urban Water Management Plan. Pg. 1-19.

Table 3-50: Physical Benefit G-Reduce Water Costs to Customers, Including DACs
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion*
Type of Benefit Claimed: Reduce Water Costs to Customers, Including DACs
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$0	$0
2015	$0	$97,958	$97,958
2016	$0	$231,588	$231,588
2017	$0	$257,270	$257,270
2018	$0	$277,993	$277,993
2019	$0	$287,848	$287,848
2020	$0	$181,531	$181,531
2021-2024	$0 ($0)	Variable ($270,579)	Variable ($270,579)
2025	$0	$70,218	$70,218
2026	$0	$35,116	$35,116
2027	$0	$14,059	$14,059
Total*	**$0**	**$1,724,160**	**$1,724,160**

Comments: Imported water costs are based on the projected average costs to member agencies from the SDCWA, the sole imported water wholesaler in the Region. The project will offset imported water supply purchases (Benefit A, **Table 3-46**), avoiding the cost of imported water.

Sources: (imported water costs) Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44).

*Some differences may occur due to rounding

Table 3-51: Physical Benefit M-Reduce Production of Green Waste
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion* **Type of Benefit Claimed:** Reduce Production of Green Waste **Units of the Benefit Claimed:** Lbs			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 lbs	0 lbs	0 lbs
2015	0 lbs	0 lbs	0 lbs
2016	23,022 lbs	7,787 lbs	15,236 lbs
2017	46,045 lbs	15,573 lbs	30,471 lbs
2018	69,067 lbs	23,360 lbs	45,707 lbs
2019	69,067 lbs	23,360 lbs	45,707 lbs
2020	69,607 lbs	23,360 lbs	45,707 lbs
2021-2024	69,067 lbs/yr (276,267 lbs)	23,360 lbs /yr (93,440 lbs)	45,707 lbs/yr (182,827 lbs)
2025	69,067 lbs	23,360 lbs	45,707 lbs
2026	46,045 lbs	15,537 lbs	30,471 lbs
2027	23,022 lbs	7,787 lbs	15,236 lbs
Total*	**690,668 lbs**	**233,600 lbs**	**457,067 lbs**

Comments: The Turf Replacement Rebate program component will convert 202,667 ft^2 to waterwise landscaping (see Attachment 4). Turf conversion can result in a 66% reduction of greenwaste, or 0.22 lbs/ft^2 per year. The program would result in 45,707 lbs./year reduction in greenwaste production (202,667ft^2 x 0.22 lbs/ft^2 per year).

Sources: The Sustainable Sites Initiative. 2009. The Case for Sustainable Landscapes. Pg. 37.

*Some differences may occur due to rounding

Technical Analysis of Physical Benefits Claimed: Regional Demand Management Program Expansion

Technical Basis of the Project

The physical benefit of the *Regional Demand Management Program Expansion* project is demand management to reduce demands for potable water. The water conserved as a result of the project was calculated as the sum of the conservation that can be attributed to each of the four components contained within the *Regional Demand Management Program Expansion*: 1) WaterSmart Landscape Efficiency Program (WSLEP); 2) Detention Facility Retrofit Project; 3) Turf Replacement Rebate Program; and 4) Landscape Workshops. Altogether, the project is anticipated to conserve 1,089 AF over the ten-year project life. The breakdown of each component's contribution to overall water conservation from the project is provided below.

WSLEP

The WSLEP will provide customer rebates to install water-efficient irrigation hardware and provide technical support to implement best practices for irrigation management. As described in Attachment 4, the program will implement irrigation efficiency hardware and irrigation management best management practices (BMPs) at twenty sites, resulting in a combined reduction in onsite water use of an estimated 20% per site. Water conservation from the hardware was estimated from a similar project, the results of which are reported in the California Public Utilities Commission (CPUC)'s Embedded Energy in Water Pilot Programs Impact Evaluations.[209] This report includes water savings from a similar project, the SDG&E Managed Landscapes Project, which reported a savings of 69,215 hundred cubic feet (HCF) per year across 13 sites[210] or an average of 5,324 HCF per site. Using standard conversion factors, these savings translate to 12.2 AFY per site. The SDG&E Managed Landscapes Project resulted in overall savings of 35% per site, on average. The WSLEP component included within the *Regional Demand Management Program Expansion* project has an overall target of reducing onsite water use by 20% per site. Therefore, if 12.2 AFY savings represents 35% conservation, 20% conservation is a savings of approximately 7 AFY per site. Over the 5-year project life, the WSLEP will conserve a total of 698 AF, with an annual savings of 140 AFY for all twenty sites.

Detention Facility Retrofit Project

The Detention Facility Retrofit Project will install electronic flush valves, low-flow showerheads, and faucet aerators at a local detention facility. As described in Attachment 4, this project is continuing work completed through an existing SDCWA program which has already installed water-saving devices at a similar detention facility in the Region (Bailey Facility). A comparable program implemented by Otay Water District previously retrofitted another detention facility, the Donovan Facility, with water-savings devices. At the Donovan Facility, onsite research showed that 55% of the facility's water use was from excessive flushing of inmate bathrooms. Prior to installation of valves to limit the number of daily flushes, toilets were flushed 18 times per day. The valves reduced flushing to 12 times per day.[211] The retrofit project completed at the Bailey Facility found that 40% of the facility's water use was from excessive flushing of inmate bathrooms. Results from the Bailey Facility project found that installing 64 controlled flush toilets save 1,615,260 gal/yr, or 25,238 gal/toilet/yr. Thirty-eight aerators installed at the Bailey Facility saved a total of 115,083 gal/yr, or 3,029 gal/aerator/yr.[212]

[209] California Public Utilities Commission Energy Division. 2011. Embedded Energy in Water Pilot programs Impact Evaluation. March 9.
[210] California Public Utilities Commission Energy Division. 2011. Embedded Energy in Water Pilot programs Impact Evaluation. March 9. Table 57 (pg. 126)
[211] Otay Water District. 2010. From Report to Reality; One Agency's Delayed Success Story. Presented at the WaterSmart Innovations Conference and Exposition. 6 October. Presented by Rhianna Pensa, Water Conservation Specialist. Pp.13-14
[212] Otay Water District. 2010. From Report to Reality; One Agency's Delayed Success Story. Presented at the WaterSmart Innovations Conference and Exposition. 6 October. Presented by Rhianna Pensa, Water Conservation Specialist. Pg. 19.

Attachment 4 demonstrates that the Detention Facility Retrofit Project component of the *Regional Demand Management Program Expansion* will install 188 "packages", which include both a controlled-flush toilet and an aerator. Per the Bailey Facility results, one such package would save 28,267 gallons per year of water. Multiplying the savings from the Bailey Facility per the 188 packages that will be installed through the project shows that an annual savings of 5,314,184 gallons per year or an annual estimated savings of 16.3 AFY would be achieved through project implementation. Over the expected 10-year life of the project, 163 AF of water would be saved by installation of 188 controlled-flush toilets and aerators.

Turf Replacement Rebate Program

The Turf Replacement Rebate Program will provide customers rebates to convert high-water use turf into low-water use WaterSmart landscapes, resulting in reduced demand for irrigation water supply. SDCWA's WaterSmart program has successfully operated in the Region for a number of years, and as of the end of June 2014, has issued or reserved 70% of their total available rebates,[213] indicating the popularity of the program. MWD recently completed a similar program[214], which has been used as the basis for the estimated water savings for this project. MWD's project found that converting 2,439,025 square feet (ft^2) of turf to water wise landscaping saved 2,745 AF over ten years.[215] This is equal to a savings of 36.7 gal/ft^2/yr. As described in Attachment 4, the project will convert 202,667 ft^2 of turf to water wise landscaping, resulting in a savings of 7,432,395 gal/yr, or 22.8 AFY. Over the ten year project life, this equals a savings of 228 AF. Note that some numbers vary due to rounding.

Landscape Workshops

Landscape workshops will provide training to homeowners to prepare them for successful turf conversion projects. Although the project will target 250 households through 10 workshop series, with a target of 50% of these households implementing turf conversion within six months of attending a workshop, there exists a possibility that these households will utilize the turf replacement rebates described above to help implement turf conversion. Therefore, despite the expectation that these landscape workshops will result in successful turf conversion, to be conservative, no additional water conservation benefits will be counted as a result of the workshops to avoid potential double-counting of benefits. Six workshop locations have been identified throughout SDCWA's service area (see **Figure 3-6**), while an additional four will be identified prior to project implementation.

Program Phasing

The primary physical benefit of the *Regional Demand Management Program Expansion* is reducing demands for potable water by a total of 1,089 AF through water savings. Benefits from each component of the program will begin to accrue as the project components are completed or implemented, as described here. **Table 3-52** shows the phasing of benefits for each of the components that make up this program, which correspond to the implementation dates shown in Attachment 6. The Detention Facility Retrofit Project facility retrofit component will be completed by March 2016. Benefits are anticipated to accrue immediately upon project completion, because testing and demobilization will occur concurrently with project completion. The WSLEP Program will begin to be offered in March 2015, because the program will include retrofits and programmatic support, benefits are anticipated to begin accruing in July 2015 and continuing for five years. The Turf Replacement Rebate Program components will begin to be offered in March 2015, but to allow time for customers to take advantage of the program and complete their turf replacement projects, benefits are assumed to begin in January 2016, with rebates distributed equally across each of the three years they will be offered. Because benefits have been phased in during the first years of implementation, they must also be phased out in the final years of the project, as shown in **Table 3-52**.

[213] SDCWA. San Diego County Water Authority Turf Replacement Program. "Available Funds". Accessed July 2, 2014. Available: http://turfreplacement.watersmartsd.org/

[214] MWD. 2013. California Friendly Turf Replacement Incentive Program Southern California Final Project Report. September 30.

[215] MWD. 2013. California Friendly Turf Replacement Incentive Program Southern California Final Project Report. September 30. Pg. 5

The Detention Facility Retrofit component and the Turf Replacement Rebate component are both assumed to have a 10-year project life, while the WSLEP will have a 5-year project life. The WSLEP project life is shorted because SDCWA will provide support to participants for one year, and assumes that benefits will continue into the future based on past experience and by teaching landowners how to use the tools at their disposal. However, because the support will not be ongoing through the project life, the life has been shortened to allow for potential changes in landowner behavior without support from SDCWA.

As described above, the Landscape Workshops will support the success of both the Turf Replacement Rebate program component and other existing turf replacement programs, but to avoid double-counting benefits, does not have any independent benefits for the purpose of this analysis. **Table 3-43** shows the decreased potable water demand benefit over the course of the project's ten-year life. As summarized in **Table 3-42**, a number of secondary benefits will be accrued as a result of this primary physical benefit. These benefits are presented over the project life in **Tables 3-43** through **3-51**, and described in more detail below. Additional information about phasing as it relates to benefit accrual is provided in **Appendix 3-1**.

Table 3-52: Timing of Benefits Achieved by Program Components in the *Regional Demand Management Program Expansion* project

Program Component	Date Benefits Begins to Accrue	% Annual Benefit Realized in Year 1	% Annual Benefit Realized in Year 2	% Annual Benefit Realized in Years 3-5	% Annual Benefit Realized in Year 6	% Annual Benefit Realized in Years 7-10	% Annual Benefit Realized in Year 11	% Annual Benefit Realized in Year 12
WSLEP	July 2015	50%	100%	100%	50%	0%	0%	0%
Detention Facility Retrofit	April 2016	75%	100%	100%	100%	100%	25%	0%
Turf Replacement Rebate	January 2016	33%	67%	100%	100%	100%	67%	33%

Note: Project life is 5 years for WSLEP component, and 10 years for Detention Facility Retrofit and Turf Replacement Rebate programs. For components that achieve partial annual benefits as their components are completed/implemented, the benefit begins to phase out at Year 1+Project Life (e.g., for 10-year project life, final year of benefit is Year 11), to achieve benefits over a period of time equal to 12 months x project life (e.g., for a 10-year project life, 120 months' worth of benefits achieved). For the Turf Replacement Rebate component, the 10-year project life begins at the time each individual turf conversion project is completed (e.g., if a homeowner participates in the Turf Replacement Rebate program component in 2016, benefits from that project will be accrued from 2016 -2025, while a homeowner who participates in the program component in 2017 would accrue benefits from 2017-2026).

Background for Benefits Claimed

As described previously, the primary physical benefit of the *Regional Demand Management Program Expansion* of reducing water demands through conservation by 1,089 AF will result in many other benefits. The information provided below is organized by each benefit that will be provided by the project, and includes background information about the Region as well as specific information about the project that explains the basis for each of the benefits claimed for the project.

Primary Physical Benefit – Reduce Potable Water Demand through Conservation

Reducing potable water demand through implementation of conservation programs has proven to be an effective means for offsetting potable and therefore imported water demands in the Region, especially during times of drought. Following the 1987-1992 drought, the Region began taking an aggressive strategy to reduce demands on imported water supplies and as a result of these efforts has reduced demands dramatically. For example, since 1991, the Region has seen a population increase of approximately 700,000 people; however, current water use is approximately the same as it was in

1991.[216] In total, demand management measures implemented by SDCWA and its member agencies have resulted in 656,000 AF of water savings from 1991 to 2010. [217]

The SDCWA has been a leader in incentivizing water demand reductions in the Region, and has been implementing residential incentive programs such as the programs included within the *Regional Demand Program Expansion* since 1991. Between 1991 and 2008 it is estimated that over 500,000 water-efficient toilets, 80,000 high-efficiency clothes washers, and other devices were installed through SDCWA's residential incentive programs and have saved the Region 383,000 AF of water.[218] Since 2008 SDCWA has expanded its residential demand management program to include incentives to reduce outdoor water demands such as rebates for weather-based irrigation controllers and turf replacement; it is estimated that these additional programs will result in over 22,000 AF of water savings.[219]

Commercial, industrial, and institutional water incentives have also been offered by SDCWA for many years, and have included partnerships with MWD, SDG&E, local non-profit organizations, and other coalitions to improve outreach and leverage funding between partners to maximize overall benefits. [220] These programs resulted in total savings of approximately 18,400 AF from 1993 to 2009.[221]

Due to the success of existing conservation programs and SDCWA's long history and track record with implementing successful programs, it is fully certain that the potable water use reduction benefits that will be provided by the project will be realized.

Benefit A-Avoid Imported Water Supply Purchases and Benefit C-Local Supply Development to Decrease Vulnerabilities

One of the secondary benefits of the project is avoided purchase of imported water supply. SDCWA is the sole imported water wholesaler to 24 member agencies within San Diego County[222]. SDCWA supplies include a mix of surface water and imported water supplied through water transfers from IID, a Quantification Settlement Agreement (QSA) on the Colorado River, canal lining projects, and purchases from MWD.[223] MWD obtains its water from two sources: the Colorado River Aqueduct, which it owns and operates, and the SWP, with which MWD has a water supply contract through the state of California. SDCWA had also acquired short-term dry-year water transfers from agencies in Northern California during the last drought.[224] Currently, imported water purchases from MWD account for about 59% (331,825 AF) of SDCWA supplies.[225] As described in Attachment 2, the current drought has restricted SWP supplies to 5% of allocations. It is anticipated that if the drought continues, SWP deliveries may be reduced to 0% in 2015.

As shown in SDCWA's *2010 UWMP*, during dry years, imported water will constitute a larger proportion of SDCWA's supplies due to reduced surface water flows.[226] SDCWA only purchases enough imported water to meet demands that cannot be met with local supplies by member agencies, per SDCWA's demand projection methods described in its UWMP.[227] Although SDCWA and its member agencies use a mix of imported water and local sources to supply their customers, imported water is more expensive to provide and is considered to be the marginal water source.[228] Thus, any reduction in demand in the

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[216] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 3-1.
[217] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 3-1.
[218] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 3-5.
[219] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 3-5 and 3-6.
[220] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 3-6 to 3-8.
[221] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 3-6.
[222] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 1-8 and 3-1.
[223] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-2.
[224] SDCWA. 2011. 2010 Urban Water Management Plan. June. Page 4-1, Section 4, San Diego County Water Authority Supplies.
[225] SDCWA. 2011. 2010 Urban Water Management Plan. June. Page 6-1, Section 6, Metropolitan Water District of Southern California.
[226] SDCWA. 2011. Urban Water Management Plan. June. Pp. 9-3 to 9-7.
[227] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[228] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10. Note that despite desalinated water's high cost, the San Diego IRWM region's priority is to reduce dependence on imported water (IRWM Plan, 2007).

Region will be used to offset purchases of imported water supplies. As such, it is assumed for this analysis that the project will directly offset 1,089 AF of imported water purchases.

Water conservation is a key component of the Region's supply diversification strategy. SDCWA's *2008 Strategic Plan* encourages supply diversification to improve water supply reliability, and outlines four strategies to achieve this goal: conservation, desalination, non-potable reuse, and water transfers.[229] Over a five-year average of supply sources, 83% of the Region's water was imported.[230] This dependence on imported water makes the Region highly vulnerable to changes in the availability of imported water. In addition to restrictions on imported water deliveries in place because of drought conditions, the Region is vulnerable to disruption in delivery because of its location at the end of the imported water distribution system. The Region's location far from source water supplies means that there is a higher probability of supply disruptions due to infrastructure failures or natural disasters such as seismic events. The importance of supply diversification, including conservation, for the Region's supply reliability is found in the inclusion of Objective E in the 2013 IRWM Plan, and the value of meeting Objective E for projects seeking inclusion in this application (refer to Attachment 1 and **Appendix 1-5**).[231]

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

Reduced demand for imported water reduces pumping from the Bay-Delta, which supplies the SWP. In a normal year, approximately two-thirds of SDCWA's imported supplies are sourced from the Bay-Delta.[232] SDCWA estimates that during drought conditions in 2014 and projected into 2015, SWP supplies make up 15% of its total imported water supplies.[233] Management of the Bay-Delta water system is controversial, and challenges arise from the need to balance water supplies to meet the needs of people, and water supplies to meet the needs of ecosystems and sensitive species.[234] The CALFED Bay-Delta Program (now managed by the Delta Stewardship council) established four objectives[235]:

- *Water Quality*: to invest in projects that improve the State's water quality from source to tap.
- *Water Supply*: comprised of five critical elements: conveyance, storage, environmental water account, water use efficiency and water transfer.
- *Ecosystem Restoration*: aims at restoring habitats, ecosystem functions, and native species.
- *Levee Integrity*: to protect water supplies by reducing the threat of levee failures.

Conservation projects that reduced demand for imported water will also reduce demand for pumping from the Bay-Delta, allowing more water to be available to help meet these needs (refer to Attachment 7).

Benefit D-Reduce Net Production of Greenhouse Gases, and Benefit E-Avoid Social Costs of Greenhouse Gases

Importing and treating water is an energy intensive activity. The Equinox Center estimates that it requires an average of 2.65 MWh/AF to convey and treat imported water to the Region.[236] Conserving 1,089 AF of water from the *Regional Demand Management Program Expansion* will offset demand for imported water, thereby saving the energy (and it associated GHG emissions) required to convey and treat the water. Climate change is caused by GHGs, and is anticipated to have a strong impact on the Region. During development of the 2013 San Diego IRWM Plan, the Region conducted a Climate Change Planning Study to assess its vulnerability and identify climate change impact priorities. Within the Region, climate

[229] SDCWA. 2008. Strategic Plan. April. Pg. 9.
[230] Attachment 2. Pers. Comm. Dana Friehauf, SDCWA, Acting Water Resources Manager. June 18, 2014. Available: 858-522-6749.
[231] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (included in this application in Appendix 1-5)
[232] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8
[233] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.
[234] Delta Stewardship Council. 2013. The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value. Pp. 10-11.
[235] CALFED Bay-Delta Program Archived Website. CALFED Objectives. Accessed 28 June 2014. Available: http://calwater.ca.gov/
[236] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).

change is anticipated to raise temperatures, increase rainfall variability, decrease availability of imported water supplies, increase drought and flooding potential, increase water quality issues, decreases habitat and ecosystem services, and inundate storm and sewer systems from sea level rise.[237]

SDCWA's service area covers all of the urban areas within the Region, and encompasses the entirety of the Region's coastal areas and majority of its population and developed areas. All of the high climate change priorities will impact SDCWA and/or its 24 member agencies. These high priorities include decrease in imported supply, higher drought potential, increased pollution from constituent concentrations, extreme weather causing flash flooding and inundation, decrease in habitat availability, inundation of storm drains and sewer systems, and decrease in ecosystem services.[238] There are costs associated with addressing these priorities, as well as other social costs associated with climate change. Within the Region, there is also concern over the increased risk of wildfires related to climate change. As stated in Attachment 2, the Region experienced a number of wildfires this spring already.

Benefit F-Contribute to 20x2020 Goals

Senate Bill X7-7 (SBX7-7) was passed as legislation in California in 2009 and included provisions for reducing per capita water use 20% by the year 2020. These provisions are referred to as the 20x2020 Water Conservation Plan, or 20x2020 Plan. The 20x2020 Plan notes that water resources are limited in California, and therefore need to be managed sustainably by reducing per capita water use.[239] 20x2020 only applies to potable water use, and recycled water can be used to reduce gpcd. However, creation of new potable supplies from non-potable sources, such as desalination or stormwater capture, does not contribute to reduced gpcd because they constitute a new potable supply.[240] As noted in the 20x2020 Plan, the water use reduction is designed to protect the Bay-Delta but will also have a number of secondary benefits such as reduced energy consumption, because approximately one-fifth of the electricity used in California goes towards water delivery, treatment, and use, and one-third of natural gas not used in power plants is used for the same purpose.[241] This project contributes to the overall reduction in the Region's per capita water use.

Benefit G-Reduce Water Costs to Customers, Including DACs

The energy and facilities required to convey and treat imported water to the Region contribute to the high cost of imported water. The *Regional Demand Management Program Expansion* project will provide water cost savings in two ways: direct savings from reduced water purchases by customers, and indirect savings to the Region as a whole from buffering against imported water cost fluctuations. As described above, imported water will be directly offset by the amount of water saved (1,089 AF). Over time, imported water is projected to increase from $1,355 in 2014 to $1,849 in 2027, when the project ends.[242] Based on these projections, it is clear that costs savings will increase over time as imported water costs increase. Attachment 8 describes the presence of DACs within SDCWA's service area. Regardless of direct participation in the project, DACs will receive the benefits realized by all of SDCWA's service area of reduced risk of price fluctuations.

Benefit I-Reduce Stormwater Loading of Pollutants

Converting high water-use lawns to native and water wise (WaterSmart) landscaping will also reduce pollutant loading. The WaterSmart Turf Rebate Program requires irrigation systems to be retrofitted to low-volume systems, and includes requirements for soil permeability.[243] These requirements mean that runoff will be minimized on sites participating in the turf conversion program. Further, lawns are input-

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[237] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 7-38.
[238] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 7-39.
[239] DWR, et al., 2010. 20x2020 Water Conservation Plan. February. Pg. ix.
[240] DWR, et al., 2010. 20x2020 Water Conservation Plan. February. Pg. 3.
[241] DWR, et al., 2010. 20x2020 Water Conservation Plan. February. Pg. 1.
[242] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44). Converted from 2012 dollars to 2014 dollars using factor of 1.04 from the Consumer Price Index Calculator (Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 24 June 2014. Available: http://www.bls.gov/data/inflation_calculator.htm)
[243] SDCWA. Turf Replacement Program – Process Guidelines. Accessed July 1, 2014. Available: http://turfreplacement.watersmartsd.org/process_guidelines

intensive landscaping, and use large amounts of pesticides and fertilizer for maintenance.[244] Converting from turf to native and WaterSmart landscaping reduces these inputs, which mean there is less probability of them running off to pollutant water ways and storm systems.

Benefit M-Reduce Production of Green Waste

The use of turf for landscaping results in on-going maintenance that includes frequent mowing and disposal of a significant portion of lawn clippings in local landfills. Lawn care can produce large amounts of green waste. In a case study in Santa Monica, a 1,900 square-foot lawn produced 647.5 lbs/yr green waste, 66% more than a native landscaped yard of equal size next door.[245] Green waste includes compostable materials, which can be used as a resource. However, even when utilizing it as a resource, costs are associated with the collection, transport, and processing of materials. In some communities, green waste may simply be disposed of with other household waste, whether by policy or customer behavior (such as disposing of lawn clippings the garbage instead of a green waste collection container). The USEPA estimates that green waste makes up 13.7% of household waste.[246] Waste collection costs vary from community to community, and within the City of San Diego, are not paid directly by residents. Costs are estimated to range between \$13 and \$23 per residence per month for cities within San Diego County.[247], [248] For residents that pay their waste collection costs directly, participants may be able to reduce their waste collection costs through participation in the *Regional Water Demand Management Program Expansion*'s Turf Replacement rebate program. Residents that do not directly pay their own waste collection costs could still experience cost savings by reducing overall waste collection and processing costs for the agency that bears the expense.

Without Project Baseline

Without the *Regional Demand Management Program Expansion* project, 1,089 AF of potable water will continue to be applied to turf, wasted through inefficient fixtures and behaviors at the detention facility, and wasted through inefficient irrigation equipment. This water would continue to be imported, and a portion of it would be pumped from the Bay-Delta system. The secondary benefits associated with water conservation would not be realized. Such benefits include reduced GHG emissions and associated social costs, reduced pollutant loading, reduced green waste production and associated cost savings, and reduced water costs. The Region would also need to find more alternate ways to meet its 20x2020 goals.

Methods Used to Estimate the Physical Benefits

Methods used to estimate the primary physical benefit – namely via reference to technical documentation – were described above under Technical Basis of the Project.

Benefit A-Avoid Imported Water Supply Purchases

SDCWA is the water wholesaler to water agencies in San Diego County, and purchases water through the MWD. MWD obtains its water from two sources: the Colorado River Aqueduct, which it owns and operates, and the SWP, with which MWD has a water supply contract through the state of California. Currently, imported water purchases from MWD account for about 59% (331,825 AF) of SDCWA supplies.[249] SWP supplies from the Bay-Delta have been restricted since 2006, due to drought and regulatory restrictions, and additional restrictions on Colorado River water limits its use for supplemental supply. As described in Attachment 2, the current drought has restricted SWP supplies even further,

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[244] Joyce, S. 1998. Why the Grass Isn't Always Greener. Environmental Health Perspectives: Volume 106, Number 8, August. Pg. 379 (The Pros and Cons of Lawns).
[245] The Sustainable Sites Initiative. 2009. The Case for Sustainable Landscapes. Pg. 37.
[246] U.S. EPA. 2009. Municipal Solid Waste Generation, Recycled, and Disposal in the United States: Facts and Figures for 2009. Pg. 4.
[247] Gloria Penner with Katie Orr. *Free Trash Collection Could End for San Diego City Residents."* http://www.kpbs.org/videos/2009/jul/31/4492/.
[248] Waste Management. 2013. Phone Call with Waste Management on 8 February 2013. 714-558-7761.
[249] SDCWA. 2011. 2010 Urban Water Management Plan. June. Page 6-1, Section 6, Metropolitan Water District of Southern California.

down to 5% of allocations. It is anticipated that if the drought continues, SWP deliveries may be reduced to 0% in 2015.

Other sources of imported water for the County are provided through a Water Conservation and Transfer Agreement with IID, an agricultural district in neighboring Imperial County, and a Quantification Settlement Agreement (QSA) on the Colorado River. SDCWA had also acquired short-term dry-year water transfers from agencies in Northern California during the last drought.[250]

As described in SDCWA's 2010 UWMP, SDCWA's imported water demands are calculated as total estimated demands less local supplies (including member agency local supplies).[251] This indicates that local supplies are used first, and imported water purchases only made to address supply deficiencies; therefore all of the water conserved by this project will be used to directly offset imported water in a 1:1 ratio. It is assumed that water demands would remain consistent, and that recycled water use would be directly offset by additional imported water from MWD via SDCWA. Therefore, by conserving water, this project will directly offset the use of an equal amount of imported water as shown in **Table 3-44** (1,090 AF over the course of the project life). It is assumed that the benefits of each component will begin to accrue once that component is complete, as described in Project Phasing, above, and shown in the schedule in Attachment 6.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described in Benefit A, all of the water produced and delivered by the *Regional Demand Management Program Expansion* project will offset imported water purchases. SDCWA's supply mix includes imported water, surface water, and recycled water. During a normal year, SDCWA's imported water supply consists of two-thirds SWP supplies and one-third Colorado River supplies. [252] As described in Attachment 2, SWP deliveries have been reduced to 5% of allotments for 2014, and are anticipated to decrease to 0% if drought conditions continue into 2015. During drought years, assumed to be 2014 and 2015, the SWP portion of SDCWA's imported water mix is 15%[253], while the normal two-thirds proportion is used for other years, assuming drought conditions cease. Applying this ratio to the avoided imported water calculated in Benefit A, the project will reduce demand for net diversions from the Bay-Delta by a total of 690 AF over the ten-year project life (including drought condition years), as shown in **Table 3-45.**

- Portion of imported water from SWP during drought (2014-2015): 15%
- Portion of imported water from SWP during normal years: 67%

Benefit C-Local Supply Development to Decrease Vulnerabilities

As described in SDCWA's 2010 UWMP, supply diversification is a key strategy to improve long-term reliability of supplies.[254] Specifically, the Region has a goal to improve the reliability and sustainability of regional water supplies, with part of the associated supply diversification objective to encourage the development of local water supplies.[255] As described in Attachment 2, imported water supplies and surface water supplies are vulnerable to reduced deliveries during drought. Further, the Region is located at the end of both of its imported water systems (refer to **Figure 3-3**), increasing the risk of delivery interruptions from accidents, natural disasters, such as seismic events or weather events exacerbated by climate change, or other events. Any new local supply development or conservation effort (conservation is treated as a supply by SDCWA in its diversification portfolio[256]) would reduce the Region's vulnerability to these and other supply interruptions. The *Regional Demand Management Program Expansion* will

[250] SDCWA. 2011. 2010 Urban Water Management Plan. June. Page 4-1, Section 4, San Diego County Water Authority Supplies.
[251] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[252] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8
[253] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.
[254] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.
[255] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (available in this application as Appendix 1-5)
[256] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.

conserve 1,090 AF over its project life. As such, all water produced by this project, as described under Benefit A, is local supply development that will decrease vulnerabilities, shown in **Table 3-46**.

Benefit D-Reduce Net Production of Greenhouse Gases

The *Regional Demand Management Program Expansion* project will reduce GHG production through energy savings from reduced imported water demand. As described above, 1,089 AF of imported water is anticipated to be offset by this program over the project life. Imported potable water has extensive energy requirements associated with transporting water from Northern California and the Colorado River to San Diego County and treatment of raw water to potable standards. By avoiding imported water supply purchases, as described in Benefit A, this project will also reduce the net production of GHGs, measured in CO2 equivalent (CO2e) associated with the production of the energy required for imported water. The 2010 Equinox Report estimates energy required to convey and treat imported water delivered to the customers in the Region is between 2,000 kWh/AF and 3,300 kWh/AF,[257] or an average of 2.65 MWh/AF. Offsetting 1,090 AF of imported water through conservation (as described under Benefit A) will save 2,889 MWh.

- Energy intensity of imported water: 2.65 MWh/AF
- Energy savings resulting from the project (assuming total project life conservation of 1,090 AF): 2,889 MWh

Converting from energy use to CO_2e emissions requires a breakdown of California electricity sources. California generates 70% of its electricity through a combination of hydroelectric, nuclear, coal, oil, natural gas, geothermal, biomass, wind, solar, and other. 10% of California's electricity is imported from the Pacific Northwest, and the remaining 20% imported from the Pacific Southwest.[258] Emission rates in lbs of CO_2e per MWh will vary based on the energy source, but can be estimated across regions, per the EPA's eGRID. California production was eGRID subregion WECC California, the Pacific Northwest is WECC Northwest, and the Pacific Southwest is WECC Southwest. Each of these regions has a CO_2e emission rate of 613.28, 846.97, and 1,182.89 lbs/MWh, respectively.[259] Taking a weighted emissions rate (using the percentage of electricity produced in each region), the average emissions for electricity in California is 750.57 lbs/MWh of CO_2e. With 2204.62 lbs per MT, a standard conversion rate for California can be calculated as 0.341 MT of CO_2e per MWh of electricity. Therefore, the total amount of CO_2e emissions expected to be saved by this project over its life is 985 MT CO2e.

- Energy savings resulting from the project: 2.65 MWh/AF
- Average GHG in California energy grid: 0.341 MT/MWh
- Resulting GHG reductions resulting from the project: 0.904 MT of CO2e/AF
- Cumulative GHG reductions resulting from the project (assuming 1,090 AF water conserved by the project over its life): 985 MT CO2e

Benefit E-Avoid Social Costs of Greenhouse Gases

There are social costs associated with increased GHG emissions related to air quality impacts and climate change. The social cost of carbon is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present.[260] Such costs include, but are not limited to, impacts to agricultural productivity, human health, increased flood risk and associated damages, and ecosystem services and their values.[261]

[257] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[258] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html
[259] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/
[260] IPCC. 2007. Summary for policymakers. In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* ML Perry, OF Canziani, JP Palutikof, PJ van der Linden, and CE Hanson (eds.). Cambridge University Press. Cambridge, UK. Pg. 17.
[261] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 1

In February 2010, the U.S. Government's Interagency Working Group on Social Cost of Carbon issued guidance on recommend values for the social cost of carbon for use in regulatory benefit-cost analysis.[262] The recommended mean estimate of the social cost of one MT of CO2 equivalent (CO2e) in 2014 dollars is $24.55. This is updated from the 2007 dollars value of $21.40 reported by the Interagency Working Group on Social Cost of Carbon[263], using the CPI Inflation Calculator.[264] An estimate of the social costs of carbon avoided by the project can be calculated by applying this $24.55/MT CO2 to the emissions savings from Benefit D. **Table 3-48** shows the avoided social costs of carbon from the *Regional Demand Management Program Expansion* project.

- Social cost of GHGs: $24.55/MT CO2e
- GHG reduction from project: 985 MT CO2e
- Social costs of GHGs reduced by the project: $24,172

Benefit F-Contribute to 20x2020 Goals

SBX7-7, also known as 20x2020, is legislation passed in 2000 that requires urban water suppliers to reduce their daily per capita water use by 20% by 2020. SDCWA's 20x2020 goal is reported in its UWMP as 167 gpcd.[265] This is a reduction of 42 gpcd (167 gpcd = 0.8*baseline → baseline = 167 gpcd/0.8 → baseline = 209 gpcd). The *Regional Demand Management Expansion* project will offset potable water use with water conservation, thereby contributing to SDCWA's 20x2020 goals. Contribution to these 20x2020 goals was calculated by converting the water saved by the project (presented in AF in Benefit A) to gpcd using the 2020 population estimates (3,438,837 people[266]) found in SDCWA's UWMP. Population estimates from 2020 were used because that is the year by which the 2020 goals must be met. The project's contribution to meeting 20x2020 goals is gpcd from the project (0.03 gpcd in 2020) as a percentage of SDCWA's overall gpcd reduction goal (42 gpcd), as shown in **Table 3-49**. Because the 20x2020 goals must be met by 2020, the benefit is only calculated to 2020, rather than through the full life of the project. When benefits are fully realized, the project will contribute 0.1% towards meeting SDCWA's 20x2020 goal.

- SDCWA's targeted reduction in 2020 gpcd: 42 gpcd
- Amount of conserved water from the project that will contribute to 20x2020 goals (amount of water conserved in 2020): 109 AF (97,271 gallons per day)
- GPCD reduction provided by the project in 2020 (97,271 gallons per day/3,438,837 people): 0.03 gpcd
- Percent contribution towards 20x2020 goals (0.03 gpcd/42 gpcd): 0.1%

Benefit G-Reduce Water Costs to Customers, Including DACs

As described under the primary physical benefit, the *Regional Demand Management Program Expansion* will reduce potable water demand through conservation. The 1,090 AF avoided potable water demand from the project over its life will directly offset the purchase of imported water, as described in Benefit A. Estimated imported water costs were provided in the Sweetwater Authority's Title XVI Technical Project Report (refer to Attachment 3, Project 1: *Reynolds Groundwater Desalination Facility Expansion*). As explained under Benefit A, SDCWA is the sole imported water provider in San Diego County. Although SDCWA member agencies do pay slightly different rates for imported water, the values reported in the Sweetwater Authority's Title XVI Technical Project Report are based on an average rate across all 24 member agencies, and can therefore be applied to other projects in the Region that provide cost savings through offset imported water. Imported water costs will vary over the life of the project, ranging from

[262] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (Pg. 28).
[263] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28).
[264] U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm
[265] SDCWA. 2011. 2010 Urban Water Management Plan. June. Table 2-6 (pg. 2-10).
[266] SDCWA. 2011. 2010 Urban Water Management Plan. June. Table 1-6 (pg. 1-19).

$1,349/AF to $1,778/AF, and averaging $1,595/AF, in 2012 dollars.[267] This translates to costs ranging from $1,403/AF to $1,849/AF, or an average of $1,659/AF in 2014 dollars over the ten-year project life, using a conversion factor of 1.04 from the Consumer Price Index.[268]

In total, the project is anticipated to offset $1,724,160 in costs of treated imported water, as shown in **Table 3-50.** These savings will be passed on to customers in the form of buffering from fluctuating water rates. As described in Attachment 8, and shown in **Figure 3-13**, there are numerous DACs within SDCWA's service area, which will receive the benefits of cost savings related to avoided imported water purchases along with the rest of the customers within SDCWA's service area.

Benefit I-Reduced Stormwater Loading of Pollutants

As described above, turf conversion from this project reduces stormwater loading of pollutants in two ways: minimizing potential runoff from landscaping, and reducing fertilizer and pesticide inputs that may have been transported in runoff when turf was still installed. Although these benefits will be realized by this project, they are difficult to quantify because of the uncertainties over individual lawn care behaviors, what the needs of the replacement landscaping will be, and the baseline amounts of runoff and pollutant loading. Therefore this benefit can only be discussed qualitatively.

Benefit M-Reduce Production of Green Waste

The Turf Replacement Rebate Program and Landscaping Workshops will reduce the amount of turf used in landscaping within SDCWA's service area. In addition to the reduction in water demands, turf conversion also reduces the amount of green waste produced from landscaping care. The Sustainable Site Initiative's *The Case for Sustainable Landscapes* profiles a series of case studies that document the benefit of conversion to sustainable landscaping.[269] The Santa Monica Garden case profiles the cost and care differences between a traditional lawn and a native plant garden. The sites were designed to be directly comparable – they were located on the same size lots, immediately adjacent to one another, and both sites were cleared completely and in the same manner prior to lawn/garden installation. This case documented a 66% reduction in green waste between the lawn and the native plant garden.[270]

The Santa Monica Garden case study provided a side-by-side comparison of yards in adjacent lots.[271] One was landscaped in the traditional manner typical of residential properties in the area. The neighboring yard was landscaped using native plants, similar to those found in the local Santa Monica Mountains. Costs, plant data, waste production, and water use associated with each garden were tracked over four years following construction. Controls were put in place to enable direct comparison between sites.

Each landscape was approximately 1,900 ft^2. The turf landscape produced 647.5 lbs/yr green waste, and the native landscape produced 219 lbs/yr green waste. This results in a 66% reduction in green waste, or 428.5 lbs/yr.[272] Based on these results, turf conversion can reduce green waste production by 0.23 $lbs/ft^2/yr$. For the *Regional Demand Management Program Expansion* project's Turf Replacement Rebate Program, an estimated 202,667 ft^2 will be converted from turf to water wise landscaping. This will result in a reduction of green waste by 45,707 lbs/yr, or a total of 457,067 lbs over the ten-year project life, as shown in **Table 3-51**.

- Green waste savings from conversion from turf to native landscaping: 0.23 lbs/ft^2 per year
- Annual green waste avoided by the project (assuming 202,667 ft^2 converted): 45,707 lbs/year
- Cumulative green waste avoided by the project over the ten-year project life: 457,067 lbs

[267] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44).
[268] Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 24 June 2014. Available: http://www.bls.gov/data/inflation_calculator.htm. $1 in 2012 = $1.04 in 2014.
[269] The Sustainable Sites Initiative. 2009. The Case for Sustainable Landscapes. Pp. 36-37.
[270] The Sustainable Sites Initiative. 2009. The Case for Sustainable Landscapes. Pg. 37.
[271] The Sustainable Sites Initiative. 2009. The Case for Sustainable Landscapes. Pp. 36-37.
[272] The Sustainable Sites Initiative. 2009. The Case for Sustainable Landscapes. Pg. 37.

New Facilities, Policies, and Actions Required to Obtain Physical Benefits

No additional facilities, policies, and actions would be required to obtain the physical benefits of the *Regional Demand Management Program Expansion* project. Rebates for the WSLEP component would not be issued until efficient irrigation equipment is installed and water management services are performed, so all benefits associated with WSLEP would be achieved once rebates are issued. The physical benefits of the Turf Replacement Rebate Program and associated Landscape Workshops components of the *Regional Demand Management Program Expansion* project require participants to complete their individual turf replacement projects. Rebates are not issued until projects are complete, so no other facilities, policies, or actions would be required to obtain the physical benefits described here. All required retrofits at the detention facility would be installed as part of this project.

Potential Physical Effects of the Project

There are no anticipated adverse physical effects from this project. There may be temporary effects associated with turf replacement such as hauling and disposal of removed turf; however these effects are anticipated to be minor and temporary in nature.

Cost Effectiveness Analysis: Regional Demand Management Program Expansion

The *Regional Demand Management Program Expansion* will achieve the benefits described above at a reasonable cost, presented in Attachment 5. A complete cost analysis was not conducted for the program because there are no alternatives that also achieve the same type and amount of benefits. Conservation projects in the Region have proven to be cost-effective in the past, given that without them, water demands would remain the same, and the majority of water demands in the Region are met with costly imported water (see Benefit G, above). **Table 3-53** (Table 6 in the PSP) provides a summary of why no alternatives were considered for this program, with a detailed explanation below.

Table 3-53: Project Analysis
Regional Demand Management Program Expansion

Project Name: *Regional Demand Management Program Expansion*	
Question 1 Physical Benefits Summary	The program will achieve eight quantifiable benefits and one qualitative benefit, summarized in **Table 3-42**, above. These benefits include avoided imported water purchases, reduced demand for Bay-Delta supplies, local supply development to decrease vulnerabilities, reduced GHG emissions, avoided social costs of GHGs, contribution to 20x2020 goals, reduced water costs to customers, reduced stormwater loading of pollutants, and reduced production of green waste.
Question 2 Alternatives Considered	No alternatives were considered for this program.
	No alternatives exist that achieve the same types and amounts of benefits described above. The primary alternative to a conservation program is continued use of imported water to meet demands. While demands are met through the provision of imported water, none of the secondary benefits associated with offsetting imported water would be achieved. Further, given the current drought that has substantially reduced imported water supplies; continued use of imported water supplies would not address any of the drought impacts discussed in Attachment 2. Other potential alternatives to the project would be different conservation projects; the ability for other conservation projects to achieve the same types and amounts of benefits would depend on the anticipated size and success of the alternatives.
Question 3 Preferred Alternative	The proposed program is the preferred alternative because it achieves the objective of reducing water demands, which offsets imported water and achieves all of the benefits described above. The program builds on existing conservation efforts that have proven to be successful in the Region. This allows the program to be implemented quickly, with high confidence that the benefits described herein will be achieved. The conservation program as designed helps meet the highest priorities for conservation in the Region.

Q1: Types of Benefits Achieved by Project

The *Regional Demand Management Program Expansion* would achieve nine physical benefits as a result of its primary physical benefit of reducing potable water demand through conservation. These benefits and how they were calculated are discussed in detail in the sections above, and summarized in **Table 3-42**. Benefits from the program (over its full life) include:

- Avoid imported water supply purchases – 1,009 AF
- Reduce demand for net diversions from the Bay-Delta – 690 AF
- Local supply development to decrease vulnerabilities – 1,089 AF
- Reduce net production of GHGs – 985 MT CO2e
- Avoid social costs of GHGs - $24,172
- Contribute to 20x2020 goals – 0.1%
- Reduce water costs to customers – $1,724,160
- Reduce stormwater loading of pollutants – Qualitative
- Reduce production of green waste – 457,067

Q2: Discussion of Project Alternatives

The program is a drought relief project that achieves water conservation goals. There are only two alternatives to a conservation project: 1) continue to use water resources to meet existing demand (no project alternative), or 2) a different conservation project. Given the existing water supply mix of the Region, the no project alternative would involve continued use of imported, potable water to meet existing demands in the Region. While such an alternative would allow the Region to continue meeting demands (as long as there are no restrictions on imported water deliveries), none of the ancillary benefits related to offsetting imported water associated with the *Regional Demand Management Program Expansion* would be achieved. Therefore, the no project alternative is not a viable alternative as it would not achieve the same types and amounts of physical benefits as the proposed project.

The second alternative, implementation of a different conservation project, could potentially achieve similar benefits related to offsetting water use, but would not likely be as successful. The program components included in the *Regional Demand Management Program Expansion* were selected based on the success of existing conservation programs in the Region. SDCWA is confident that the program components included herein will be successful in achieving the program's goal of reducing water demand. Further, because these program components are an expansion of existing conservation programs, they are easier and faster to implement given experience of the project sponsor and its partners, and benefits would be realized on an expedited timeline consistent with the goals of DWR's *2014 IRWM Drought Solicitation Implementation Grant Proposal*.

The program was designed to leverage existing programs and address high-priority conservation issues, as identified by SDCWA, its member agencies, and its partners.

WSLEP

SDCWA has a long-standing partnership with SDG&E, the Region's primary energy supplier, with whom SDCWA has implemented a number of water-energy conservation programs. Such programs have included rebates for energy and water efficient washing machines, distribution of low-flow fixtures, installation of pre-rinse spray valves, energy audits for water agencies, home energy and water savings kits, and marketing on joint energy-water savings programs.[273] Through this more than 20-year long partnership, SDCWA and SDG&E have gained an understanding of which programs are effective, and have proven to be successful. This insight has helped to shape the conservation components included in the WSLEP program component.

The WSLEP program component is modeled after SDG&E's Managed Landscapes Program, which was implemented in the San Diego Region. SDG&E's program installed water-efficient irrigation hardware and software that converted irrigation controllers into smart controllers that regulate irrigation based on weather and evapotranspiration rates.[274] The SDG&E program then delivered ongoing irrigation management services using this technology to ensure a 35% reduction in water use at participating sites. The WSLEP component seeks to achieve 20% reduction in water use, and the benefits described in the model program have been revised in the calculations for the WSLEP above to account for the lower conservation goal. Potential alternatives to this component could include installation of other forms of smart irrigation hardware. For the SDG&E program, a competitive bid process was implemented prior to selection of a contractor.[275] The implication is that the program as implemented by SDG&E was the best alternative to meet the program's desired goals.

Detention Facility Retrofit Project

As described above, the Detention Facility Retrofit Project component is based on a highly successful existing project at the Bailey Facility and Donovan Facility. SDG&E reports that detention facility retrofits

[273] SDG&E. 2014. Water/Energy Relationship at SDG&E. Available: http://www.cpuc.ca.gov/NR/rdonlyres/3A4B6FD1-C33E-4A79-92CD-2BEED6906315/0/SanDiegoGEandWaterAuthority.pdf. pp. 10-12.

[274] California Public Utilities Commission Energy Division. 2011. Embedded Energy in Water Pilot Programs Impact Evaluation. March 9. Pg. iii.

[275] California Public Utilities Commission Energy Division. 2011. Embedded Energy in Water Pilot Programs Impact Evaluation. March 9. Pg. 118.

have saved over 300 AFY water.[276] Otay Water District reports a reduction in water use of approximately 500 AF at the Bailey Facility between 2009 when the project was implemented, and 2010 when the full benefits were realized.[277] Looking over a comparable nine-month time period in 2009 and 2010, water use at the Bailey facility decreased nearly 400 AF as a result of the project.[278] The two detention facilities were the top commercial and industrial users for Otay Water District, by an entire order of magnitude.[279] It is reasonable to assume that detention facilities in general are large water users, and should be targeted by water conservation programs.

Water conservation measures have already been installed at the targeted detention facility, but additional measures can be taken to further reduce water use. The toilets at the facility are tamper-proof, helping to ensure that the controls installed at the facility will remain intact and functional, while the success of the model program at the Bailey and Donovan Facilities has proven that full-scale retrofits, including aerators and efficient showerheads are effective in achieving desired conservation benefits.

Turf Replacement Rebate Program

The Turf Replacement Rebate Program component continues a long-standing program of turf replacement rebates in the Region, which has been in place for a number of years, and has been successful enough to have received funding through past IRWM Implementation Grants under Proposition 50 and Proposition 84. The program has been popular with customers in the Region, with 70% of the available rebates spoken for.[280] In addition to the existing SDCWA Turf Replacement Program, MWD has implemented a similar turf replacement program in Southern California (including the Region), which has also proven highly successful. Alternatives to the Turf Replacement Rebate Program that would achieve the same types and amount of benefits would be other forms of a rebate to convert turf. Such alternatives were not considered because the existing rebate rate and corresponding outreach activities have proven to be successful in achieving turf conversion and anticipated water conservation benefits. A smaller rebate may not incentivize as high a participation rate, while a larger rebate would either reduce the total area that could be converted or would be a higher cost to achieve the same conversion area and associated benefits.

Landscape Workshops

There is concern that a contributing factor to participation in turf conversion programs, including the Turf Replacement Rebate component, is awareness and understanding of how to implement a water wise landscaping project and take advantage of rebate programs. As described previously, the Landscape Workshops will increase participation in the existing rebate programs by providing tools for achieving successful turf conversion to homeowners. Alternatives to the Landscape Workshop component are other forms of outreach. SDCWA already has an extensive website dedicated the turf replacement program (available: http://turfreplacement.watersmartsd.org/), as well as marketing materials related to the program. Workshops represent an effective way to reach homeowners, and have already been successfully implemented by SDCWA through a pilot program.

Q3: Preferred Project Alternative

The program as presented here is the preferred project alternative because it is a drought preparedness project that will implement known, successful conservation components. Conservation projects in the Region are generally highly cost effective because they offset the use of expensive imported water. As explained previously, the program was designed to take advantage of existing conservation projects that

[276] SDG&E. 2014. Water/Energy Relationship at SDG&E. Available: http://www.cpuc.ca.gov/NR/rdonlyres/3A4B6FD1-C33E-4A79-92CD-2BEED6906315/0/SanDiegoGEandWaterAuthority.pdf. pp. 16.
[277] Otay Water District. 2010. From Report to Reality: One Agency's Delayed Success Story. WaterSmart Innovations Conference and Exposition. October 6. Pg. 23.
[278] Otay Water District. 2010. From Report to Reality: One Agency's Delayed Success Story. WaterSmart Innovations Conference and Exposition. October 6. Pg. 24.
[279] Otay Water District. 2010. From Report to Reality: One Agency's Delayed Success Story. WaterSmart Innovations Conference and Exposition. October 6. Pg. 7.
[280] SDCWA. San Diego County Water Authority Turf Replacement Program. Accessed July 9, 2014. Available: http://turfreplacement.watersmartsd.org/

have proven to be successful in the Region but require additional funding to continue into the future. The high success rate of the model projects indicates that the program here will also be highly successful. Utilizing the knowledge gained from the previous incarnations of the program components, along with their existing structures, materials, and expertise of people involved, ensures that the program can be implemented quickly and affordably. Given past successes, ease of implementation, and quick realization of benefits, this program was considered the preferred alternative. A cost effectiveness analysis was not performed because there are no project alternatives that achieve the same type and amount of benefits that can also be implemented as quickly as the selected program to meet the requirements of the drought solicitation as well as the Region's local IRWM priorities.

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Project 5: San Diego Water Use Reduction Program

Project Sponsor: City of San Diego (City)
Partner: San Diego Gas & Electric (SDG&E)

The following sections of this application include project-specific information for the *San Diego Water Use Reduction Program*, and include the following information pursuant to the PSP:

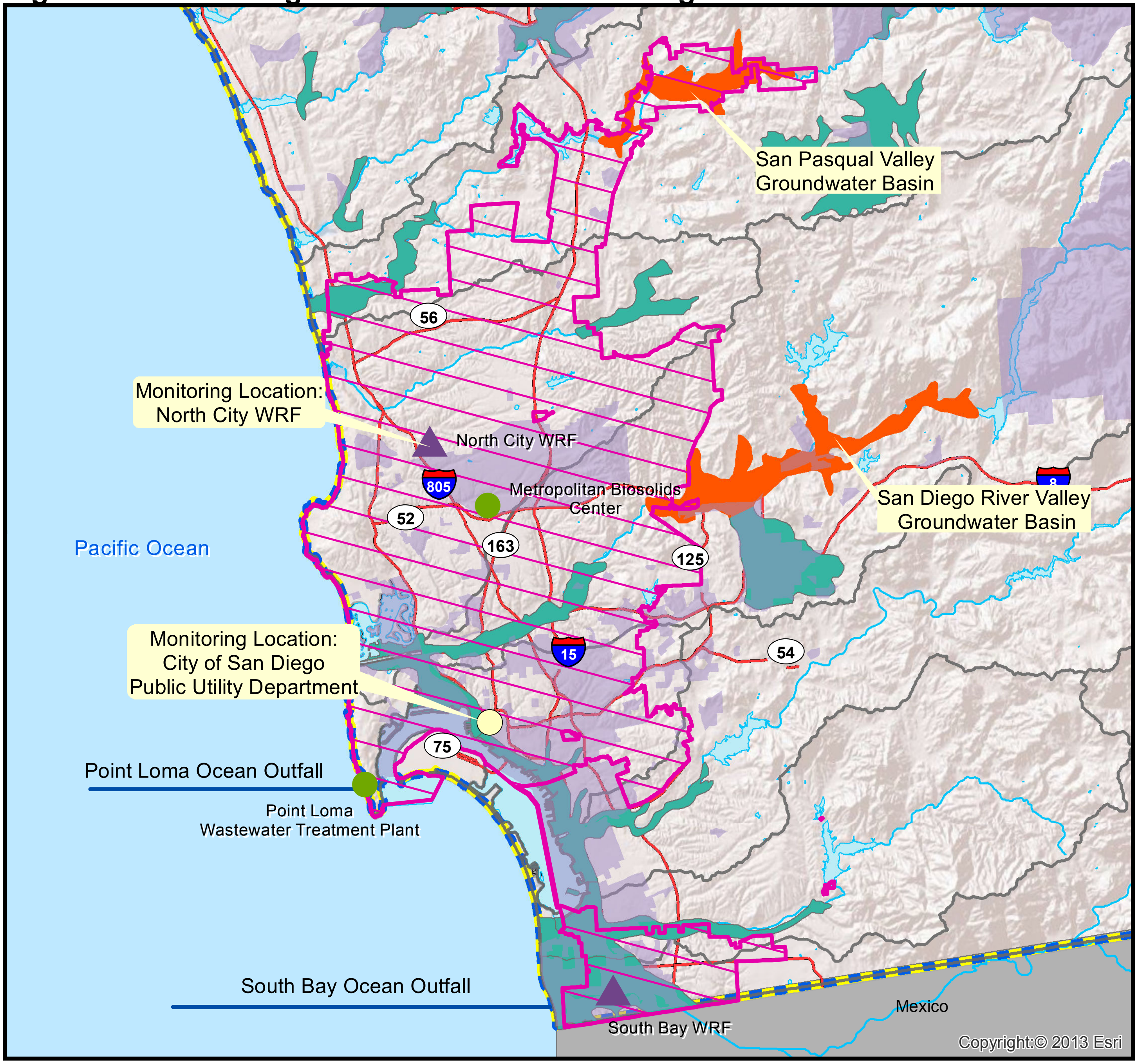
1. Project Description
2. Project Map
3. Project Physical Benefits
4. Technical Analysis of Physical Benefits Claimed, which includes the following sub-sections:
    - Technical Basis of the Project
    - Background for Benefits Claimed (Recent and Historical Conditions)
    - Without-Project Baseline (Estimates of Without-Project Conditions)
    - Methods Used to Estimate Physical Benefits
5. New Facilities, Policies, and Actions Required to Obtain Physical Benefits
6. Potential Physical Effects of the Project
7. Cost Effectiveness Analysis

Project Map: San Diego Water Use Reduction Program

Figure 3-15 shows the *San Diego Water Use Reduction Program* project area, the service areas of the project sponsor, and the project's relation to groundwater basins and DACs. **Figure 3-16** shows the recycled water service areas within the City, which provides context for the recycled water filling station component of the project.

Existing Recycled Water Filling Station at South Bay Water Reclamation Plant

Figure 3-15: San Diego Water Use Reduction Program



Legend

- San Diego IRWM Region
- Funding Area Boundary
- Watershed
- Freeway
- Waterbody
- Disadvantaged Community
- Medium Priority Basin
- Groundwater Basin
- City of San Diego
- City of San Diego Public Utilitiy Department
- City of San Diego Water Reclamation Facility
- City of San Diego Wastewater Treatment Plant
- Ocean Outfall

N

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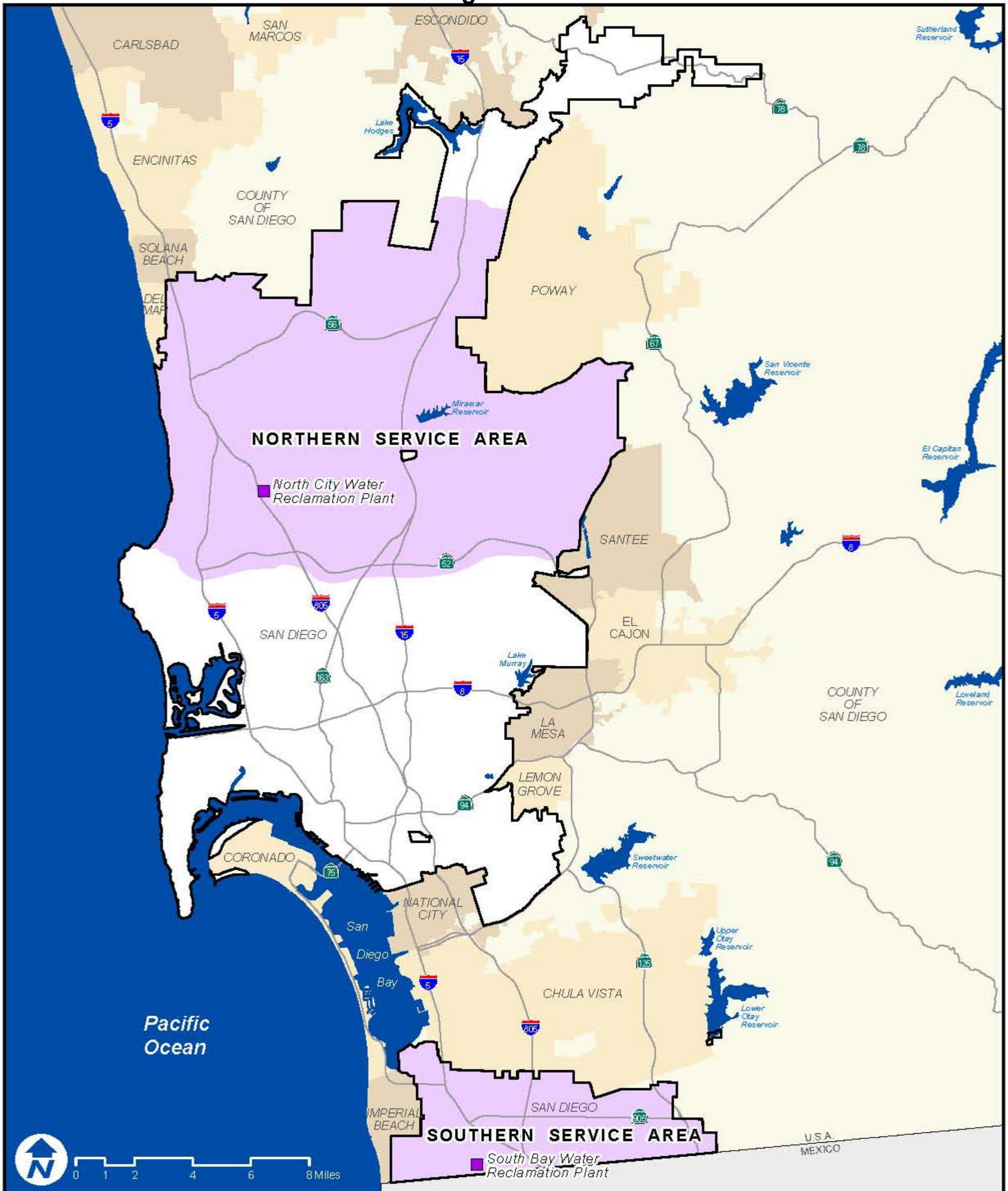
Miles

Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-8_Proj5_CityDrought_15Jul14.mxd

Figure 3-16



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02/07/11

City of San Diego
PUBLIC UTILITIES
Water & Wastewater

Long-Range Planning & Water Resources Division

City of San Diego
Recycled Water Service Areas

SanGIS

Project Description: San Diego Water Use Reduction Program

Program reduces potable water demands by implementing a pressure reducing valve incentive program and installation of a recycled water filling station for construction activities.

Project Nexus to Drought Impacts

The *San Diego Water Use Reduction Program* meets two of the Drought Project Elements defined by DWR (**Table 3-1**). The project provides drought preparedness through water waste reduction through installation of pressure reducing valves and increasing the use of recycled water with a recycled water filling station The project will also reduce water quality or ecosystem conflicts by reducing drawdown on reservoirs, where low water levels exacerbate water quality issues, and by reducing demand for SWP supplies, allowing more water to remain in the Bay-Delta system to meet the needs of sensitive ecosystems.

The *San Diego Water Use Reduction Program* addresses seven drought impacts to the Region identified in Attachment 2:

- Ability to Meet Drinking Water Demands: The project reduces potable water demand through conservation and increased use of recycled water. This allows potable supplies to be reserved to meet drinking water needs. It also offsets demand for imported water, decreasing supply vulnerabilities, helping to protect the Region's ability to meet demand.
- Ability to Meet Agricultural Water Demands: Cutbacks to imported supplies can lead to cutbacks to agricultural users. Through offsetting imported water, the project helps to provide a buffer against such cutbacks. It also increases supplies available to meet agricultural demands by reducing overall demand through conservation.
- Ability to Meet Ecosystem Demands: The project reduces drawdown on reservoirs, which has water quality impacts. Such water quality impacts adversely affect ecosystems. Reduced demand for imported water will also reduce demand for Bay-Delta supplies. This allows more water to remain in the Bay-Delta to serve the needs of sensitive ecosystems there.
- Drinking Water MCL Violations: Water quality impacts in reservoirs from decreased water levels could increase the potential for MCL violations, particularly secondary MCL violations. The project reduced demand for water from reservoirs, helping to reduce drawdown, thereby providing water quality protection that helps prevent drinking water MCL violations.
- Groundwater Basin Overdraft: During drought, groundwater becomes an attractive local supply source. By conserving water and reducing potable demand, more water is available for critical needs, reducing the need to turn to groundwater to meet demand, thereby reducing the potential for groundwater basin overdraft.
- Increased Wildfire Risk and Water Quality Impacts: Climate change increases the risk of wildfire, which has already had large impacts on the Region this year alone. The project reduces GHG emissions, thereby reducing contribution to climate change. It also conserves water, which could be used to fight wildfires in the event of an incident. Wildfire protection would reduce the impacts of wildfires on water quality.
- Economic Impacts: Increasing water supply reliability will help to ensure that demands associated with the regional economy can be adequately met. Specifically, reduced water costs (via access to recycled water) for new development will help ensure continued growth of the regional economy.

The project was selected for inclusion in this expedited funding round because it is an IRWM-project providing multiple benefits, addresses drought impacts in the Region, and can be implemented and benefits realized on an expedited timeline. Expedited funding is needed for this project because it is a high-priority project that conserves water and reduces potable demand, which is critical during droughts. Further, the project will help to meet specific needs associated with the drought and help reduce impacts on the economy given that it will increase the availability of recycled water for construction projects.

Project Physical Benefits: San Diego Water Use Reduction Program

Tables 3-55 through **3-63** summarize the primary and secondary physical benefits anticipated to be achieved by the *San Diego Water Use Reduction Program*. The primary physical benefit of the project is a decrease in 381 AFY of potable demand through conservation and the use of recycled water. As shown in **Table 3-54**, this results in eight quantifiable secondary benefits, and two qualitative secondary benefits. Benefits are quantified over the ten-year project life, with benefits phasing in and out in accordance with the project schedule (Attachment 6) and as described below under Project Phasing. **Appendix 3-1** includes detailed spreadsheets that show how the quantified benefits were calculated.

Table 3-54: Physical Benefits Summary
San Diego Water Use Reduction Program

Physical Benefit	Result of Physical Benefit		Annual Quantification of Benefits (cumulative quantification)
Decrease potable water demand through conservation and recycled water use (381 AFY)	A	Avoid Imported Water Supply Purchases	381 AFY (3,813 AF)
	B	Reduce Demand for Net Diversions from the Bay-Delta	254 AFY (2,488 AF)
	C	Local Supply Development to Decrease Vulnerabilities	381 AFY (3,813 AF)
	D	Reduce Net Production of Greenhouse Gases	334 MT CO_2/year (3,345 MT CO2e)
	E	Avoid Social Costs of GHG Emissions	$8,212/year ($82,117)
	F	Contribute to 20x2020 Goals	0.6%
	G	Reduce Water Costs to Customers, Including DACs	Variable ($5,742,112)
	H	Reduce Discharge to Outfall	37 AFY (368 AF)
	I	Reduce Stormwater Loading of Pollutants	Qualitative
	R	Reduce Damage to Plumbing	Qualitative

Table 3-55: Primary Physical Benefit-Decrease Potable Water Demand through Conservation and Recycled Water Use
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*
Type of Benefit Claimed: Decrease Potable Water Demand through Conservation and Recycled Water use
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	105 AF	105 AF
2016	0 AF	209 AF	209 AF
2017	0 AF	295 AF	295 AF
2018	0 AF	381 AF	381 AF
2019-2024	0 AFY (0 AF)	381 AFY (2,288 AF)	381 AFY (2,288 AF)
2025	0 AF	277 AF	277 AF
2026	0 AF	172 AF	172 AF
2027	0 AF	86 AF	86 AF
Total*	**0 AF**	**3,813 AF**	**3,813 AF**

Comments: There are two components to this program, which decreases potable water demand. The Pressure Regulating Valve (PRV) Rebate Program will conserve 344 AFY, based on savings of 61.5 gallons per day per PRV, and installation of 5,000 PRVs. The Recycled Water Filling Station (RWFS) component will reduce potable demand by increasing availability of recycled water by 37 AFY. This is based on the use of another RWFS owned by the City of San Diego, which has an average truck size of 5,000 gallons, and can serve 400 trucks per meter per year (2,000,000 gallons per meter per year). The RWFS constructed by this program will have six meters, therefore it can serve 12,000,000 gallons per year, or 37 AFY.

The decrease in potable water demand are phased in by component as each is implemented. The PRV component will be implemented immediately upon receipt of the grant award (assumed October 16, 2014), with a delay in benefits until January 2015 to allow the program to start up. The rebate program will be implemented until rebates run out, assumed to be no later than 2018, and benefits were assumed to be accrued evenly across those four years. 25% of the annual benefits of the PRV component will be realized in 2015, 50% in 2016, 75% in 2017, and 100% in 2018. The RWFS will begin serving recycled water in July 2015, with benefits accruing immediately (50% of annual benefits in 2015, 100% in subsequent years). Benefits are phased out in accordance with how they were phased in, as reflected in this table.

Source: (PRV water savings) Joey Jacoby, Conservation Analyst, City of San Diego Public Utilities Department. 2013. Available: 619-533-7548.; (recycled water truck size) Geosyntec. 2011. Revised Final Engineering Report for Distribution and Use of Reclaimed Water Sunrise Powerlink Project, San Diego County, California. August. Pg. 7; (number of trucks per station) Kyrsten Burr-Rosenthal, Senior Management Analyst, City of San Diego Public Utilities Department. 2014. Pers. Comm. Available: 619-533-5380.

*Some differences may occur due to rounding

Table 3-56: Physical Benefit A-Avoid Imported Water Supply Purchases
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program* **Type of Benefit Claimed:** Avoid Imported Water Supply Purchases **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project** **(cumulative without project)**	**Annual With Project** **(cumulative with project)**	**Annual Change Resulting from Project** **(cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	105 AF	105 AF
2016	0 AF	209 AF	209 AF
2017	0 AF	295 AF	295 AF
2018	0 AF	381 AF	381 AF
2019-2024	0 AFY (0 AF)	381 AFY (2,288 AF)	381 AFY (2,288 AF)
2025	0 AF	277 AF	277 AF
2026	0 AF	172 AF	172 AF
2027	0 AF	86 AF	86 AF
Total*	**0 AF**	**3,813 AF**	**3,813 AF**

Comments: Within the San Diego IRWM Region, local water supplies are used before purchasing imported water to meet demand deficits. Because this program will reduce potable demand by 381 AFY, this will directly offset the purchase of imported water. This benefit will be realized consistent with the decreased potable demand benefit described in **Table 3-57** (Primary Physical Benefit).

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13.

*Some differences may occur due to rounding

Table 3-57: Physical Benefit B-Reduce Demand for Net Diversions from the Bay-Delta
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program* **Type of Benefit Claimed:** Reduce Demand for Net Diversions from the Bay Delta **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	16 AF	16 AF
2016	0 AF	139 AF	139 AF
2017	0 AF	197 AF	197 AF
2018	0 AF	254 AF	254 AF
2019-2024	0 AFY (0 AF)	254 AFY (1,525 AF)	254 AFY (1,525 AF)
2025	0 AF	185 AF	185 AF
2026	0 AF	115 AF	115 AF
2027	0 AF	57 AF	57 AF
Total*	**0 AF**	**2,488 AF**	**2,488 AF**

Comments: The San Diego County Water Authority (SDCWA) is the sole imported water wholesaler in the San Diego IRWM Region. Although SDCWA supplies include a mix of sources, local supplies are used first, and imported water purchased only to satisfy unmet demand once local supplies are exhausted. SDCWA's imported supply mix includes water from the State Water Project (SWP), which comes from the Sacramento-San Joaquin Delta (Bay-Delta), and the Colorado River. During normal years, SDCWA's imported supply mix is 2/3 SWP and 1/3 Colorado River. Under drought conditions in 2014 and 2015, SWP is 15% of SDCWA's imported supply. This analysis assumes 15% imported water is from the SWP during 2014 and 2015, and 2/3 from SWP during other years. This proportion was applied to the offset imported water calculated under Benefit A (**Table 3-57**), above.

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13; (SDCWA supply mix) Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8; (imported mix during drought) Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

*Some differences may occur due to rounding

Table 3-58: Physical Benefit C-Local Supply Development to Decrease Vulnerabilities
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*
Type of Benefit Claimed: Local Supply Development to Decrease Vulnerabilities
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	105 AF	105 AF
2016	0 AF	209 AF	209 AF
2017	0 AF	295 AF	295 AF
2018	0 AF	381 AF	381 AF
2019-2024	0 AFY (0 AF)	381 AFY (2,288 AF)	381 AFY (2,288 AF)
2025	0 AF	277 AF	277 AF
2026	0 AF	172 AF	172 AF
2027	0 AF	86 AF	86 AF
Total*	**0 AF**	**3,813 AF**	**3,813 AF**

Comments: The Region's high reliance on imported water supplies increases its vulnerability to water shortages (see Attachment 2). Local supply development is a key regional strategy to address this issue. The RWFS will increase use of local supplies in the form of recycled water, while for the purposes of reducing supply vulnerabilities, SDCWA considers conservation (such as that from the PRV component) a local supply. The local supply development from this program as related to decreasing supply vulnerabilities is equal to the amount of offset imported water calculated under Benefit A (**Table 3-58**).

Source: (strategy to reduce vulnerabilities) SDCWA. 2008. Strategic Plan. April. Pg. 9
*Some differences may occur due to rounding

Table 3-59: Physical Benefit D-Reduce Net Production of Greenhouse Gases
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*
Type of Benefit Claimed: Reduce Net Production of Greenhouse Gases
Units of the Benefit Claimed: MT CO2e

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 MT CO2e	0 MT CO2e	0 MT CO2e
2015	94 MT CO2e	5 MT CO2e	89 MT CO2e
2016	189 MT CO2e	10 MT CO2e	179 MT CO2e
2017	267 MT CO2e	10 MT CO2e	257 MT CO2e
2018	345 MT CO2e	10 MT CO2e	334 MT CO2e
2019-2024	345 MT CO2e/yr (2,067 MT CO2e)	10 MT CO2e/yr (60 MT CO2e)	334 MT CO2e/yr (2,007 MT CO2e)
2025	250 MT CO2e	5 MT CO2e	245 MT CO2e
2026	156 MT CO2e	0 MT/CO2e	156 MT/CO2e
2027	78 MT CO2e	0 MT CO2e	78 MT CO2e
Total*	**3,445 MT CO2e**	**100 MT CO2e**	**3,345 MT CO2e**

Comments: Importing water is energy intensive, requiring 2.65 MWh/AF to import water to the Region. Recycled water, on the other hand, only requires 0.8 MWh/AF. California produces 70% of its energy with a CO2e emissions factor of 613.28 lbs/MWH. 10% of California's energy is imported from the Pacific Northwest, with a CO2e emissions factor of 846.97 lbs/MWH, and 20% imported from the Pacific Southwest, with a CO2e emissions factor of 1,182.89 lbs/MWh. Using a weighted average, CO2e emissions from California's energy is 750.57 lbs/MWh, or 0.341 MT/MWh. This was applied to the energy intensity of imported water offset by the project (see Benefit A, **Table 3-58**). To account for the energy used for the RWFS, the energy intensity of recycled water was applied to the portion of the program's Primary Physical Benefit attributable to the RWFS component (37 AFY), which was then subtracted from the energy intensity of the total offset imported water to produce the total energy savings of the program.

Sources: (energy intensity of imported water and recycled water) Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10); (California energy mix) CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html; (CO2e emissions factors) U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

*Some differences may occur due to rounding

Table 3-60: Physical Benefit E-Avoid Social Costs of Greenhouse Gases
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*
Type of Benefit Claimed: Avoid Social Costs of Greenhouse Gases
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$0	$0
2015	$0	$2,196	$2,196
2016	$0	$4,391	$4,391
2017	$0	$6,301	$6,301
2018	$0	$8,212	$8,212
2019-2024	$0/yr ($0)	$8,212/yr ($49,270)	$8,212/yr ($49,270)
2025	$0	$6,016	$6,016
2026	$0	$3,821	$3,821
2027	$0	$1,910	$1,910
Total*	**$0**	**$82,117**	**$82,117**

Comments: There are social costs associated with GHG emissions, which were estimated at $21.40/MT CO2e in 2007 dollars. This is converted to $24.55/MT CO2e in 2014 dollars. This value is applied to the reduced GHG emission calculated under Benefit D, above (**Table 3-61**).

Sources: (social cost of GHGs) Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28); (conversion from 2012 to 2014 dollars) U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm.

*Some differences may occur due to rounding

Table 3-61: Physical Benefit F-Contribute to 20x2020 Goals
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*
Type of Benefit Claimed: Contribute to 20x2020 Goals
Units of the Benefit Claimed: %

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2020	0	0.6%	0.6%

Comments: The City of San Diego's 20x2020 goal is 142 gpcd. Their baseline is therefore 177.5 gpcd (142 gpcd/80%). This is a reduction of 35.5 gpcd from the baseline to 2020. The City's population is projected to be 1,483,986 people in 2020. In 2020, the project will deliver 381 AFY recycled water. This is 340,376 gallons per day, or 0.23 gpcd (340,376 gallons/1,483,986 people). 0.23 gpcd is 0.6% of the total reduction of 35.5 gpcd from the baseline to the 20x2020 goal.

Sources: (20x2020 goal) City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 3-10; (2020 population) City of San Diego. 2011. 2010 Urban Water Management Plan. Table 3-1 (pg. 3-1).

Table 3-62: Physical Benefit G-Reduce Water Costs to Customers, Including DACs
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*
Type of Benefit Claimed: Reduce Water Costs to Customers, Including DACs
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$0	$0
2015	$0	$120,810	$120,810
2016	$0	$250,039	$250,039
2017	$0	$388,223	$388,223
2018	$0	$535,541	$535,541
2019-2024	$0/yr ($0)	Variable ($3,510,929)	Variable ($3,510,929)
2025	$0	$463,718	$463,718
2026	$0	$313,623	$313,623
2027	$0	$159,229	$159,229
Total*	**$0**	**$5,742,112**	**$5,742,112**

Comments: Imported water costs are based on the projected average costs to member agencies from the SDCWA, the sole imported water wholesaler in the Region. The project will offset imported water supply purchases (Benefit A, **Table 3-58**), avoiding the cost of imported water. The RWFS will provide a cheaper water supply than potable, but due to the potential for increased costs to users by driving to the centralized filling station and trucking water to sites, rather than using the nearest potable supply, cost savings for the RWFS are not included in this benefit. For this benefit, the projected costs of imported water over the project life was applied only to the portion of offset imported water attributed to the PRV program component (344 AFY).

Sources: (imported water costs) Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44);

*Some differences may occur due to rounding

Table 3-63: Physical Benefit H-Reduce Discharge to Outfall
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*
Type of Benefit Claimed: Reduce Discharge to Outfall
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	18 AF	18 AF
2016	0 AF	37 AF	37 AF
2017	0 AF	37 AF	37 AF
2018	0 AF	37 AF	37 AF
2019-2024	0 AFY (0 AF)	37 AFY (221 AF)	37 AFY (221 AF)
2025	0 AF	18 AF	18 AF
2026	0 AF	0 AF	0 AF
2027	0 AF	0 AF	0 AF
Total*	**0 AF**	**368 AF**	**368 AF**

Comments: Wastewater from the City is sent to Point Loma Wastewater Treatment Plant (PLWTP), where it is treated and then discharged to the Point Loma Ocean Outfall (PLOO). Diverting wastewater to be recycled for use at the RWFS will directly offset discharges to the PLOO (37 AFY).

Sources: (wastewater system) City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 4-8 to 4-9; and
San Diego Regional Water Quality Control Board. 2009. Waste Discharge Requirements and National Pollutant Discharge Elimination System Permit for the City of San Diego E. W. Blom Point Loma Metropolitan Wastewater Treatment Plan Discharge to the Pacific Ocean Through the Point Loma Ocean Outfall, San Diego County (Order No. R9-2009-0001 [NPDES No. CA 0107409]). June 10. Pg. 6.

*Some differences may occur due to rounding

Technical Analysis of Physical Benefits Claimed: San Diego Water Use Reduction Program

Technical Basis of the Project

The *San Diego Water Use Reduction Program* has two components providing physical benefits: 1) Pressure Regulator Incentive Pilot Program (PRIP), which will provide customer rebates for installation of pressure reducing valves, and 2) Recycled Water Filling Station (RWFS), which will increase recycled water use through a filling station for construction use purposes. Although these benefits are different, they result in the same physical benefit of decreased potable water demand, the primary physical benefit discussed here.

Pressure Regulator Incentive Pilot Program

Pressure regulating valves (PRVs) are a common water conservation tool, and are included as one of the key residential water conservation measures that should be implemented in a local jurisdiction's (City of Chula Vista) Water Conservation Plan Guidelines[281]. The PRIP component of the program is estimated to offset 344 AFY of potable water through conservation when fully implemented. These offsets were calculated based on an assumption that approximately 5,000 valves will be installed throughout the City of San Diego at residential and commercial sites where higher-than-standard water pressure is causing water waste (i.e., flow rates are too high and irrigation systems leak because of high pressure). Water savings per valve were calculated through an analysis of manufacturers' specifications about pressure regulating valves. The Watts Regulator Company (Watts) reports information about water waste as related to supply pressure.[282] The City of San Diego conducted Home Pressure Regulation research and analysis, and used the Hazen-Williams equation for pressure versus flow rate to calculate potential water savings. Per this analysis, reducing pressure from 115 psi to 60 psi results in a 35% flow rate reduction. It is estimated that under this scenario, valves installed at individual homes would save 78 gallons per day.[283] Using numbers from the Watts document, the analysis found that reducing pressure from 100 psi to 65 psi results in a 20% flow rate reduction. For this second scenario, the analysis found that installing a pressure reducing valve at the house would result in a savings of 45 gallons per day.[284] Because pressure varies across the City of San Diego's distribution system (as with any large distribution system), an average of these two values was used to estimate that the water savings per valve per year from this program would be 61.5 gals/day/valve. With an estimated 5,000 valves to be installed, this is a savings of 307,500 gals/day or 344 AFY. Over the ten-year life of the project, it is estimated that the program would result in a total water savings of 3,444 AF.

Recycled Water Filling Station

The RWFS component of the program will offset potable water demand by providing recycled water for non-potable uses primarily at construction sites. As described in Attachment 4, the program will install one filling station with six meters at the City's North City Water Reclamation Plant (NCWRP). The City estimates that each meter will serve 400 trucks per year, based on experience and consultation with SDG&E, one of the anticipated primary customers that would be served by the filling station.[285] It is estimated that the trucks using the filling station will average 5,000 gals capacity (7,000 gals for tanker trucks, and 3,000 gals for support trucks[286]). This results in an estimated recycled water use (as equivalent offset of potable demand) of 12,000,000 gal/yr, or 37 AFY.

[281] City of Chula Vista. 2003. Water Conservation Plan Guidelines. May. Pg. 1.
[282] Watts. 2010. 23 Questions and Answers About Water Pressure Reducing Valves. Pg. 3.
[283] Pers. Comm. Joey Jacoby, Conservation Analyst, City of San Diego Public Utilities Department. 2014. Available: 619-533-7548.
[284] Pers. Comm. Joey Jacoby, Conservation Analyst, City of San Diego Public Utilities Department. 2014. Available: 619-533-7548.
[285] Pers. Comm. Kyrsten Burr-Rosenthal, Senior Management Analyst, City of San Diego Public Utilities Department. 2014. Available: 619-533-5380.
[286] Geosyntec. 2011.Revised Final Engineering Report for Distribution and Use of Reclaimed Water Sunrise Powerlink Project, San Diego County, California. August. Pg. 7.

Project Phasing

The PRIP Program will begin upon receipt of the grant, October 16, 2014, and continue to be offered through 2018, as described in Attachment 6. To allow time for the PRIP program to get underway and for customers to complete installation of their PRVs, benefits of the PRIP program are assumed to begin in January 2015. Rebates (and therefore the associated benefits) are assumed to be distributed evenly across the years the rebate is offered (until 2018). Although PRVs are "life-of-mortgage" products – generally only requiring cleaning or minor repair, rather than replacement[287] – and benefits from the PRVs could be claimed for long periods of time, the project only considers benefits associated with the first ten years of use. This is consistent with the ten-year life of the RWFS. The RWFS will be completed in December 2015. To allow time for the station to become established and encourage customers to use the RWFS, a buffer time of six months is being used between the time the RWFS is completed and when benefits begin to accrue. Because benefits have been phased in during the first year of operation, they must also be phased out in the final year of the project, as shown in **Table 3-64**. **Table 3-55** shows the primary physical benefit of the *San Diego Water Use Reduction Program* of offsetting potable water demand through conservation and recycled water use.

Table 3-64: Timing of Benefits Achieved by Program Components in the *Regional Demand Management Program Expansion* project

Program Component	Date Benefits Begins to Accrue	% Annual Benefit Realized in Year 1	% Annual Benefit Realized in Year 2	% Annual Benefit Realized in Year 3	% Annual Benefit Realized in Years 4-9	% Annual Benefit Realized in Year 10	% Annual Benefit Realized in Year 11	% Annual Benefit Realized in Year 12
PRIP	January 2015	25%	50%	75%	100%	75%	50%	25%
RWFS	July 2016	50%	100%	100%	100%	50%	0%	0%
Note: Project life is 10 years. For components that achieve partial annual benefits as their components are completed/implemented, the benefit begins to phase out in Year 11, for a total project benefit of 120 months (10 years x 12 months/year). For the PRIP component, the 10-year project life begins at the time each individual PRV project is completed (e.g., if a homeowner participates in the PRIP in 2016, benefits from that project will be accrued from 2016 -2025, while a homeowner who participates in the PRIP in 2017 would accrue benefits from 2017-2026).								

Background for Benefits Claimed

As described previously, the primary physical benefit of the *San Diego Water Use Reduction Program* is reducing potable demand through conservation of 3,444 AF and use of 368 AF recycled water over the ten-year project life. This primary physical benefit creates a number of secondary benefits. The information below is organized by benefit, and includes background information about the Region as well as specific information about the project that explains the basis for each of the benefits claimed for the project.

Primary Physical Benefit – Decrease Potable Water Demand through Conservation and Recycled Water Use

The City of San Diego is committed to local water supply development and in 1997 developed the Strategic Plan for Water Supply, which focuses on planning and developing local water supplies so that the City could become less dependent upon imported water.[288] As a result of these efforts, in 2002 the City adopted the Long-Range Water Resources Plan, which identified water conservation, water recycling, groundwater desalination, groundwater storage, ocean desalination, marine transport, water transfers, and imported water as potential near-term and long-term water supply options available to the City.[289]

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[287] Watts. Water Safety & Flow Control Support – Frequently Asked Questions: Water Pressure Regulators. Accessed July 2, 2014. Available: http://www.watts.com/pages/faq.asp?catId=64&faqId=7#73

[288] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 4-1.

[289] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 4-1.

Part of the City's ongoing plan for increasing independence from imported water supplies includes recognizing water as a precious resource that should not be wasted at any time. In recognition of the City's commitment to water conservation, the City of San Diego's Municipal Code (Sec. 67.3803) requires ongoing mandatory water waste restrictions at all times, and outlines penalties for violations.[290] While the City has many local requirements for water conservation, including that all new buildings must be constructed with pressure regulators, a significant number of homes experience excessive pressure issues. According to an in-house survey of the City's water system, approximately 13% of homes that were reviewed for pressure levels were found to have readings at 100 psi or above and 20% were found to have pressure readings at 90 psi or above; the industry standard for homes is 60 to 65 psi.[291] As a result of these findings and the City's goal to determine cost-effective measures that could be immediately implemented to increase water conservation, the City developed the PRIP to provide rebates to homeowners to install pressure regulator systems.

The City of San Diego's recycled water system is divided into two service areas: the Northern Service Area, which is supplied water from NCWRP, and the Southern Service Area, which is supplied water from the South Bay Water Reclamation Plant (SBWRP) (refer to **Figure 3-16**). An evaluation of NCWRP shows that while the plant has the capacity to treat up to 30 MGD of wastewater and produce up to 30,000 AFY of recycled water, the existing distribution system is not large enough to match the plant's capacity.[292] One of the ways in which recycled water supplies available at NCWRP could be beneficially reused without expanding the existing distribution system would be to construct a RWFS at the site. This idea is based upon a successful effort that was completed at the SBWRP and involved construction and operation of a RWFS that is used to supply recycled water for dust suppression and other purposes for construction projects.[293] The RWFS at SBWRP was initially used for large construction projects as part of an effort to minimize impacts on the local potable water supply; however, if the drought continues in the Region there will be an additional need for recycled water for construction activities.[294] As explained in Attachment 2, it is anticipated that the Region will increase to a Level 2 Drought in the upcoming months, meaning that additional restrictions on water use will be set into place. For the City of San Diego, the Level 2 Drought restrictions stipulate that, "use of recycled water or non-potable water is required for construction purposes when available."[295] As such, an additional RWFS that is located within the Northern Service Area will increase the availability of recycled water for construction purposes, and therefore further reduce the need to use potable water when completing construction activities.

Benefit A-Avoid Imported Water Supply Purchases and Benefit C-Local Supply Development to Decrease Vulnerabilities

The City of San Diego's water supplies consist of imported water purchased from SDCWA, local surface water, recycled water, and groundwater.[296] Approximately 84% of the City's 2015 water supplies are projected to be purchased from SDCWA, San Diego County's regional imported water wholesaler.[297] SDCWA supplies include local surface water, and imported water purchased from MWD, canal lining projects, and transfers from IID.[298] MWD supplies include water from the SWP and the Colorado River,

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[290] City of San Diego. 2014. Permanent Mandatory Water Use Restrictions and Voluntary Level 1 Restrictions. Accessed July 15, 2014. Available: http://www.sandiego.gov/water/conservation/drought/prohibitions.shtml

[291] Pers. Comm. Kyrsten Burr-Rosenthal, Senior Management Analyst, City of San Diego Public Utilities Department. 2014. Available: 619-533-5380.

[292] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 3.

[293] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 4.

[294] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 3.

[295] City of San Diego. 2014. Waste No Water Information and Resources. Accessed July 15, 2014. Available: http://www.sandiego.gov/water/conservation/drought/droughtlevels2.shtml. Note that these restrictions are mandatory during Level 2 drought per City of San Diego Municipal Code §67.3806, which makes all voluntary restrictions under Level 1 (San Diego Municipal Code §67.3805) mandatory, including the use of non-potable water for construction.

[296] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 4-1.

[297] City of San Diego. 2011. 2010 Urban Water Management Plan. Table 4-15 (pg. 4-16).

[298] SDCWA. 2011. 2010 Urban Water Management Plan. June Pg. 1-8

while water from IID is supplied from the Colorado River. The amount of water imported into the Region varies depending on hydrologic conditions, but in recent years the Region's water supply has consisted of between 79% and 93% imported water.[299] Using a 5-year average, approximately 83% of the Region's water was imported.[300] By 2010, the SDCWA had decreased reliance on MWD imports to 59% (331,825 AF), with increased use of IID transfers (13% or 70,000 AF), canal lining transfers (14% or 80,200 AF), and member agency local sources (14% or 76,100 AF).[301] As shown in SDCWA's 2010 UWMP, during dry years, imported water will constitute a larger proportion of SDCWA's supplies due to reduced surface water flows.[302] Per SDCWA's demand project methods described in its UWMP, member agencies only purchase water from SDCWA to meet demand that cannot be met by member agencies' local supplies.[303] Although SDCWA and its member agencies use a mix of imported water and local sources to supply their customers, imported water is more expensive to provide and is considered the marginal water source.[304] Thus, any water conservation or new supplies in the Region (such as recycled water) will be used to offset purchase of imported water supplies.

The Region is located at the bottom of both of its imported water distribution systems, making it potentially vulnerable to disruptions anywhere along the imported water pipelines, which traverse a large part of the state. Attachment 2 explains how the Region's high reliance on imported water contributes to its water supply vulnerability. SDCWA's Strategic Plan identifies supply diversification as the key to improving water supply reliability in the Region.[305] Due to the City's high use of SDCWA supplies to meet demand, it is also subject to the supply vulnerabilities affecting the Region as a whole, as related to reliance on imported water. This goal has been applied throughout the Region with its inclusion in the 2013 San Diego IRWM Plan as Objective E, which was prioritized over other IRWM Objectives and weighted so heavily that projects needed to meet this objective in order to be successful in the project scoring process for inclusion in this expedited funding application.[306] The Strategic Plan includes four strategies for achieving supply diversification: conservation, desalination, non-potable reuse, and water transfers.[307] The *San Diego Water Use Reduction Program* implements two of these strategies: conservation and non-potable reuse. Increasing local supplies or otherwise offsetting imported water demand will help to reduce water supply vulnerabilities by increasing supply diversification and providing a buffer to potential changes in imported water supply availability.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described above, imported water purchased by the City from SDCWA is partially supplied by MWD, which imports water from the SWP and the Colorado River. The SWP draws water from the Bay-Delta. During normal years, SWP supplies account for approximately two-thirds of SDCWA's imported water supplies. Attachment 2 explains that SWP deliveries are restricted during drought, due to reduced flows required to meet the needs of people and ecosystems. Management of the Bay-Delta system requires balancing supplies to meet the needs of people and the needs of sensitive ecosystems.[308] The CALFED Bay-Delta Program (now managed by the Delta Stewardship council) established four objectives[309]:

- *Water Quality*: to invest in projects that improve the State's water quality from source to tap.

[299] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-26.
[300] Pers. Comm. Dana Friehauf, SDCWA, Acting Water Resources Manager. June 18, 2014. Available: 858-522-6749. (Attachment 2).
[301] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 4-4, 4-6, and 6-1.
[302] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 9-3 to 9-7.
[303] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[304] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10. Note that despite desalinated water's high cost, the San Diego IRWM region's priority is to reduce dependence on imported water (IRWM Plan, 2007).
[305] SDCWA. 2008. Strategic Plan. April. Pg. 9.
[306] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (excerpted in this application in Appendix 1-5).
[307] SDCWA. 2008. Strategic Plan. April. Pp. 9-11.
[308] Delta Stewardship Council. 2013. The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value. Pp. 10-11.
[309] CALFED Bay-Delta Program Archived Website. CALFED Objectives. Accessed 28 June 2014. Available: http://calwater.ca.gov/

- *Water Supply*: comprised of five critical elements: conveyance, storage, environmental water account, water use efficiency and water transfer.
- *Ecosystem Restoration*: aims at restoring habitats, ecosystem functions, and native species.
- *Levee Integrity*: to protect water supplies by reducing the threat of levee failures.

Considering SDCWA's overall supply mix, and understanding that imported water will be offset before any local supplies, reduced demand for imported water will also contribute to reduced pumping from the Bay-Delta. This allows more water to be available to meet Bay-Delta management needs (refer to Attachment 7).

Benefit D-Reduce Net Production of Greenhouse Gases and Benefit E-Avoid Social Costs of Greenhouse Gases

Reducing imported water demand provides more benefits than just reducing supply vulnerabilities and benefitting the Bay-Delta. It also reduces production of GHGs, and helps to avoid the social costs associated with GHG emissions. Imported water is an energy intensive water supply for the Region, on average requiring more than three times the energy required for recycled water.[310] Conservation would offset all of the energy required to import and treat water, while increasing recycled water use would offset the energy difference between imported and recycled water. Reducing demand for imported water offsets the GHGs produced by the energy associated with imported water. GHGs are the primary cause of climate change, which is anticipated to have impacts on the Region. The 2013 San Diego IRWM Plan incorporated the results of a Climate Change Planning Study for the Region that describes the Region's vulnerabilities and highest priorities related to climate change. Potential impacts of climate change on the Region include temperature increases, increased variability in rainfall, decreased availability of imported water supplies, increased water demands, increased wildfires, and sea level rise.[311] A vulnerability analysis found that the highest priority climate change impact was reduced availability of imported water supplies. Other high priority impacts included sensitivity due to higher drought potential, increased concentration of pollutants, extreme weather-caused flooding, inundation of sewer and storm systems from sea level rise, and a decrease in ecosystem services.[312] GHG emissions and climate change have an associated social cost to them, ranging from costs to mitigate climate change impacts to public health costs and economic impacts.

Benefit F-Contribute to 20x2020 Goals

Reducing potable demand through conservation and increased recycled water use also serves to meet 20x2020 goals. Senate Bill x7-7 (SBx7-7) was passed as part of plans to improve the Bay-Delta, and mandates a 20% reduction in California's per capita water use by 2020. The 20x2020 Water Conservation Plan (20x2020 Plan) was developed to define the goals of the SBx7-7 legislation and provide guidance for compliance for urban water suppliers affected by the legislation.[313] In addition to reducing water use through conservation, the 20x2020 Plan allows recycled water to be applied towards urban water suppliers' compliance with the 20x2020 goals because recycled water offsets potable supply and does not constitute a new supply.[314]

Each urban water supplier was required to set its 20x2020 goal in its 2010 UWMP. The City's 20x2020 goal is to reduce water use to 142 gpcd by 2020.[315] As noted in the 20x2020 Plan, the statewide mandated water use reductions are designed to protect the Bay-Delta, but will also have a number of secondary benefits. For example, the 20x2020 plan will help to reduce energy consumption, because approximately one-fifth of the electricity used in California is allocated to water delivery, treatment, and use, and one-third of natural gas not used in power plants is used for the same purpose.[316]

[310] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10
[311] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-15 (pg. 7-38).
[312] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-16 (pg. 7-39).
[313] DWR, et al. 2010. 20x2020 Water Conservation Plan. February Pg. ix.
[314] DWR, et al. 2010. 20x2020 Water Conservation Plan. February. Pg. 3.
[315] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 3-8.
[316] DWR, et al. 2010. 20x2020 Water Conservation Plan. February. Pg. 1.

Benefit G-Reduce Water Costs to Customers

The *San Diego Water Use Reduction Program* reduces costs to customers in two ways: direct cost savings from reduced water demand, and indirect cost savings from reduced reliance on imported water. Although recycled water is cheaper than potable - $0.80 per HCF for recycled water compared to $4.014 per HCF for potable water in December 2011[317] – cost savings to customers using the RWFSs are not included in this benefit analysis because use of recycled water available only at the North City WRF may incur additional costs that would have been avoided if customers were able to use potable water. Such costs could include additional time and energy to transport water further distances.

Customers receive cost savings benefits from conserving water, thereby reducing the amount of water they purchase from the City. Due to the variability in water rates for customers related to customer type and level of use, as well as uncertainty over future rate increases, cost savings were calculated using projected imported water costs (which will be offset by the project), rather than the City's rates. This is both conservative because it does not account for the costs the City incurs and must pass on to customers related to their efforts in getting water from SDCWA to their customers, and appropriate because cost savings related to imported water will be passed along to customers in other ways.

As described in Attachment 8, the City of San Diego is home to numerous DACs. These DACs will receive costs savings benefits directly from the *San Diego Water Use Reduction Program* if they choose to participate. Even for individuals who choose not to participate, benefits will be felt in the form of protection from imported water rate fluctuations. This protection is provided by the City's reduced reliance on imported supplies described under Benefit A.

Benefit H-Reduce Discharge to Outfall

Other cost savings will be realized through reduced discharge to the Point Loma Ocean Outfall. The City's wastewater is collected and sent to the Point Loma Wastewater Treatment Plant (PLWTP) or one of its two recycled water facilities. In addition to serving the wastewater needs of the City, the PLWTP also treats wastewater from Lemon Grove Sanitation District, Otay Water District, Padre Dam MWD, the Cities of Chula Vista, Coronado, Del Mar, El Cajon, Imperial Beach, La Mesa, National City, and Poway, and the communities of Lakeside/Alpine, Spring Valley, Wintergardens, and East Otay Mesa.[318] Treated wastewater from PLWTP is then discharged to the Point Loma Ocean Outfall, a 4.3 mile long deep water outfall.[319] In 2010, 108,952 AFY treated wastewater was disposed of through the Point Loma Ocean Outfall. Although this is anticipated to decrease to 102,744 AFY in 2015 because of increased water recycling, it is anticipated to increase over time as the population served by the PLWTP grows.[320]

Capacity concerns are prevalent with the PLWTP because of the large population it serves, as well as the waiver required to permit the PLWTP to treat wastewater to advanced primary rather than secondary prior to discharge to the ocean. During receipt of the 2010 permit for the PLWTP, the City agreed to conduct a Recycled Water Study, which was finalized in 2012. This study aimed to maximize reuse and minimize flows to the PLWTP.[321] Offloading flows to the PLWTP are hoped to reduce conflicts over the quality of discharge from the facility and reduce the need to upgrade the plant to provide secondary treatment, which would be costly and technically challenging due to the plant's location along the coastal cliffs between the ocean and the Cabrillo National Monument. Increasing recycled water use will help offset the flows to the PLWTP by diverting more flows to the water recycling facilities, while the PRVs will reduce flows by conserving indoor water use.

[317] City of San Diego. Recycled Water Rate – Future Recycled Water Rate Increase. Accessed July 2, 2014. Available: http://www.sandiego.gov/water/recycled/recycledrates/rateincrease.shtml
[318] City of San Diego. 2011. 2010 Urban Water Management Plan. Pp. 4-8 to 4-9.
[319] San Diego Regional Water Quality Control Board. 2009. Waste Discharge Requirements and National Pollutant Discharge Elimination System Permit for the City of San Diego E. W. Blom Point Loma Metropolitan Wastewater Treatment Plant Discharge to the Pacific Ocean Through the Point Loma Ocean Outfall, San Diego County (Order No. R9-2009-0001 [NPDES No. CA 0107409]). June 10. Pg. 6.
[320] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 4-9.
[321] City of San Diego. 2012. San Diego Recycled Water Study. July. Pg. 1-1.

Benefit I-Reduce Stormwater Loading of Pollutants

A significant factor in pollutant loading is irrigation runoff. Urban runoff contributes to water quality issues. The 2013 San Diego IRWM Plan notes that runoff has contributed to pollution in the San Diego Bay, which in turn as impacted subsistence fishermen.[322] It also described the high impact of low "dry weather flows" that are partially a result of runoff on water quality in the Region.[323] Growth in the Region has increased urban runoff and non-storm flows.[324] High water pressure leads to excess water delivered by fixtures, as well as contributes to leaks[325]. These fixtures include faucets, showerheads, and may include hoses, sprinklers, and other outdoor irrigation equipment. For residences that participate in the PRV program and install the PRV to pipes serving their outdoor irrigation equipment, water conservation benefits will be realized from outdoor irrigation. The reduced pressure could reduce over application of water, thereby reducing the risk of runoff, and associated pollutant loading.

Benefit R-Reduce Damage to Plumbing

The 2013 California Plumbing Code, part of the California Building Code, requires households with water pressures greater than 80 psi to install a pressure regulating valve on private properties.[326] These PRVs reduce high pressure to more reasonable levels as water enters a property after the meter. Excessive water pressure causes a number of negative impacts on plumbing, and can lead to leaks, cause "water hammer", damage water appliances (e.g., water heater, washing machine, or dishwasher), and lead to inefficient or ineffective irrigation from sprinklers.[327]

Without Project Baseline

Without the *San Diego Water Use Reduction Program* project, the City would continue to use 381 AFY imported potable water for household use and non-potable applications such as at construction sites. There would be no incentive program to encourage households to install PRVs, so excessive water would continue to be delivered by fixtures, damage to plumbing from high water pressure would continue, and other nuisances such as "water hammer" could occur. The other secondary benefits of the project would also not be realized without the project. Such benefits include offloading flows to the Point Loma Ocean Outfall, offset demand for imported water and associated offset of Bay-Delta demand, avoided GHG emissions and their associated social costs, and reduced water costs for customers – including DACs. The City would also need to find more alternate methods for meeting its 20x2020 goal.

Methods Used to Estimate the Physical Benefits

Methods used to estimate the primary physical benefit – namely via reference to technical documentation – were described above under Technical Basis of the Project.

Benefit A-Avoid Imported Water Supply Purchases

The City of San Diego purchases imported water from SDCWA, the water wholesaler to water agencies in San Diego County, which purchases water through the MWD. MWD obtains its water from two sources: the Colorado River Aqueduct, which it owns and operates, and the SWP, with which MWD has a water supply contract through the state of California. Currently, imported water purchases from MWD account for about 59% (331,825 AF) of SDCWA supplies.[328] SWP supplies from the Bay-Delta have been restricted since 2006, due to drought and regulatory restrictions, and additional restrictions on Colorado River water limits its use for supplemental supply. As described in Attachment 2, the current drought has

[322] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-18.
[323] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-32.
[324] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-35.
[325] Watts. 2010. 23 Questions and Answers About Water Pressure Reducing Valves. Pg. 8
[326] California Building Standards Commission. 2014. CCR Title 24, Part 5. 2013 California Plumbing Code. January. §608.2 Excessive Water Pressure.
[327] Otay Water District. 2012. Water Pressure Regulator (video outreach). March 21. Accessed July 13, 2014. Available: https://www.youtube.com/watch?v=Ye0I3V6KCw4
[328] SDCWA. 2011. 2010 Urban Water Management Plan. June. Page 6-1, Section 6, Metropolitan Water District of Southern California.

restricted SWP supplies even further, down to 5% of allocations. It is anticipated that if the drought continues, SWP deliveries may be reduced to 0% in 2015.

Other sources of imported water for the County are provided through a Water Conservation and Transfer Agreement with IID, an agricultural district in neighboring Imperial County, and a Quantification Settlement Agreement (QSA) on the Colorado River. SDCWA had also acquired short-term dry-year water transfers from agencies in Northern California during the last drought.[329]

As described in SDCWA's 2010 UWMP, SDCWA imported water demands are calculated as total estimated demands less local supplies (including member agency local supplies).[330] This indicates that local supplies are used first, and imported water purchases only made to address supply deficiencies; therefore all of the water conserved by this project, and all of the recycled water delivered by this project, will be used to directly offset imported water in a 1:1 ratio. Therefore, by reducing potable demands, this project will directly offset the use of 381 AFY of imported water. It is assumed that the benefits of each component will begin to accrue once that component is complete, and that benefits would be achieved equally throughout the year (e.g., if a component is completed at the end of May, 2016, the benefits accrued for that component in 2016 would be 50% of the component's annual benefit). **Table 3-56** shows the avoided imported water benefit from the project over its ten-year life.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described in Benefit A, all of the water produced and delivered by the *San Diego Water Use Reduction Program* project will offset imported water purchases. SDCWA's supply mix includes imported water, surface water, and recycled water. During a normal year, SDCWA's imported water supply consists of two-thirds SWP supplies and one-third Colorado River supplies. [331] Attachment 2 describes how SWP deliveries have been reduced to 5% of allotments for 2014, and are anticipated to decrease to 0% if drought conditions continue into 2015. During drought years, assumed to be 2014 and 2015, the SWP portion of SDCWA's imported water mix is estimated to be 15%[332], while the normal two-thirds proportion is used for other years, assuming drought conditions cease. Applying this ratio to the avoided imported water calculated in Benefit A, the project will reduce demand for net diversions from the Bay-Delta by 254 AFY, or a total of 2,488 AF over the ten-year project life, as shown in **Table 3-57.**

Benefit C-Local Supply Development to Decrease Vulnerabilities

As described in SDCWA's 2010 UWMP, supply diversification is a key strategy to improve long-term reliability of supplies.[333] Specifically, the Region has a goal to improve the reliability and sustainability of regional water supplies, with part of the associated supply diversification objective to encourage the development of local water supplies.[334] As described in Attachment 2, imported water supplies and surface water supplies are vulnerable to reduced deliveries during drought. Further, the Region is located at the end of both of its imported water systems, increasing the risk of delivery interruptions from accidents, natural disasters, such as seismic events or weather events exacerbated by climate change, or other events. Any new local supply development (such as use of recycled water) or conservation effort (conservation is treated as a supply by SDCWA in its diversification portfolio[335]) would reduce the Region's vulnerability to these and other supply interruptions. The *San Diego Water Use Reduction Program* will conserve 344 AFY, and increase recycled water use 37 AFY. As such, all water produced by this project, as described under Benefit A, is local supply development that will decrease vulnerabilities, shown in **Table 3-58**.

[329] SDCWA. 2011. 2010 Urban Water Management Plan. June. Page 4-1, Section 4, San Diego County Water Authority Supplies.
[330] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[331] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8
[332] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.
[333] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.
[334] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (available in this application as Appendix 1-5)
[335] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.

Benefit D-Reduce Net Production of Greenhouse Gases

The *San Diego Water Use Reduction Program* will reduce GHG production through energy savings from reduced imported water demand. As described above, 381 AFY of imported water is anticipated to be offset by this program. Imported potable water has extensive energy requirements associated with transporting water from Northern California and the Colorado River to San Diego County and treatment of raw water to potable standards. By avoiding imported water supply purchases, as described in Benefit A, this project will also reduce the net production of GHGs, measured in CO2 equivalent (CO2e) associated with the production of the energy required for imported water. As described above, the project will offset imported water in two ways, conservation and use of recycled water. Energy savings from conservation is a direct offset of the energy used to convey and treat imported water, while energy savings from recycled water use is the difference between the energy associated with imported water and the energy associated with recycled water production and use.

The 2010 Equinox Report estimates energy required to convey and treat imported water delivered to the customers in the Region is between 2,000 kWh/AF and 3,300 kWh/AF,[336] or an average of 2.65 MWh/AF. Offsetting 344 AFY of imported water through conservation (as described under Benefit A) will save 913 MWh/year. The 2010 Equinox Report estimates recycled water energy intensity is between 600 kWh/AF and 1,000 kWh/AF,[337] or an average of 0.8 MWh/AF. Every AF of imported water offset by recycled water results in 1.85 MWh energy savings. Offsetting 37 AFY imported water through recycled water use will save 68 MWh/year. For the program as a whole, there will be energy savings of 980 MWh/yr (913 MWh/yr + 68 MWh/yr).

- Energy intensity of imported water: 2.65 MWh/AF
- Energy intensity of recycled water: 0.8 MWh/AF
- Energy savings from project (assumes recycled water component delivers 37 AFY, and PRV delivers 344 AFY): 980 MWh/year

Converting from energy use to CO_2e emissions requires a breakdown of California electricity sources. California generates 70% of its electricity through a combination of hydroelectric, nuclear, coal, oil, natural gas, geothermal, biomass, wind, solar, and other. 10% of California's electricity is imported from the Pacific Northwest, and the remaining 20% imported from the Pacific Southwest.[338] Emission rates in lbs. of CO_2e per MWh will vary based on the energy source, but can be estimated across regions, per the EPA's eGRID. California production was eGRID subregion WECC California, the Pacific Northwest is WECC Northwest, and the Pacific Southwest is WECC Southwest. Each of these regions has a CO_2e emission rate of 613.28, 846.97, and 1,182.89 lbs/MWh, respectively.[339] Taking a weighted emissions rate (using the percentage of electricity produced in each region), the average emissions for electricity in California is 750.57 lbs/MWh of CO_2e. With 2204.62 lbs. per MT, a standard conversion rate for California can be calculated as 0.341 MT of CO_2e per MWh of electricity. Therefore, the total amount of CO_2e emissions expected to be saved by this project is 334 MT/year, or a total of 3,345 MT CO2e over the ten-year project life. These benefits are summarized in the bullets below, and provided by year in **Table 3-59**.

- Energy savings resulting from the project (assuming 37 AFY recycled water and 344 AFY conserved water): 980 MWh/year
- Average GHG in California energy grid: 0.341 MT/MWh
- Annual GHG reductions resulting from the project: 334 MT CO2e
- Cumulative GHG reduction over project lifetime: 3,345 MT Co2e

[336] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[337] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[338] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html
[339] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

Benefit E-Avoid Social Costs of Greenhouse Gases

There are social costs associated with increased GHG emissions related to air quality impacts and climate change. The social cost of carbon is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present.[340] Such costs include, but are not limited to, impacts to agricultural productivity, human health, increased flood risk and associated damages, and ecosystem services and their values.[341] In February 2010, the U.S. Government's Interagency Working Group on Social Cost of Carbon issued guidance on recommend values for the social cost of carbon for use in regulatory benefit-cost analysis.[342] The recommended mean estimate of the social cost of one MT of CO2 in 2014 dollars is $24.55. This is updated from the $21.40 in 2007 dollars reported by the Interagency Working Group on Social Cost of Carbon[343], using the CPI Inflation Calculator.[344] An estimate of the social costs of GHGs avoided by the project can be calculated by applying this $24.55/MT CO2 to the emissions savings from Benefit D. **Table 3-60** shows the avoided social costs of GHGs from the *San Diego Water Use Reduction Program* by year, while the benefit is summarized in the bullets below.

- Annual GHG reductions resulting from the project (assuming 37 AFY recycled water use and 344 AFY conserved water): 334 MT CO2e/year
- Social cost of GHGs: $24.55 per MT CO2e
- Annual avoided social costs of GHG emissions from the project: $8,212/ per year
- Cumulative avoided social costs of GHG emissions from the project over its lifetime: $82,117

Benefit F-Contribute to 20x2020 Goals

SBX7-7, also known as 20x2020, is legislation passed in 2000 that requires urban water suppliers to reduce their daily per capita water use by 20% by 2020. The City of San Diego's 20x2020 goal is reported in its UWMP as 142 gpcd.[345] This is a reduction of 35.5 gpcd (142 gpcd = 0.8*baseline → baseline = 142 gpcd/0.8 → baseline = 177.5 gpcd). The legislation allows recycled water to contribute towards 20x2020 goals.[346] The *San Diego Water Use Reduction Program* will offset potable water use with recycled water, thereby contributing to the City of San Diego's 20x2020 goals. Contribution to these 20x2020 goals was calculated by converting the potable water offset of the project, 381 AFY (presented above), to gpcd using the 2020 population estimates (1,483,986 people[347]) found in The City of San Diego's UWMP. Population estimates from 2020 were used because that is the year by which the 2020 goals must be met. The project's contribution to meeting 20x2020 goals is gpcd from the project (0.23 gpcd once full benefits realized) as a percentage of the City of San Diego's overall gpcd reduction goal (35.5 gpcd), as shown in **Table 3-61**. Because the 20x2020 goals must be met by 2020, the benefit is only calculated to 2020, rather than through the full life of the project. When benefits are fully realized, the project will contribute 0.6% towards meeting City of San Diego's 20x2020 goal. Further details about this calculation are provided below:

- City of San Diego's target reduction in gpcd: 35.5 gpcd

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[340] IPCC. 2007. Summary for policymakers. In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* ML Perry, OF Canziani, JP Palutikof, PJ van der Linden, and CE Hanson (eds.). Cambridge University Press. Cambridge, UK. Pg. 17.

[341] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 1.

[342] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 28.

[343] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28).

[344] U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm

[345] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 3-10.

[346] DWR, et al. 2010. 20x2020 Water Conservation Plan. February. Pg. 3.

[347] City of San Diego. 2011. 2010 Urban Water Management Plan. Table 3-1 (pg. 3-1).

- Amount of water from the project that will contribute to 20x2020 goals: 381 AFY (340,376 gallons per day)
- City of San Diego's projected 2020 population: 1,483,986 people
- GPCD reduction provided by the project in 2020: 0.23 gpcd
- Percent contribution towards 20x2020 goals: 0.6%

Benefit G-Reduce Water Costs to Customers, Including DACs

As described in Benefit A, the *San Diego Water Use Reduction Program* will offset potable imported water demand through conservation from the pressure reducing valves and conversion from potable to recycled water for non-potable uses for filling station customers. For recycled water customers using the filling station, the direct cost of water is lower than using potable, but may not result in actual reduced water-related costs. Trucks may need to drive further to fill up using recycled water at the filling station than alternative potable water filling options, leading to extra expenses in time, fuel, maintenance of the vehicles. These potential additional costs may offset the savings of using recycled water over potable for these users. For these reasons, cost savings of recycled water over imported potable water is not included in this benefit calculation.

For customers participating in the pressure reducing valve rebate program, the water conserved by the project will reduce their water costs by an amount equal to the cost of the conserved water. It is anticipated that the pressure reducing valves will conserve 344 AFY, or 3,444 AF over the project life. The City's water rates vary by customer type and use level[348], and future rate increases are uncertain. For these reasons, a proxy was used to calculate the potential water cost savings, based on the cost of imported water. As described for other projects in this Proposal, Sweetwater Authority's Title XVI Technical Project Report contains projected average imported water costs for imported water purchased from SDCWA. Because SDCWA is the sole imported water purveyor in the Region, these projections can be used for any project in the Region that offsets imported water. For the years that benefits will be accrued during the life of the pressure reducing valve component of the *San Diego Water Use Reduction Program*, imported water costs range between $1,349/AF and $1,778/AF in 2012 dollars.[349] Using a conversion factor of 1.04 from the Consumer Price Index to convert these values to 2014 dollars[350], imported water costs range from $1,403/AF and $1,849/AF, for an average of $1,659/AF over the project life. As shown in **Table 3-62**, offsetting imported water through conservation using pressure reducing valves results in a total of $5,742,112 in reduced water costs.

These water costs will be passed along to customers through direct reduction in water purchases, and by providing a buffer from water price fluctuations. As described in Attachment 8, and shown in **Figure 3-15**, the City of San Diego serves a number of DACs. Because the benefits accrued from the pressure reducing valve component of the program will be realized by any household that chooses to participate, these benefits can be achieved by DACs within the City of San Diego's service area. Further, the water price buffering from reduced imported water purchases will help all customers within the service area, regardless of direct participation in the program.

Benefit H-Reduce Discharge to Outfall

As described above, the *San Diego Water Use Reduction Program* will increase the use of recycled water by 37 AFY. Recycled water is sourced from treated wastewater, which in the City of San Diego, is discharged to the ocean through Point Loma.[351] Therefore any increase in recycled water use will reduce the amount of wastewater discharged through the ocean outfall by an equal volume. **Table 3-63** shows the reduced outfall discharge and associated increase in available capacity over the life of the project. The PRVs will conserve indoor water use, which will also reduce flows to the PLWTP, but it is not

[348] City of San Diego. Water Rates. Accessed July 2, 2014. Available: http://www.sandiego.gov/water/rates/rates/index.shtml

[349] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44).

[350] Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 24 June 2014. Available: http://www.bls.gov/data/inflation_calculator.htm

[351] City of San Diego. 2012. San Diego Recycled Water Study. July. Pg. 2-2.

possible to determine how much of the water conserved by the PRV component will be outdoor water use and how much is indoor, so benefits of reduced discharge to the outfall related to PRV installation is limited to qualitative discussion only.

Benefit I-Reduce Stormwater Loading of Pollutants

As described above, high water pressure can cause leaks, breakages, and excess delivery of water.[352] Some residences that participate in the PRV rebate program will install their PRVs in a location such that it conserves water for both indoor and outdoor use. This would include outdoor irrigation equipment. The reduced pressure could reduce over-application of water, thereby reducing the risk of runoff, and associated pollutant loading. Due to uncertainties surrounding the number of residences that would receive conservation benefits from the PRV related to outdoor irrigation and the amount of existing runoff and associated pollutant loading, this benefit, while expected, cannot be quantified with any certainty.

Benefit R-Reduce Damage to Plumbing

Excessive water pressure damages water appliances and fixtures, as described above. It can also lead to broken pipes through the "water hammer" effect.[353] Reducing water pressure to below 80 psi as required in the California Plumbing Code[354], will reduce the damage to plumbing and water appliances associated with high water pressure. Although damage to appliances and plumbing can be attributed to high water pressure, it is not possible to quantify this damage due to variability associated with the individual appliances and water pressure at individual sites, and uncertainty over which households will choose to participate in the PRV rebate program.

New Facilities, Policies, and Actions Required to Obtain Physical Benefits

To receive the rebate for the PRV, residences must complete installation of the PRV. Therefore, no additional facilities will be required to achieve the benefits once the PRV rebates are issued. To complete installation of the PRV, residences may require additional fittings or other incidental plumbing parts. In addition the cost of the PRV (of which up to $85 will be reimbursed by the rebate), costs for installing the valve are anticipated to run between $170 and $250, depending on the individual site. To achieve the full benefits from the RWFS component, customers would need to rent water trucks and hire drivers to deliver the recycled water to their individual use sites. Costs for these services is anticipated to be approximately $750 per truck delivery.

Potential Physical Effects of the Project

There may be some temporary adverse effects during and related to construction of the RWFS at the North City WRF. However, these are anticipated to be minor, and will be short-term in nature. There are no adverse physical effects anticipated from the PRV component of the program.

[352] Watts. 2010. 23 Questions and Answers About Water Pressure Reducing Valves. Pg. 8
[353] Otay Water District. 2012. Water Pressure Regulator (video outreach). March 21. Accessed July 13, 2014. Available: https://www.youtube.com/watch?v=Ye0I3V6KCw4
[354] California Building Standards Commission. 2014. CCR Title 24, Part 5. 2013 California Plumbing Code. January. §608.2 Excessive Water Pressure.

Cost Effectiveness Analysis: San Diego Water Use Reduction Program

The *San Diego Water Use Reduction Program* is a drought preparedness program that reduces potable water demands through demand management and increased use of recycled water. The primary physical benefit described above is reduced demand for potable water, which results in the numerous benefits described above. Some of these benefits are highly project-specific, and cannot be achieved through project alternatives. **Table 3-65** (Table 6 in the PSP) provides a brief summary of why no project alternatives exist that also achieve the same types and amounts of benefits, while more detail is provided below.

Table 3-65: Project Analysis
San Diego Water Use Reduction Program

Project Name: *San Diego Water Use Reduction Program*	
Question 1 Physical Benefits Summary	The primary physical benefit of reducing potable water demand through conservation and increased use of recycled water will result in the secondary benefits summarized in **Table 3-54**, above. These benefits include: avoid imported water supply purchases, reduce demand for net diversions from the Bay-Delta, local supply development to decrease vulnerabilities, reduced GHG emissions, avoid social costs of GHGs, contribute to 20x2020 goals, reduce water costs, reduce discharge to outfall, reduce stormwater loading of pollutants, and reduce damage to plumbing systems.
Question 2 Alternatives Considered	Alternatives were considered for both the Pressure Reducing Valve program component and the Recycled Water Filling Station program component. Alternatives would provide the same types of benefits, but not necessarily the same amount of benefits. See details in discussion following this table.
	<u>Pressure Reducing Valve:</u> The alternative considered was a lower rebate value per valve, $65 instead of the selected $85, for the same number of rebates (5,000). The alternative would have the same costs as the selected program component for all other costs associated with the component. The alternative would therefore cost $100,000 less than the selected component. <u>Recycled Water Filling Station:</u> Multiple alternatives were considered for this program component, based on type of filling station and location. Only one filling station type alternative would provide the same amount of benefits as the selected component – the automated multi-user filling station, which had a capital cost of $175,000, and a net present value of -$96,793, compared to the capital cost of the preferred station type ($80,000) with a net present value of +$15,326. The location alternatives considered for the RWFS had the same capital and O&M costs, based on the selected filling station type. Alternative locations also included costs for on-site security personnel. The selected location already has on-site personnel, and would not incur this cost. Net present value of the program component at any of the alternate locations is -$705,476, while the net present value of the component at the selected location is +$15,326.
Question 3 Preferred Alternative	The preferred alternative for the Pressure Reducing Valve is not the least cost alternative, but is anticipated to be more effective to encourage full participation in the rebate program, and will potentially encourage DAC participation by covering most, if not all, of the cost of the valve. It was also the alternative selected by the Region's stakeholders as the preferred alternative. The rebate offered by the program component is well within the normal range for similar programs, and is lower than another PRV in the Region. The preferred alternative for the Recycled Water Filling Station program component is the least cost alternative that also provides the same amount and type of benefit. It also supports the Region's priorities and provides protection against potential economic impacts of the drought if the drought continues into the future and additional drought restrictions are implemented. Details about why the program components were selected over potential alternatives are provided in the discussion below.

Q1: Types of Benefits Achieved by Project

The *San Diego Water Use Reduction Program* would achieve ten physical benefits as a result of its primary physical benefit of reducing potable water demand through conservation and increased use of recycled water. These benefits and how they were calculated are discussed in detail in the sections above, and summarized in **Table 3-54**. Benefits from the program include:

- Avoid imported water supply purchases – 381 AFY
- Reduce demand for net diversions from the Bay-Delta – 254 AFY
- Local supply development to decrease vulnerabilities – 381 AFY
- Reduce net production of GHGs – 334 MT CO2e per year
- Avoid social costs of GHGs - $8,212 per year
- Contribute to 20x2020 goals – 0.6%
- Reduce water costs to customers, including DACs – $5,742,112 (over 10-year project life)
- Reduce discharge to outfall – 37 AFY
- Reduce stormwater loading of pollutants – Qualitative
- Reduce damage to household plumbing and associated nuisances – Qualitative

Q2: Discussion of Project Alternatives

The program is a drought relief project that achieves water conservation and recycled water use goals. While many of the benefits described here could be achieved by other conservation or recycled water projects, some of the benefits are specific to the program as designed, and could not be achieved by alternate projects. The program has two components, which each can be evaluated separately as regards project alternatives.

Pressure Regulating Valves

The PRV component of the program provides rebates to homeowners to install PRVs that reduce water pressure in their plumbing and fixtures. High water pressure leads to water waste through excessive delivery of water at fixtures and increased risk of leaks and pipe failures. High water pressure also causes nuisances such as “water hammer” and noisy pipes, described above. If only the primary objective of water conservation is considered, other conservation projects may exist as alternatives. However, such conservation alternatives would not achieve any of the benefits specifically related to reducing water pressure. Therefore, the only alternatives that would achieve all of the same types and amounts of benefits would be the use of different PRVs or changing the value of the rebate.

The first alternative, the use of different PRVs, is not relevant because the program component is a rebate program. There are no restrictions on which valve(s) must be purchased by the homeowner, simply that a PRV be purchased and installed to reduce water pressure to an appropriate level. The second alternative, reimbursing homeowners for a different amount, was initially considered by the City of San Diego. When first proposed, the program included a $65 rebate for each pressure regulating valve, with a goal of issuing 5,000 rebates. As the program was evaluated during the Region’s local project selection process (see Attachment 1), the local Project Selection Workgroup recommended that the rebate be increased to increase customer participation in the program. The Project Selection Workgroup recommended that the rebates be increased to $85 per device, maintaining the goal of issuing a total of 5,000 rebates. This recommendation was made because the Workgroup felt it would increase participation in the program and could potentially increase participation by DACs by reducing the costs for end-users. As described in Attachment 1, the recommendation of the Workgroup was discussed and approved by the Regional Advisory Committee (RAC), the local advisory committee to the RWMG that consists of stakeholders across the Region from a wide variety of backgrounds and perspectives.

Recycled Water Filling Station

The RWFS component of the program will construct one RWFS with six meters at the City’s existing NCWRP. This component is based on the success of a similar project at the South Bay Water

Reclamation Plant.[355] As a construction component, alternatives were considered prior to selection of the preferred alternative. In total, 20 alternatives were considered for the RWFS program component. These alternatives included[356]:

- Do not construct the RWFS (no project alternative)
- Use the RWFS at the South Bay Water Reclamation Plant
- Six location alternatives
- Three filling station alternatives
    - Manual single-user filling station
    - Manual multi-user filling station
    - Automated multi-user filling station

The City's Recycled Water Filling Station Abstract Business Case Evaluation (Business Case Evaluation) evaluated the benefits and disadvantages of each of the above-listed alternatives, along with their financial impacts. Evaluation of the alternatives considered two things: location and filling station type. Per this evaluation, the manual multi-user filling station type was the most cost-effective, while the NCWRP location was the most cost-effective.[357] **Table 3-66** and **Table 3-67** show the cost effectiveness of each location and each station type, as presented in the Business Case Evaluation.

Table 3-66: Net Present Value by Filling Station Type[358]

Filling Station Type	Capital Costs	30-year Net Present Value
No project	$0	$0
Manual Single User	$75,000	($66,468)
Automated Multi-User	$175,000	($96,793)
Manual Multi-User	**$80,000**	**$15,326**

Table 3-67: Net Present Value by Filling Station Location[359]

Potential Filling Station Location	Capital Costs	30-year Net Present Value
No project	$0	$0
Black Mtn. Rd. and Carmel Valley Rd.	$80,000	($705,476)
Olivenhain, San Dieguito Rd.	$80,000	($705,476)
Camino del Sur and Torrey Santa Fe Rd.	$80,000	($705,476)
Park Village Rd. and Camino del Sur	$80,000	($705,476)
North City Water Reclamation Plant	**$80,000**	**$15,326**
Metropolitan Biosolids Center, Convoy St.	Permitting would not allow for additional truck trips to accommodate new filling station – site infeasible	N/A

The filling stations considered in the Business Case Evaluation were all found to have advantages and disadvantages. The manual single user option was the cheapest for initial capital costs and ongoing O&M ($75,000 and $1,000, respectively), but because this option could only serve one customer at a time, it provides the least amount of annual benefits of the three options ($1,947 per year) – thereby not providing the same benefit-level as the selected alternative. The automated multi-user option increased

[355] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 4.
[356] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 5.
[357] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 12.
[358] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 12.
[359] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pg. 12.

the annual benefit to $11,680 per year by serving multiple customers at once, but due to the required equipment for an automated system, also came with the highest capital and O&M costs ($175,000 and $3,000, respectively). The manual multi-user station type has low capital and O&M costs ($80,000 and $1,100 respectively), only slightly higher than that of the manual single user station type. In addition, by being able to serve multiple customers, this option can achieve higher annual benefits $11,680 per year. The net present value of the manual multi-user was positive, while the other station types had negative net present value.[360] For this reason, the manual multi-user station type was selected, and used to evaluate the potential filling station locations.

The locations considered all had the same capital costs ($80,000), O&M costs ($1,100), and annual benefit (recycled water sales - $11,680). The difference in Net Present Value between the selected NCWRP site and the alternatives is related to the annual on-site personnel wages ($80,000) that would be incurred by the other locations. This represents the costs required to hire on-site security personnel. Security would not need to be hired at the NCWRP site, because the site is already owned and operated by the City of San Diego and has on-site security personnel. The Metro Biosolids Center location was considered, but found to be infeasible due to permitting issues that would have prohibited the additional truck trips required to accommodate a new filling station at the site.[361]

Q3: Preferred Project Alternative

The program as presented here is the preferred project alternative because it achieves all of the benefits described above in a cost effective manner. No satisfactory alternative exists for the PRIP Program component. Although a cheaper alternative for this program component was initially considered, the final $85 per device rebate for residential customers was recommended by stakeholders as appropriate to ensure that all 5,000 rebates would be distributed prior to project completion. This rebate amount is still lower than a 2012 pressure regulator valve rebate offered by another agency in the Region, Otay Water District, which offered up to $350 per pressure regulator valve installation (covers both the valve and potential retrofit costs).[362] The intention of the rebate provided in the *San Diego Water Use Reduction Program* is to cover most, if not all, of the cost of the valve itself, which will vary in cost based on the size of the pipe, type of connection, and individual valve. Installation costs, such as labor and incidental plumbing parts, estimated to range between $170 and $250, are not eligible for the rebate, which will only cover up to $85 of the cost of the valve itself.[363]

As described above, the Recycled Water Filling Station program component is the most cost effective of the alternatives considered that achieved the same amount and type of benefits as the selected program component. This program component is a priority in the Region because potable water restrictions during drought can delay or halt construction activities. At the City of San Diego's current Level 1 Drought Watch status, non-potable water use is strongly encouraged for construction activities if available.[364] If the drought conditions persist into the future, the City anticipates increasing to a Level 2 Drought Alert Condition. At Level 2, what had been recommended water conservation practices are implemented as mandatory, and enforced.[365] Therefore, if a Level 2 drought is declared, construction activities must use non-potable water. Without additional recycled water filling stations, recycled water may not be accessible to construction projects, potentially delaying their completion and impacting the regional economy.

[360] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pp. 7-8.
[361] City of San Diego. 2014. North City Water Reclamation Plant Recycled Water Filling Station Abstract Business Case Evaluation. June. Pp. 9-11.
[362] Otay Water District. 2012. Customer Agreement Pressure Regulating Valve Rebate Program. February. Pg. 1.
[363] Pers. Comm. Mehdi Khalili, Senior Water Resources Engineer, City of San Diego Public Utilities Department. June 6, 2014. Available: 619-533-5356.
[364] City of San Diego. 2011. San Diego Municipal Code. Chapter 6: Public Works and Property, Public Improvement and Assessment Proceedings. §67.3805 (b)(4).
[365] City of San Diego. 2011. San Diego Municipal Code. Chapter 6: Public Works and Property, Public Improvement and Assessment Proceedings. §67.3806 (b).

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Project 6: Rincon Customer-Driven Demand Management Program

Project Sponsor: Rincon del Diablo Municipal Water District (Rincon)
Partner: City of Escondido

The following sections of this application include project-specific information for the *Rincon Customer-Driven Demand Management Program*, and include the following information pursuant to the PSP:

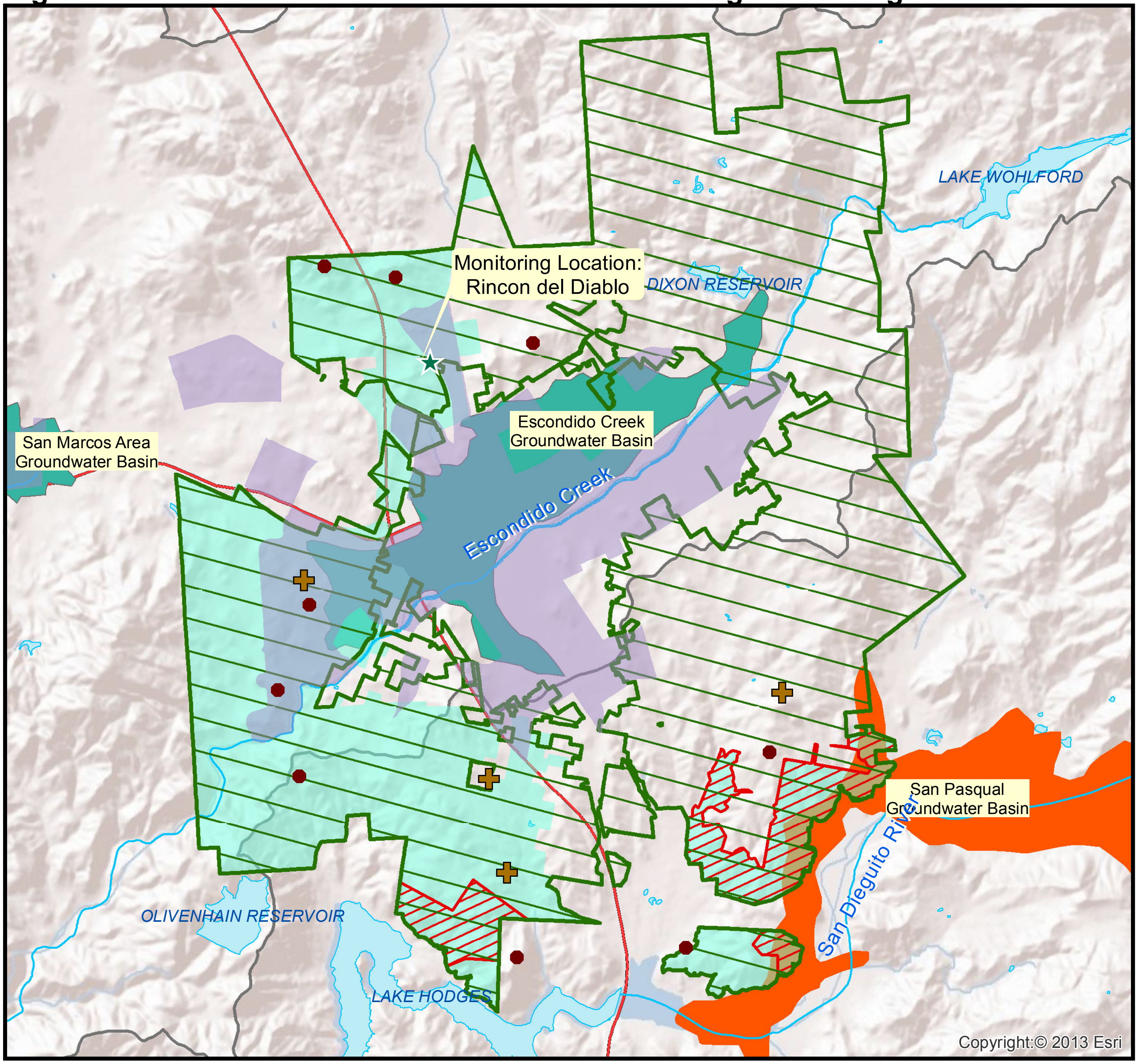
1. Project Description
2. Project Map
3. Project Physical Benefits
4. Technical Analysis of Physical Benefits Claimed, which includes the following sub-sections:
    - Technical Basis of the Project
    - Background for Benefits Claimed (Recent and Historical Conditions)
    - Without-Project Baseline (Estimates of Without-Project Conditions)
    - Methods Used to Estimate Physical Benefits
5. New Facilities, Policies, and Actions Required to Obtain Physical Benefits
6. Potential Physical Effects of the Project
7. Cost Effectiveness Analysis

Project Map: Rincon Customer-Driven Demand Management Program

Figure 3-17 shows the *Rincon Customer-Driven Demand Management Program* project area, the service area of the project sponsor, and the project's relation to groundwater basins and DACs. **Figure 3-18** shows an additional detailed map of the project that provides context for the benefits claimed herein.

Graphic of Advanced Metering Infrastructure and WaterSmart Software included in the Rincon Customer-Driven Demand Management Program

Figure 3-17: Rincon Customer-Driven Demand Management Program



Legend

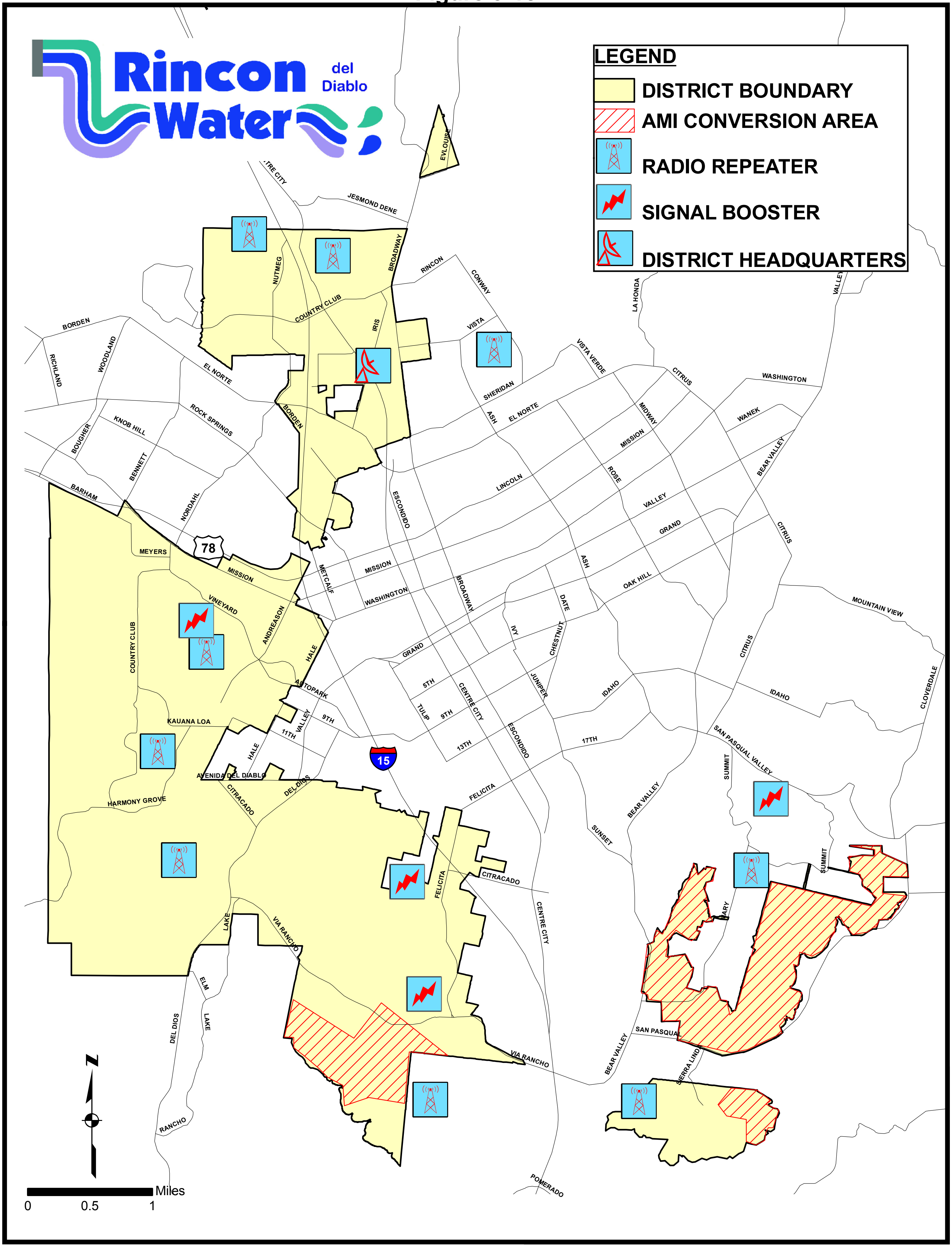
- San Diego IRWM Region
- Funding Area Boundary
- Watershed
- Freeway
- Waterbody
- Disadvantaged Community
- Medium Priority Basin (monitored)
- Rincon del Diablo Municipal Water District
- District Headquarters
- Transmitter
- Signal Booster
- Irrigation Districts 1 and A (Project Area)
- Remaining 20% for Meter Installation
- Groundwater Basin

N

0 0.325 0.65 1.3
Miles

Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-9_Proj6_Rincon_15Jul14.mxd

Figure 3-18



Source: SANGIS Base layers

Project Description: Rincon Customer-Driven Demand Management Program

Project will provide "smart" technology to customers through real-time access to water consumption data and conservation/efficiency opportunities to reduce overall water use by 400 AFY.

Project Nexus to Drought Impacts

The *Rincon Customer-Driven Demand Management Program* will address two of the Drought Project Elements identified by DWR (see **Table 3-1**). The project will provide regional drought preparedness because it promotes water conservation and achieves long-term reduction of water use by contributing to changes in customer water use behaviors. Demand management achieved through the project is based entirely on changes in behavior, which is a long-term way to affect changes in water use. The project will also reduce water quality or ecosystem conflicts by reducing local reservoir drawdown and reducing demand for imported water, which is partially sourced from the Bay-Delta. This allows water that would have been imported for Rincon's needs to remain in the Bay-Delta system to meet sensitive ecosystem needs.

The *Rincon Customer-Driven Demand Management Program* addresses seven of the drought impacts identified in Attachment 2:

- Ability to Meet Drinking Water Demands: The project reduces potable water demand. Rincon's potable supplies are purchased entirely from SDCWA, which supplies imported water to the Region. Imported water is a vulnerable supply, especially in times of drought. Reduced demand conserves potable supplies for potable uses, and reduces the vulnerability of the Region's water supplies. This helps the Region's ability to meet drinking water demands.
- Ability to Meet Agricultural Water Demands: By reducing water demands, the project allows more water to be available to meet other needs, including agricultural. Cutbacks to imported water lead to cutbacks to delivery of water for agricultural users. Water conservation provides a buffer against the degree of potential cutbacks to this important economic sector.
- Ability to Meet Ecosystem Demands: Reduced demand helps to maintain water levels in local reservoirs and the Bay-Delta. Low water levels are a factor in reduced water quality, which impacts habitat quality and can kill fish species within the reservoirs.
- Drinking Water MCL Violations: Protecting water levels in reservoirs through reduced demand, thereby protecting water quality in the reservoirs, reduces the probability of algal blooms that could affect secondary MCLs. Reduced demand also reduces imports from the Colorado River, which has high TDS, which also impacts water quality, and contribute to potential MCL violations.
- Groundwater Basin Overdraft: Conserving water reduces water demands, which in turn reduces the amount of water supplies the Region needs to secure. Groundwater is an attractive supply source during drought, but can suffer overdraft with reduced inflows and increased demand. By reducing water demand, the project reduces the need to turn to groundwater to meet local demand, thereby reducing the risk of groundwater overdraft.
- Increased Wildfire Risk and Water Quality Impacts: Wildfire risks are anticipated to increase because of climate change. Reducing imported water demands reduces the Region's GHG emissions and contribution to climate change, thereby reducing wildfire risks. Further, demand management provided by the project allows for more water to be available for firefighting purposes.
- Economic Impacts: Increasing water supply reliability will help to ensure that demands associated with the regional economy can be adequately met.

The project was selected for inclusion in this expedited grant funding application because it is a multi-benefit project that helps the Region's drought preparedness, and can be implemented and benefits realized on an expedited timeline. Expedited funding is needed for this project because it is a high-priority project that addresses drought impacts to the Region.

Project Physical Benefits: Rincon Customer-Driven Demand Management Program

The *Rincon Customer-Driven Demand Management Program* will reduce water demand through conservation. In so doing, the project will also provide numerous secondary benefits, summarized in **Table 3-68**. The Technical Analysis of Physical Benefits Claimed, below, provides information on how these benefits were calculated, and provides background on the Region and the benefits. As described in Project Phasing, the project benefits will phase in and out over the course of the 20-year project life. **Tables 3-69** through **3-76** show how each of the benefits associated with the project will accrue over the project life. **Appendix 3-1** includes detailed spreadsheets that show how the quantified benefits were calculated.

Table 3-68: Physical Benefits Summary
Rincon Customer-Driven Demand Management Program

Physical Benefit	Result of Physical Benefit		Annual Quantification of Benefits (cumulative quantification)
Reduce water demand through conservation (400 AFY)	A	Reduce Imported Water Supply Purchases	300 AFY (6,000 AF)
	B	Reduce Demand for Net Diversions from the Bay-Delta	200 AFY (3,968 AF)
	C	Local Supply Development to Decrease Vulnerabilities	300 AFY (6,000 AF)
	D	Reduce Net Production of Greenhouse Gases	298 MT CO2e/yr (5,968 MT CO2e)
	E	Avoid Social Costs of Greenhouse Gases	$7,325/yr ($146,502)
	F	Contribute to 20x2020 Goals	66%
	G	Reduce Water Costs to Customers, Including DACs	Variable ($10,755,165)
	I	Reduce Stormwater Loading of Pollutants	Qualitative

Table 3-69: Primary Physical Benefit-Reduce Water Demand through Conservation
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven Demand Management Program* **Type of Benefit Claimed:** Reduce Water Demand through Conservation **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	83 AF	83 AF
2016	0 AF	400 AF	400 AF
2017-2034	0 AF	400 AFY (7,200 AF)	400 AFY (7,200 AF)
2035	0 AF	317 AF	317 AF
Total*	**0 AF**	**8,000 AF**	**8,000 AF**

Comments: A similar pilot program was implemented by East Bay Municipal Utility District, which found that water use decreased by 3.5% - 6.5%. This primary physical benefit of reduced water demand through conservation was calculated by applying the average of this range (5%) to Rincon's FY 2013-2014 and 2014-2015 water sales (10,020 AFY). Of this, 6,235 AFY was potable water sales, and 3,785 AFY was recycled water sales. In total, Rincon can expect 501 AFY reduction in demand, but for the purpose of this analysis, this has been revised down to 400 AFY to be conservative. It is anticipated that greater savings will be seen for potable water customers, and for the purpose of this analysis, of the 400 AFY total conserved, 300 AFY will be potable water and 100 AFY will be recycled water.

Sources: (conservation from project) EBMUD. 2013. Evaluation of East Bay Municipal Utility District's Pilot of WaterSmart Home Water Reports. December. Pg. 56; (Rincon water sales) Rincon. 2013. Rincon del Diablo Municipal Water District Budget: Fiscal Years 2013-14 and 2014-15. Pp. 4-5.

*Some differences may occur due to rounding

Table 3-70: Physical Benefit A-Avoid Imported Water Supply Purchases
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven Demand Management Program* **Type of Benefit Claimed:** Avoid Imported Water Supply Purchases **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	63 AF	63 AF
2016	0 AF	300 AF	300 AF
2017-2034	0 AF	300 AFY (5,400 AF)	300 AFY (5,400 AF)
2035	0 AF	238 AF	238 AF
Total*	**0 AF**	**6,000 AF**	**6,000 AF**

Comments: Within the San Diego IRWM Region, local water supplies are used before purchasing imported water to meet demand deficits. Because the project will reduce potable demand by 300 AFY, this will directly offset the purchase of imported water. The project will reduce recycled water demand, but because Rincon is able to meet all of its current recycled water demand, the recycled water conserved by this project is not anticipated to be able to be used, and will not therefore offset imported water.

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13.

*Some differences may occur due to rounding

Table 3-71: Physical Benefit B-Reduce Demand for Net Diversions from the Bay-Delta
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven Demand Management Program*
Type of Benefit Claimed: Reduce Demand for Net Diversions from the Bay-Delta
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	9 AF	9 AF
2016	0 AF	200 AF	200 AF
2017-2034	0 AFY (0 AF)	200 AFY (3,600 AF)	200 AFY (3,600 AF)
2035	0 AF	158 AF	158 AF
Total*	**0 AF**	**3,968 AF**	**3,968 AF**

Comments: The San Diego County Water Authority (SDCWA) is the sole imported water wholesaler in the San Diego IRWM Region. Although SDCWA supplies include a mix of sources, local supplies are used first, and imported water purchased only to satisfy unmet demand once local supplies are exhausted. SDCWA's imported supply mix includes water from the State Water Project (SWP), which comes from the Sacramento-San Joaquin Delta (Bay-Delta), and the Colorado River. During normal years, SDCWA's imported supply mix is 2/3 SWP and 1/3 Colorado River. Under drought conditions in 2014 and 2015, SWP is 15% of SDCWA's imported supply. This analysis assumes 15% imported water is from the SWP during 2014 and 2015, and 2/3 from SWP during other years. This proportion was applied to the offset imported water calculated under Benefit A (**Table 3-72**), above.

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13; (SDCWA supply mix) Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8; (imported mix during drought) Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

*Some differences may occur due to rounding

Table 3-72: Physical Benefit C-Local Supply Development to Decrease Vulnerabilities
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven Demand Management Program*
Type of Benefit Claimed: Local Supply Development to Decrease Vulnerabilities
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 AF	0 AF	0 AF
2015	0 AF	63 AF	63 AF
2016	0 AF	300 AF	300 AF
2017-2034	0 AFY (0 AF)	300 AFY (5,400 AF)	300 AFY (5,400 AF)
2035	0 AF	238 AF	238 AF
Total*	**0 AF**	**6,000 AF**	**6,000 AF**

Comments: The Region's high reliance on imported water supplies increases its vulnerability to water shortages (see Attachment 2). Local supply development is a key regional strategy to address this issue. In the context of protecting against supply vulnerabilities, conservation that offsets imported water is considered a local supply. Because the recycled water conserved by the project is not guaranteed to be used elsewhere, it was not included in Benefit A (**Table 3-72**), which forms the basis for Benefit C, here.

Source: (strategy to reduce vulnerabilities) SDCWA. 2008. Strategic Plan. April. Pg. 9

*Some differences may occur due to rounding

Table 3-73: Physical Benefit D-Reduce Net Production of Greenhouse Gases
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven Demand Management Program*
Type of Benefit Claimed: Reduce Net Production of Greenhouse Gases
Units of the Benefit Claimed: MT CO2e

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	0 MT CO2e	0 MT CO2e	0 MT CO2e
2015	0 MT CO2e	62 MT CO2e	62 MT CO2e
2016	0 MT CO2e	298 MT CO2e	298 MT CO2e
2017-2034	0 MT CO2e	298 MT CO2e/yr (5,371 MT CO2e)	298 MT CO2e/yr (5,371 MT CO2e)
2035	0 MT CO2e	236 MT CO2e	236 MT CO2e
Total*	**0 MT CO2e**	**5,968 MT CO2e**	**5,968 MT CO2e**

Comments: Importing water is energy intensive, requiring 2.65 MWh/AF to import water to the Region. In contrast, recycled water in the Region only requires 0.8 MWh/AF. California produces 70% of its energy with a CO2e emissions factor of 613.28 lbs/MWH. 10% of California's energy is imported from the Pacific Northwest, with a CO2e emissions factor of 846.97 lbs/MWH, and 20% imported from the Pacific Southwest, with a CO2e emissions factor of 1,182.89 lbs/MWh. Using a weighted average, CO2e emissions from California's energy is 750.57 lbs/MWh, or 0.341 MT/MWh. This was applied to the energy intensity of imported water offset by the project (see Benefit A, **Table 3-72**). Potable water conservation's energy savings are direct offsets of the energy of imported water, while the energy savings from the recycled water conserved by the project is a direct offset of the energy of recycled water. The project will avoid 300 AFY imported water (Benefit A, **Table 3-72**), and 100 AFY recycled water.

Sources: (energy intensity of imported and recycled water) Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10); (California energy mix) CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html; (CO2e emissions factors) U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

*Some differences may occur due to rounding

Table 3-74: Physical Benefit E-Avoid Social Costs of Greenhouse Gases
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven Demand Management Program*
Type of Benefit Claimed: Avoid Social Costs of Greenhouse Gases
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$0	$0
2015	$0	$1,526	$1,526
2016	$0	$7,325	$7,325
2017-2034	$0/yr ($0)	$7,325/yr ($131,852)	$7,325/yr ($131,852)
2035	$0	$5,799	$5,799
Total*	**$0**	**$146,502**	**$146,502**

Comments: There are social costs associated with GHG emissions, which were estimated at $21.40/MT CO2e in 2007 dollars. This is converted to $24.55/MT CO2e in 2014 dollars. This value is applied to the reduced GHG emission calculated under Benefit D, above (**Table 3-75**).

Sources: (social cost of GHGs) Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28); (conversion from 2012 to 2014 dollars) U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm.

*Some differences may occur due to rounding

Table 3-75: Physical Benefit F-Contribute Towards 20x2020 Goals
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven Demand Management Program* **Type of Benefit Claimed:** Contribute Towards 20x2020 Goals **Units of the Benefit Claimed:** %			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2020	0%	66%	66%
Comments: Rincon's 20x2020 goal is 218 gpcd. Their baseline is therefore 272.5 gpcd (218 gpcd/80%). This is a reduction of 54.5 gpcd from the baseline to 2020. Rincon's water service population is projected to be 7,390 people in 2020. In 2020, the project will conserve 300 AFY potable water. This is 267,823 gallons per day, or 36 gpcd (267,823 gallons/7,390 people). 36 gpcd is 66% of the total reduction of 54.5 gpcd from the baseline to the 20x2020 goal. Sources: (20x2020 goal) Rincon. 2014. 2013 Urban Water Management Plan. Pg. 13; (2020 population) Rincon. 2014. 2013 Urban Water Management Plan. Table 11 (pg. 13).			

Table 3-76: Physical Benefit G-Reduce Water Costs to Customers, Including DACs
Rincon Customer-Driven Demand Management Program

Project Name: *Rincon Customer-Driven* Demand through Conservation *Demand Management Program* **Type of Benefit Claimed:** Reduce Water Costs to Customers, Including DACs **Units of the Benefit Claimed:** $			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2014	$0	$0	$0
2015	$0	$87,664	$87,664
2016	$0	$435,552	$435,552
2017-2034	$0/yr ($0)	Variable ($9,737,208)	Variable ($9,737,208)
2035	$0	$494,741	$494,741
Total*	**$0**	**$10,755,165**	**$10,755,165**
Comments: Imported water costs are based on the projected average costs to member agencies from the SDCWA, the sole imported water wholesaler in the Region. The project will offset imported water supply purchases (Benefit A, **Table 3-72**), avoiding the cost of imported water. Additional water savings from conservation of recycled water will be realized by recycled water customers, however, projected costs for recycled water is not available for the project life, therefore these benefits are not included in this calculation. Sources: (imported water costs) Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44). *Some differences may occur due to rounding			

Technical Analysis of Physical Benefits Claimed: Rincon Customer-Driven Demand Management Program

Technical Basis of the Project

The Rincon service area includes portions of the cities of Escondido, Vista, and San Marcos, as well as portions of unincorporated San Diego County. Rincon provides fire services across its entire service area, and serves potable and recycled water to customers within its Improvement District (ID)-1 and ID-A areas, as shown on **Figure 3-18**. Rincon has one of the highest per capita water uses of the water agencies included in this Proposal, with a 20x2020 baseline of 266 gpcd (see Benefit F). Relatively high gpcd within Rincon's service area can be partially attributed to the large lot size typical of Rincon's service area. Within ID-1 and ID-A, the majority of lots are single family residential and low-density single family residential. Comparing the number of units within these two categories with the total acreage of these categories, ID-1 had an average lot size of 0.5 acres in 2008 (3,057 acres of single-family properties/5,822 single-family units), and ID-A had an average lot size of 0.8 acres in 2008 (761 acres of single-family properties/942 single-family units).[366] With large lots, water demands are high per household, and if leaks occur, large volumes of water can potentially be wasted prior to identification and repair.

One strategy to reduce water demand within Rincon's service area is to install advanced metering infrastructure (AMI) and increase communication with customers on individual real-time water use and opportunities for conservation through WaterSmart software. As part of this effort, Rincon has already installed 6,486 AMI[367], which represents approximately 80% of its service area.[368] The project will install AMI for the remaining 20% of meter connections (see Attachment 4). Although AMIs have been installed for the majority of Rincon's service area, the district has not been able to maximize water savings as the meters alone do not communicate water use, savings, or other information to customers. The WaterSmart software will allow information from all of the AMI to be communicated to customers, showing real-time water use and other information to customers through an interactive website that will be managed by Rincon. AMI data provided to the WaterSmart software will also result in recommendations to customers about how to reduce water use, and will link customers to water conservation programs, rebate programs such as turf rebates offered by SDCWA and MWD, and even provide comparisons between one household's water use and its neighbors, thereby offering social motivation to conserve water.

Within Rincon's service area, there are both potable water and recycled water customers; as such, water savings associated with this program are anticipated to accrue for both recycled water and potable water customers. Rincon's potable water sales are calculated as 6,235 AFY for fiscal years 2013-14 and 2014-15.[369] Its recycled water sales are estimated as 3,785 AFY.[370] This comprises total water sales of 10,020 AFY. Applying the average water use reduction from EBMUD's program, Rincon can expect to save 501 AFY from implementation of the *Rincon Customer-Driven Demand Management Program*. However, to be conservative, Rincon has revised this number down to 400 AFY. This anticipated savings is expected to be achieved as a reduction in potable use by 300 AFY, and a reduction in recycled water use by 100 AFY.

Project Phasing

It is assumed that the benefits of each component will begin to accrue once that component is complete, and that benefits would be achieved equally throughout the year (e.g., if a component is completed in September, 2014, the benefits accrued for that component in 2014 would be 25% of the component's annual benefit). The program life will be 20 years, based on the AMI warranty, and it is assumed that

[366] Rincon. 2014. 2013 Urban Water Management Plan. February. Appendix C. Pp. C-1; C-3 to C-4; C-6.
[367] Rincon. Customer Database. Accessed: June 19, 2014.
[368] Pers. Comm. Julia Escamilla, Public Services Information Officer, Rincon del Diablo MWD. May 28, 2014. Available: 760-745-522x503.
[369] Rincon. 2013. Rincon del Diablo Municipal Water District Budget: Fiscal Years 2013-14 and 2014-15. Pg. 4.
[370] Rincon. 2013. Rincon del Diablo Municipal Water District Budget: Fiscal Years 2013-14 and 2014-15. Pg. 5.

meters installed prior to implementation of this program have not yet begun using their battery life.[371] This is reasonable given that the currently-installed AMIs do not have the ability to transmit data to customers, because WaterSmart software is not yet available. Meter and transmitted installation will be complete by the end of 2014, and WaterSmart software purchased in January 2015. Rincon will develop its customer interface between January 2015 and mid-August 2015. Benefits are assumed to begin accruing two months later (starting mid-October) to allow for customer transition to the new interface. In 2015, 21% of annual benefits will be realized (2.5/12 months), with full benefits realized from 2016-2034. To account for the phasing in of the benefits, the project is anticipated to achieve 79% of annual benefits in 2035, for a total of 240 months of benefits realized by the project. Over the anticipated 20-year life of the project, the project would result in total water savings of 8,000 AFY, with 6,000 AFY potable and 2,000 AFY recycled water conserved. Project phasing as it relates to benefit accrual is explained in further detail in **Appendix 3-1**.

Background for Benefits Claimed

As described above, the project's primary physical benefit of offsetting water demand will result in multiple secondary benefits. This section provides background and information on the Region relevant to these secondary benefits. The benefits are summarized in **Tables 3-69** through **3-76**, above, and background is provided by benefit here. The methodology for how these benefits were calculated is described under Methods Used to Estimate the Physical Benefits, below.

Primary Physical Benefit-Reduce Water Demand through Conservation

Due to the relatively high gpcd within Rincon's service area, Rincon has sought to implement conservation measures that would reduce water demands on a service area-wide basis. Rincon does not have any unmetered customers, and therefore has the opportunity to install AMIs across its service area as a cost-effective means for reducing water demands.[372] In addition to demand management benefits, the decision to install AMI was prompted by limited economic resources, persisting drought, and Rincon's existing meter placement program (i.e. all customers have meters). With limited economic resources available, AMI provides an opportunity to collect water user data in an electronic format, which is much more efficient than the previous method of reading individual meters.

Further, data from the San Francisco Bay Area (including Oakland, Berkeley, and Richmond) from a similar program that was implemented by East Bay Municipal Utility District (EBMUD) in 2012 and 2013 shows that households reduced water use between 3.5% and 6.5% based on how customers received their water bills.[373] In total, EBMUD found an average water use reduction of 5% from implementation of a similar program involving AMIs and WaterSmart Software. Given Rincon's relatively high gpcd and large lot sizes, implementing a program that would provide customers with a real-time view of their water use and corresponding water bills is believed to be an efficient and effective way to reduce demands across Rincon's service area.

Benefit A-Avoid Imported Water Supply Purchases and Benefit C-Local Supply Development to Decrease Vulnerabilities

Rincon purchases 100% of its potable supply from SDCWA, through direct purchases from SDCWA and through purchases of SDCWA water from the City of Escondido.[374] Rincon purchases recycled water from the City of Escondido's Hale Avenue Resource Recovery Facility (HARRF).[375] SDCWA is the sole imported water wholesaler for the Region, serving 24 member agencies, including Rincon and the City of Escondido. SDCWA purchases water through MWD, who obtains its water from two sources: the Colorado River Aqueduct, which it owns and operates, and the SWP, for which MWD has a water supply contract through the state of California. Currently, imported water purchases from MWD account for about

[371] Pers. Comm. Julia Escamilla, Public Services Information Officer, Rincon del Diablo MWD. July 15, 2014. Available: 760-745-522x503.
[372] Rincon. 2014. 2013 Urban Water Management Plan. February. Pg. 10.
[373] EBMUD. 2013. Evaluation of East Bay Municipal Utility District's Pilot of WaterSmart Home Water Reports. December. Pg. 56.
[374] Rincon. 2014. 2013 Urban Water Management Plan. February. Pp. 7-8.
[375] Rincon. 2014. 2013 Urban Water Management Plan. February. Pg. 7.

59% (331,825 AF) of SDCWA supplies.[376] SWP supplies from the Bay-Delta have been restricted since 2006, due to drought and regulatory restrictions, and additional restrictions on Colorado River water limits its use for supplemental supply. As described in Attachment 2, the current drought has further restricted SWP supplies, down to 5% of allocations for 2014. It is anticipated that if the drought continues, SWP deliveries may be reduced to 0% in 2015.

Other sources of SDCWA's imported water include water from a Water Conservation and Transfer Agreement with IID, an agricultural district in neighboring Imperial County, and a QSA on the Colorado River.

Within the Region, including Rincon's service area, imported water is considered the marginal supply. Any reduction in potable water demand from the project will offset imported supplies, as evidenced by SDCWA's methods for calculating demand projections. Per SDCWA's 2010 UWMP, SDCWA demands are calculated as total demand for the Region less local supplies of its 24 member agencies, and imported demand is directly linked to local supply availability.[377]

The Region has a high reliance on imported water, as described above. This reliance make it vulnerable to supply disruption. Increasing the risk of supply disruption is the Region's location at the bottom of the pipeline for both of its imported water infrastructure systems, which must cross long distances between source waters and delivery to the Region (see **Figure 3-3**). This distance increases the risk of damage to the infrastructure from accident or disaster, such as a seismic event. Attachment 2 describes how a heavy reliance on imported water makes the Region vulnerable to supply disruptions, particularly in times of drought when imported water deliveries may be restricted.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described above, a portion of SDCWA's (and therefore Rincon's) imported water comes from the SWP, which is supplied by the Bay-Delta system. In a normal year, approximately two-thirds of SDCWA's imported supplies come from the SWP.[378] As noted in Attachment 2, SWP supplies are restricted in drought conditions, and for 2014 and 2015, are anticipated to make up 15% of SDCWA's imported water supplies.[379] Management of the Bay-Delta water system is controversial, and challenges arise from the need to balance water supplies to meet the needs of both people and sensitive ecosystems.[380] The CALFED Bay-Delta Program (now managed by the Delta Stewardship council) established four objectives[381]:

- *Water Quality*: to invest in projects that improve the State's water quality from source to tap.
- *Water Supply*: comprised of five critical elements: conveyance, storage, environmental water account, water use efficiency and water transfer.
- *Ecosystem Restoration*: aims at restoring habitats, ecosystem functions, and native species.
- *Levee Integrity*: to protect water supplies by reducing the threat of levee failures.

Projects that offset demand for water from the Bay-Delta also provide benefits that reduce conflicts over Bay-Delta supply management related to water availability (refer to Attachment 7).

[376] SDCWA. 2011. 2010 Urban Water Management Plan. June. Page 6-1, Section 6, Metropolitan Water District of Southern California.
[377] SDCWA. 2011. 2010 Urban Water Management Plan. Pg. 2-13.
[378] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8
[379] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.
[380] Delta Stewardship Council. 2013. The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value. Pp. 10-11.
[381] CALFED Bay-Delta Program Archived Website. CALFED Objectives. Accessed 28 June 2014. Available: http://calwater.ca.gov/

Benefit D-Reduce Net Production of Greenhouse Gases and Benefit E-Avoid Social Costs of Greenhouse Gases

In addition to benefits to the Bay-Delta, offsetting demand for imported water provides energy savings. Imported water is energy intensive, requiring over three times the energy to treat and convey to the Region as producing and delivering recycled water.[382] Water conservation and increased use of recycled water offsets the energy costs of imported water, thereby reducing GHG emissions associated with imported water. GHGs are the leading cause of climate change, which is anticipated to impact the Region. The 2013 San Diego IRWM Plan incorporated the results of a Climate Change Planning Study for the Region. This planning study demonstrated that climate change is anticipated to increase temperatures, increase rainfall variability, decrease imported water supplies, increase water demand, increase wildfires, and cause sea level rise.[383]

A vulnerability analysis of these potential impacts identified high climate-change priorities for the Region to reduce vulnerabilities. The highest priorities include decreasing imported water supplies, supply impacts from higher drought impacts, water quality issues related to increased concentration of pollutants, increased flood risks from extreme weather, a decrease in habitat and ecosystem services, and inundation of storm and sewer systems from sea level rise.[384] As described in Attachment 2, the risk of wildfires increases with climate change. There is a history of damaging wildfires in the Region, most recently in May, 2014. The Cocos Fire, which burned 1,995 acres from May 14 to May 22, 2014, was located in Rincon's western service area. This was the largest of the May 2014 fires in San Diego County, and resulted in 51,000 evacuations.[385] These impacts can have a cascading effect in the region, which would incur costs. As potential climate change impacts are better understood, the social costs of GHGs are also being refined, such as estimates from the U.S. Government's Interagency Working Group on Social Cost of Carbon.[386]

Benefit F-Contribute Towards 20x2020 Goals

Another local benefit from the project's reduction in potable water demand is its contribution to Rincon's 20x2020 goal. Senate Bill X7-7 (SBX7-7) was passed as part of plans to improve the Bay-Delta, and mandates a 20% reduction in California's per capita water use by 2020. The 20x2020 Water Conservation Plan (20x2020 Plan) was developed to define the goals of the SBX7-7 legislation and provide guidance for compliance for urban water suppliers affected by the legislation.[387] In addition to reducing water use through conservation, the 20x2020 Plan allows recycled water to be applied towards urban water suppliers' compliance with the 20x2020 goals because recycled water offsets potable supply and does not constitute a new supply.[388]

Each urban water supplier was required to set its 20x2020 goal in its 2010 UWMP. Rincon's 20x2020 goal is to reduce water use to 218 gpcd by 2020.[389] As noted in the 20x2020 Plan, the statewide mandated water use reductions are designed to protect the Bay-Delta, but will also have a number of secondary benefits. For example, the 20x2020 plan will help to reduce energy consumption, because approximately one-fifth of the electricity used in California is allocated to water delivery, treatment, and use, and one-third of natural gas not used in power plants is used for the same purpose.[390]

Benefit G-Reduce Water Costs to Customers

As noted above, imported water is expensive. Offsetting demand for imported water provides cost savings to customers by helping to buffer against price fluctuations. This form of cost savings is available to all customers within Rincon's service area, regardless of individual reduction in water consumption.

[382] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[383] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-15 (pg. 7-38).
[384] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-16 (pg. 7-39).
[385] County of San Diego. 2014. May 2014 San Diego County Wildfires After Action Report. June. Pg. 10.
[386] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February.
[387] DWR, et al. 2010. 20x2020 Water Conservation Plan. February Pg. ix.
[388] DWR, et al. 2010. 20x2020 Water Conservation Plan. February. Pg. 3.
[389] Rincon. 2014. 2013 Urban Water Management Plan. February. Pg. 13.
[390] DWR, et al. 2010. 20x2020 Water Conservation Plan. February. Pg. 1.

There are also direct savings to customers who use the information provided by Rincon from the AMI and through the WaterSmart software to reduce their individual water use, which results in lower water bills. As shown in **Figure 3-17,** the project will serve DACs. Both forms of cost savings are available to DACs within the project area, because at project completion, AMIs will be installed throughout the entirety of Rincon's water delivery service area, including its DACs.

Benefit-I Reduce Stormwater Loading of Pollutants

A significant factor in pollutant loading is urban runoff, which contributes to water quality issues. The 2013 San Diego IRWM Plan notes the high impact on water quality of low "dry weather flows" that are partially a result of urban runoff.[391] Growth in the Region has increased urban runoff and non-storm flows.[392] Urban runoff is caused by impermeable surfaces, and during dry weather, generally caused by over irrigation, leaks, and other water waste. Efficient water use that would result from the *Rincon Customer-Driven Demand Management Program* would result in less runoff, which would therefore reduce stormwater loading of pollutants.

Without Project Baseline

Without the *Rincon Customer-Driven Demand Management Program*, customers in Rincon's ID-1 and ID-A districts would continue to use potable and recycled water at their current combined rate of 10,020 AFY. There would not be the 400 AFY reduction in water demand anticipated from the project, and this amount of water would continue to be purchased from SDCWA and the City of Escondido. The secondary benefits associated with this offset water would not be realized, such as the reduction in imported water and associated reduction in demand for Bay-Delta supplies, the reduction in GHG emissions and associated avoided social costs of GHGs, and continued high costs to customers, who would remain vulnerable to price fluctuations related to reliance on imported water.

Methods Used to Estimate the Physical Benefits

Methods used to estimate the primary physical benefit – namely via reference to technical documentation – were described above under Technical Basis of the Project.

Benefit A-Avoid Imported Water Supply Purchases

Rincon is entirely dependent on purchases from SDCWA for its potable water, and purchases from the City of Escondido's HARRF for its recycled water.[393] Although the offset recycled water could be used for other purposes, thereby offsetting additional potable water, at the moment, there is no additional recycled water demand within Rincon's service area that cannot be met with its current recycled water supply. Therefore, there are no anticipated potable water offsets from the conserved recycled water from the project, and thus no imported water offsets from this portion of the project's primary physical benefit.

Conserved potable water, on the other hand, would directly offset purchases from SDCWA. As described in SDCWA's 2010 UWMP, SDCWA imported water demands are calculated as total estimated demands less local supplies (including member agency local supplies).[394] Local supplies are used first, and imported water purchases only made to address supply deficiencies; therefore all of the potable water conserved by this project will be used to directly offset imported water in a 1:1 ratio. By conserving water, this program will directly offset the use of 300 AFY of imported water. **Table 3-70** shows the avoided imported water benefit from the program over its twenty-year life (refer to Attachment 6 for component completion dates).

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described in Benefit A, all of the potable water conserved by the *Rincon Customer-Driven Demand Management Program* will offset imported water purchases. SDCWA's supply mix includes imported water, surface water, and recycled water. During normal years, SDCWA's imported water supply consists

[391] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-32.
[392] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-35.
[393] Rincon. 2014. 2013 Urban Water Management Plan. February. Pp. 7-8.
[394] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.

of two-thirds SWP supplies and one-third Colorado River supplies. [395] As described in Attachment 2, SWP deliveries have been reduced to 5% of allotments for 2014, and are anticipated to decrease to 0% if drought conditions continue into 2015. During drought years, assumed to be 2014 and 2015, the SWP portion of SDCWA's imported water mix is approximately 15%[396], while the normal two-thirds proportion is used for other years over the project life, using the assumption that drought conditions will cease. Applying this ratio to the avoided imported water calculated in Benefit A, the project will reduce demand for net diversions from the Bay-Delta by 200 AFY, or a total of 3,968 AF over the twenty-year project life, as shown in **Table 3-71.**

Benefit C-Local Supply Development to Decrease Vulnerabilities

As described in SDCWA's 2010 UWMP, supply diversification is a key strategy within its service area to improve long-term reliability of supplies.[397] Specifically, the Region has a goal to improve the reliability and sustainability of regional water supplies, with part of the associated supply diversification objective to encourage the development of local water supplies.[398] As described in Attachment 2, imported water supplies and surface water supplies are vulnerable to reduced deliveries during drought. Further, the Region is located at the end of both of its imported water systems, increasing the risk of delivery interruptions from accidents or natural disasters, such as seismic events. Any new local supply development such as conservation, which is treated as a supply by SDCWA in its diversification portfolio[399], would reduce the Region's vulnerability to these and other supply interruptions. The *Rincon Customer-Driven Demand Management Program* will conserve 300 AFY potable water. Similar to Benefit A, the program will conserve an additional 100 AFY recycled water, but this water is not being counted towards local supply development because Rincon is able to meet all of its existing recycled water demands with current supplies. For this reason, recycled water conserved by this program will not be used to offset potable (and therefore imported) water demand. Further, recycled water is a drought-proof local supply, and does not represent a vulnerable supply. As such, all potable water conserved by this program, is local supply development that will decrease vulnerabilities, shown in **Table 3-72**, while the conserved recycled water will not contribute towards decreasing supply vulnerabilities.

Benefit D-Reduce Net Production of Greenhouse Gases

The *Rincon Customer-Driven Demand Management Program* will reduce GHG production through energy savings from reduced imported water demand. As described above, 300 AFY of imported water is anticipated to be offset by this program. Imported potable water has extensive energy requirements associated with transporting water from Northern California and the Colorado River to San Diego County and treatment of raw water to potable standards. By avoiding imported water supply purchases, as described in Benefit A, this project will also reduce the net production of GHGs, measured in CO2 equivalent (CO2e) associated with the production of the energy required for imported water. The program will also offset the use of 100 AFY recycled water. Energy savings from potable water conservation is a direct offset of the energy used to convey and treat imported water, while energy savings from recycled water use is a direct offset of the energy associated with recycled water production and use.

The 2010 Equinox Report estimates energy required to convey and treat imported water delivered to the customers in the Region is between 2,000 kWh/AF and 3,300 kWh/AF,[400] or an average of 2.65 MWh/AF. Offsetting 300 AFY of potable water demand, thereby offsetting 300 AFY imported water through conservation (as described under Benefit A) will save 795 MWh/year. The 2010 Equinox Report estimates recycled water energy intensity is between 600 kWh/AF and 1,000 kWh/AF,[401] or an average of 0.8 MWh/AF. Offsetting 300 AFY potable water will avoid 795 MWh/year, while offsetting 100 AFY

[395] Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8
[396] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.
[397] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.
[398] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (available in this application as Appendix 1-5)
[399] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.
[400] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).
[401] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).

recycled water will avoid 80 MWh/year. For the program as a whole, there is an anticipated energy savings of 875 MWh/yr.

- Energy to treat and convey imported water: 2.65 MWh/AF
- Imported water offset by program: 300 AFY
- Imported water energy conserved by program: 795 MWh/year
- Energy to treat and convey recycled water: 0.8 MWh/AF
- Recycled water offset by program: 100 AFY
- Recycled water energy conserved by program: 80 MWh/year
- Annual energy savings from the program: 875 MWh/year
- Cumulative energy savings from the program: 17,500 MWh

Converting from energy use to CO_2e emissions requires a breakdown of California electricity sources. California generates 70% of its electricity through a combination of hydroelectric, nuclear, coal, oil, natural gas, geothermal, biomass, wind, solar, and other. 10% of California's electricity is imported from the Pacific Northwest, and the remaining 20% imported from the Pacific Southwest.[402] Emission rates in lbs. of CO_2e per MWh will vary based on the energy source, but can be estimated across regions, per the EPA's eGRID. California production was eGRID subregion WECC California, the Pacific Northwest is WECC Northwest, and the Pacific Southwest is WECC Southwest. Each of these regions has a CO_2e emission rate of 613.28, 846.97, and 1,182.89 lbs/MWh, respectively.[403] Taking a weighted emissions rate (using the percentage of electricity produced in each region), the average emissions for electricity in California is 750.57 lbs/MWh of CO_2e. With 2204.62 lbs. per MT, a standard conversion rate for California can be calculated as 0.341 MT of CO_2e per MWh of electricity. Therefore, the total amount of CO_2e emissions expected to be saved by this project is 298 MT/year, or a total of 5,968 MT CO2e over the twenty-year project life as shown in **Table 3-73**.

- Emissions from California energy mix: 0.341 MT CO2e per MWh
- Energy savings from program: 875 MWh/year
- Annual emissions savings from program: 298 MT CO2e per year
- Cumulative emissions savings from program over 20-year life: 5,968 MT CO2e

Benefit E-Avoid Social Costs of Greenhouse Gases

There are social costs associated with increased GHG emissions related to air quality impacts and climate change. The social cost of GHG emissions is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present.[404] Such costs include, but are not limited to, impacts to agricultural productivity, human health, increased flood risk and associated damages, and ecosystem services and their values.[405] In February 2010, the U.S. Government's Interagency Working Group on Social Cost of Carbon issued guidance on recommend values for the social cost of greenhouse gas emissions for use in regulatory benefit-cost analysis.[406] The recommended mean estimate of the social cost of one MT of CO2 in 2014 dollars is $24.55. This is updated from the $21.40 in 2007 dollars reported

[402] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html
[403] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/
[404] IPCC. 2007. Summary for policymakers. In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* ML Perry, OF Canziani, JP Palutikof, PJ van der Linden, and CE Hanson (eds.). Cambridge University Press. Cambridge, UK. Pg. 17.
[405] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 1.
[406] Interagency Working Group on Social Cost of Carbon, United States Government.2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 28.

by the Interagency Working Group on Social Cost of Carbon[407], using the CPI Inflation Calculator.[408] An estimate of the social costs of GHGs avoided by the project can be calculated by applying this $24.55/MT CO2 to the emissions savings from Benefit D. **Table 3-74** shows the avoided social costs of greenhouse gas emissions from the *Rincon Customer-Driven Demand Management Program*. Over the twenty-year life of the project, these avoided social costs are $146,502, or $7,325 per year.

- Social cost of GHGs: $24.55/MT CO2e
- Annual emissions savings from program: 298 MT CO2e per year
- Annual avoided social costs of GHG from program: $7,325 per year
- Cumulative avoided social costs of GHG from program over 20-year life: $146,502

Benefit F-Contribute Towards 20x2020 Goals

SBX7-7, also known as 20x2020, is legislation passed in 2000 that requires urban water suppliers to reduce their daily per capita water use by 20% by 2020. Rincon's 20x2020 goal is reported in its UWMP as 218 gpcd.[409] Calculating the baselines from this as 272.5 gpcd (218 gpcd divided by 80% equals baseline), the 20x2020 goal is a reduction of 54.5 gpcd. The *Rincon Customer-Driven Demand Management Program* will offset urban water demands through potable water conservation, thereby contributing to Rincon's 20x2020 goals. The legislation allows recycled water to contribute towards 20x2020 goals[410], but conserved recycled water does not contribute to 20x2020 gpcd because it does not offset additional potable water use. Therefore conservation of recycled water from the *Rincon Customer-Driven Demand Management Program* does not contribute towards meeting Rincon's 20x2020 goal.

Contribution to Rincon's 20x2020 goal was calculated by converting the reduced potable water demand, 300 AFY (presented above), to gpcd using the 2020 population estimates (7,390 people[411]) found in Rincon's UWMP. Population estimates from 2020 were used because that is the year by which the 2020 goals must be met, and achievement of the 20x2020 goal will be calculated as water use per person in 2020. The project's contribution to meeting 20x2020 goals is gpcd from the project in 2020 (36 gpcd) as a percentage of Rincon's overall gpcd reduction goal (53.2 gpcd), as shown in **Table 3-75**. Because the 20x2020 goals must be met by 2020, the benefit is only calculated for the year 2020, rather than through the full life of the project. Based on these numbers, the project will contribute 66% towards meeting Rincon's 20x2020 goal.

- Rincon's water use reduction to meet 20x2020 goal: 54.5 gpcd
- Potable water conserved by program in 2020: 300 AFY (267,823 gallons per day)
- Rincon's ID-1 and ID-A projected population in 2020: 7,390 people
- GPCD reduction provided by program: 36 gpcd (267,823 gallons per day / 7,390 people)
- Program's contribution to Rincon's 20x2020 goal: 66% (36 gpcd/54.5 gpcd)

Benefit G-Reduce Water Costs to Customers, Including DACs

As described above, the *Rincon Customer-Driven Demand Management Program* will offset potable imported water demand and recycled water demand through conservation (300 AFY and 100 AFY, respectively). Therefore, the cost savings associated with the project's offset of imported water is equal to the cost of purchasing an amount of imported potable water equal to the volume of the offset (300 AFY). The cost savings from conserving recycled water is equal to the cost of purchasing an equal amount of recycled water (100 AFY).

[407] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28).
[408] U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm
[409] Rincon. 2014. 2013 Urban Water Management Plan. February. Pg. 13.
[410] DWR et al. 2010. 20x2020 Water Conservation Plan. February. Pg. 3.
[411] Rincon. 2014. 2013 Urban Water Management Plan. February. Table 11 (pg. 13).

As described for other projects in this Proposal, Sweetwater Authority's Title XVI Technical Project Report contains projected average imported water costs for imported water purchased from SDCWA. Because SDCWA is the sole imported water purveyor in the Region, these projections can be used for any project in the Region that offsets imported water. For the years that benefits will be accrued during the life of the *Rincon Customer-Driven Demand Management Program*, imported water costs range between $1,349/AF and $2,003/AF in 2012 dollars.[412] Using a conversion factor of 1.04 from the Consumer Price Index to convert these values to 2014 dollars[413], imported water costs range from $1,403/AF and $2,083/AF, for an average of $1,781/AF over the twenty-year project life. As shown in **Table 3-76**, offsetting imported water through conservation results in a total of $10,755,165 in reduced water costs.

These water costs will be passed along to customers through direct reduction in water purchases by the customers, and by providing a buffer from water price fluctuations. As described in Attachment 8, and shown in **Figure 3-18**, Rincon serves a number of DACs. Because the project completes AMI installation throughout Rincon's service area, and utilizes WaterSmart software to communicate with all customers, benefits accrued from the project will be realized all households in Rincon's service area, including DACs. Further, the water price buffering from reduced imported water purchases will help all customers within the service area, regardless of a household's individual amount of conservation.

Direct savings to customers can be discussed qualitatively as the reduction in customers' water bills resulting from the program. This value cannot be accurately quantified because rates vary by location, volume of water use, customer type/water use, and type of water.[414] There are no projections available for future water rates for Rincon customers, so benefits cannot be projected over the life of the project. Despite this inability to accurately quantify the benefits directly accrued by Rincon customers, we can discuss them qualitatively. Current potable water rates for residential water customers ranges in price from $4.78 to $6.03 per 1,000 gallons, depending on how much water is used.[415] Benefits for potable water customers would therefore vary depending on their baseline water use prior to implementation of the program, their individual conservation, and whether that conservation drops them down to a lower water use level. Recycled water is charged as a flat rate of $4.07 per 1,000 gallons.[416] This implies that the program would save customers $132,622 per year (100 AFY is 32,585,143 gallons). As with potable water, there are no projections available for potential changes in Rincon's recycled water rates, therefore, the savings from conserving recycled water cannot be projected out over the program life and can only be discussed qualitatively.

Benefit I-Reduce Stormwater Loading of Pollutants

As described above, overirrigation and impermeable surfaces contribute to high urban runoff and associated pollutant loading. *Rincon Customer-Driven Demand Management Program* would reduce runoff by encouraging conservation, including conservation of irrigation water. This would reduce the potential for overirrigation and associated runoff. This benefit cannot be quantified because the amount of irrigation water that would be conserved by the program is unknown, as well as how such conservation would affect the total amount of runoff.

New Facilities, Policies, and Actions Required to Obtain Physical Benefits

No additional facilities, policies, or actions are required to obtain the physical benefits of the project. Rincon has incorporated a budget of $13,000 for meter replacement in its annual renewals and replacement program, in the event that a failed AMI meter requires replacement. To maintain the WaterSmart software beyond the two years funding by this project, licensing would have to be renewed, at an anticipated cost of $64,000 per year. This fee could be passed along to customers for approximately

412 Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44).
413 Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 24 June 2014. Available: http://www.bls.gov/data/inflation_calculator.htm
414 Rincon. 2013. Water Rates and System Operations Charges. Effective September 2013.
415 Rincon. 2013. Water Rates and System Operations Charges. Effective September 2013.
416 Rincon. 2013. Water Rates and System Operations Charges. Effective September 2013.

$7.11 per customer per year, either as an additional monthly charge or incorporated into overall rates. It is anticipated that the WaterSmart would continue to be licensed and used by Rincon.

Potential Physical Effects of the Project

There are no anticipated adverse physical effects of the *Rincon Customer-Driven Demand Management Program*.

Cost Effectiveness Analysis: Rincon Customer-Driven Demand Management Program

The *Rincon Customer-Driven Demand Management Program* will provide the primary physical benefit of reduced water demand through conservation, which in turn results in eight ancillary benefits, many of which are related to offsetting imported water demands. Six different AMI manufacturers were considered for this program, but only the selected alternative is both feasible and provides the full benefits described above. **Table 3-77** (Table 6 in the PSP) provides a brief summary of the alternatives evaluation, while more detail is provided in the discussion following the table.

Table 3-77: Project Analysis
Rincon Customer-Driven Demand Management

Question 1 Physical Benefits Summary	The program will achieve the physical benefits summarized in **Table 3-68**. These benefits include: avoid imported water supply purchases, reduce demand for net diversions from the Bay-Delta, local supply development to decrease vulnerabilities, reduce GHG emissions, avoid social costs of GHGs, contribute to 20x2020 goals, reduce water costs to customers, and reduce stormwater loading of pollutants.
Question 2 Alternatives Considered	Alternatives have been considered that would achieve the same types and amounts of physical benefits for the program.
	The alternatives considered for the program include the use of Badger Meter AMI (the selected program), and consideration of meters from other manufacturers. Considerations when evaluating alternatives included performance of previously-installed AMIs, costs, and failure rates. Four of six manufacturers were eliminated based on poor performance. Two alternatives performed well – Badger Meter AMIs and Elster AMCO AMIs. Badger Meter AMIs are 17% more expensive than AMIs from other manufacturers.
Question 3 Preferred Alternative	The Badger Meter AMI alternative was selected even though it is not the least cost alternative because Elster AMCO no longer sells AMIs in North America. The other alternatives that had been considered performed poorly and/or had failure rates above Rincon's acceptable levels. For these reasons, the preferred alternative was considered the only feasible alternative, and the only alternative that provides the same types and amounts of benefits.

Q1: Types of Benefits Achieved by Project

The *Rincon Customer-Driven Demand Management Program* would achieve eight physical benefits as a result of its primary physical benefit of reducing imported water demand through conservation. These benefits and how they were calculated are discussed in detail in the sections above, and summarized in **Table 3-68**. Benefits from the program include:

- Avoid imported water supply purchases – 300 AFY
- Reduce demand for net diversions from the Bay-Delta – 200 AFY
- Local supply development to decrease vulnerabilities – 300 AFY
- Reduce net production of GHGs – 298 MT CO2e per year
- Avoid social costs of GHGs - $7,325 per year
- Contribute to 20x2020 goals – 66%
- Reduce water costs to customers, including DACs – $10,755,165 (over 20-year project life)
- Reduce stormwater loading of pollutants – Qualitative

Q2: Discussion of Project Alternatives

The *Rincon Customer-Driven Demand Management Program* completes installation of AMI within Rincon's ID-1 and ID-A districts (the portion of Rincon's service area within which Rincon provides water services). The AMI selected for this program is produced by Badger Meter. Project alternatives included consideration of meters from five other manufacturers. During installation of AMI prior to this program, AMI from each of the six manufacturers were installed and evaluated. Performance issues narrowed the field of AMI down to two manufacturers – Elster AMCO and Badger Meter.[417] Meter costs have increased since the initiation of AMI installation by 20% as a result of manufacturers changing to lead-free bronze.[418] This cost increase was experienced across all manufacturers. Meter manufacturers were selected based on durability and compatibility, to allow Rincon to purchase meters from multiple sources to allow Rincon to use the most competitively priced manufacturer, and as security against a manufacturer going out of business or poor performance on the part of a manufacturer's meters.[419]

The Badger Meter AMIs are 17% more expensive than other AMIs, but have performed reliably and are the most durable.[420]

Q3: Preferred Project Alternative

The preferred alternative of using the Badger Meter AMI for the *Rincon Customer-Driven Demand Management Program* was selected because it is the only AMI available that meets Rincon's performance standards. Previously, Rincon used Elster AMCO AMI because this meter was able to meet performance standards and were less expensive than the Badger Meter AMI, which was the only other AMI that met Rincon's performance standards. However, Elster AMCO is no longer selling mechanical water meters in North America;[421] therefore this alternative is no longer feasible.

The only remaining project alternative is the selected program – use of the Badge Meter AMI. While this meter is not the most cost-effective of the alternatives, it is the only available alternative that meets Rincon's standards for performance and failure rate. Therefore, the preferred alternative is the only viable alternative that achieves the same type and amount of benefits of the program. The program as designed also meets Rincon's goal to collect quality data to realize the full benefit potential of the program.[422]

[417] Rincon. 2014. Memo 3C: Authorized Budget Increase for the Completion of the District's Advanced Metering Infrastructure (AMI) System. March 25. Pg. 2.
[418] Rincon. 2014. Memo 3C: Authorized Budget Increase for the Completion of the District's Advanced Metering Infrastructure (AMI) System. March 25. Pg. 1.
[419] Rincon. 2014. Memo 3C: Authorized Budget Increase for the Completion of the District's Advanced Metering Infrastructure (AMI) System. March 25. Pg. 1.
[420] Rincon. 2014. Memo 3C: Authorized Budget Increase for the Completion of the District's Advanced Metering Infrastructure (AMI) System. March 25. Pg. 2.
[421] Rincon. 2014. Memo 3C: Authorized Budget Increase for the Completion of the District's Advanced Metering Infrastructure (AMI) System. March 25. Pg. 1.
[422] Rincon. 2014. Memo 3C: Authorized Budget Increase for the Completion of the District's Advanced Metering Infrastructure (AMI) System. March 25. Pg. 2.

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Project 7: Regional Emergency Storage and Conveyance System Intertie Optimization

Local Project Sponsor: City of San Diego
Partner: Santa Fe Irrigation District (SFID) and San Diego County Water Authority (SDCWA)

The following sections of this application include project-specific information for the *Regional Emergency Storage and Conveyance System Intertie Optimization* project, and include the following information pursuant to the PSP:

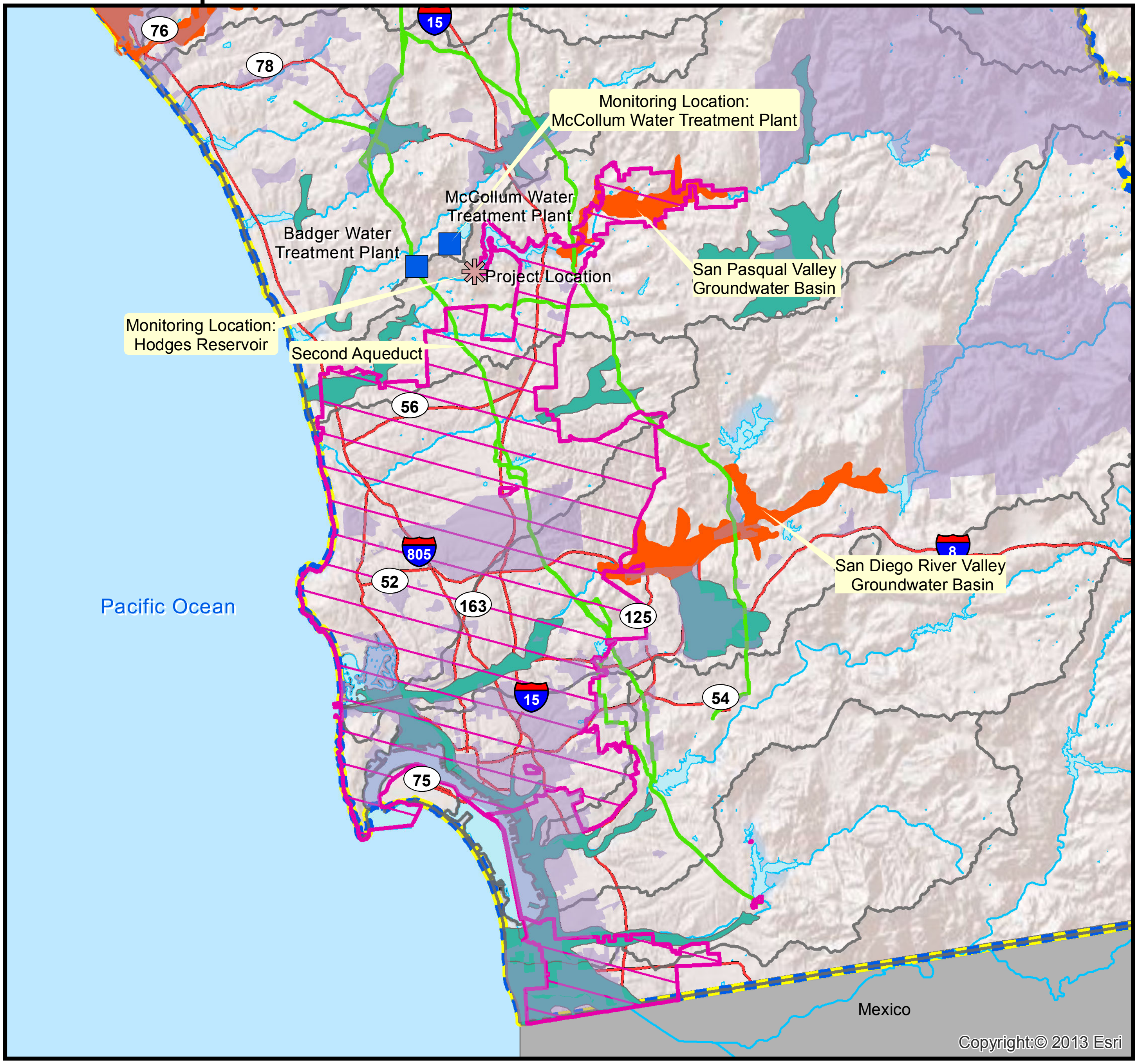
1. Project Description
2. Project Map
3. Project Physical Benefits
4. Technical Analysis of Physical Benefits Claimed, which includes the following sub-sections:
   - Technical Basis of the Project
   - Background for Benefits Claimed (Recent and Historical Conditions)
   - Without-Project Baseline (Estimates of Without-Project Conditions)
   - Methods Used to Estimate Physical Benefits
5. New Facilities, Policies, and Actions Required to Obtain Physical Benefits
6. Potential Physical Effects of the Project
7. Cost Effectiveness Analysis

Project Map: Regional Emergency Storage and Conveyance System Intertie Optimization

Figure 3-19 shows the *Regional Emergency Storage and Conveyance System Intertie Optimization* project area, the service area of the project sponsor, and the project's relation to groundwater basins and DACs.

Speece Cone System at Comanche Reservoir

Figure 3-19: Regional Emergency Storage and Conveyance System Intertie Optimization



Legend

San Diego IRWM Region
Funding Area Boundary
Watershed
Freeway
Waterbody
Disadvantaged Community
Medium Priority Basin
Groundwater Basin
City of San Diego
Water Treatment Plant
Speece Cone
San Diego County Water Authority Aqueducts

N

0 1.5 3 6
Miles

Sources: San Diego Association of Governments (SANDAG) - GIS Data Warehouse
\\rmcsd\RMCSD\Projects GIS\0188-003 SDIRWM Plan Update\DroughtGrantMaps\3-10_Proj7_Hodges_15Jul14.mxd

Project Description: Regional Emergency Storage and Conveyance System Intertie Optimization

Project will control algal productivity in Hodges Reservoir and improve water quality, thus making stored surface water available as water supply through a regional intertie.

Project Nexus to Drought Impacts

The *Regional Emergency Storage and Conveyance System Intertie Optimization* project meets three of the Drought Project Elements defined by DWR (**Table 3-1**). The project provides drought preparedness through system interties by improving water quality in an existing impaired surface water reservoir, thereby making the stored water available as water supply through SDCWA's aqueduct system. The project increases local water supply reliability and the delivery of safe drinking water by increasing capture and use of surface water supplies within the Hodges Reservoir by 5,377 AFY in the long-term. It also helps to reduce ecosystem conflicts created by the drought by improving water quality conditions for aquatic species within the Hodges Reservoir and reducing demands from the Bay-Delta, which is subject to pumping restrictions to protect water levels for sensitive ecosystems.

The *Regional Emergency Storage and Conveyance System Intertie Optimization* project addresses seven of the drought impacts identified in Attachment 2:

- Ability to Meet Drinking Water Demands: The project will supply an additional 5,377 AFY of potable water that is currently unavailable for use by customers in the City of San Diego service area. This project will reduce reliance on imported water, thereby helping the Region meet drinking water demands that could be threatened by increased imported water restrictions. As a local supply, the water made available by this project is not vulnerable to restrictions on imported water deliveries, and utilizes available water storage capacity in an existing reservoir to maximize local water capture and efficient use.
- Ability to Meet Agricultural Water Demands: Any cutbacks on imported water supplies from MWD could result in local water restrictions to agricultural users. Local supplies such as those supplied by the project provide a buffer that allows the Region to avoid water use restrictions to agricultural users even in times of drought and cutbacks from MWD.
- Ability to Meet Ecosystem Demands: Reservoirs serve as important habitat for sensitive species, though many of the Region's reservoirs are listed on the 303(d) list. This includes Hodges Reservoir, which is listed for nutrients that cause eutrophication. The project will improve water quality and associated habitat conditions for aquatic species in Hodges Reservoir. Reduced demand for imported water will also conserve Bay-Delta supplies to meet ecosystems needs there.
- Drinking Water MCL Violations: The poor water quality in Hodges Reservoir cannot be moved into the aqueduct because of the increased difficulty in treating it to meet drinking water standards. In the event of emergency, water could be moved into the aqueduct, posing a risk of MCL violations. Improving water quality in Hodges Reservoir with the project reduces the difficulty of treating said water, thereby reducing the potential for drinking water MCL violations.
- Increased Wildfire Risk and Water Quality Impacts: The project reduces wildfire risk by reducing contribution to the causes of climate change (GHG emissions). Increased supplies and improved supply reliability also allows water to be available to fight wildfires with a reduced impact on supplies needed to meet demand. Decreasing wildfire risks, and increasing ability to fight wildfires provides protection from water quality impacts related to wildfires.
- Economic Impacts: Increasing water supply reliability will help to ensure that demands associated with the regional economy can be adequately met.

The project was selected for inclusion in this expedited funding application because it is an IRWM-project that addresses drought impacts and is able to be implemented and provide benefits within an expedited timeline. Expedited funding is needed for this project, because it is high-priority and provides additional local water supplies that are critical in times of drought. Further, the project will resolve water quality issues that will help the Region to utilize surface water resources on a long-term basis, which will help to increase the Region's ability to buffer against future droughts.

Project Physical Benefits: Regional Emergency Storage and Conveyance System Intertie Optimization

Tables 3-79 through **3-85** provide summaries of the primary and secondary physical benefits anticipated to be achieved through implementation of the *Regional Emergency Storage and Conveyance System Intertie Optimization* project. The primary physical benefit of the project is an increase in capture and use of local surface water supplies to create new potable water supplies – this benefit has been quantified as a 3,889 AFY short term benefit for immediate drought response or a 5,377 AFY long-term annual benefit resulting from improved reservoir operation. As shown in **Table 3-78**, this results in six quantifiable secondary physical benefits and four qualitative benefits. Benefits are quantified over the useful life of the project, which is expected to be 20 years, with benefits beginning to accrue in August 2017, one year after project construction is complete. Project Phasing, below, explains the timing of the benefits to be achieved by the project, which due to the nature of the project, are not phased in the same manner as the other projects included in this funding application. Benefits are presented for conditions under both a short-term scenario (based on current drought conditions) for the first year of benefits, and long-term scenario (based on hydrology over the history of Hodges Reservoir) for the remaining years. **Appendix 3-1** includes detailed spreadsheets that show how the quantified benefits were calculated.

Table 3-78: Physical Benefits Summary
Regional Emergency Storage and Conveyance System Intertie Optimization

Primary Physical Benefit	Secondary Physical Benefit		Annual Quantification of Benefit (cumulative quantification)
Increase surface water capture for potable use (3,889 AFY – Short Term; 5,377 AFY – Long Term)	A	Avoid Imported Water Supply Purchases	3,889 AFY – short term 5,377 AFY – long term (106,052 AF)
	B	Reduce Demand for Net Diversions from the Bay-Delta	2,593 AFY – short term 3,585 AFY – long term (70,701 AF)
	C	Local Supply Development to Decrease Vulnerabilities	3,889 AFY – short term 5,377 AFY – long term (106,052 AF)
	D	Reduce Net Production of Greenhouse Gases	1,757 MT CO2e/yr – short term 2,455 MT CO2e/yr – long term (48,393 MT CO2e)
	E	Avoid Social Costs of Greenhouse Gases	$43,127/yr – short term $60,259/yr – long term ($1,188,045)
	F	Reduce Water Costs to Customers, Including DACs	Variable ($187,972,288)
	N	Improve Water Quality of Surface Reservoir	Qualitative
	O	Reduce Downstream Flooding During Wet Weather Events	Qualitative
	P	Increase Ability to Operate Regional Intertie	Qualitative
	Q	Improve Water Quality for Aquatic Species	Qualitative

Table 3-79: Primary Physical Benefit – Increase Surface Water Capture for Potable Use
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization*
Type of Benefit Claimed: Increase Water Capture for Potable Use
Units of the Benefit Claimed: AFY

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2017	0 AF	3,899 AF	3,899 AF
2018	0 AF	5,377 AF	5,377 AF
2019-2036	0 AFY (0 AF)	5,377 AFY (96,786 AF)	5,377 AFY (96,786 AF)
Total*	**0 AF**	**106,052 AF**	**106,052 AF**

Comments: Production of new potable supply under short term conditions was derived from calculations based on historical data from the City of San Diego, knowledge of the configuration and constraints in the system, and modeling results from the City of San Diego SDSIM model. The short-term benefit was based on current reservoir conditions, and projected similar conditions of natural inflows and outflows in the near future. An initial storage of 11,613 AF results in the short term benefit of 3,889 AF after accounting for dead storage in the reservoir, rights to the water from other agencies, pumping capacity to serve the water and elevation constraints to pump. Detailed information on the model inputs and system operation is provided in the discussion for this project's Technical Analysis of Physical Benefits Claimed.

The long term benefit represents the annualized benefit from the reduction in spills resulting from exercising the reservoir seasonal and discretionary pools (more optimal operation). This reduction in spills represents local runoff that is captured above the expected levels with no oxygenation project. The cumulative spill volume over the length of the 45-year simulation under the baseline simulation is equal to 1,094,326 AF. The project simulation results show a cumulative volume of spills of 852,381 AF. The difference, the additional runoff captured due to project implementation, is 241,945 AF. Over a long range simulation of 45-yr, the annualized benefit is thus 5,377 AFY that can be applied to the life of the project.

For this analysis, short term conditions are assumed to be the first year of the project life, 2017, while long term conditions are assumed for the remaining years of the project life (2018-2036).

<u>Sources:</u> (historic data) SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual; Jeffery Pasek. City of San Diego. Pers.Comm. "Hodges Hydrology through April 2014" excel file. June 2, 2014; (SDSIM model) SDSIM model developed by City of San Diego for their long-range water resources plan. Model is described in City of San Diego. 2012. City of San Diego 2012 Long-Range Water Resources Plan. Appendix B.

*Some differences may occur due to rounding

Table 3-80: Physical Benefit A-Avoid Imported Water Supply Purchases
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization* **Type of Benefit Claimed:** Avoid Imported Water Supply Purchases **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2017	0 AF	3,899 AF	3,899 AF
2018	0 AF	5,377 AF	5,377 AF
2019-2036	0 AFY (0 AF)	5,377AFY (96,786 AF)	5,377AFY (96,786 AF)
Total*	**0 AF**	**106,052 AF**	**106,052 AF**

Comments: Within the San Diego IRWM Region, local water supplies are used before purchasing imported water to meet demand deficits. Because the project will be increase stormwater capture and increase local water supply availability, it will directly offset the purchase of imported water, in accordance with the Primary Physical Benefit calculated in **Table 3-82**.

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13.
*Some differences may occur due to rounding

Table 3-81: Physical Benefit B-Reduce Demand for Net Diversions from the Bay-Delta
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization* **Type of Benefit Claimed:** Reduce Demand for Net Diversions from the Bay-Delta **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2017	0 AF	2,593 AF	2,593 AF
2018	0 AF	3,585 AF	3,585AF
2019-2036	0 AFY (0 AF)	3,585 AFY (64,524 AF)	3,585 AFY (64,524 AF)
Total*	**0 AF**	**70,701 AF**	**70,701 AF**

Comments: The San Diego County Water Authority (SDCWA) is the sole imported water wholesaler in the San Diego IRWM Region. Although SDCWA supplies include a mix of sources, local supplies are used first, and imported water purchased only to satisfy unmet demand once local supplies are exhausted. SDCWA's imported supply mix includes water from the State Water Project (SWP), which comes from the Sacramento-San Joaquin Delta (Bay-Delta), and the Colorado River. During normal years, SDCWA's imported supply mix is 2/3 SWP and 1/3 Colorado River. Under drought conditions in 2014 and 2015, SWP is 15% of SDCWA's imported supply. This analysis assumes 15% imported water is from the SWP during 2014 and 2015, and 2/3 from SWP during other years. This proportion was applied to the offset imported water calculated under Benefit A (**Table 84**), above.

Sources: (local supplies used first) SDCWA. 2011. *2010 Urban Water Management Plan*. Pg. 2-13; (SDCWA supply mix) Equinox Report. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 8; (imported mix during drought) Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.
*Some differences may occur due to rounding

Table 3-82: Physical Benefit C–Local Supply Development to Decrease Vulnerabilities
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization* **Type of Benefit Claimed:** Local Supply Development to Decrease Vulnerabilities **Units of the Benefit Claimed:** AFY			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2017	0 AF	3,899 AF	3,899 AF
2018	0 AF	5,377 AF	5,377 AF
2019-2036	0 AFY (0 AF)	5,377AFY (96,786 AF)	5,377AFY (96,786 AF)
Total*	**0 AF**	**106,052 AF**	**106,052 AF**

Comments: The Region's high reliance on imported water supplies increases its vulnerability to water shortages (see Attachment 2). Local supply development is a key regional strategy to address this issue. The project will increase stormwater capture and availability of local supplies, implementing this strategy to decrease vulnerabilities. The amount of water captured and made available by the project is calculated under the Primary Physical Benefit (**Table 3-82**), above.

Source: (strategy to reduce vulnerabilities) SDCWA. 2008. Strategic Plan. April. Pg. 9

*Some differences may occur due to rounding

Table 3-83: Physical Benefit D-Reduce Net Production of Greenhouse Gases
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization*
Type of Benefit Claimed: Reduce Net Production of Greenhouse Gases
Units of the Benefit Claimed: CO2e

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2017	3,514 MT CO2e	1,758 MT CO2e	1,757 MT CO2e
2018	4,859 MT CO2e	2,404 MT CO2e	2,455 MT CO2e
2019-2036	4,859 MT CO2e/yr (87,461 MT CO2e)	2,404 MT CO2e/year (43,279 MT CO2e)	2,455 MT CO2e/year (44,182 MT CO2e)
Total*	**95,834 MT CO2e**	**47,441 MT CO2e**	**48,393 MT CO2e**

Comments: Importing water is more energy intensive than operating the Speece Cone at Hodges Reservoir and moving water into the Second Aqueduct. Imported water requires 2.65 MWh/AF to import water to the Region. Energy to operate the Speece Cone and pump water into the Second Aqueduct is 5,154 MWh/yr in the short-term (2017), and 7,051 MWh/year in the long-term (2018-2037). The Speece Cone's energy intensity was calculated as an average dissolved oxygen (DO) demand of 1.8 tons DO (TDO) per day, and requires 300 kWh/TDO. This is 540 kWh/day, or 197 MWh/year. Energy demands for pumping were calculated based on system head (total system head = 997 ft.), average flow based on total volume of water to be moved and the pumping time (14,468 GPM under shot-term pumping conditions of 3,889 AFY over two months and 10,002 GPM under long-term pumping conditions of 5,377 AFY over four months), and 80% pump efficiency.

California produces 70% of its energy with a CO2e emissions factor of 613.28 lbs/MWH. 10% of California's energy is imported from the Pacific Northwest, with a CO2e emissions factor of 846.97 lbs/MWH, and 20% imported from the Pacific Southwest, with a CO2e emissions factor of 1,182.89 lbs/MWh. Using a weighted average, CO2e emissions from California's energy is 750.57 lbs/MWh, or 0.341 MT/MWh. This was applied to the energy intensity of imported water offset by the project (see Benefit A, **Table 3-85**), and the energy intensity of water captured and made available by the project under long-term conditions (see Primary Physical Benefit, **Table 3-83**).

Sources: (energy intensity of imported water) Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10); (required DO) City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Draft Conceptual Report. Pg. 4-4; (energy intensity of Speece Cone) USACE. 2011. Analysis of Oxygen Injection in the Black River in Support of the Savannah Harbor Expansion Project. July 26. Pg. 5; (system head) SDCWA. 2008. Lake Hodges Project Reservoir Regulation Manual. April. Pg. 6-7 and SDCWA. 2013. Capital Improvement Program Water System Planning Schematic Aqueducts, Flow Control Facilities and Gradient Control Structure. April; (California energy mix) CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html; (CO2e emissions factors) U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/

*Some differences may occur due to rounding

Table 3-84: Physical Benefit E-Avoid Social Costs of Greenhouse Gases
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization*
Type of Benefit Claimed: Avoid Social Costs of Greenhouse Gases
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2017	$0	$43,127	$43,127
2018	$0	$60,259	$60,259
2019-2036	$0/yr ($0)	$60,259/yr ($1,084,659)	$60,259/yr ($1,084,659)
Total*	**$0**	**$1,188,045**	**$1,88,045**

Comments: There are social costs associated with GHG emissions, which were estimated at $21.40/MT CO2e in 2007 dollars. This is converted to $24.55/MT CO2e in 2014 dollars. This value is applied to the reduced GHG emission calculated under Benefit D, above (**Table 3-90**).

Sources: (social cost of GHGs) Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28); (conversion from 2012 to 2014 dollars) U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm.

*Some differences may occur due to rounding

Table 3-85: Physical Benefit G-Reduce Water Costs to Customers, Including DACs
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization*
Type of Benefit Claimed: Reduce Water Costs to Customers, Including DACs
Units of the Benefit Claimed: $

(a)	(b)	(c)	(d)
Year	**Annual Without Project (cumulative without project)**	**Annual With Project (cumulative with project)**	**Annual Change Resulting from Project (cumulative change from project)**
2017	$5,844,389	$326,300	$5,518,089
2018	$8,360,160	$345,163	$8,014,996
2019-2036	Variable ($180,652,144)	$345,163/year ($6,212,942)	Variable ($174,439,203)
Total*	**$194,856,693**	**$6,884,105**	**$187,972,288**

Comments: Imported water costs are based on the projected average costs to member agencies from the SDCWA, the sole imported water wholesaler in the Region. The project will offset imported water supply purchases (Benefit A, **Table 3-84**), avoiding the cost of imported water. Water costs for supplies captured and made available by the project are based on the operations and maintenance costs of the Speece Cone, along with the pumping costs to move water into the Second Aqueduct. Speece Cone O&M costs are anticipated to be $277,000 per year. Pumping costs are based on the energy intensity calculated as described under Benefit D (**Table 3-X**), which under short-term conditions (2017) is 4,957 MWh/yr, and under long-term conditions (2018-2036) is 6,854 MWh/yr. Energy for pumping costs $0.72/kW-year, or $8.219/MWh, in 2008 dollars. This converts to $9.041/MWh in 2014 dollars. A 10% contingency was added to pumping costs to account for system maintenance costs. Cost savings were calculated as the cost difference between purchasing imported water and capturing and making available water from the project.

Sources: (imported water costs) Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44); (Speece Cone O&M costs) City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study Conceptual Planning Report. Pg. 6-2; (energy costs for pumping) SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pg. D-8.

*Some differences may occur due to rounding

Technical Analysis of Physical Benefits Claimed: Regional Emergency Storage and Conveyance System Intertie Optimization

Technical Basis of the Project

The *Regional Emergency Storage and Conveyance System Intertie Optimization* project will reduce and control algal productivity in Hodges Reservoir to improve water quality, which is currently so poor that stored water is not available as water supply to the Region. Proposed installation of a Speece Cone Hypolimnetic Oxygenation System (HOS) would add dissolved oxygen to the reservoir's bottom water, to prevent anaerobic conditions from occurring, thereby resolving water quality issues that prevent water transfers. The project will restore the drinking water supply beneficial use, allowing for greater water supply flexibility and reliability by enabling SDCWA to transfer local runoff captured in Hodges Reservoir into the regional aqueduct system.

The Hodges Reservoir Pumped Storage Project (pumped storage) is a major element of SDCWA's Emergency Storage Project (ESP) and allows connectivity between the City of San Diego's Hodges Reservoir and SDCWA's Olivenhain Reservoir. The facilities associated with pumped storage operation can be used for both hydropower operation and conveyance of Hodges Reservoir water to SDCWA's raw water aqueduct for delivery to the Region for water supply. In addition to the pumped storage operation, Hodges Reservoir operation includes[423]:

- A regional emergency storage pool of up to 20,000 AF for SDCWA
- A local emergency storage pool for the City of San Diego
- A seasonal, carryover and discretionary pool that can be used to supply water to the Region and can provide significant storage for winter flows into the reservoir

Seasonally degraded water quality in Hodges Reservoir generates conditions that prevent the use of stored water in Hodges Reservoir as water supply. Today's operation of Hodges Reservoir includes only the hydroelectric generation with pumped storage but poor water quality has not allowed water supplies to be transferred into the regional aqueduct system. Improving water quality in Hodges Reservoir will allow for optimal water pumping flexibility and connectivity to SDCWA's imported water system.

Estimates of the short-term and long-term water supply benefits of the *Regional Emergency Storage and Conveyance System Intertie Optimization* project were derived from computations of water supply flows from Hodges Reservoir under different conditions. These computations are based on:

- Historical data from the City of San Diego[424]
- Knowledge of the physical configuration and constraints in the system, documented in the *Lake Hodges Projects Reservoir Regulation Manual*[425]
- Modeling results from the City of San Diego SDSIM model, with specific simulations for the analysis of benefits under this project

The short-term benefit of 3,889 AFY was determined by analysis of current reservoir conditions, projecting similar conditions of natural inflows and outflows into the near future, and assuming the reservoir operation that will be possible once the project is implemented.

Long-term benefits were estimated as 5,377 AFY, based on a calibrated model of Hodges Reservoir from the City's long-term water supply planning tool (SDSIM model), dynamically simulating the reservoir operation with and without the HOS project under multiple hydrology conditions. The model was used to estimate the additional water that could be captured in the reservoir during wet years.

[423] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Page 6-3.
[424] Pers. Comm. Jeffery Pasek. Watershed Manager, City of San Diego. "Hodges Hydrology through April 2014" excel file. June 2, 2014. Available: 619-533-7599
[425] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April.

Project Phasing

As shown in Attachment 6, the project will be constructed from October 2014 through August 2016, with operation of the HOS beginning in August 2017 after performance testing. Operation of the HOS would allow for the possibility of water transfers into the regional raw water aqueduct due to improved water quality conditions beginning in 2017. Benefits can be immediately accrued upon operation, because all pipelines and infrastructure necessary to deliver the water into SDCWA's aqueduct are already in place. The project life is anticipated to be 20 years, based on the life cycles of components included in the oxygenation system, which range from 5-40 years.[426] For example, a Speece Cone installed in 1993 by EBMUD at its Camanche Reservoir in the San Joaquin Valley is still operating, indicating a life cycle of at least 20 years.[427]

The primary physical benefit of the project is an additional 3,889 AFY new potable water supply available in the short-term (2017) through transfer of existing surface water into the regional intertie in response to near-term (2014/2015) drought conditions, and 5,377 AFY of new potable water supply over the long-term (2018-2036) due to operation of the HOS system and resulting additional supply yield. Because pumping capacity is sufficient to accommodate pumping of all of the short-term benefit water over two months, full benefits can be achieved within the first year of operation (2017). Long-term benefits are achieved through the continued operation of the oxygenation system, and will pump the entire annual long-term benefit of 5,377 AFY over the course of four months (September through December). Full long-term benefits will be realized immediately following the short-term through the end of the project life (i.e., 2018-2036). **Table 3-79** show these primary physical benefits as they accrue over the 20-year life of the project. As described below, there are many other benefits that are achieved by the project as a result of these primary benefits. These benefits are summarized in **Table 3-78**, and presented in greater detail in **Table 3-80** through **3-85**, and described below.

Background for Benefits Claimed

As described previously, the primary physical benefit associated with the *Regional Emergency Storage and Conveyance System Intertie Optimization* project is an additional 3,889 AFY in the short-term and 5,377 AFY in the long-term of new potable water supply available through transfer of existing surface water into the regional intertie. The information provided below is organized by each benefit that will be provided by the project and includes background information about the Region, as well as specific information about the project that explain the basis for each of the benefits.

Regional Context

Hodges Reservoir lies within the San Dieguito River watershed. Drainage from several hydrologic areas totaling 192,585 acres (about 301 square miles) flows into Hodges Reservoir. Hodges Reservoir was built in 1918 with the construction of Hodges Dam on San Dieguito River. The City of San Diego purchased the dam and reservoir in 1925. When full, the reservoir has 1,234 surface acres and a water storage capacity of approximately 30,250 acre-feet (AF).[428,429] The average annual inflow to Hodges Reservoir from fiscal year (FY) 1919-1920 through FY 1988-1989 was 28,887 AF, with a maximum inflow of 211,104 AF occurring in FY 1979-1980 and a minimum inflow of 178 AF in FY 1960-1961. The median annual runoff inflow over the same time period was 8,696 AF.[430]

Currently, the dominant beneficial use of Hodges Reservoir is as a source of drinking water supply for Santa Fe Irrigation District (SFID) and San Dieguito Water District (SDWD), who jointly retain water rights to the surface water in Hodges Reservoir through an agreement with the City of San Diego. In any single year, 50% of the annual hydraulic yield is the shared property of SFID/SDWD, and the remaining 50% is

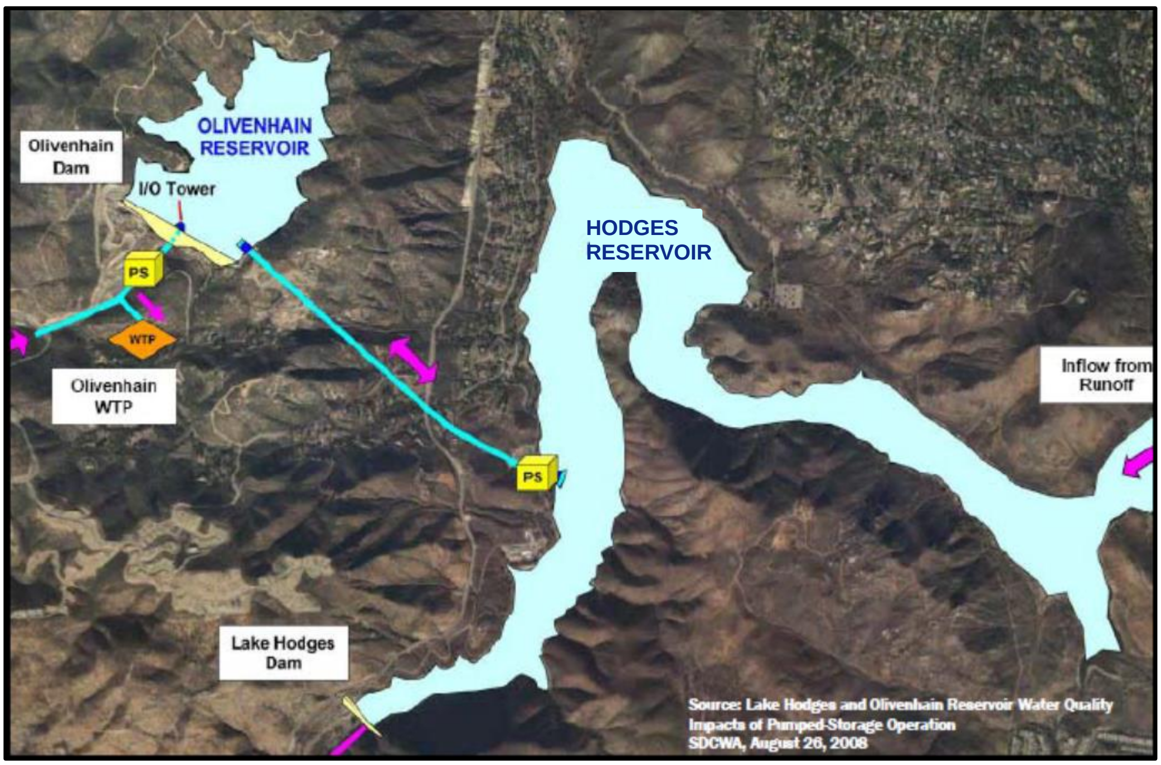
[426] Pers. Comm. Goldamer Herbon, Senior Water Resources Specialist, City of San Diego – Public Utilities Department. June 11, 2014. Available: 619-533-4120.
[427] ECO Oxygen Technologies. 2014. Success Story: 20 Years of Hypolimnetic Oxygenation of a Reservoir. Presentation at the Oklahoma Clean Lakes and Watersheds 23rd Annual Conference. April 2-3.
[428] SFID. 2011. 2010 Urban Water Management Plan. June. Page 12.
[429] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report. March 19. Page vii.
[430] Pers.Comm. Jeffery Pasek. City of San Diego. "Hodges Hydrology through April 2014" excel file. June 2, 2014.

the City's. SFID/SDWD have rights to the first 5,700 AF entering the lake. Any surface runoff in excess of 11,400 AF is split 50/50 between SFID/SDWD and the City.[431,432] Passive Hodges Reservoir management typically allows the lake to fill in high runoff years and draw down slowly in a sequence of years with limited runoff. The water flows by gravity through existing conveyance facilities that originate at Hodges Dam. Water delivered is treated by SFID/SDWD at the Badger Water Treatment Plant. Significant volumes of Hodges Reservoir water are temporarily stored at San Dieguito Reservoir where it receives aeration before it is treated at the Badger Plant. Use of the existing facilities will continue as a separate function from the ESP's Olivenhain/Hodges conveyance system, described below.

Hodges Reservoir has historically received all of its water supply from local runoff. With construction of SDCWA's ESP, Hodges Reservoir was hydraulically connected through Olivenhain Reservoir, the Lake Hodges Pump Station (LHPS), and the Lake Hodges to Olivenhain Pipeline (LHOP) to Pipeline 5 of SDCWA's Second Aqueduct. A graphic of the Olivenhain/Hodges conveyance system is shown in **Figure 3-20** and a schematic of the Hodges Reservoir connection to the regional aqueduct system is shown in **Figure 3-21**. Hodges Reservoir is an important component of the ESP and is needed to increase the ability to deliver water within San Diego County during significant water supply shortages. Following completion of the San Vicente Dam Raise project, SDCWA obtained 20,000 AF of storage rights in Hodges Reservoir.[433]

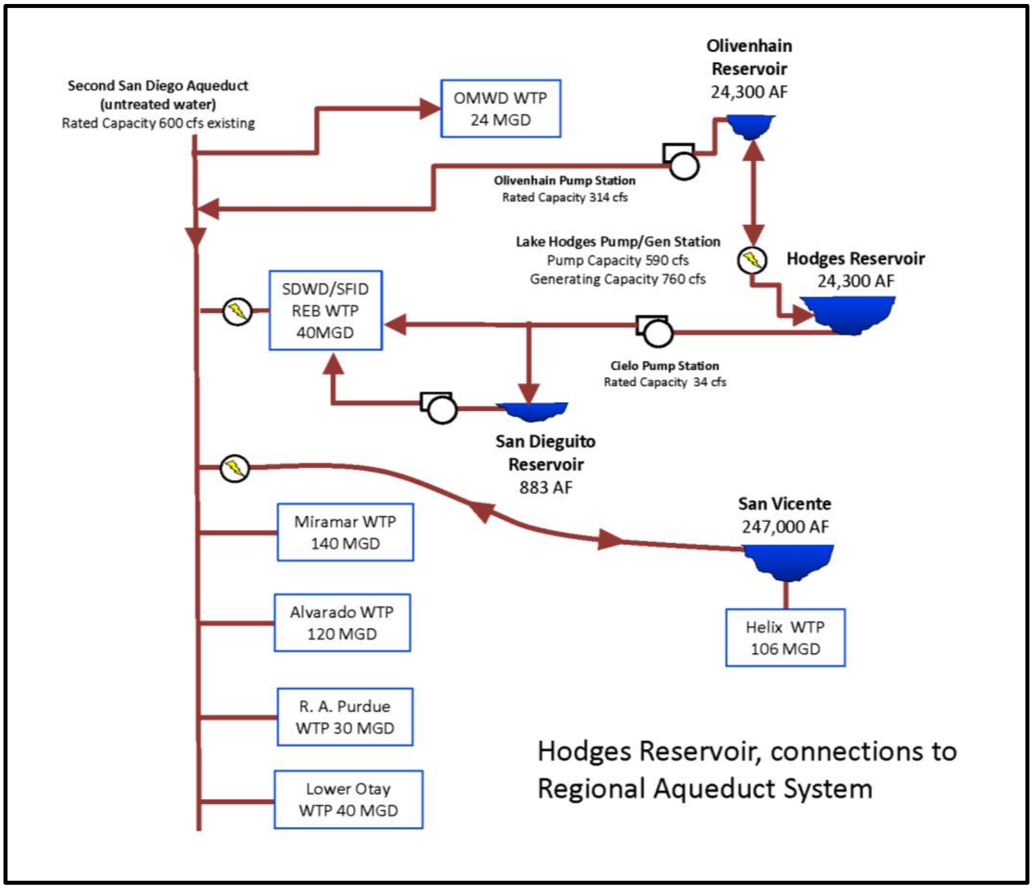
Under optimal operations, filling of Hodges Reservoir from runoff could be supplemented as needed with imported untreated water supplies from MWD via Pipeline 5 through Olivenhain Reservoir. Water in Hodges Reservoir can also be pumped to Olivenhain Reservoir, where it could be delivered in turn to Pipeline 5 and/or to the Olivenhain Municipal Water District's water treatment plant.[434] Implementation of the *Regional Emergency Storage and Conveyance System Intertie Optimization* project is intended to allow reoperation of the Hodges Reservoir to achieve these water supply benefits.

Figure 3-20: Olivenhain/Hodges Conveyance System



431 SFID. 2011. 2010 Urban Water Management Plan. June. Pg. 32.
432 City of San Diego, SFID, and SDWD. 1998. Lake Hodges Water Agreement. March.
433 SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pg. 1-2.
434 SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pg. 2-5 to 2-6.

Figure 3-21: Schematic of Hodges Reservoir Connections to Regional Aqueduct System



Drought / Emergency Conditions

A regional emergency event is a catastrophic interruption of imported water supplies, or any other emergency situation in which SDCWA has insufficient water available to supply at least 75% of the total demand of its service area, or any portion thereof. SDCWA has identified multiple emergency scenarios that form the basis for planning and operation of ESP facilities, including: earthquakes which sever First and Second Aqueducts in San Diego County or aqueducts in Riverside and/or Los Angeles County; terrorism or similar deliberate act of sabotage directed at civil infrastructure; or a severe prolonged drought.[435]

SDCWA has the right to utilize City of San Diego water in storage in Hodges Reservoir in the event of an emergency that adversely affects the water supply for the Region, if the use of City water is deemed necessary by SDCWA to meet the water supply needs of the Region.[436] In the Short Term Drought Response benefit, SDCWA/City of San Diego could use the existing available supply within Hodges Reservoir to meet drinking and agricultural water demands if faced with severe or prolonged drought conditions.

Wet Weather Conditions

Using water from Hodges Reservoir on an annual basis would optimize available storage and supplement supply for City of San Diego. Natural runoff into the reservoir can be significant in normal to wet conditions; the average runoff volume into the reservoir for the years 1965 to 2013 was 10,070 AFY.[437] During extreme wet years, dam spills can occur as Hodges is unable to store all of the runoff. Over the

[435] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pp. 2-7 to 2-8.
[436] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pg. 6-4.

49-years of data, Hodges Dam spilled 12 times, for an average spill of 89,614 AF. The annualized average overflow was 21,946 AFY.[438]

According to the 1998 Lake Hodges Water Agreement (described above), the City of San Diego and SFID/SDWD share rights to any ‘excess’ local runoff captured within Hodges Reservoir (beyond the agreed-upon average yield).[439] If the water quality in Hodges Reservoir allowed for transfer of lake water through the regional intertie, the City of San Diego could utilize their portion of this ‘excess’ supply in wet years to supplement existing sources. In the Long Term Water Supply Yield benefit, the City of San Diego would use Hodges Reservoir to capture more natural runoff during wet years for water supply.

Water Quality

The Regional Board has designated Hodges Reservoir as being “impaired” for seven water quality parameters: color, pH, manganese, methylmercury, nitrogen, phosphorous, and turbidity. This is pursuant to both Clean Water Act sections 305(b) and 303(d). While these impairment listings of Hodges Reservoir are significant regulatory drivers and need to be addressed, they oversimplify the most pressing water quality issue to be remedied – algal productivity or eutrophication (reduced dissolved oxygen levels). High algal productivity impairs the usability of the reservoir as a drinking water source because of taste and odor events, high levels of disinfection bi-product precursors, filter clogging, high turbidity, and contribution to anoxic conditions in the reservoir’s deeper waters.[440] Thus, managing algal growth is key to restoring and sustaining Hodges Reservoir’s dominant beneficial use as a drinking water reservoir.

Primary Physical Benefit - Increase Surface Water Capture for Potable Use

Short Term Drought Response

As described above, Hodges Reservoir has been connected to Olivenhain Reservoir and SDCWA’s Pipeline 5 through facilities constructed per the ESP. Ever since the lake was connected, however, no water from Hodges Reservoir has been served into Pipeline 5 due to poor water quality. The *Regional Emergency Storage and Conveyance System Intertie Optimization* project will solve the water quality issues that have prevented flows from Hodges Reservoir from being served to the City of San Diego using Pipeline 5. The Short Term Drought Response benefit of 3,889 AFY would occur during a severe or prolonged drought, if existing surface water stored in Hodges Reservoir were transferred into the regional intertie to meet drinking and agricultural water demands. For the purposes of this analysis, the short-term benefit is assumed to be realized only in the first year of operation, 2017.

The approach to estimating the short-term benefit was to start the benefit computation with today's conditions of storage and the most recent data on natural inflows (local runoff and rain on surface) and natural outflows (evaporation, seepage and leaks), and estimate the volume that could be used in the year following project implementation accounting for relevant constraints and commitments. The Short Term Drought Response benefit is 3,889 AFY for a near-term transfer into the regional intertie.

Today's Conditions

The most recent record from the City of San Diego on storage from Lake Hodges is 11,613 AF[441], corresponding to June 23, 2014. Data provided by City of San Diego on Hodges Hydrography[442] (records the City keeps with historical information) shows that natural inflows and outflows into Lake Hodges for 2012 and 2013 correspond to drought conditions, where the natural local runoff is significantly lower than the long-term average (1965 to 2013) of 10,070 AFY. **Table 3-86** shows the natural inflows and outflows for the two most recent full calendar years. On average, there has been a net loss in the reservoir of 194 AFY (algebraic sum of the three columns in the table) in 2012 and 2013.

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[437] Pers.Comm. Jeffery Pasek. City of San Diego. “Hodges Hydrology through April 2014” excel file. June 2, 2014.
[438] Pers.Comm. Jeffery Pasek. City of San Diego. “Hodges Hydrology through April 2014” excel file. June 2, 2014.
[439] City of San Diego, SFID, and SDWD. 1998. Lake Hodges Water Agreement. March.
[440] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report. March 19. Pg. vii.
[441] City of San Diego. 2014. Water Levels. June 23. Available: http://www.sandiego.gov/water/recreation/levels.shtml.
[442] Pers.Comm. Jeffery Pasek. City of San Diego. “Hodges Hydrology through April 2014” excel file. June 2, 2014.

Table 3-86: Lake Hodges Recent Natural Inflows and Outflows

Year	Runoff and Rain on Surface (AFY)	Evaporation, Leaks and Spills	Unaccounted for Loss/Gain[1]
2012	425	(1,278)	767
2013	488	(956)	164
Total	913	(2,234)	932
Average	457	(1,117)	466

In addition to the natural flows into and out of Hodges Reservoir, there are controlled withdrawals for SFID/SDWD water supply and controlled draft and inflows to and from Olivenhain Reservoir as part of pumped storage operation. The way these controlled inflows and outflows are considered in the analysis is described below.

Commitments and Agreements

According to the 1998 Lake Hodges Water Agreement, SFID/SDWD are entitled to 5,700 AFY from Hodges Reservoir.[443] SFID/SDWD historically withdraw these flows from the lake by gravity using the lower elevation outlets in the reservoir. This entitlement has been taken into account in the computation of the project benefit, by assuming that the 5,700 AFY to SFID/SDWD will be withdrawn by gravity following HOS project implementation. Those flows, then, have not been counted in the benefit calculations.

An additional agreement considered in the calculation is that between the City and SDCWA related to the use of Hodges Reservoir, Olivenhain Reservoir, and their associated pumping/generating facilities to generate electricity in pumped storage operation. There is a minimum level at which Hodges Reservoir needs to be maintained in order for pumped storage operation to take place. That minimum level is 290 ft., corresponding to a volume of approximately 10,385 AF based on the Volume-Area-Storage curves for Hodges Reservoir.[444] This minimum elevation requirement for pumped storage operation has been preserved as a constraint in the long-term benefit computations for the HOS project, but it has *not* been preserved for the short-term benefit computation. The implication of not preserving the minimum level for pumped storage operations is that energy generation is a secondary priority to water supply, which is consistent with the priorities established in the *Reservoir Regulation Manual*.[445]

Capacity and System Constraints

The system capacities from Hodges Reservoir to Pipeline 5 (LHOP, LHPS, pipeline to feed water into Pipeline 5, and Pipeline 5 turnout capacities to serve City of San Diego) have been considered in the computation of the short-and long-term benefits. The elevation of the dam outlets and required elevations for pumping from Hodges Reservoir to Olivenhain Reservoir for supply purposes have also been accounted for.

The *Reservoir Regulation Manual* establishes a capacity related to serving City of San Diego of 168 cfs (333/AF per day). This capacity is smaller than the pumped storage operation capacity described above, but it has been used in the analysis given that it is established in the operational priorities for the reservoir in the *Reservoir Regulation Manual*[446], as the capacity to serve the City's supply.

In terms of Hodges Reservoir elevations resulting from reservoir withdrawals, the following elevations have been considered in the analysis:

- Dead storage: accounted for (1,830 AF El = 264 ft.)

[443] City of San Diego, SFID, and SDWD. 1998. Lake Hodges Water Agreement. March.
[444] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Appendix B-1, page B-3.
[445] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Section 6.4.4 Operational Priorities, page 6-8.
[446] Water Authority. 2008. Lake Hodges Projects Reservoir Regulation Manual. Section 6.4.4, page 6-8.

- Minimum level for pump storage operations (10,385 AF El = 290 ft.) was *not* considered a constraint in the short-term benefit estimates but was taken into account for long-term benefit operation simulation
- Minimum level to operate Lake Hodges pump station was treated as hard constraint at elevation of El 280 ft., equivalent to a volume of 5,990 AF
- Dam Outlet #4 at El 284 ft. not used (assumed LHPS will serve all water to San Diego). Dam Outlet #4 is higher than minimum level for LHPS
- Dam Outlet #3 El 275 ft. was not used since it is lower than minimum LHPS operation elevation

Computations/Results

Starting with the most recent data on Hodges Reservoir storage, the computation is based on that storage minus net loss (resulting from the balance of natural inflows and outflows), minus the water to which SFID/SDWD are entitled. The computation accounts also for dead storage and the minimum elevation that is required for pumping with the LHPS.

Results indicate that the Short Term Drought Response benefit of the HOS project would be 3,889 AFY, resulting in a minimum level in the reservoir (after City pumping) of 283.5 ft., which is higher than the minimum level required for the operation of LHPS. After the City's withdrawals, which can happen in less than one month based on pumping capacity, SFID/SDWD will be able to withdraw their entitlement of 5,700 AF, with a resulting end of year storage equal to the top of the dead storage pool.

1.	Today's Level:	11,613 AF
2.	Required for Districts:	5,700 AF
3.	Net change in storage from natural inflows and outflows:	(194) AFY
4.	Available after Districts Draft and Natural Inflows and Outflows:	5,719 AF
5.	Dead Storage:	1,830 AF
6.	***Available to City for the Year*** *(5,718 AF – 1,830 AF):*	***3,889 AF***
7.	Storage after Natural Inflows and Outflows and City Pumping:	7,530 AF
8.	Elevation after Natural Inflows and Outflows and City Pumping:	El 283.5 ft.
9.	Minimum Elevation for LHPS Operation:	El 280 ft.
10.	Elevation Buffer between Level after City Pumping and Level Required:	3.5 ft.
11.	Storage after Natural Inflows and Outflows, Districts Draft and City Pumping:	1,830 AF

Long Term Water Supply Yield

The Long Term Water Supply Yield benefit would derive from the ability to use water from Hodges Reservoir on an annual basis, making some storage available to capture natural runoff and supplement supply for City of San Diego on a regular basis and during dry years. With the *Regional Emergency Storage and Conveyance System Intertie Optimization* project, the non-emergency storage pools in Hodges Reservoir can be exercised dynamically, opening seasonal storage to capture the natural runoff that occurs during winter. As described above, Hodges Reservoir has overflown in wet years due to the inability to operate the discretionary and seasonal pools so a supply benefit of the HOS project will be ability to capture more natural runoff during wet years for water supply. There are several ways the Long Term Water Supply Yield benefit could be calculated, ranging from 5,523 AFY to 8,900 AFY (see detailed discussion below). For the purpose of this analysis, the long-term benefit is assumed to be realized for each of the years following the short term benefit (2018-2037).

The long-term benefits were estimated using a dynamic mass balance model for Hodges Reservoir developed as a sub-model to the City's long-range water supply model known as SDSIM. SDSIM is a model built in STELLA software specifically for water supply planning for the City. The model includes all raw water reservoirs owned by City of San Diego as well as the City's treatment plants that are used to treat raw water for drinking purposes. The model runs on a monthly basis and includes time series for water demands and for hydrologic variables in the reservoirs (local runoff and evaporation). All data in SDSIM has been validated and documented in the City's long-range water supply documents: *City of San*

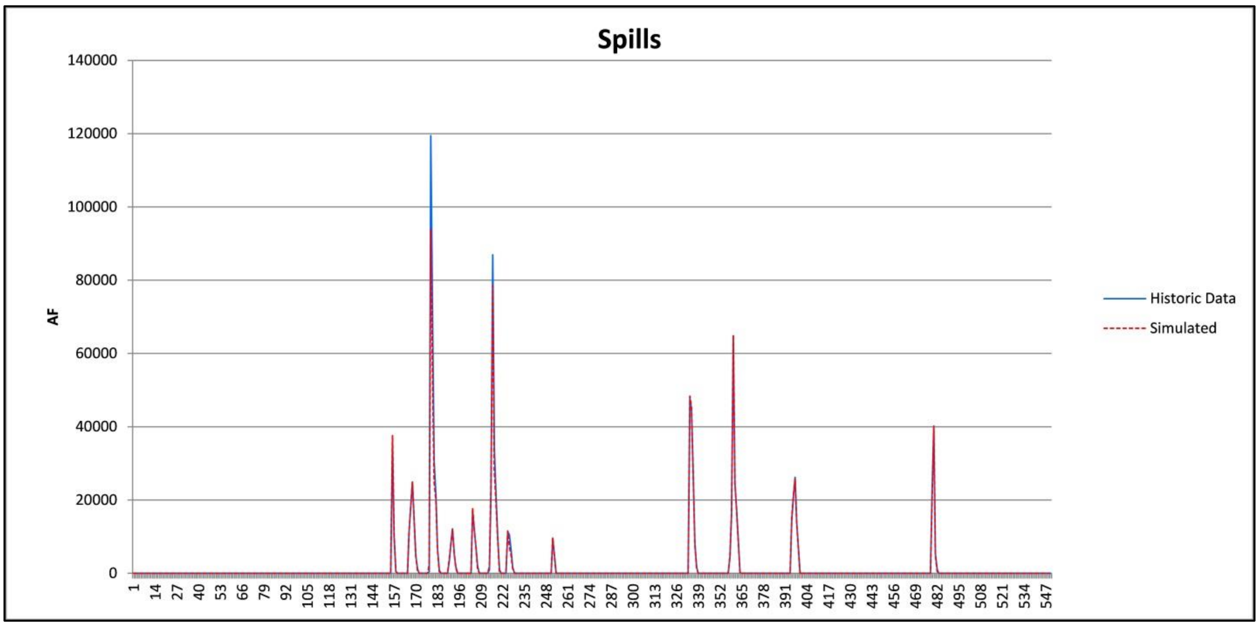
Diego 2004 Long-Range Water Resources Plan[447] and *City of San Diego 2012 Long-Range Water Resources Plan*[448].

To assess the long-term benefits of the HOS project, the Hodges Reservoir section of SDSIM was isolated and updated with the most recent data on the lake hydrology (provided by City of San Diego[449]) and with functionality to test lake operations without and with the HOS project by introducing guide curves based on the *Reservoir Regulation Manual*[450].

Before the simulation of a baseline condition and a project condition, the Lake Hodges SDSIM sub-model was calibrated based on the available historical data. The calibration variables were reservoir storage and spills. The model computed storage with an average error of 1.9% and spills with an average error of 0.7% for the entire simulation, and 4.0% for spill events. **Figures 3-22** and **3-23** show the calibration graphics for spills and storage, respectively. It should be noted that the data available (plotted in blue in **Figure 3-22**) show maximum reservoir levels higher than Hodges Reservoir capacity corresponding to the top of the spillway crest given that the reservoir has a surcharge capacity to the top of Hodges Dam. The model was considered calibrated based on its good replication of the storage and spills trend, and based on the low error (lower than 2% for storage and lower than 5% for spills).

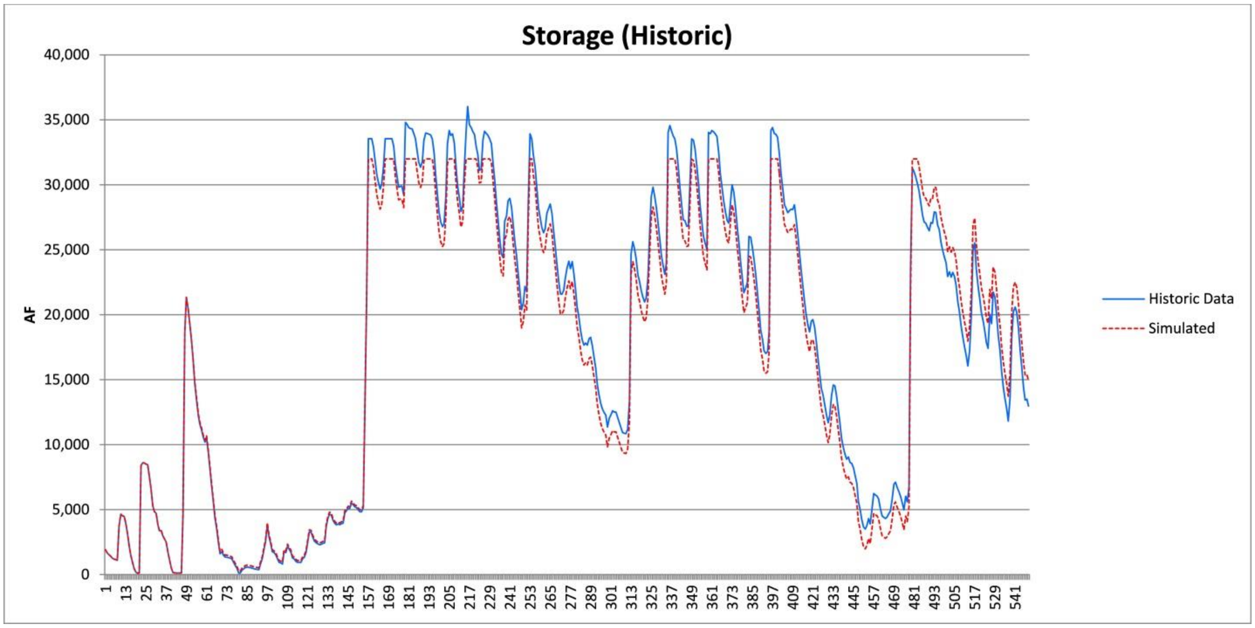
In order to compute the benefit of the HOS project on a long-term basis, two simulations were run corresponding to a baseline (no project) and a project simulation. These simulations are described below.

Figure 3-22 – Lake Hodges SDSIM Sub-Model Calibration of Spills



[447] City of San Diego. 2004. City of San Diego Long-Range Water Resources Plan (2002-2030). Section 6.
[448] City of San Diego. 2013. City of San Diego 2012 Long-Range Water Resources Plan. December. Appendix B.
[449] Pers.Comm. Jeffery Pasek. City of San Diego. “Hodges Hydrology through April 2014” excel file. June 2, 2014.
[450] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pages C-24 - C-25.

Figure 3-23 – Lake Hodges SDSIM Sub-Model Calibration of Storage



Baseline Simulation

The baseline simulation is similar to the historical simulation in that no water can be served to the Region using the LHPS due to poor water quality. But it differs from it in that the Hodges Reservoir projects have been completed and there are now two main conditions that are different from historical conditions: 1) pumped storage operation; and 2) introduction of local and regional emergency storage pools for the City and SDCWA, with specific seasonal targets (guide curve).

The baseline simulation is a simulation with 45 years of hydrology, corresponding to 1965 to 2010. This period of record includes both significantly wet years, in addition to significantly dry years, as well as sequential wet and dry years (droughts). It also corresponds to a period where no imported water was introduced into the lake, making it ideal for the modeling effort. The simulation runs on a monthly unit time and includes historical runoff and precipitation, leaks and evaporation, unaccounted flows, and SFID/SDWD's draft. Additionally, the simulation includes a guide curve developed specifically for the baseline condition, in which three factors are considered: a regional emergency pool, a local emergency pool, and minimum level requirements for pumped storage operation.[451]

Guide curves for the reservoir are defined in the *Reservoir Regulation Manual* Figures C.2 and C.3. The rule curve for the baseline simulation was defined as being the same as the guide curve for the first two years in Figure C.3, but more conservative (more emergency storage in the lake) for the third year until the end of the simulation. This was decided as a reasonable approach that assumes that SDCWA will require or decide to use the Lake Hodges Regional Emergency Storage Pool at higher levels than reflected in Figure C.3 of the *Reservoir Regulation Manual*.

The baseline simulation runs the historical record with the new Hodges Reservoir rule curve but *assumes that no water can be withdrawn from the reservoir through the LHPS, due to poor water quality* (which is the current condition). This results in outflows for water supply equal to SFID/SDWD's draft only. The model computes the Hodges Dam spills that would occur under those conditions.

Project Simulation

The project simulation uses the same historical period and data, the same SFID/SDWD draft, and the same rule curves for the reservoir as the baseline simulation. The difference with the baseline is that the

[451] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Definition of pools: page A-2. Minimum levels for pumped storage operations is 290 ft.: Figure 6.1, page 6-14.

project simulation assumes that the water can be pumped with the LHPS from October through January (as intended and described in the *Reservoir Regulation Manual*, Appendix C) due to improved water quality resulting from the implementation of the HOS project. This results in significant improvements in seasonal pool management, compared to the baseline, making significantly more storage available to capture winter runoff. The model computes the Hodges Dam spills that would occur under those conditions.

Long-Term Benefit from Additional Runoff Captured for Supply

The Long-Term Benefit from Additional Runoff Captured for Supply can be computed by the reduction in Hodges Dam spills resulting from exercising the reservoir seasonal and discretionary pools (more optimal operation, see **Figure 3-24**). This reduction in spills represents local runoff that is captured above the expected levels with no HOS project.

The cumulative spill volume over the length of the 45-year simulation under the baseline simulation is equal to 1,094,326 AF. The project simulation results show a cumulative volume of spills of 852,381 AF. The difference, the additional runoff captured due to project implementation, is 241,945 AF. Over a 45-yr simulation, the annualized benefit is thus 5,377 AFY. In the period simulated (1965 to 2010), there have been 12 events of spills from Hodges Dam. For the baseline condition, spill events would increase to 16, while under the project condition, spill events would be reduced to 11. Using the historical 12 events as a basis, the benefit expressed in approximate volume per event is 20,162 AF. **Figure 3-25** shows the simulated spills for baseline and project conditions.

Figure 3-24 – Hodges Reservoir Storage under Baseline and Project Conditions

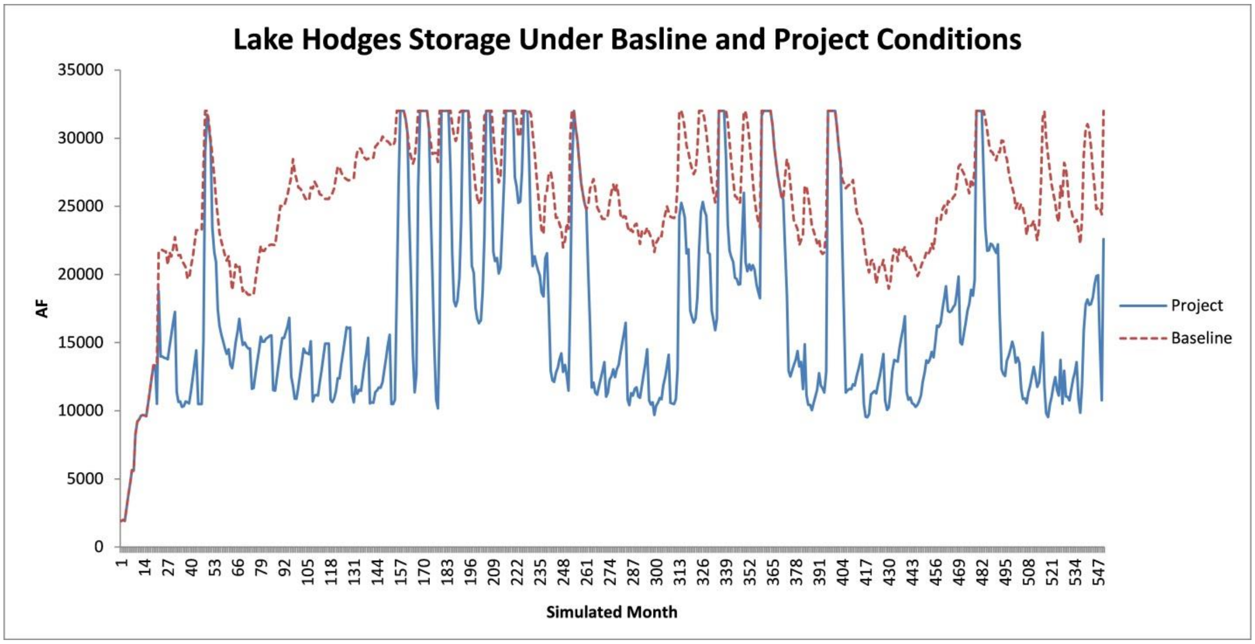
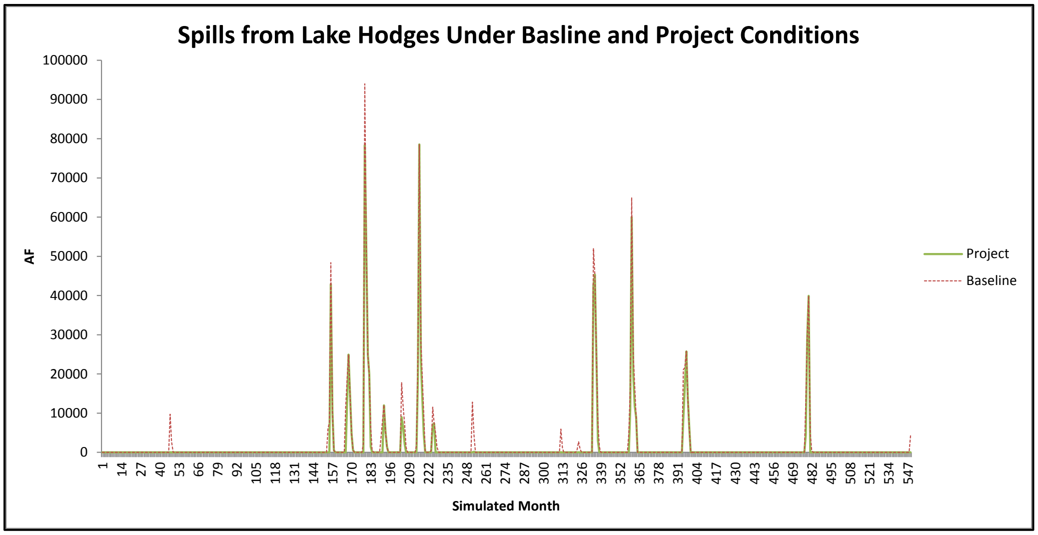


Figure 3-25 – Simulated Spills from Hodges Reservoir Under Baseline and Project Conditions



Benefit A-Avoid Imported Water Supply Purchases and Benefit C-Local Supply Development to Decrease Vulnerabilities

The *Regional Emergency Storage and Conveyance System Intertie Optimization* project would reduce and control algal productivity in Hodges Reservoir to improve water quality, thus making the stored water available as water supply through a regional intertie. Estimates of the short-term and long-term benefits were derived from computations of water supply flows from Hodges Reservoir under different conditions, as described above. The Short Term Drought Response benefit is 3,889 AFY for a near-term transfer into the regional aqueduct system during severe or prolonged drought conditions. The Long Term Water Supply Yield benefit of 5,377 AFY would derive from the ability to use water from Hodges Reservoir on an annual basis, making some storage available to capture natural runoff and supplement supply for City of San Diego on a regular basis and during dry years.

One of the secondary benefits of the project is avoided purchase of imported water supply. SDCWA is the sole imported water wholesaler to 24 member agencies within San Diego County, including the City of San Diego[452]. SDCWA supplies include a mix of surface water and imported water supplied through water transfers from Imperial Irrigation District, canal lining projects, and purchases from MWD.[453] As shown in SDCWA's 2010 UWMP, during dry years, imported water will constitute a larger proportion of SDCWA's supplies due to reduced surface water flows.[454] Per local policy, SDCWA supplies are purchased only to meet demand that cannot be met with local supplies by member agencies, as evidenced by SDCWA's demand projection methods described in its UWMP (sales = total demand – local member agency supplies).[455] Although SDCWA and its member agencies use a mix of imported water and local sources to supply their customers, imported water is more expensive to provide and is considered to be the marginal water source.[456] Thus, any new supplies that are available in the Region, including increased usability of supplies from Hodges Reservoir, will be used to offset purchase of imported water supplies.

SDCWA purchases most of the Region's imported water (sourced from the SWP and the CRA) from the MWD, and receives additional imported supplies through a conservation and transfer agreement with the IID.[457] SDCWA distributes the aforementioned supply to its 24 member agencies, which include all major

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[452] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 1-8 and 3-1.
[453] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-2.
[454] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 9-3 to 9-7.
[455] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[456] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Pg. 10. Note that despite desalinated water's high cost, the San Diego IRWM region's priority is to reduce dependence on imported water (IRWM Plan, 2007).
[457] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 1-8.

water agencies in the San Diego Region. The amount of water imported into the Region varies depending on hydrologic conditions, but in recent years the Region's water supply has consisted of between 79% and 93% imported water.[458] By 2010, SDCWA had decreased reliance on MWD imports to 59% (331,825 AF), with increased use of IID transfers (13% or 70,000 AF), canal lining transfers (14% or 80,200 AF), and member agency local sources (14% or 76,100 AF).[459] The City of San Diego's local supplies consist of surface water collected by local reservoirs (including Hodges reservoir), small volume of groundwater, and recycled water.[460]

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described above, a portion of SDCWA's imported supplies (and therefore the City's) come from the SWP, which is supplied the Bay-Delta. Conflict over management of the Bay-Delta system has been ongoing for decades, and stems from the challenge of balancing the needs and demands of people and ecosystems.[461] The CALFED Bay-Delta Program (now managed by the Delta Stewardship council) established four objectives[462] for the Bay-Delta system:

- *Water Quality*: to invest in projects that improve the State's water quality from source to tap.
- *Water Supply*: comprised of five critical elements: conveyance, storage, environmental water account, water use efficiency and water transfer.
- *Ecosystem Restoration*: aims at restoring habitats, ecosystem functions, and native species.
- *Levee Integrity*: to protect water supplies by reducing the threat of levee failures.

As described in Attachment 7, reduced pumping from the Bay-Delta will help to reduce the conflicts surrounding management of Bay-Delta supplies by allowing more water to be available to help meet water-based needs of all users, including people and ecosystems.

Benefit D-Reduce Net Production of Greenhouse Gases and Benefit E-Avoid Social Costs of Greenhouse Gases

Imported water is known to be an energy intensive supply of water, as explained below under Benefit D. The energy required to move and treat imported water supplies results in GHG emissions, which contribute to climate change. The *2013 San Diego IRWM Plan* incorporated the results of a Climate Change Planning Study for the Region. This planning study demonstrated that climate change is anticipated to increase temperature between 1.5˚F and 4.5˚F, increase variability in rainfall, decrease imported water supplies, increase water demand, increase wildfires, and cause sea level rise.[463] A vulnerability analysis of the effects of climate change on the Region found that the highest priority to help the Region reduce its vulnerability to climate change impacts is to decrease imported water supply reliance, followed by supply impacts from higher drought potential, water quality issues from increased concentration of pollutants, increased in flooding from extreme weather, decrease in habitat, inundation of storm and sewer systems from sea level rise, and a decrease in ecosystem services.[464] Projects that increase local supplies help to address the highest climate-change priorities for the Region.

The Region has already been impacted by wildfires exacerbated by the drought and climate change. Within a two week period in May 2014, 14 wildfires burned 26,000 acres, led to the evacuation of 121,000 people, and caused over $29.8 million in damages to private property. Costs to fight these fires are estimated at $28.5 million.[465]

[458] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 3-26.
[459] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pp. 4-4, 4-6, and 6-1.
[460] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 4-1.
[461] Delta Stewardship Council. 2013. The Delta Plan: Ensuring a Reliable Water Supply for California, a Healthy Delta Ecosystem, and a Place of Enduring Value. Pp. 10-11.
[462] CALFED Bay-Delta Program Archived Website. CALFED Objectives. Accessed 28 June 2014. Available: http://calwater.ca.gov/
[463] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-15 (pg. 7-38).
[464] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Table 7-16 (pg. 7-39).
[465] County of San Diego. 2014. May 2014 San Diego County Wildfires After Action Report. June. Pg. 2.

Each of these climate change related impacts has a cascading effect on the Region including costs associated with mitigating the effects of climate change and economic impacts to industry and businesses.

Benefit G-Reduce Water Costs to Customers, Including DACs

As described above, the Region is heavily reliant on imported water to meet demands, including the City of San Diego. The City has purchased between 100,000 AF and 228,000 AF imported water per year between 1990 and 2010. Imported water purchases are anticipated to be 201,719 AF in 2015[466], or nearly 84% of the City's projected total water use.[467] Along with being an energy intensive supply, imported water is also expensive, one of the contributing factors of it being the marginal supply, as described above. Avoiding the cost of purchasing imported water would result in cost savings to customers, passed along in the form of protection from price fluctuations associated with imported water. Reducing supply vulnerabilities also protects customers from high water rates by reducing the need for water use restrictions, which are often accompanied by fees and higher rates for excessive water use.

As described above, importing water contributes to climate change through its GHG emissions, which in turn results in social costs. These avoided social costs will also benefit the Region. In particular, avoided costs (social costs of GHGs as well as costs to import water) will benefit DACs, which have fewer resources to accommodate the potential impacts of climate change or increasing water costs. As shown in **Figure 3-19**, and described in Attachment 8, the City serves a number of DACs.

Benefit N-Improve Water Quality of Surface Reservoir and Benefit Q-Improve Water Quality for Aquatic Species

Raw water used by SFID/SDWD consists primarily of water from Hodges Reservoir. SFID/SDWD has the ability to move raw water directly into their treatment plant; however, it is infrequently operated this way because water from Hodges Reservoir is more difficult to treat without first flowing through San Dieguito Reservoir for pre-conditioning.[468] SFID/SDWD report that compared to imported water purchased through SDCWA, the local water supply has multiple challenging water quality characteristics: higher turbidity, higher total organic carbons (TOCs) leading to disinfection by-products (DBPs), manganese, algae, taste and odor (T&O) compounds, and low dissolved oxygen (DO).[469] Since the late 2000s, SFID/SDWD have implemented use of aquamats, floating islands, aeration, real time water quality monitors, and perimeter vegetation removal as a pre-treatment system for Hodges Reservoir water, in order to effectively treat that raw water supply at their treatment plant.[470]

Managing algal productivity is key to restoring and sustaining Hodges Reservoir's dominant beneficial use as a source of drinking water supply. High algal productivity in the reservoir is fueled by excessive loading of nutrients and organic carbon, and impairs the usability of the reservoir as a drinking water source.[471] The *Reservoir Regulation Manual* establishes primary water quality parameters which limit delivery of Olivenhain Reservoir water into the regional intertie.[472] Until water quality in Hodges Reservoir (and subsequently Olivenhain Reservoir, due to pumped storage operations) is improved, local runoff cannot be transferred into the regional aqueduct for water supply.

The HOS project would arrest the natural internal cycling processes that increase primary productivity and the turnover of nutrients in the reservoir, thereby reducing total nutrient loads. In addition, eutrophic conditions induce sulfate-reducing bacteria's methylation of mercury at the lakebed surface, making elemental mercury bioavailable for consumption by fish, wildlife and humans. Oxygenation has been

[466] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 4-1.
[467] City of San Diego. 2011. 2010 Urban Water Management Plan. Pg. 3-6. Total water use in 2015 is projected to be 240,472 AF.
[468] SFID and SDWD. 2012. Joint Facilities Master Plan: R.E. Badger Water Filtration Plant. March. Page 1-2.
[469] SFID and SDWD. 2012. Joint Facilities Master Plan: R.E. Badger Water Filtration Plant. March. Page 2-1 and 3-1.
[470] SFID and SDWD. 2012. Joint Facilities Master Plan: R.E. Badger Water Filtration Plant. March. Page 4-7.
[471] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report. March 19. Pg. vii.
[472] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Appendix C, Table C.3.

suggested as a potential mechanism for reducing methylmercury concentrations in fish located in the reservoir, for which Hodges Reservoir is listed as impaired.

Without Project Baseline

Without the *Regional Emergency Storage and Conveyance System Intertie Optimization* project, the HOS system would not be installed and existing and future local runoff would not be available as water supply for the Region. As such, Hodges Reservoir water would continue to be used by SFID/SDWD for local supply, but would not be served into the regional aqueduct system due to ongoing water quality concerns. This essentially reduces (or "wastes") the reservoir impound capacity and spills over the Hodges Dam would continue in wet years. The project sponsors would continue to purchase imported water to meet demand, and as costs of imported water increase as predicted (see Benefit F), costs will be passed along to customers, including DACs. GHG emissions associated with imported water would continue, and impacts from climate change felt sooner, and potentially more intensely. Additionally, poor water quality within Hodges Reservoir would continue to bioaccumulate methylmercury in aquatic species associated with the lake.

Methods Used to Estimate the Physical Benefits

Methods used to estimate the primary physical benefit – namely via reference to technical documentation and subsequent STELLA modeling – were described above under Technical Basis of the Project and Background for Benefits Claimed.

Benefit A-Avoid Imported Water Supply Purchases

Local supplies, such as surface water, groundwater, and recycled water, will always be used first to meet demands, because imported water supplies are considered to be a marginal water source (see above). Imported water is purchased by the City of San Diego to meet demands that cannot be met with local supplies. SDCWA is the imported water purveyor for the Region, and its projected water demands (sales) are based on total demands minus local supplies from its 24 member agencies,[473] including the City of San Diego. Due to the prioritization of water sources in the Region, all of the water made available by the project would be used to offset imported water supply purchases.

The volume of avoided imported water supply purchases are equivalent to the local supply made available by the project (3,889 AFY in 2017 and 5,377 AFY from 2018-2036). This benefit is presented in the table above as Physical Benefit A. **Table 3-80** shows the avoided imported water supply purchases from the increased water supply availability created by the project.

Benefit B-Reduce Demand for Net Diversions from the Bay-Delta

As described in Benefit A, all of the water made available by the *Regional Emergency Storage and Conveyance System Intertie Optimization* project, under both short-term and long-term conditions, will offset imported water purchases. The City of San Diego purchase imported water from SDCWA, whose supply mix includes imported water, surface water, and recycled water. During a normal year, SDCWA's imported water supply consists of two-thirds SWP supplies and one-third Colorado River supplies. As described in Attachment 2, SWP deliveries have been reduced to 5% of allotments for 2014, and are anticipated to decrease to 0% if drought conditions continue into 2015. During drought years, assumed to be 2014 and 2015, the SWP portion of SDCWA's imported water mix is 15%.[474] To determine the project's contribution to reduction in demand for Bay-Delta supplies, this proportion was applied to the project's imported water offset (Benefit A, **Table 3-80**) in 2014 and 2015, while the average year two-thirds proportion is used for other years, assuming drought conditions cease. Although the short-term benefit (3,889 in 2017) is based on current drought conditions, for consistency with the other projects in this proposal, the two-thirds normal year assumption was applied to the 2017 short-term benefit. See Table **3-81** to see this benefit over the project life.

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[473] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 2-13.
[474] Pers. Comm. Tim Bombardier, SDCWA, Senior Water Resources Specialist. June 27, 2014. Available: 858-522-6600.

Benefit C-Local Supply Development to Decrease Vulnerabilities

Supply diversification is a key strategy for the Region to improve long-term reliability of its water supplies.[475] Specifically, the Region has a goal to improve the reliability and sustainability of regional water supplies, with part of the associated supply diversification objective to encourage the development of local water supplies.[476] As described in Attachment 2, imported water supplies and surface water supplies are vulnerable to reduced deliveries during drought. Further, the Region is located at the end of both of its imported water systems (see **Figure 3-3**), increasing the risk of delivery interruptions from accidents, natural disasters, such as seismic events or weather events exacerbated by climate change, or other events. Any new local supply development would reduce the Region's vulnerability to these and other supply interruptions. The *Regional Emergency Storage and Conveyance System Intertie Optimization* project creates new local supply through increasing water availability. As such, all water produced by this project, as described under Benefit A (**Table 3-80**), constitutes local supply development that will decrease vulnerabilities. The decreased supply vulnerability benefit is shown in **Table 3-82**.

Benefit D-Reduce Net Production of Greenhouse Gases

As described under Benefit A, water made available through the project would directly offset imported water purchases by the City of San Diego. GHG reduction from this imported water offset can be calculated as the difference between GHG emissions associated with importing water in the Region (MWD's water GHG emissions) and GHG emissions associated with operating the Speece Cone and pumping water from Hodges Reservoir into Pipeline 5. Imported supply from MWD is an energy intensive water supply. For delivery to the Region, imported water requires pumping over large distances. A 2010 report produced by a San Diego-based think-tank (Equinox Center) estimates energy required to convey imported water delivered to the agencies in the Region is 2.65 MWh/AF.[477] Under short-term conditions, 3,889 AFY of water is available from the project. The 3,889 AFY imported water offset under the short-term conditions requires 10,306 MWh/year. Under long-term conditions, 5,377 AFY water is available from the project. The 5,377 AFY imported water offset under long-term conditions requires 14,249 MWh/year.

To calculate energy intensity of the project requires understanding the energy required for operating the Speece Cone and the energy required to operate pumping from Hodges Reservoir into Olivenhain Reservoir and from there into Pipeline 5. The Lake Hodges Reservoir Water Quality Assessment Draft Conceptual Report states that the energy requirement for the Speece Cone is dependent on the amount of DO delivered by the cone per day. This analysis used the midpoint in DO from the cone, equal to 1.8 tons of DO per day (TDO/day).[478] The energy to operate the Speece Cone is 540 kWh/day, based on the energy per TDO delivered by the cone, which is 300 kWh/TDO. Converting to MWh/year, this equals 197 MWh/year.

Pumping energy demands will vary in the system depending on the water levels in Lake Hodges and Olivenhain Reservoir. High operating limits correspond to 314 ft. in Lake Hodges and 1,078 ft. in Olivenhain Reservoir, while low operating limits are 290 ft. in Lake Hodges and 1,040 ft. in Olivenhain Reservoir. For this analysis we have used the average elevation difference of the mid-point of high and low operating limits, which corresponds to 757 ft. In addition to the pumping required between the reservoirs, additional pumping is required to feed Olivenhain Reservoir water into Pipeline 5. The pump station at Olivenhain serving this purpose has a total dynamic head of 240 ft.[479],[480] The total system head (TSH) will be approximately 997 ft. Assuming a pump efficiency of 80% we determine a horsepower

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[475] SDCWA. 2011. 2010 Urban Water Management Plan. June. Pg. 9-9.

[476] RWMG. 2013. San Diego Integrated Regional Water Management Plan. September. Pg. 2-9 (available in this application as Appendix 1-57)

[477] Equinox Center. 2010. San Diego's Water Sources: Assessing the Options. July. Table 1a (pg. 10).

[478] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report. March 19. Pg. 4-4.

[479] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pg. 6-7

[480] SDCWA. 2013. Capital Improvement Program. Water System Planning Schematic. Aqueducts, Flow Control Facilities and Gradient Control Structures. April.

requirement using flow in gpm times TSH in feet, divided by pump efficiency and a conversion factor of 3,960 gal/min/ft.

As described above, the City has the capacity to pump the 3,889 AFY under short-term conditions into the aqueduct in one month. This analysis assumes that the full 3,889 AFY will be pumped in two months resulting in an average of 14,468 gallons per minute (1,944 AF in 1 month x 325,851.4 gallons/AF ÷ 43,800 minutes/month). This is an energy intensive process, requiring 4,553 hp over the two month period of pumping, corresponding to 4,957 MWh/year. All told, the total energy required under short-term conditions to oxygenate Hodges Reservoir and pump the full 3,889 AF to the aqueduct in two months is 5,154 MWh/year.

Under long-term conditions, the full 5,377 AFY is assumed to be pumped equally over the course of four months, consistent with the operations expected for Lake Hodges. This is less power intensive than pumping over a short time frame, as under short-term conditions. The long-term 5,377 AFY equals 10,002 gallons per minute when pumped over the course of four months (1,344 AF/month x 325,851.4 gallons/AF ÷ 43,800 minutes/month). Converting to horsepower, this is 3,148 hp over the four months period of pumping, corresponding to 6,854 MWh/year. Together with the Speece Cone energy requirements, the total energy to oxygenate Hodges Reservoir and pump the 5,377 AFY long-term benefit over the course of a year (in four months) is 7,051 MWh/year.

The benefits are calculated in energy per year, and have already incorporated the water produced and offset by the project. As such, to calculate the energy benefits over the life of the project, we can apply the annual benefit that would be achieved for each year of the project to the energy intensities of imported water and oxygenated Hodges Reservoir water under short-term and long-term conditions. The annual benefit realized each year is calculated based on the project schedule presented in Attachment 6. The project will begin delivering benefits in August 2017, therefore 100% of the annual benefit can be accrued in 2017 by pumping the 3,889 AF in two months between August and December. Full annual benefits will also be realized each year from 2018 to 2036. The annual benefit and the assumptions included in the energy savings calculation are presented in the bullets below:

- Energy use of Speece Cone: 197 MWh/yr
- Energy to pump water from Hodges to aqueduct under short-term conditions: 4,957 MWh/yr
- Energy to pump water from Hodges to aqueduct under long-term conditions: 6,854 MWh/yr
- Total energy from project to oxygenate and pump Hodges water under short-term conditions (2017): 5,154 MWh/yr
- Total energy from project to oxygenate and pump Hodges water under long-term conditions (2018-2036): 7,051 MWh/yr
- Energy intensity of imported water offset under short-term conditions (2017; assuming 3,889 AFY offset): 10,306 MWh/yr
- Energy intensity of imported water offset under long-term conditions (2018-2036; assuming 5,377 AFY offset): 14,249 MWh/yr
- Annual energy savings resulting from the project under short-term conditions (2017): 5,152 MWh/yr.
- Annual energy savings resulting from the project under long-term conditions (2018-2036): 7,198 MWh/yr

Under both, short term and long-term conditions the *Regional Emergency Storage and Conveyance System Intertie Optimization* project is more energy efficient than importing water. Therefore Benefit D will be realized under short-term and long-term conditions.

To translate energy savings into net reduction of GHG emissions, California energy mix and associated GHG emissions were determined from the California Energy Commission (CEC) and USEPA's eGRID. Per the CEC's Energy Almanac, California produces 70% of its energy and imports 10% from the Pacific

Northwest, and 20% from the Pacific Southwest.[481] USEPA eGRID data provides information about the GHGs associated with each of the energy supplies (calculated as carbon dioxide equivalent units or CO2e) as 613.28 pounds of CO2e per MWH (lbs/MWh), 846.97 lbs/MWh, and 1,182.89 lbs/MWh, respectively.[482] Averaging each of these CO2e emissions factors shows that California energy supplies have a combined CO2e emissions factor of 750.57 lbs/MWh, or 0.341 MT of CO2e per MWh. Applying this number to the energy savings associated with the project under long-term conditions, results in a GHG reduction of 1,757 MT CO2e per year short term and 2,455 MT CO2e per year long term. Over the life of the project, a total of 86,863 MT CO2e will be reduced. These benefits are summarized in the bullets below and provided by year in **Table 3-83**:

- Energy savings resulting from the project: 5,152 MWh/year short term (2017) and 7,198 MWh/year long term (2018-2036)
- Average GHG in California energy grid: 0.341 MT/MWh
- Resulting GHG reductions resulting from the project: 1,757 MT of CO2e/year short term (2017) and 2,455 MT of CO2e/yr long term (2018-2036)
- Cumulative GHG reductions over project lifetime: 48,393 MT CO2e

Benefit E-Avoid Social Costs of Greenhouse Gases

Increased GHG emissions have social costs related to air quality impacts and climate change. The social cost of GHGs (reported as CO2e) is estimated as the aggregate net economic value of damages from climate change across the globe, and is expressed in terms of future net benefits and costs that are discounted to the present day.[483] Such costs include, but are not limited to, impacts to agricultural productivity, human health, increased flood risk and associated damages, and ecosystem services and their values.[484] The recommended mean estimate of the social cost of one MT of CO2e in 2014 is $24.55. This is updated from the 2007 value of $21.40 reported by the Interagency Working Group on Social Cost of Carbon[485], using the CPI Inflation Calculator.[486] Applying this value to the reduction in GHGs from the project calculated in Benefit D provides an estimate of the avoided social costs of GHGs from the project. **Table 3-84** shows the avoided social costs of GHGs from the project. This benefit is summarized in the bullets below:

- Annual GHG reductions resulting from the project : 1,757 MT/yr under short-term conditions (2017), and 2,455 MT/yr under long-term conditions (2018-2036)
- Social cost of CO2e: $24.55 per MT CO2e
- Annual avoided social costs of GHG emissions from the project: $43,127/yr under short-term conditions (2017), and $60,259/yr under long-term conditions (2018-2037)
- Cumulative avoided social costs of GHG emissions over project lifetime: $1,188,045

Benefit G-Reduce Water Costs to Customers, Including DACs

Potential water cost savings of the *Regional Emergency Storage and Conveyance System Intertie Optimization* project would be accrued through avoiding the purchase of imported water. As described

[481] CEC. 2013. California Electrical Energy Generation Total Production, by Resource Type (Gigawatt hours). Accessed 24 June 2014. Available: http://energyalmanac.ca.gov/electricity/electricity_generation.html
[482] U.S. Environmental Protection Agency (USEPA). 2014. eGRID 9th edition Version 1.0 Year 2010 Summary Tables. February. Available: http://www.epa.gov/cleanenergy/energy-resources/egrid/
[483] IPCC. 2007. Summary for policymakers. In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* ML Perry, OF Canziani, JP Palutikof, PJ van der Linden, and CE Hanson (eds.). Cambridge University Press. Cambridge, UK. Pg. 17.
[484] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Pg. 1.
[485] Interagency Working Group on Social Cost of Carbon, United States Government. 2010. Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866. February. Table 4 (pg. 28).
[486] U.S. Bureau of Labor Statistics. CPI Inflation Calculator. Available: http://www.bls.gov/data/inflation_calculator.htm

above, SDCWA is the sole imported water wholesaler to local water agencies in the Region. As such, projections of average imported water costs from SDCWA can be applied to any of the 24 member agencies. Sweetwater Authority's Title XVI Technical Project Report for the Reynolds Facility (refer to *Project 1: Reynolds Groundwater Desalination Facility Expansion*) reports the cost of imported water, ranging from $1,303/AF to $2,033/AF, with an average of $1,708/AF in 2012 dollars for the years of the *Regional Emergency Storage and Conveyance System Intertie Optimization* project.[487] A conversion factor of 1.04 from the CPI Cost Index[488] was applied to these values to convert 2012 dollars to 2014 dollars (accounting for discounting).

Costs to provide water from the project are based on the costs to operate the Speece Cone as well as the pumping costs to move water from Hodges into the aqueduct. It was assumed that the pumping costs included only the cost of energy to move the water, while the costs to operate the Speece Cone are based on total annual O&M. As reported in the City's 2014 Lake Hodges Reservoir Water Quality Assessment Study Conceptual Planning Report, O&M costs for the Speece Cone are anticipated to be $277,000 per year.[489] Pumping costs are based on the energy required to move the water from Hodges Reservoir to the aqueduct. The 2008 Lake Hodges Project Reservoir Regulation Manual reports that energy costs $72 per kw-year.[490] This converts to $8.22 per MWh. Using a conversion factor of 1.1 from the CPI Cost Index to convert from 2008 dollars to 2014 dollars[491], this is $9.04 per MWh.

Under short-term conditions (2017), energy to pump the water into the aqueduct is 4,957 MWh/year (refer to Benefit D). Costs to pump the water under short-term conditions would therefore be $44,818 per year. Including a 10% contingency to account for increases to maintenance costs for the pump stations and pipelines related to the increased pumping results in an annual cost of $49,300 per year for pumping under short-term conditions. Total costs under short-term conditions to oxygenate Hodges Reservoir and pump the water into the aqueduct would be $326,300 per year. Under long-term conditions, energy to pump the water into the aqueduct is 6,854 MWh/year (refer to Benefit D). Costs to pump water under long-term conditions would be $61,967 per year, or $68,163 per year when including a 10% contingency for increased maintenance costs associated with increased pumping. The total annual costs to oxygenate Hodges Reservoir and move water from the reservoir under long-term conditions into the aqueduct is $345,163/year.

Over the full 20-year project life, the total cost of water captured and made available by the project is $6,884,405. Imported water costs under the same conditions vary annually, but totals $194,856,693. The project would provide $187,972,288 in water cost savings, as shown in **Table 3-85**. These cost saving will be passed along to customers through protection of water rates from the price fluctuations associated with imported water and by improving supply reliability. Protecting the Region's supply from vulnerabilities also reduces the need for strict water rationing and associated high usage fees. As described in Attachment 8, this project will serve DACs in the City of San Diego's service area. Therefore the water cost savings from the project that benefit all customers within the project sponsor's service area will also benefit DACs.

Benefit N-Improve Water Quality of Surface Reservoir

As described above, Hodges Reservoir is an impaired water body for a variety of constituents. The low water quality is the reason that water cannot be moved into the Second Aqueduct via Pipeline 5. The *Regional Emergency Storage and Conveyance System Intertie Optimization* project will improve water quality in Hodges through oxygenation. Although the project is anticipated to improve water quality to the

[487] Sweetwater Authority. 2014. WaterSMART: Title XVI Water Reclamation and Reuse Program Technical Proposal. January. Table 3-18 (pg. 44).
[488] Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 24 June 2014. Available: http://www.bls.gov/data/inflation_calculator.htm
[489] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report. March 19. Pg. 6-2.
[490] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Pg. D-8.
[491] Bureau of Labor Statistics. CPI Inflation Calculator. Accessed 8 July 2014. Available: http://www.bls.gov/data/inflation_calculator.htm

extent that it can be moved into the Regional system, it is difficult to accurately quantify the benefit of improved water quality from the project. As such, this benefit can only be discussed qualitatively.

Benefit O-Reduce Downstream Flooding During Wet Weather Events

As described above, Hodges Reservoir experiences spills every four years, on average (12 spills over 49 years of data). Each spill event averages 89,614 AFY, though individual spill events range from 14,080 AF to 248,623 AF.[492] With each spill event comes the risk of flooding downstream. Existing data does not include peak flow during spill events; therefore, the risk of flooding per spill event cannot be quantified, and must instead be discussed qualitatively. Large floods were recorded in San Diego County eleven times since 1862, with major floods recorded in years that also saw spills at Hodges Reservoir include 1979, 1980, and 1995.[493] Other recent years that had flooding and dam spills at Hodges Reservoir are 1998 and 2005.[494] The average spill event during these flood years was 122,243 AF.[495]

Benefit P-Increase Ability to Operate Regional Intertie

As stated throughout this project, the poor water quality in Hodges Reservoir prevents its use in the Regional ESP. The project will improve water quality through oxygenation such that water from Hodges Reservoir can be pumped into the Regional system without undue adverse impacts on water already in the system and the Region’s treatment plants. Hodges Reservoir is a key component to the ESP and would increase the ability to deliver water within San Diego County during significant water supply shortages. Although the City of San Diego is confident that the oxygenation system will improve water quality enough to allow for operation of Hodges Reservoir’s connection to the Regional system, based on the success of similar aeration systems in San Dieguito Reservoir to increase lake turnover[496], the benefit of increased ability to operate the regional intertie is not quantifiable.

Benefit Q-Improve Water Quality for Aquatic Species

Per the Lake Hodges and Olivenhain Reservoir Limnology Study, Hodges Reservoir is stratified by a thermocline. Above the thermocline, dissolved oxygen (DO) levels are adequate to support fish species, while below the thermocline, DO was too low to support fish species, year round. This limited fish habitat to the portion of the reservoir above the thermocline, or the upper 20 feet.[497] The project will oxygenate below the thermocline, expanding suitable aquatic habitat below the thermocline.

[492] Pers.Comm. Jeffery Pasek. City of San Diego. “Hodges Hydrology through April 2014” excel file. June 2, 2014.
[493] RWMG. 2013. San Diego Integrated Regional Water Management Plan. Appendix 7-B: Integrated Flood Management Planning Study. April. Pg. 3-5
[494] RWMG. 2013. San Diego Integrated Regional Water Management Plan. Appendix 7-B: Integrated Flood Management Planning Study. April. Pg. 3-4
[495] Pers.Comm. Jeffery Pasek. City of San Diego. “Hodges Hydrology through April 2014” excel file. June 2, 2014.
[496] Santa Fe Irrigation District. 2013. Enhancing Local Water Supplies in an Era of Uncertainty. October. Slides 12-13.
[497] SDCWA. 2007. Lake Hodges and Olivenhain Reservoir Limnology Study. April. Pg. 12

New Facilities, Policies, and Actions Required to Obtain Physical Benefits

The physical benefits of the *Regional Emergency Storage and Conveyance System Intertie Optimization* project will require construction of all the project components described in the Work Plan (Attachment 4). These components include a masonry unit onshore building, oxygen generation units, skid-mounted Speece Cone, intake screen, connecting piping and discharge manifold/diffuser, and pump and oxygen pipeline. Water made available for transfer into the regional aqueduct system due to water quality improvements resulting from the HOS project will be transmitted through existing pipelines owned and operated by the City of San Diego and SDCWA. No additional transmission or pumping facilities will be necessary to provide the identified benefits. All agreements and policies are in place for the water use agreements between the City of San Diego, SFID, and SDWD.[498]

Additional facilities may be necessary, however, to further improve water quality in order to ultimately meet the primary water quality parameters established in the *Reservoir Regulation Manual* which limit delivery of Olivenhain Reservoir water into the regional intertie.[499] The *Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report* recommended two future phases after implementation of the HOS project:[500]

- *Mid-Lake Vigorous Epilimnetic Mixing (VEM)* – VEM would mix shallow reservoir areas to discourage the growth of potentially toxic blue green algae. VEM would use three shallow water diffuser lines each about 3,000 feet long, supplied by an air compressor system installed near the recreation area boat ramp.
- *Upper Wetlands Filtering* – A floating pump station along the southern shoreline would pump water skimmed from the reservoir's top half meter through a pipeline laid on the reservoir bottom, to the upstream end of a constructed wetland. A constructed wetland of 25 surface acres would receive water skimmed from the reservoir surface and wetlands plants would filter out the algae.

Based on the water quality monitoring conducted as part of the *Regional Emergency Storage and Conveyance System Intertie Optimization* project, the City of San Diego would then determine the need to implement one or more of these additional phases.

Potential Physical Effects of the Project

There may be temporary environmental impacts during construction of the onshore building, piping, and Speece Cone facilities underwater, as well as ongoing noise and vibration from operation of the HOS system. Water quality monitoring is ongoing for Hodges Reservoir, so oxygenation levels can be adjusted as needed to achieve desired results. Mitigation measures included in the project MND will address all of these potential impacts and ensure that the project will not have a significant impact on the environment.

[498] City of San Diego, SFID, and SDWD. 1998. Lake Hodges Water Agreement. March.
[499] SDCWA. 2008. Lake Hodges Projects Reservoir Regulation Manual. April. Appendix C, Table C.3.
[500] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report. March 19. Page viii - ix.

Cost Effectiveness Analysis: Regional Emergency Storage and Conveyance System Intertie Optimization

The *Regional Emergency Storage and Conveyance System Intertie Optimization* project will improve water quality within Hodges Reservoir, thereby enabling the City of San Diego to move water from Hodges Reservoir into the regional conveyance system. This will allow available water in Hodges Reservoir to be moved into the regional system in times of drought and also use water that, in wet years, spills over the dam. Project benefits will be achieved through water quality improvements from an oxygenation system using a Speece Cone. This primary physical benefit will result in a number of ancillary benefits, described above, and summarized in **Table 3-78**. This project was developed as part of a comprehensive water quality improvement program for Hodges Reservoir. Alternatives were assessed and only feasible and applicable alternatives were incorporated into the recommended comprehensive program. The alternatives that were considered were grouped into complementary alternatives, and prioritized, with the program's intention to implement all three priority alternatives in phases. This project is the first phase of the comprehensive program. **Table 3-87** provides a brief overview of the benefits, the complementary alternatives, and the reason for selecting the proposed project. More detail is provided in the discussion following the table.

Table 3-87: Project Analysis
Regional Emergency Storage and Conveyance System Intertie Optimization

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization*	
Question 1 Physical Benefits Summary	The proposed project will achieve six physical benefits and four qualitative benefits, described in detail above. These benefits include: avoid imported water supply purchases, reduced demand for Bay-Delta supplies, local supply development to decrease vulnerabilities, reduce GHG emissions, avoid social costs of GHGs, reduce water costs to customers, improve water quality of the reservoir, reduce downstream flooding, increase ability to operate regional intertie, and improve water quality for aquatic species.
Question 2 Alternatives Considered	The *Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report*[501] identified three primary alternatives to improve water quality in Hodges Reservoir: 1) Hodges Oxygenation System *(proposed project)*, 2) Vigorous Epilimnetic Mixing (VEM), and 3) Wetlands Filtering.
	The three alternatives are considered complementary, not exclusive from one another. All three alternatives are anticipated to eventually be implemented at Hodges Reservoir to manage algae, and improve and protect water quality. <u>Reservoir HOS</u> (*proposed project)* This is the selected project, which has a total project cost of $2,841,000, based on engineering and administration costs of $522,000, environmental planning and permitting costs of $50,000, and capital costs of $2,269,000. Note that the costs included in the budget in Attachment 5 incorporate additional costs such as project-related assessment and evaluation, outreach, and grant administration, and has been revised to reflect the lower cost of a refurbished Speece Cone located by the City of San Diego for potential use in the project. <u>Mid-Lake VEM</u> This alternative has a total project cost of $1,394,000, based on engineering and administration costs of $233,000, environmental planning and permitting costs of $50,000, and capital costs of $1,111,000. <u>Upper Wetlands Filtering</u> This alternative has a total project cost of $9,800,000, based on engineering and administration costs of $1,885,000, environmental planning and permitting costs of $377,000, and capital costs of $7,538,000.

[501] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study: Draft Conceptual Planning Report. March 19. Page 6-2.

Project Name: *Regional Emergency Storage and Conveyance System Intertie Optimization*	
Question 3 Preferred Alternative	The proposed project is the least cost alternative of a Speece Cone because the City proposes to use a refurbished Speece Cone as opposed to a new Speece Cone. The proposed project is not the least cost of the alternatives described, but is the highest priority alternative because it can be implemented quickly and achieve the project goal of improving water quality to the extent necessary to allow water to be moved from Hodges Reservoir into the regional aqueduct. Aeration efforts by SFID on water sourced from Hodges Reservoir shows that this alternative will be successful, making the City confident that it will achieve the benefits described herein.

Q1: Types of Benefits Achieved by Project

The *Regional Emergency Storage and Conveyance System Intertie Optimization* project would achieve six quantifiable physical benefits as a result of its primary benefit of increasing surface water capture for potable use. These benefits are summarized in **Table 3-78,** and information about how the benefits were calculated is discussed in detail in the sections above. Benefits from the program include:

- Avoid imported water supply purchases – 3,889 AFY (short-term) / 5,377 AFY (long-term)
- Reduce demand for net diversions from the Bay-Delta – 2,593 AFY (short-term) / 3,585 AFY (long-term)
- Local supply development to decrease vulnerabilities – 3,889 AFY (short-term) / 5,377 AFY (long-term)
- Reduce net production of GHGs – 1,757 MT CO2e per year (short-term)/2,455 MT CO2e per year (long-term)
- Avoid social costs of GHGs - $43,127 per year (short-term)/$60,259 per year (long-term)
- Reduce water costs to customers –$187,972,288 over 20-year project life
- Improve water quality of surface reservoir – Qualitative
- Reduce downstream flooding during wet weather events – Qualitative
- Increase ability to operate regional intertie – Qualitative
- Improve water quality for aquatic species – Qualitative

Q2: Discussion of Project Alternatives

The *Regional Emergency Storage and Conveyance System Intertie Optimization* will install an oxygenation system in Hodges Reservoir to improve anoxic conditions that contribute to poor water quality in the reservoir. The low water quality of Hodges Reservoir prevents water from being moved out of Hodges Reservoir into the Regional system and stored in the larger San Vicente Reservoir, allowing additional surface water to be captured at Hodges Reservoir, which is fed by a large catchment.

The *Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report* (Conceptual Planning Report) considered a series of 17 alternatives designed to address water quality issues in Hodges Reservoir. Of these 17 alternatives, six were found to be not applicable or not needed; one of the alternatives was already being successfully implemented, two were not recommended, one was deemed uncertain, and another was left to be determined at a later date. One of the remaining seven alternatives was to be used rarely in emergencies only, and not considered as an alternative to this project. This leaves six alternatives for consideration:[502]

- Mixing and/or destratification
- Wetland filters (off-line)
- Algae harvesting
- Selective withdrawal of hypolimnion
- Oxygenation/aeration

[502] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 3-2.

- Biomanipulation

These six alternatives were further refined and combined to create a prioritized list of alternatives, presented here from highest priority to lowest:[503]

- Hypolimnetic oxygenation system (HOS) using a Speece Cone
- Vigorous epilimnetic mixing (VEM)
- Wetland filters for algae and other pollutants (with associated algae corralling)
- Biomanipulation
- Algaecides/herbicides/molluscicides (and other Quagga mussel controls)

The first three alternatives were considered to be the recommended alternative within the Conceptual Planning Report and designed to be implemented in phases per water quality demands and budget allotments.[504] The other two alternatives were determined to be high cost and lower priority per the Conceptual Planning Report. No further discussion of these alternatives is included herein.

Acknowledging that the proposed alternatives are not considered to be exclusive from one another, and are designed to be complementary, the discussion provided herein allows for context for the project in relation to the other planned future potential projects to improve water quality at Hodges Reservoir.

HOS Using a Speece Cone

The HOS Using a Speece Cone alternative is the preferred alternative for this drought solicitation. The HOS is described in detail above, but involves deep water oxygenation to reduce anoxia using a horizontal oxygenated plume.[505] This alternative is considered to be the preferred alternative, because local source data from Santa Fe Irrigation District shows that aeration can effectively improve water quality of water within Hodges Reservoir; therefore, direct oxygenation is anticipated to be highly effective in addressing water quality issues. Further, because Speece Cones are an “off-the-shelf” technology, design of the HOS is considered relatively straight-forward and simple, making design and implementation of this project expeditious and able to be implemented within parameters established by DWR for this Drought Solicitation.

VEM

VEM mixes water within the water column enough to prevent effective buoyancy control of blue-green algae (BGA). This prevents BGA from taking advantage of optimal conditions and therefore preventing algal growth. VEM also keeps conditions in the water suitable for diatoms to remain higher in the water column, rather than sinking out as they do in calm waters. This would reduce the ability of BGAs to dominate the ecosystem.[506]

Wetland Filters with Algae Scum Corralling

The wetland filters would be designed to filter algae and other pollutants to remove pollutants from the watershed before they enter Hodges Reservoir. This wetland would be designed to target algae removal from the water collected by the algae scum corralling component of this alternative. The algae scum corralling component would vacuum BGA scum from the surface of the reservoir and send it to a wetland constructed at the reservoir.[507] Algae scum corralling would work in concert with VEM, because BGA scum tends to collect in rings around the VEM area, and VEM can be designed to move this scum

[503] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 3-10.
[504] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 3-10.
[505] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 3-5.
[506] City of San Diego. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 3-5.
[507] City of San Diego Public Utilities. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 3-6.

towards areas of historical scum concentrations where it could be collected.[508] Because BGA would be the targeted pollutant to be removed by the wetland, a short residence time would be required, approximately 2 days, and a specific mix of appropriate vegetation that would support conditions to remove the BGA would be planted.

Q3: Preferred Project Alternative

As mentioned, the alternatives described above are meant to be implemented as complementary water quality management projects. The HOS Speece Cone alternative is the highest priority of these alternatives because it is a verified technology that is able to improve water quality enough to allow for water to be moved out of Hodges Reservoir based on Santa Fe Irrigation District's aeration system. A preliminary cost estimate was developed for each of the three complementary alternatives. These costs are presented in **Table 3-88**.

Table 3-88: Costs for Complementary Alternatives[509]

Alternative	Engineering and Administration Costs	Environmental Planning and Permitting Costs	Capital Costs	Total Costs	O&M Costs
HOS Speece Cone	$522,000	$50,000	$2,269,000	$2,481,000	$277,000
VEM	$233,000	$50,000	$1,111,000	$1,394,000	$111,000
Wetlands Filtering	$1,885,000	$377,000	$7,538,000	$9,800,000	$942,000

The Speece Cone alternative is not the most cost effective of the three complementary alternatives, approximately 75% more expensive of the VEM alternative, though nearly a quarter of the cost of the Wetland Filtering alternative. Because the alternatives discussed here are not true either/or alternatives, but are instead complementary alternatives that are all planned to be implemented, they must be evaluated based upon the order in which they should be implemented, not whether they should be implemented. As the highest priority alternative that also meets the project goal of being able to move the water into the aqueduct, the HOS is the preferred alternative. VEM is not considered the highest-priority alternative, because it has not yet been implemented in Hodges Reservoir. While this strategy is anticipated to be effective, it has not yet been verified for Hodges Reservoir and is therefore slightly more risky (and therefore lower priority) compared to the HOS.

For the HOS Speece Cone alternative, the budget as included in this application (see Attachment 5) includes additional costs such as outreach and grant administration that are not included in the costs presented in **Table 3-88**, above. The City has been able to locate a refurbished Speece Cone that would meet the project needs, and save $120,000.[510] If this project is funded and able to implemented, the project as planned would be the least cost alternative of the Speece Cone option because it would use the lower-cost used Speece Cone, as opposed to a full-cost new Speece Cone. This reduced-cost Speece Cone would only be available if the grant funding is awarded in a timely manner, as intended by DWR under this drought solicitation.

[508] City of San Diego Public Utilities. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 3-6.
[509] City of San Diego Public Utilities. 2014. Lake Hodges Reservoir Water Quality Assessment Study Draft Conceptual Planning Report. March 19. Pg. 6-2.
[510] Pers. Comm. Jeffery Pasek, City of San Diego. Hodges Reservoir Oxygenation System Proposition 84 IRWM Drought Relief Grant (presentation). May 28, 2014. Available: 619-533-7599

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