Water Reuse Program

Project 6: Integrated Water Resource Solutions for the Carlsbad Watershed

Local Project Sponsor: San Elijo Joint Powers Authority (San Elijo JPA)
Partners: City of Encinitas, City of Solana Beach, San Dieguito Water District (SDWD), Santa Fe Irrigation District (SFID), Olivenhain Municipal Water District (OMWD), and San Elijo Lagoon Conservancy (SELC)

Project Summary

The project will implement recycled water and low impact development (LID) strategies to offset potable water demands, reduce urban runoff, and implement water quality monitoring.

Project Maps

Figure 2-9 shows the *Integrated Water Resource Solutions for the Carlsbad Watershed* project area, the service areas of the project sponsor, the project facilities and the project's relation to groundwater basins and surface water, disadvantaged communities (DACs) and proposed monitoring locations. An excerpt from the 30% design for the LID improvements for Component 1 is shown in **Figure 2-10**, while **Figures 2-11** through **2-13** provide detailed location for the recycled water pipelines in Components 3, 4, and 5.

LID strategies will address non-point source pollution in Cottonwood Creek (left); Recycled water pipeline expansion will serve the Coastal Rail Trail (above)

Project Description

This project will implement multiple streetscape improvements and approximately 4 miles of recycled water pipeline along and adjacent to the Highway 101 corridor in the City of Encinitas and the City of Solana Beach to convert 100 acre-feet per year (AFY) of irrigation from potable water to recycled water, and to decrease flows to the San Elijo Ocean Outfall. San Elijo JPA owns and operates the San Elijo Water Reclamation Facility (WRF), a 5.25 million gallons per day (mgd) wastewater treatment and 3.02 mgd water reclamation facility serving irrigation demands within the City of Del Mar, SDWD, SFID, and OMWD. In conjunction with project partners, San Elijo JPA is pursuing an integrated approach to water quality, water conservation, and climate change along and adjacent to the Highway 101 corridor in North San Diego County. This project includes the following eight elements:

Component 1: Highway 101 Streetscape - Located just north of Encinitas Boulevard, this project element will be constructed by the City of Encinitas and includes reconstruction of Highway 101 from A Street to North Court to include plumbing for recycled water.

Component 2: Highway 101 Greenstreet Retrofit – Led by the City of Encinitas, this component will construct LID streetscape improvements along Highway 101 in the City of Encinitas, which will reduce peak runoff by 4.6%, total runoff by 3.5%, and coliforms reaching the Cottonwood Creek, a 303(d)-listed body of water, by an estimated 45%. The LID elements will be located along Highway 101, just south of Encinitas Boulevard, between E Street and F Street.

Component 3: Manchester Avenue Recycled Water Pipeline – Led by OMWD, this component will extend Pipeline No. 1 east along Manchester Avenue in the City of Encinitas to serve Mira Costa College, homeowners associations (HOAs), religious centers, and other customers.

Component 4: Via de la Valle/Highway 101 Recycled Water Pipeline – Led by SFID, this component will extend Pipeline No. 2 west along Via De La Valle and then north on Highway 101 in Solana Beach, allowing for conversion of several HOAs, and the City's Coastal Rail Trail to recycled water.

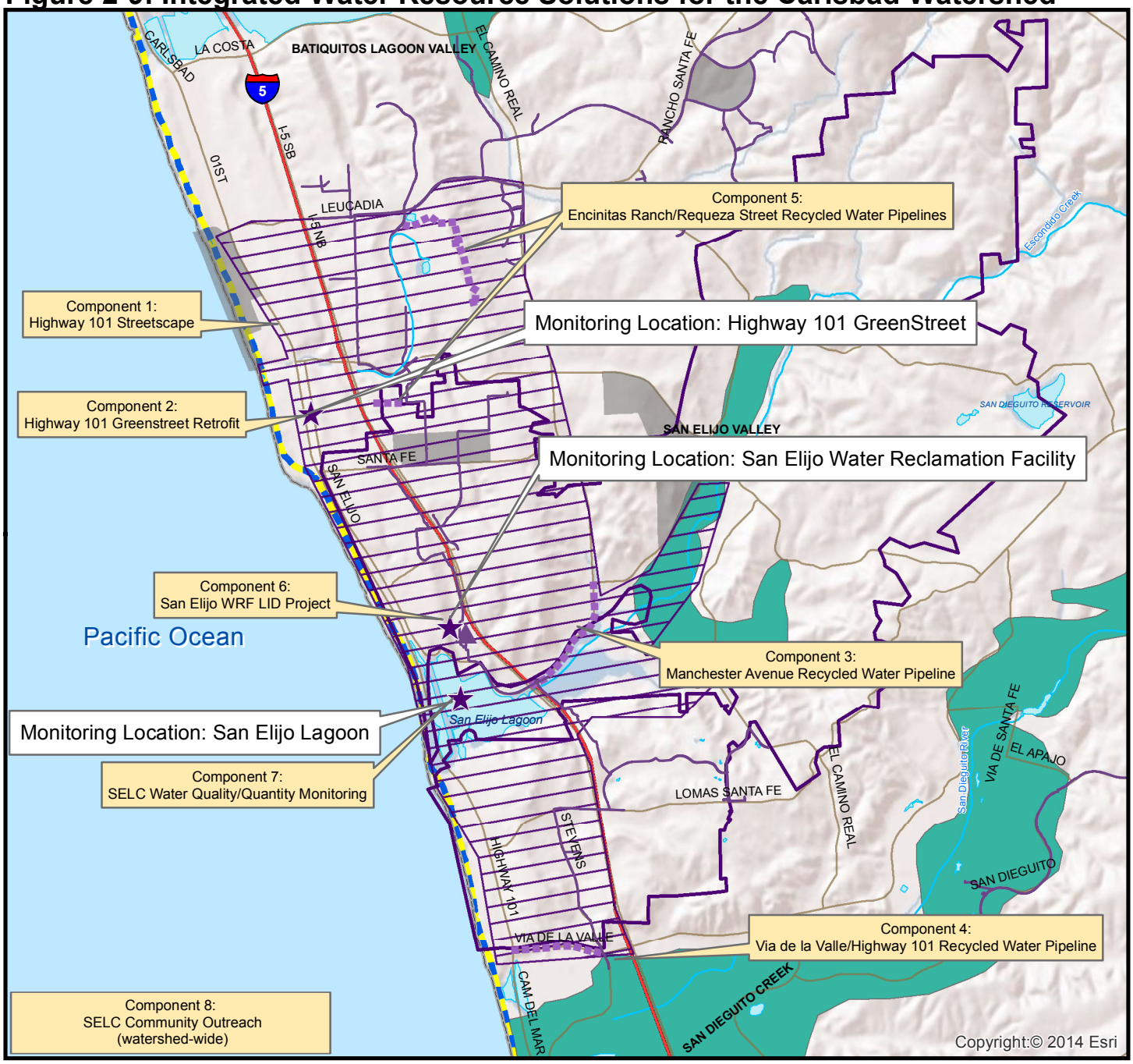
Component 5: Encinitas Ranch / Requeza Street Recycled Water Pipelines – Led by SDWD, this component will extend Pipeline No. 3 east adjacent to Paseo De Las Flores in the City of Encinitas to allow for conversion of several HOAs, agricultural sites, and recreational trails to recycled water use. Pipeline No. 4 will also be extended along Requeza Street to serve multiple HOAs.

Component 6: San Elijo WRF LID Project – San Elijo JPA will construct low impact development (LID) facilities at the San Elijo WRF, which will reduce Total Suspended Solids (TSS) entering San Elijo Lagoon, a 303(d)-listed body of water.

Component 7: SELC Water Quality/Quantity Monitoring – SELC will conduct water quality and quantity monitoring in the San Elijo Lagoon. The San Elijo Lagoon, a 303(d) listed body of water that is adjacent to the San Elijo WRF, is a vital and unique ecosystem in the Carlsbad Watershed. This program element proposes to support existing water quality and quantity monitoring efforts in the San Elijo Lagoon and will provide funding for data collection and uploading efforts for two years.

Component 8: SELC Community Outreach - This program element will support an existing outreach effort by SELC, which transports students from middle through high school to key areas in the watershed, such as the Elfin Forest Recreational Reserve and the San Elijo Lagoon, to participate in water conservation/quality education using a state approved curriculum. The proposed support will reach approximately 434 students over two years, including 313 students from Title I low-income schools in Escondido (including Central Elementary, Lincoln Elementary, Farr Elementary, and Felicity Elementary).

Figure 2-9: Integrated Water Resource Solutions for the Carlsbad Watershed



Coordinates: 33.01673, -117.27366

0 0.5 1 2
Miles

N

Legend

- San Diego IRWM Region
- Funding Area Boundary
- Freeway
- Major Roads
- Waterbody
- County
- DAC Area*
- Very Low Priority Groundwater Basins
- Benefit Area: 6 Integrated Water Resources Solutions for the Carlsbad Watershed
- San Elijo JPA
- Monitoring Locations
- San Elijo Water Reclamation Facility
- Existing Recycled Water Pipelines
- Proposed Recycled Water Pipelines

*Note: DAC as determined by census tract and block group data for the year 2013, from the American Community Survey 2009-2013 5-year results. DAC determined based on definition of median household incomes below 80% of the statewide MHI or $48,875.

Sources: U.S. Census 2013 ACS 5-year estimates; San Diego Association of Governments (SANDAG) - GIS Data Warehouse
Document Path: N:\Projects GIS\0188-003 SDIRWM Plan Update\Prop84_Rnd4\MXD\Project maps\2-7_SEJPAProject28072015.mxd

Figure 2-10: Excerpt from 30% Design for Component 1 Highway 101 Streetscape

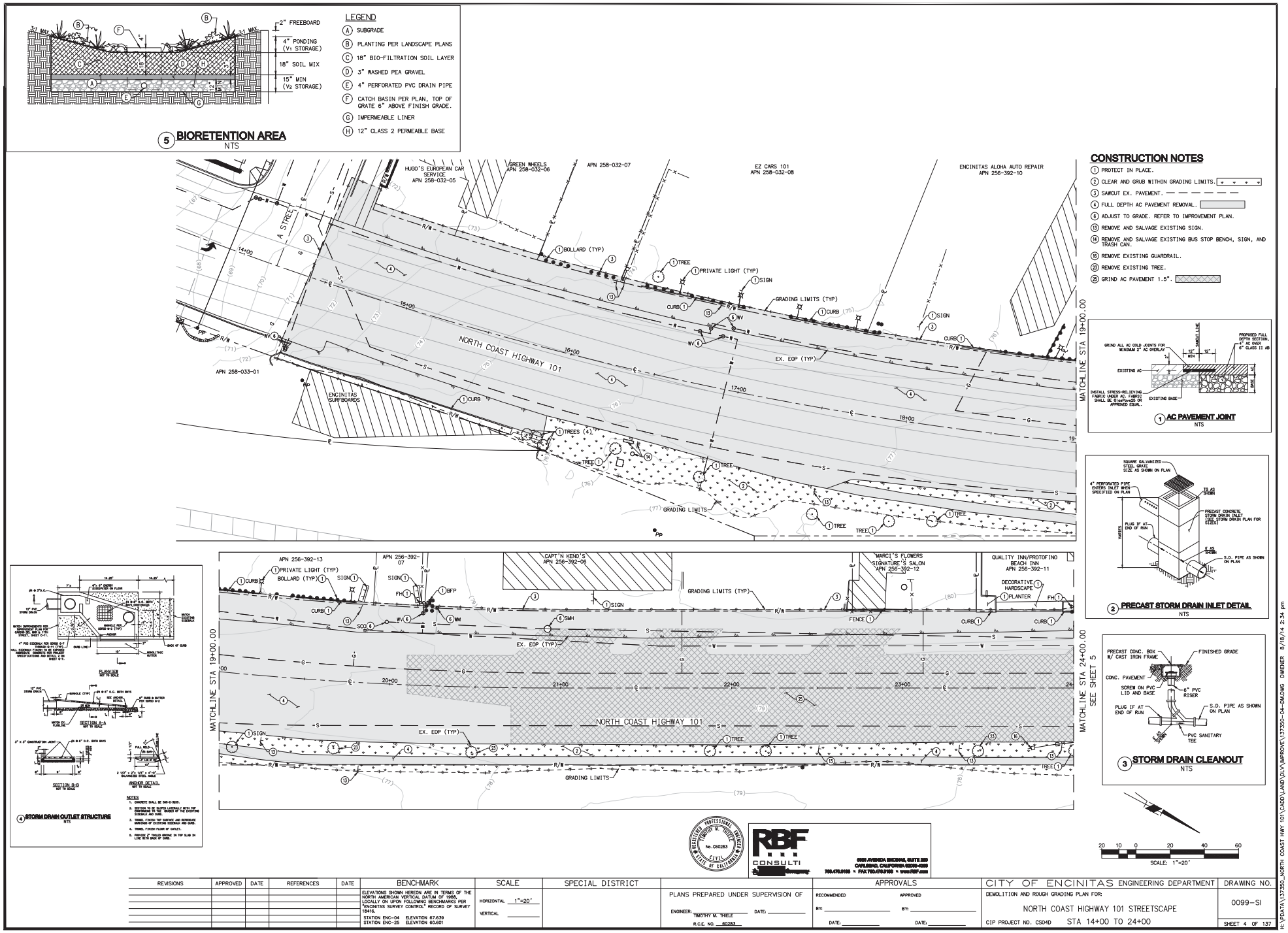


Figure 2-11: Component 3 Manchester Avenue Recycled Water Pipeline

Figure 2-12: Component 4 Via de la Valle Highway/101 Recycled Water Pipeline

Figure 2-13: Component 5 Encinitas Ranch/Requeza Street Recycled Water Pipeline

Encinitas Map

SDWD:
Requeza Recycled Water Main Extension
8" PVC Main

DISCLAIMER:

This map should not be used for Engineering, Survey, or Site-Specific Analysis.

Every reasonable effort has been made to assure the accuracy of the data provided; nevertheless, some information may not be accurate. The City of Encinitas assumes no liability or responsibility arising from the use of or reliance upon this information.

- Map Coordinates: Stateplane NAD83 Feet, CA Zone 6
- Parcel lines are not survey accurate, and some parcels can be positionally off up to +/- 40 feet
- Photo flight dates: July 2009. 4 inch pixel resolution. Digital true color.
- Orthophoto and Topo positional accuracy meet the precision adequate to support National Map Accuracy Standards for 1" = 100' mapping.

N

0 200 Feet

1 inch = 200 feet

Project Physical Benefits

The primary and secondary benefits of the project are, respectively, generating new Water Supply via recycled water and providing Water Quality improvements via stormwater management. These benefits are important to the sustainability of the urban setting and the protection of natural habitats.

The primary benefit is Water Supply through the expansion of the local recycled water systems for Santa Fe Irrigation District (SFID), San Dieguito Water District (SDWD), and Olivenhain Municipal Water District (OMWD), who are all served by the San Elijo WRF. The project will increase recycled water use for irrigation demands by providing a drought-tolerant local water supply. The recycled water diversion from the San Elijo Ocean Outfall also decreases pollutant loading to the Pacific Ocean. The baseline was calculated as the average volume of recycled water delivered by San Elijo JPA over the last three years. Annual deliveries ranged between 1,355 AFY and 1,561 AFY between FY2012/13 and FY 2014/15, for an average delivery of 1,477.5 AFY. The baseline is shown as a static value because no additional capital expenditures for recycled water have been committed at this time beyond the proposed project. The value of recycled water demands for this benefit was calculated from the City of Solana Beach's *Preliminary Design Report for Recycled Water Extension* and internal analysis performed by OMWD and SDWD based on existing irrigation usage. Over the life of the project, the *Integrated Water Resource Solutions for Carlsbad Watershed* project will deliver 5,900 AF of additional recycled water to customers.

Table 2-31: Primary Physical Benefit – Water Supply
Integrated Water Resource Solutions for Carlsbad Watershed

Project Name: *Integrated Water Supply and Water Quality Solutions for Carlsbad Watershed*
Type of Benefit Claimed: Water Supply – Recycled water delivered to new customers
Units of the Benefit Claimed: AFY
Anticipated Useful Life of Project (years): 60

(a)	(b)	(c)	(d)
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2018	1,477.5 AFY	1,510.8 AFY	33.3 AFY
2019	1,477.5 AFY	1,544.2 AFY	66.7 AFY
2020-2077	1,477.5 AFY	1,557.5 AFY	100 AFY

Comments: The anticipated useful life of the recycled water pipelines is 60 years. All four proposed recycled water pipelines will be completed in late 2017, with delivery of recycled water anticipated in 2018. Because onsite retrofits may occur following completion of the pipeline, this analysis assumes phasing of the recycled water deliveries by 33% in each year 2018-2020. There will be no phasing out of the recycled water benefit.

Sources: *Component 3 Manchester Avenue Recycled Water Pipeline* (11 AFY) – Pers. Comm. Adam Hoch, Consulting Engineer, 7/29/15. Based on OMWD analysis of irrigation demands along Manchester Avenue.

Component 4 Via de la Valle/Highway 101 Recycled Water Pipeline (38 AFY) – City of Solana Beach. *Preliminary Design Report for Recycled Water Extension*. May 2015. Pg. 4.

Component 5 Encinitas Ranch/Requeza Street Recycled Water Pipelines (35 AFY) - Pers. Comm. Adam Hoch, Consulting Engineer, 7/29/15. Based on SDWD analysis of irrigation demands along Requeza and in/adjacent to Encinitas Ranch HOA.

The secondary benefit of the project is Water Quality improvement through implementation of LID facilities along Highway 101 and at the San Elijo WRF. This would improve surface runoff to Cottonwood Creek and San Elijo Lagoon, respectively. The baseline was calculated from onsite stormwater quality data collected and analyzed at the San Elijo WRF laboratory. The value of the Water Quality Improvement was calculated based on San Elijo JPA's *Facility Plan Update for the San Elijo JPA's San Elijo WRF* and the City of Encinitas' *Cottonwood Creek Watershed LID Retrofit Plan – Draft*.

Table 2-32: Secondary Physical Benefit – Water Quality Improvement
Integrated Water Resource Solutions for Carlsbad Watershed

Project Name: *Integrated Water Supply and Water Quality Solutions for Carlsbad Watershed* **Type of Benefit Claimed:** Water Quality – Total suspended solids (TSS) reduction from LID facilities **Units of the Benefit Claimed:** mg/L **Anticipated Useful Life of Project (years):** 60 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2018-2077	92 mg/L	2.8 mg/L	-89.2 mg/L
Comments: The anticipated useful life of the LID facilities is 60 years. Both of the LID components will be completed in mid-2017, with operation beginning in the second half of the year. This analysis assumes 100% accrual of the water quality benefit (in terms of concentration) throughout the 2018-2077 lifetimes of the facilities. There will be no phasing out of the water quality benefit. Sources: San Elijo JPA Laboratory. *Stormwater #2 12/2/14, Stormwater #3 12/2/14*. Reviewed December 30th 2014. San Elijo JPA. April 2015. *Facility Plan Update for the San Elijo JPA's San Elijo WRF*. City of Encinitas and SWRCB. Prepared by Tetra Tech et al. 2015. *Cottonwood Creek Watershed LID Retrofit Plan – Draft*. RBF Consulting. August 2014. *30% Plans for Construction of North Coast Highway 101 Streetscape*. Environmental Services Division Department of Environmental Resources – Prince George's County, MD. *Bioretention Manual*. December, 2007. pg. 7.			

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

In the midst of one of the most severe droughts on record in California, Californians are being asked to conserve water on an unprecedented level. In response, cities, water districts, and wastewater agencies are pursuing water conservation on all fronts – including expanding conservation programs, increasing recycled water production, exploring potable reuse feasibility, and studying alternate local water supplies via desalination, brackish, and groundwater supplies. At the same time, water resource priorities within the State and San Diego County remain high with adoption of new drought regulations, and storm water regulations. SEJPA and its partners often collaborate on water infrastructure projects with goals that broach water conservation and water quality and move the region toward water sustainability.

San Elijo JPA is responsible for collecting, treating, and disposing of wastewater within its service area that includes the City of Solana Beach, portions of the City of Encinitas, portions of the community of Rancho Santa Fe, and the City of Del Mar. The San Elijo WRF is a tertiary treatment facility that has a secondary capacity of 5.25 mgd and a tertiary capacity of 3.02 mgd. Secondary-treated wastewater that is not treated to tertiary levels and reused is discharged to the ocean through the San Elijo Ocean Outfall. Expansion of San Elijo JPA's recycled water system will both beneficially reuse the wastewater and will offload the ocean outfall. San Elijo WRF is also enrolled for coverage under State Water Resources Control Board (SWRCB) Order No. 97-03-DWR (NPDES CAS 000001), the statewide general permit covering stormwater runoff from industrial facilities.

San Elijo JPA sells recycled water to four water purveyors: SFID, SDWD, OMWD, and the City of Del Mar. The purveyors then sell the recycled water to end customers located within their individual service areas. The San Elijo JPA owns the majority of the recycled water infrastructure system including treatment, storage, and pipelines

for all the facilities (with the exception of those in OMWD's service area). In 2013, San Elijo JPA added an advanced water treatment (AWT) facility at San Elijo WRF that provides highly treated recycled water using microfiltration and reverse osmosis processes. The facility operates in parallel to the existing sand filtration system thus providing operational flexibility and treatment redundancy. The AWT facility allows the San Elijo JPA to control the level of total dissolved solids (TDS) to 900 mg/l or less in the recycled water. The improved water quality has allowed the San Elijo JPA to serve new markets, including industrial systems such as cooling towers that are sensitive to mineral deposits. While San Elijo JPA is prepared to increase recycled water production, it also needs to expand its recycled water distribution system in order to utilize the recycled water and offset potable water demands.

SFID's water supply mix is: 48% imported water via SDCWA; 48% local surface water; and 4% recycled water.[1] SDWD's water supply mix is: 25% imported water via SDCWA; 68% local surface water; and 7% recycled water.[2] OMWD's water supply mix is: 88% imported water via SDCWA and 12% recycled water.[3] In order to reduce demand for imported water supplies, which are unreliable, these water districts are implementing water conservation and recycled water projects.

Carlsbad Watershed features a significant number of the San Diego IRWM Region's coastal lagoons. Approximately half of the 211-square mile Carlsbad Watershed is urbanized, with a high percentage of the undeveloped land in private ownership. Urban and agricultural runoff is a critical concern within the Carlsbad Watershed, and can impact both the coastal lagoons and local beaches.[4] The San Elijo Lagoon, which is adjacent to the San Elijo WRF, provides a vital and unique ecosystem in the Carlsbad Watershed. San Elijo Lagoon is noted for being surrounded by steep coastal bluffs that cause sediment issues in the lagoon due to erosion; sedimentation and sand deposition require regular dredging of the lagoon to maintain its connectivity with the ocean. The lagoon also contains the most extensive stands of freshwater marsh vegetation in the watershed.[5] San Elijo Lagoon is on the Clean Water Act 303(d) list of impaired water bodies for eutrophication, indicator bacteria, and sedimentation/siltation. Installation of LID facilities at the San Elijo WRF site will reduce potential loading to the lagoon.

Cottonwood Creek, which also receives storm water from the project area, is on the Clean Water Act 303(d) list of impaired water bodies for dichlorodiphenyltrichloroethane (DDT), selenium, and sedimentation/siltation. The Pacific Ocean shoreline at the Cottonwood Creek outlet (Moonlight State Beach) is on the 303(d) list for total coliform. Stakeholders in the Carlsbad Watershed have been working together on successful efforts to reduce pollutant loading into Cottonwood Creek, including upstream best management practices (BMP) and development of plans to implement an urban runoff treatment facility to further reduce pollutant loading to the beach.[6]

San Elijo Lagoon (above); Students learning about water conservation and water quality (right)

[1] Santa Fe Irrigation District. 2011. *2010 Urban Water Management Plan*.
[2] San Dieguito Water District. 2011. *2010 Urban Water Management Plan*.
[3] Olivenhain Municipal Water District. 2011. *2010 Urban Water Management Plan*.
[4] San Diego RWMG and RAC. 2013. *2013 San Diego IRWM Plan*. Chapter 5: Watersheds.
[5] Carlsbad Watershed Network (CWN). 2002. *Carlsbad Watershed Management Plan*. February 2002.
[6] James Rasmus and Kathy Weldon. 2003. *Moonlight Beach Urban Runoff Treatment Facility*.

Without-Project Conditions

Without *Integrated Water Resource Solutions for the Carlsbad Watershed*, approximately 100 AFY of additional treated wastewater from the San Elijo JPA would continue to be discharged to the Pacific Ocean through the San Elijo Ocean Outfall. The irrigation demands along the Manchester Avenue, Via de la Valle, Encinitas Ranch, and Requeza Street alignments would continue to use potable water, primarily from imported sources. Within the combined OMWD, SDWD, and SFID service areas, approximately 1,477.5 AFY of recycled water will continue to be served to local customers for non-potable irrigation and industrial purposes by these agencies with San Elijo JPA supplies.

Without the LID facilities along Highway 101 and at the San Elijo WRF, impervious surfaces would remain in place, thereby allowing non-point source contaminants and bacteria to continue to enter San Elijo Lagoon, Cottonwood Creek, and Moonlight Beach at current rates. Storm water quality from the local drainage systems will remain at 92 mg/L of TSS as discharged to San Elijo Lagoon and Cottonwood Creek/Moonlight Beach. If the proposed project is not implemented, the Municipal Separate Storm Sewer System (MS4) parties will need to develop and implement alternative BMPs to address loading to these water bodies.

Without the public outreach components, students from Title I low-income schools in Escondido would not receive water conservation and water quality education to enable water use behavior changes. The field trips offered to both Encinitas and Escondido area students would not occur. SELC would need to either seek alternative funding to provide these services, modify their education program to reduce costs (such as eliminating the field trip portion of the program), serve fewer schools, or cease providing their education and outreach program to local schools.

Methods Used to Estimate the Physical Benefits

Primary Benefit – Water Supply

The primary benefit is generating recycled water supply of 100 AFY through better utilization of recycled water production at the San Elijo WRF. The expansion of recycled water use will replace potable water demands for several HOAs, the Coastal Rail Trail, Mira Costa College, religious centers, businesses, and other customers. Customer demands for the proposed recycled water pipeline alignments include:

- *Component 1 Manchester Avenue Recycled Water Pipeline* (11 AFY)[7] – based on OMWD analysis of irrigation demands along Manchester Avenue.
- *Component 2 Via de la Valle/Highway 101 Recycled Water Pipeline* (38 AFY)[8] – based on May 2015 *Preliminary Design Report*. Note that the report estimated irrigation demands as 44 AFY, which have been discounted to account for irrigation efficiencies.
- *Component 3 Encinitas Ranch/Requeza Street Recycled Water Pipelines* (51 AFY)[9] – based on SDWD analysis of irrigation demands along Requeza and in/adjacent to Encinitas Ranch HOA.

This results in beneficial use of 100 AFY of water currently discharged to the Pacific Ocean through San Elijo Ocean Outfall. The recycled water use will offset potable demand, and represents better use and management of a drought-tolerant water supply.

$$11\ AFY + 38\ AFY + 51\ AFY = \mathbf{100\ AFY}$$

[7] Pers. Comm. Adam Hoch, Consulting Engineer, 7/29/15. Based on OMWD analysis of irrigation demands along Manchester Avenue.
[8] Infrastructure Engineering Corporation. *Preliminary Design Report for Recycled Water Extension*. May 2015. Pg. 4
[9] Pers. Comm. Adam Hoch, Consulting Engineer, 7/29/15. Based on SDWD analysis of irrigation demands along Requeza and in/adjacent to Encinitas Ranch HOA.

Secondary Benefit - Water Quality

The secondary benefit is Water Quality improvement through removal of 89 mg/L of TSS within urban runoff draining to Cottonwood Creek/Moonlight Beach and San Elijo Lagoon. The benefit comes from the installation of LID facilities as part of the Highway 101 Greenstreet and San Elijo WRF LID Project components.

Bioretention areas are small-scale, shallow, vegetated areas with engineered soil media and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. Such BMPs usually consist of a media bed, ponding area, mulch layer, and planting soil media and may or may not include an underdrain. The depressed area is planted with small- to medium-sized vegetation including trees, shrubs, and groundcover that can withstand urban environments and tolerate periodic inundation and dry periods. Pretreatment of storm water flowing into bioretention BMPs is recommended to remove large debris, trash, and larger particulates. Permeable pavements work by allowing streets, parking lots, sidewalks, and other hardscape to retain their natural infiltration capacity while maintaining the structural and functional features of the materials they replace. Permeable pavements contain small voids that allow water to drain through the pavement to an aggregate reservoir and then infiltrate into the soil.[10]

The Highway 101 Streetscape and Greenstreet projects improve water quality by reducing stormwater runoff through the use of pervious pavement and bioswales.

The runoff water treated by bioretention facilities reportedly removes 97% of the TSS in the treated flow.[11] According to laboratory records from the San Elijo WRF, local surface runoff assumed to have an average TSS concentration of 92 mg/L for a 0.5 inch storm event.[12] The LID facilities would reduce the runoff TSS concentration from 92 mg/L to 2.8 mg/L, removing 89.2 mg/L of TSS.

The bioretention facilities will have a similar positive effect in decreasing nitrate, heavy metals, and bacteria concentrations as well. The Highway 101 Greenstreet Retrofit is a recommended project in the *Cottonwood Creek Watershed LID Retrofit Plan – Draft* and is designed to reduce peak runoff by 4.6%, total runoff by 3.5%, and coliforms reaching the Cottonwood Creek by an estimated 45%. The bacterial reduction is significant, given that both Cottonwood Creek and Moonlight Beach are on the 303(d) list for total coliform and Moonlight Beach experiences heavy recreational use of by both local residents and visitors. However, this analysis presents TSS reduction, which can be reported in mg/L format.

[10] Tetra Tech et al. 2015. *Cottonwood Creek Watershed LID Retrofit Plan – Draft.*
[11] Environmental Services Division Department of Environmental Resources – Prince George's County, MD. *Bioretention Manual*. December, 2007.
[12] San Elijo JPA Laboratory. *Stormwater #2 12/2/14, Stormwater #3 12/2/14*. Reviewed December 30th 2014.

$$\left(\frac{TSS\ mg/L\ sample\ \#1 + TSS\ mg/L\ sample\ \#2}{2}\right) * \%\ TSS\ removed\ via\ biorentention = TSS\frac{mg}{L}reduction$$

$$\left(\frac{58\frac{mg}{L} + 126\frac{mg}{L}}{2}\right) * 97\% = \mathbf{89.2\ mg/L}$$

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

The physical benefits of the *Integrated Water Resource Solutions for Carlsbad Watershed* will require construction of all the project components. These components include design, permitting, and construction of approximately 19,834 LF of recycled water pipeline along four separate alignments to serve local irrigation demands. The Coastal Rail Train is already plumbed to allow for irrigation with recycled water, but the remaining new customers will need to implement onsite retrofits, in order to receive and distribute the recycled water. Onsite retrofits will include upgrades to irrigation equipment, installation of a new recycled water meter, and staff training.

The project also includes construction of the Highway 101 Streetscape elements in the City of Encinitas, including recycled water irrigation improvements and biorentention facilities. The bioretention areas along Highway 101 and at San Elijo WRF will need regular maintenance to ensure effective percolation and treatment of storm flows.

Potential Adverse Physical Effects of the Project and Mitigation

There may be temporary adverse effects during construction of the various project components, such as noise, traffic, or air quality impacts. A Categorical Exemption is planned for the Highway 101 Greenstreet and San Elijo WRF LID components because no adverse physical impacts are anticipated. The four recycled water pipelines – Manchester Avenue, Via de la Valle, Encinitas Ranch, and Requeza Street – will be addressed in a Mitigated Negative Declaration (MND), which will mitigate any potential environmental impacts. The Highway 101 Streetscape component, however, is expected to have unavoidable adverse impacts related to traffic (through lane closures), hazards (disruption of evacuation routes), and air quality (from excavation) and an Environmental Impact Report (EIR) is being prepared to address those issues. Ultimately, the distribution of additional recycled water and treatment of storm water pollution are anticipated to have long-term benefits, not adverse effects, to the region.

In the future, San Elijo JPA, SFID, and OMWD each intend to implement potable reuse projects that route wastewater flows for advanced treatment and ultimate delivery into the potable drinking water system. Continued expansion of the non-potable water distribution system could result in near-term construction-related adverse impacts, and then lie as stranded assets if tertiary treated water is no longer available to customers. However, San Elijo JPA and its partners have committed to continue recycled water deliveries to current customers in order to offset potable demands during the drought and while potable reuse regulations are still being developed and adopted.

Long-Term Drought Preparedness

Integrated Water Resource Solutions for the Carlsbad Watershed will help to achieve long-term drought preparedness through three of the methods described in Table 1 of the *2015 Guidelines*: reuse and recycling, long-term water-use reduction, and system interties. The project will distribute 100 AFY of recycled water, which will directly offset potable water use and increase use of a local, drought-resistant supply of water. The project will construct reliable recycled water infrastructure, which will help achieve long-term reductions in water use and also includes a system intertie between OMWD and San Elijo JPA recycled water infrastructure just east of Interstate 5 along Manchester Avenue.

Direct Water-Related Benefit to DACs

Although the project area is only 3% DAC by population (see **Table 7-2** in *Attachment 7 Disadvantaged Communities*), the *Integrated Water Resource Solutions for Carlsbad Watershed* project would still benefit DACs located within San Elijo JPA's service area. The project provides directly address DAC needs through outreach that will specifically target DAC residents. This outreach will include implementation of state-approved curriculum for students in grades K-12, and conducting field trips for schools in Encinitas and Escondido to the San Elijo

Lagoon. Over 70% of the students reached by this program attend Title I schools, which serve students from predominantly low-income households (313 out of 434 students reached).

Project Performance Monitoring Plan

Benefits of the *Integrated Water Resource Solutions for Carlsbad Watershed* project will accrue as described in **Tables 2-31** and **2-32** above. **Table 2-33** describes the methods that will be used to measure the quantified benefits of this project. San Elijo JPA and its project partners will monitor water supply benefits by collecting and reporting monthly water meter data for new customers along the four proposed recycled water pipelines. The City of Encinitas and San Elijo JPA will monitor water quality benefits by collecting and reporting annual water quality data for the LID components.

Table 2-33: Project Monitoring for *Integrated Water Resource Solutions for Carlsbad Watershed*

Proposed Physical Benefits	Measurement Tools and Methods	Targets
Water Supply – Recycled Water	*Manchester Avenue Recycled Water Pipeline* – OMWD will provide monthly data from the recycled water irrigation meters for all connected customers. *Via de la Valle/Highway 101 Recycled Water Pipeline* – SFID will provide monthly data from the recycled water irrigation meters for all connected customers. *Encinitas Ranch/Requeza Street Recycled Water Pipelines* – SDWD will provide monthly data from the recycled water irrigation meters for all connected customers.	100 AFY of recycled water delivered (11 AFY from Manchester Avenue, 38 AFY from Via de la Valle, 35 AFY from Encinitas Ranch, and 16 AFY from Requeza Street)
Water Quality Improvement	*Highway 101 Greenstreets* – The City of Encinitas will provide water quality data for locations upstream and downstream from the biorentention facilities once per year. *San Elijo WRF LID* – San Elijo JPA will provide water quality data for locations upstream and downstream from the biorentention facilities once per year.	89.2 mg/L reduction in TSS concentration at each location

Cost Effectiveness Analysis

The *Integrated Water Resource Solutions for Carlsbad Watershed* project will achieve two quantifiable physical benefits described in the sections above, and summarized in **Table 2-31 and 2-32**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-34** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-34: Cost Effective Analysis for *Integrated Water Resource Solutions for Carlsbad Watershed*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-31 and 2-32.* Water Supply – 100 AFY of recycled water delivery Water Quality – 89.2 mg/L of TSS reduction in stormwater
Question 2 Alternatives Considered	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why? If yes, list the methods (including the proposed project) and estimated costs. For Components 1-2, the City of Encinitas developed a *Cottonwood Creek Watershed LID Retrofit Plan – Draft* to consider the various BMP alternatives available for managing non-point source pollution and selecting a preferred set of implementation actions. Costs outlined in Chapter 3 of the Retrofit Plan for the top eight candidate sites ranges from $22,510 for a BMP with 4% projected efficacy to $2.5 million for a BMP with a 21% projected efficacy (calculated as average annual bacteria removal/cost). Cost is always a significant factor in selecting storm water BMPs. For Components 3-5, each water district conducted a master planning process to consider market demand for recycled water, alternative alignments to deliver recycled water to the highest priority customers, and selection of a preferred alignment to best meet the district's goals. Cost is always a significant factor for the water districts in selecting the preferred alignments. In OMWD's *Northwest Quadrant/ Village Park Recycled Water Study*,[13] three scenarios describe alternatives to serve RW to the Village Park area. There is no preferred alternative, all of them cost more than they make. Scenario 1 is the least expensive. 1. In Scenario 1, the recycled water pipelines would be built to serve 198 AFY from the Mahr Reservoir. The program would have a capital cost of $5.07 million, with an annual cost of $1,020/AF. 2. In Scenario 2, the recycled water pipelines would be built to serve 393 AFY from the Wanket Reservoir. The program would have a capital cost of $11.01 million, with an annual cost of $1,020/AF. In SFID's *Eastern Service Area Recycled Water Facilities Plan*,[14] five alternative recycled water pipe infrastructure plans are proposed, corresponding with three source options. Option 1 is preferred alternative, predicted lowest in total project cost per AF. 1. San Elijo WRF hook up would provide a buildout recycled water yield of 689 AFY through 8.4 miles (44,600 LF) of pipeline. The project will cost $18.73 million in capital expenditure. 2. City of San Diego North City Water Reclamation Plant (NCWRP) hook up through the City's San Dieguito recycled water system termination point. SFID would receive 689 AFY of RW through 6.6 (35,100 LF) miles of pipeline. This benefit would cost $17.59 million in capital expenditure. 3. City of San Diego NCWRP hook up through the OMWD pipeline paralleling SFID's Eastern Service Area boundary. This option would supply 744 AFY of recycled water through 9.4 miles of pipeline. The project would cost $20.08 million in capital expenditure. 4. CSDs Demineralization would deliver 360 AFY of recycled water from Rancho Santa Fe CSD through 3.4 miles (17,700 LF) of pipeline. The project would cost $5.93 million in capital expenditure.

[13] OMWD. *Northwest Quadrant/ Village Park Recycled Water Study-Olivenhain Municipal Water District*. April 22, 2011.
[14] SFID. *Santa Fe Irrigation Eastern Service Area Recycled Water Facilities Plan*. September 2, 2011.

Cost Effective Analysis	
	5. CSD Blend option would deliver 432 AFY of recycled water from Rancho Santa Fe CSD through 4.7 miles (24,800 LF) of pipeline. The project would cost $9.17 million in capital expenditure. No master planning document is available for SDWD's Component 5. The San Elijo JPA's *Recycled Water Optimization and Expansion Study* discussed options for maintaining and expanding the plant. However, this study did not specifically address the proposed LID Project.
Question 3 Preferred Alternative	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* For Components 1-2, the selected LID (bioswale and permeable pavers) components are not the least cost alternative. However, the City of Encinitas chose to complete the Greenstreet improvements in tandem with installation of recycled water plumbing, given the timing of improvements being conducted by the partner agencies. These improvements are expected to significantly improve stormwater runoff into Cottonwood Creek and Moonlight Beach. For Component 3, the proposed Manchester Avenue alignment is not the least cost alternative. Rather, it is part of Scenario 2 described above. However, degraded water quality at the Mahr Reservoir since the 2011 study was completed has limited OMWD's ability to market that recycled water to new customers. Rather, OMWD has chosen to partner with San Elijo JPA to source recycled water via the Wanket Reservoir, in order to effectively convert customers to recycled water and contribute to meeting the State's emergency drought regulations. For Component 4, the proposed Via de la Valle/Highway 101 alignment is the least cost alternative, as it is sourced from San Elijo JPA. The project helps the agency to reduce potable water demands by converting customers to recycled water. The proposed project is a suite of recycled water supply, storm water treatment, and public outreach components that collectively meet the partners' goals of potable water conservation, water quality improvement, and climate change resiliency.

Project 7: UCSD Water Conservation and Watershed Protection

Local Project Sponsor: University of California San Diego (UCSD)
Partners: San Diego Coastkeeper, WildCoast, Urban Corps of San Diego, and Tijuana River National Estuarine Research Reserve (TRNERR)

Project Summary

The project will expand water reuse at UCSD's cooling tower, reuse HVAC system water, replace turf, monitor/treat stormwater, and implement a watershed protection program.

Project Map

Figure 2-14 shows the *UCSD Water Conservation and Watershed Protection* project area, the service areas of the project sponsor, the project facilities and the project's relation to groundwater basins and surface water, disadvantaged communities (DACs) and proposed monitoring locations. **Figure 2-15** shows the expanded recycled and reclaimed water facilities at the UCSD campus that will be constructed by this project.

Clockwise from left: Recycled water pipeline installation at UCSD campus, view of Tijuana River Valley, and trash in the Tijuana River

Project Description

Through the *UCSD Water Conservation and Watershed Protection* project, UCSD will support its leadership role in regional water resource protection by partnering with community-based organizations – San Diego Coastkeeper, WildCoast, and Urban Corps of San Diego – to reduce potable water use, improve irrigation efficiencies, increase public awareness and education on water conservation and watershed pollution, reduce non-point source pollution, and restore watershed habitats. This project will provide benefits to the following sensitive natural resources: Tijuana River National Estuarine Research Reserve (TRNERR); Tijuana River Regional Park and Border Field State Park; Tijuana River Mouth Marine Protected Area (MPA); La Jolla Shores Area of Special Biological Significance (ASBS); and San Diego Bay.

Water conservation and watershed protection will be achieved by the following project components:

Component 1 Central Utilities Plant (CUP) Reclaimed Water Cooling Tower Retrofit: This component will extend recycled water lines across the UCSD campus to the Central Utilities Plant Cooling Towers. By bringing recycled water to the Plant and retrofitting the cooling tower equipment and controls, 70% of current potable water use in the towers will be replaced with recycled water. This will reduce potable water use by 27,500,000 gallons per year in 2016 and 60,000,000 gallons per year in 2017 and beyond.

Component 2 Air Handling Unit Condensate Collection and Reuse: This element includes retrofitting two buildings on campus to reuse Heating-Ventilation-Air Conditioning (HVAC) condensation water for irrigation savings of approximately 1 million gallons of potable water a year.

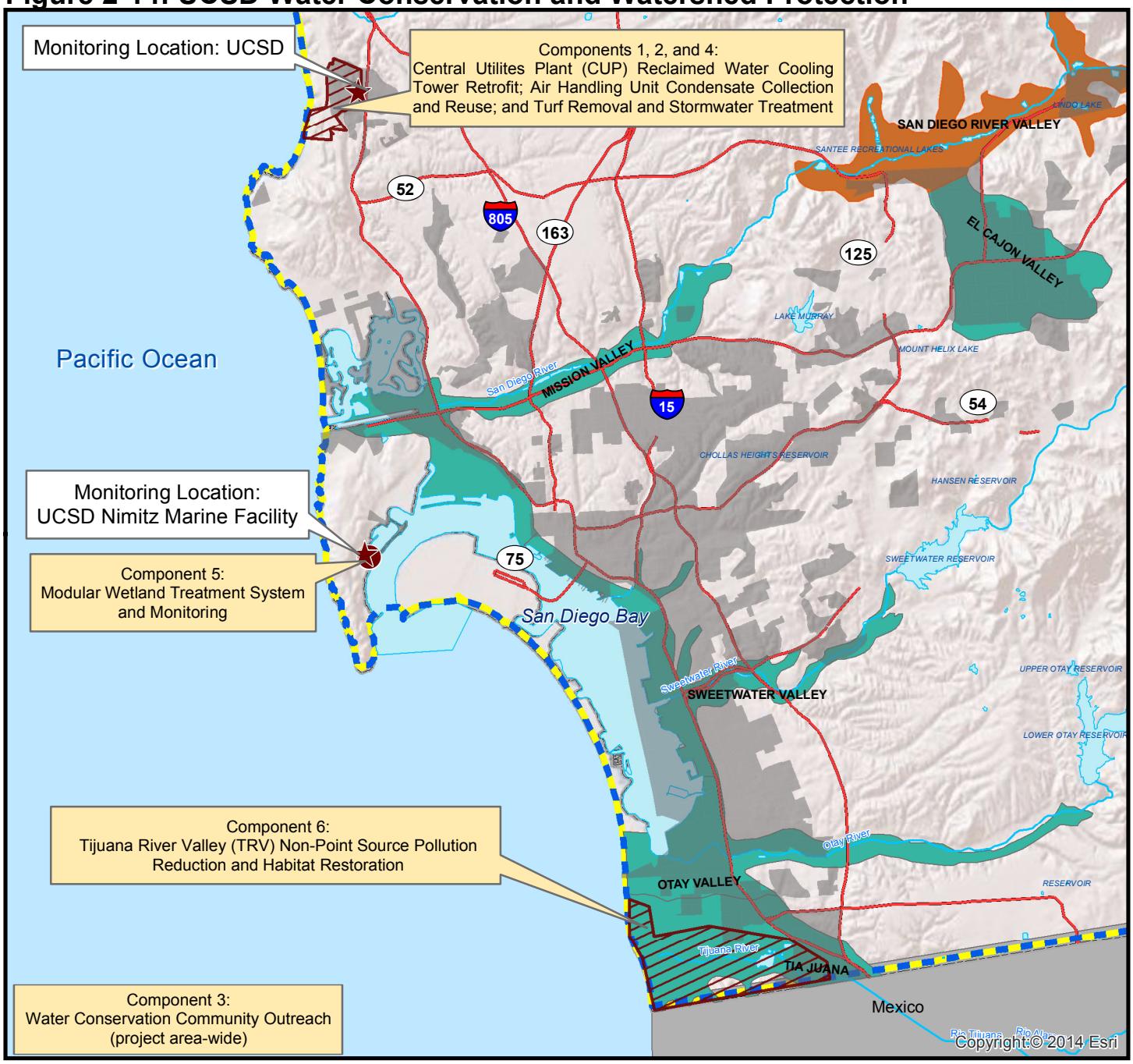
Component 3 Water Conservation Community Outreach: This component will engage stakeholders and increase public awareness of measures they can implement to conserve water. Coastkeeper will conduct education and outreach to inform residents (including UCSD students), businesses and decision makers about the region's water supply, the need for and benefits of conservation, and the actions that can be taken to lower water use in the region.

Component 4 Turf Removal and Stormwater Treatment: This component will replace turf with storm water treatment landscaping at two locations on campus to reduce irrigation, prevent non-storm water flows, and treat stormwater runoff from roads and a parking lot. This will reduce pollutants discharged into the Penasquitos Watershed and the La Jolla Shores ASBS, such as total suspended solids (TSS) and bacteria. The Revelle Parking Lot Retrofits include turf removal and bioretention areas to collect and infiltrate stormwater runoff from the lot. At the UCSD Entrance, turf will be replaced with drought tolerant landscaping and a bioretention basin to reduce stormwater runoff and the discharge of pollutants.

Component 5 Modular Wetland Treatment System and Monitoring: This component includes installing a Modular Wetland Stormwater Treatment System at the UCSD Nimitz Marine Facility. The system will treat stormwater runoff from a concrete swale that discharges directly into the San Diego Bay. Monitoring of storm water runoff upstream and downstream from this system will be performed to evaluate the effectiveness of this system at removing heavy metals and sediment from runoff.

Component 6 Tijuana River Valley (TRV) Non-Point Source Pollution Reduction and Habitat Restoration: This element will provide non-point source pollution reduction and habitat restoration. WildCoast/Urban Corps/TRNERR will remove trash, debris, and invasive non-native species in the TRV to reduce or eliminate the discharge of pollutants into the Tijuana Watershed. This project will engage underserved community members and youth in stewardship and restoration of habitat in the TRV and prevent pollutants from entering coastal ecosystems. The project will engage an estimated 5,000 volunteers in the removal of 80 tons of waste, 1,000 tires and also restore 1 acre of habitat in the TRV over 24 months.

Figure 2-14: UCSD Water Conservation and Watershed Protection



Coordinates: 32.87272, -117.24099

Legend

- San Diego IRWM Region
- Funding Area Boundary
- Freeway
- Waterbody
- County
- DAC Area*
- Medium Priority Groundwater Basin
- Very Low Priority Groundwater Basins
- Benefit Area: 7 UCSD Water Conservation and Watershed Protection (Note: 3 project sites)
- Monitoring Location
- Modular Wetland

0 1.75 3.5 7
Miles

N

*Note: DAC as determined by census tract and block group data for the year 2013, from the American Community Survey 2009-2013 5-year results. DAC determined based on definition of median household incomes below 80% of the statewide MHI or $48,875.

Sources: U.S. Census 2013 ACS 5-year estimates; San Diego Association of Governments (SANDAG) - GIS Data Warehouse
Document Path: N:\Projects GIS\0188-003 SDIRWM Plan Update\Prop84_Rnd4\MXD\Project maps\2-8_UCSDProject29072015.mxd

Figure 2-15: UCSD's Recycled Water Distribution System

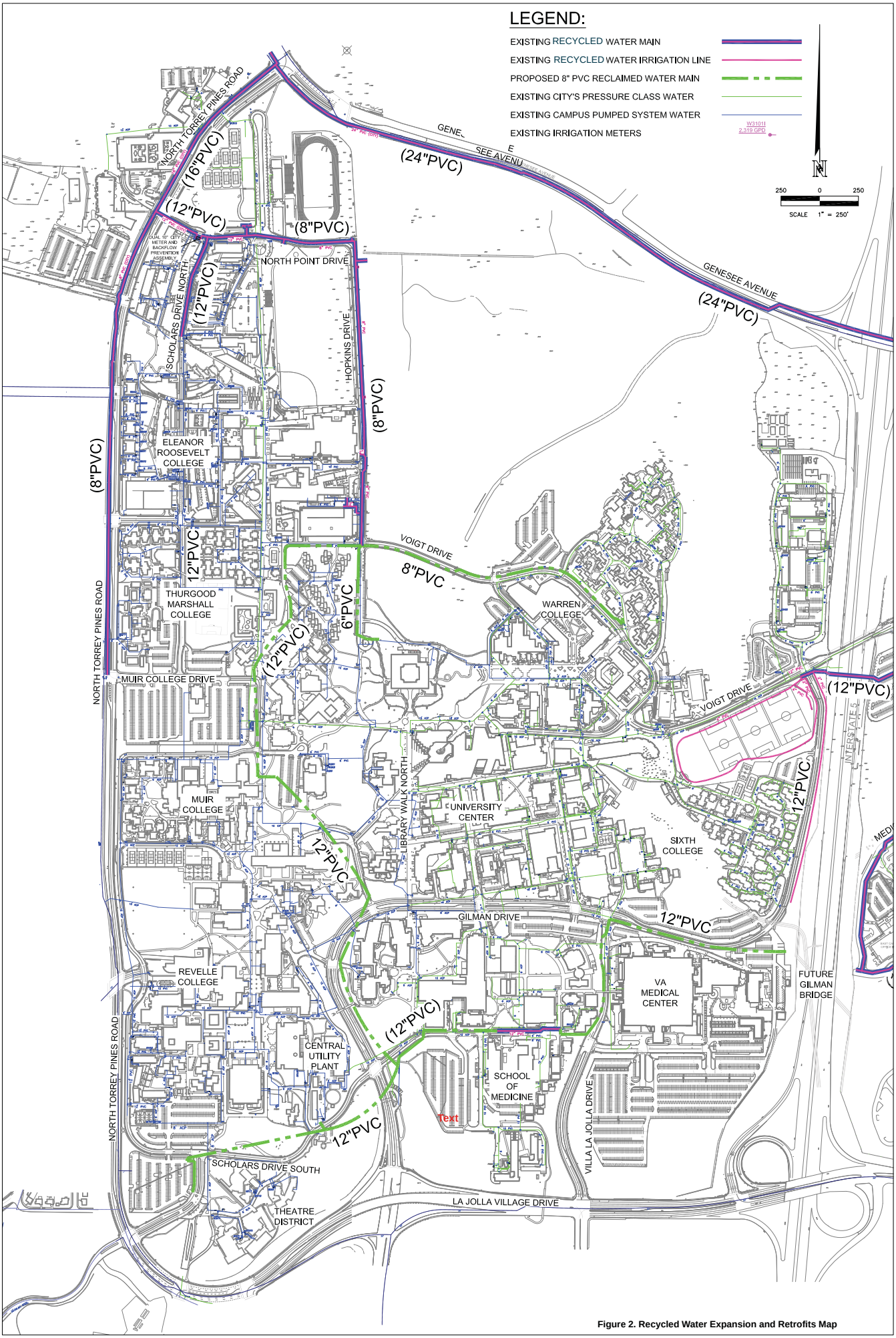


Figure 2. Recycled Water Expansion and Retrofits Map

Project Physical Benefits

The primary and secondary benefits of the project include 1) water supply (acre feet per year [AFY]) from recycled municipal water, HVAC condensate reuse, and turf conversion, and 2) water quality (mg/L) improvement from reduced heavy metals in stormwater runoff.

The water supply benefit comes from a combination of recycled water use for the non-potable cooling tower demand, reuse of HVAC condensate and RO reject water, and) conservation savings from turf removal. Current recycled water use at the UCSD campus averages 97 AFY. The baseline is shown as a static value because no additional capital expenditures for recycled water have been committed at this time beyond the proposed project. The anticipated useful life of the recycled water system serving the CUP Cooling Tower is 60 years. The Turf Removal component is anticipated to have a 20 year useful life; this useful life is longer than expected at residential properties (and used in this Proposal's Conservation Program) because it is located on an institutional campus where there will not be owner turnover. The value of recycled water offset (184 AFY at buildout) comes from the *Industrial Engineering Report for Recycled Water System-University of California San Diego Central Utilities Plan,* completed in June 2015. Potable water use will be further decreased with condensate collection from HVAC systems to be used for landscape irrigation. The value of condensate reuse (16.2 AFY at buildout) comes from the *University of California, San Diego Building Air Handling Unit Condensate Collection Feasibility Study* (September 2014) and the *Condensate Collection at Bonner Hall – Basis of Design* (July 2015). Finally, turf removal and replacement with bioswales will provide for water conservation (2.3 AFY). This value is based on the *UCSD Revelle Stormwater and Turf Removal Project Cost Estimate*. Over the course of the project life, the *UCSD Water Conservation and Watershed Protection* project will create an additional 11,514 AF of reclaimed water for non-potable reuse. Cumulative potable water savings over the life of the project (2016 to 2076) total 11,322 AF.

Table 2-35: Primary Physical Benefit – Water Supply
UCSD Water Conservation and Watershed Protection

Project Name: UCSD Water Conservation and Watershed Protection
Type of Benefit Claimed: Water Supply – from recycled water, HVAC condensate reuse, and turf removal
Units of the Benefit Claimed: AFY
Anticipated Useful Life of Project (years): 20-60 years

(a)	(b)	(c)	(d)
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2016	97 AFY	181 AFY	84 AFY
2017	97 AFY	281 AFY	184 AFY
2018	97 AFY	284 AFY	187 AFY
2019-2037	97 AFY	300 AFY	203 AFY
2038	97 AFY	297 AFY	200 AFY
2039-2076	97 AFY	281 AFY	184 AFY

Comments: The baseline recycled water use at UCSD is 97 AFY. When the CUP Recycled Water Project is completed, the recycled water will be blended into the system slowly over time starting at 10% recycled water to 90% potable water. By the end of 2016, 27.5 MG per year of potable water will be saved (84 AFY). It is anticipated that the water blend used in the cooling towers will consist of 70% recycled water and 30% potable water, saving 60 MG per year of potable water (184 AFY) in 2017 and beyond. The anticipated useful life of the recycled water system is 60 years. The HVAC condensate component will be completed in 2018, with benefits (16.2 AFY) accruing starting in 2019 for 20 years. The turf removal component will be completed in 2017, with benefits (2.3 AFY) accruing starting 2018 for 20 years; this useful life is longer than expected at residential properties because it is located on an institutional campus where there will not be owner turnover.

Sources: Michael Baker International/RBF Consulting. *Industrial Engineering Report for Recycled Water System-University of California San Diego Central Utilities Plan*. June 3, 2015.

Energy Systems Engineering, Inc. *UCSD Central Utility Plant, Reclaimed Water Cooling Tower Retrofit* – Design Drawings. April 6, 2015.

Energy Systems Engineering, Inc. *University of California, San Diego Building Air Handling Unit Condensate Collection Feasibility Study*. September 2014. Pg. 3-2

Energy Systems Engineering, Inc. *Condensate Collection at Bonner Hall – Basis of Design*. July 13, 2015.

Energy Systems Engineering, Inc. *UCSD Building AHU Condensate Collection* – Design Drawings. August 28, 2014.

Nolte Vertical Five, Inc. *UCSD Revelle College Hardscape Runoff Improvements – Design Drawings*.

TBD Consultants. April 2015. *UCSD Revelle Stormwater and Turf Removal Project Cost Estimate.*

The Water Quality improvement benefit will result from reduction in heavy metals through runoff treatment by a modular treatment wetland. This will significantly reduce toxic heavy metals exposure, specifically zinc (-0.746 mg/L reduction) to fish resulting from stormwater runoff to San Diego Bay. The baseline for this benefit is the current concentration of runoff entering the San Diego Bay at the Nimitz Marine Facility (1.02 mg/L). The value of water quality improvement is based on stormwater quality data collected at the Nimitz Marine Facility and performance data reported in the *Modular Wetland Stormwater Treatment System Product Information.*

Table 2-36: Secondary Physical Benefit – Water Quality
UCSD Water Conservation and Watershed Protection

Project Name: UCSD Water Conservation and Watershed Protection **Type of Benefit Claimed:** Water Quality Improvement – reduction in zinc concentration to San Diego Bay **Units of the Benefit Claimed:** mg/L **Anticipated Useful Life of Project (years):** 20 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2018-2037	1.02 mg/L	0.335 mg/L	-0.746 mg/L
Comments: The baseline for this benefit is the current concentration of runoff entering the San Diego Bay at the Nimitz Marine Facility (1.02 mg/L). The modular treatment wetlands will be installed in late 2017. The estimated useful life of the modular wetlands is 20 years (2018-2037). Sources: Pers. Comm. – Kimberley O'Connell, July 2015, UCSD Nimitz Strm Data.xls. Modular Wetlands. 2015. *Modular Wetland Stormwater Treatment System Product Information*. Nolte Vertical Five, Inc. *UCSD MARFAC Stormwater Project, Phase 2 – Design Drawings*.			

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

UCSD, one of the largest water users in the City of San Diego, is partnering with municipal and tribal governments, agencies, and community-based organizations to support regional water conservation and watershed protection efforts. Potable water use reduction projects on the campus, water quality improvements in local surface waters, and stakeholder engagement in water conservation support the San Diego IRWM Region's response to the ongoing drought.

Potable water supply is provided to UCSD's private water system from the City of San Diego. The City of San Diego's water supply mix is: 84% imported water via San Diego County Water Authority; 12% local surface water; 4% recycled water; and a negligible amount of groundwater.[15] In order to reduce demand for imported water supplies, which are occasionally limited, customers such as UCSD are implementing water conservation and recycled water projects. Generally, the existing cooling tower and irrigation systems at the UCSD campus are connected to the potable water system that is sourced from the City of San Diego. UCSD's Central Utilities Plant (CUP) provides chilled water for the campus utilizing chillers and cooling tower systems. The cooling system includes the use of cooling towers to transfer heat. The existing cooling towers are located in an outdoor yard and are currently supplied with make-up water via an 8-inch domestic water pipeline.[16] Campus cooling tower make-up comprise a large proportion of water use on campus; employing new technologies, such as recycled water, within the cooling towers will allow UCSD to better manage local water resources.

Wastewater collected on campus is sent to the City of San Diego's metropolitan sewer system, treated at the Point Loma Wastewater Treatment Plant, and ultimately discharged to the Pacific Ocean. Many of UCSD's large classroom and laboratory buildings generate condensate from the cooling coils of air conditioning units that is currently discharged to the sewer.[17] Currently, onsite laboratories use treated potable water for scientific experiments. With minimal treatment, the condensate could be reused for reverse osmosis/deionized (RO/DI) laboratory water, thereby offsetting ocean discharges and potable water demands.

Stormwater runoff is a water quality issue in the San Diego region. Stormwater flows in the Peñasquitos Watershed, where the main UCSD campus is located, have resulted in poor water quality along the Pacific Ocean shoreline. The watershed discharges into two Areas of Special Biological Significance (ASBS): La Jolla Ecological

[15] City of San Diego. 2011. *2010 Urban Water Management Plan*.
[16] Michael Baker International/RBF Consulting. *Industrial Engineering Report for Recycled Water System-University of California San Diego Central Utilities Plan*. June 3, 2015.
[17] Energy Systems Engineering, Inc. *University of California, San Diego Building Air Handling Unit Condensate Collection Feasibility Study*. September 2014.

Reserve and San Diego-Scripps. The La Jolla Ecological Reserve ASBS is approximately 1.7 miles of shoreline adjacent to the City of San Diego (offshore from UCSD campus) and contains 453 acres of marine habitat, including the La Jolla State Marine Conservation Area.[18] The key pollution threats to La Jolla Ecological Reserve ASBS are from stormwater runoff from development, roadways, and parking lots. There are 184 direct discharges of urban runoff into La Jolla Ecological Reserve ASBS. Nine are naturally occurring streams or gullies with the majority of discharges coming from pipes or holes through seawalls, draining bluffs, and landscaped areas. The Pacific Shoreline is on the Clean Water Act 303(d) list of impaired waters for total coliform and fecal coliform.[19] The San Diego Regional Water Quality Control Board (RWQCB) has adopted a regional Total Maximum Daily Load (TMDL) for *Indicator Bacteria: Revised Project 1: Twenty Beaches and Creeks in San Diego Region (including Tecolote Creek)*[20] due to the severity of bacteria loading into local waterways, including the La Jolla Ecological Reserve ASBS. Although bacteria is a primary concern for the region, water quality improvements (such as bioswales or modular wetlands) will also help to address other non-point source pollutants that impair local waters.

Similarly, in the Pueblo Watershed, where the Nimitz Marine Facility is located, stormwater flows carry pollutants in urban runoff from residential areas, streets and roadways, shipyard operations, commercial and industrial areas, and construction. The San Diego Bay and shoreline is on the Clean Water 303(d) list for sediment toxicity, Enterococcus, fecal coliform, total coliform, copper, chlordane, and polynuclear aromatic hydrocarbons (PAHs).[21] The San Diego RWQCB has adopted TMDLs for *Shelter Island Yacht Basin Dissolved Copper*[22] and for *Chollas Creek Copper, Lead, and Zinc.*[23] The bay bottom provides habitat for many aquatic organisms and functions as an important component of aquatic ecosystems. However, the bay bottom sediment serves as a repository for persistent and toxic chemicals causing toxicity to marine life and benthic community impairments. The modular wetlands will help to address pollutants collected by the Nimitz Marine Facility hardscape and discharged to San Diego Bay.

Watershed protection is needed in the Tijuana River Valley (TRV) area, which is heavily impacted by cross border trash, pollution, and invasive species, which impacts wildlife and access. There is a need for ongoing small-scale volunteer-driven restoration to help mitigate these impacts and to engage the surrounding low-income communities in stewardship of these protected areas. Waste tires, excessive sedimentation, trash and invasive species pose a public health risk to people living and recreating in the TRV, as well as the TRV estuary's sensitive habitats and the wildlife that depend on them. By removing waste tires and increasing native plant cover, the project will improve water quality, public safety, and habitat for endangered birds. By providing paid job training for underserved young adults in the Urban Corps youth development program, the project helps meet the needs of local DACs for workforce development and employment opportunities. Low-income communities often lack access to open space and opportunities for nature-based recreation, and this project works to engage these community members in stewardship of open space areas.

Without-Project Conditions

Without the *UCSD Water Conservation and Watershed Protection Project*, recycled water use would not be expanded on the UCSD campus and building retrofits to allow for HVAC condensation and RO reject water reuse would not occur. UCSD would continue to use approximately 2,148 AFY potable water per year, and the 202.7 AFY of potable water per year to be saved by the project would continue to be purchased from the City of San Diego, which comprises 84% from imported sources. The CUP cooling towers and onsite irrigation systems would continue to use potable water, and the campus would continue to only use

Watershed protection achieved through nonpoint source pollution reduction, habitat restoration, and stormwater treatment in the Peñasquitos, Pueblo, and Tijuana Watersheds – including the Tijuana River National Estuarine Research Reserve (TRNERR), Tijuana River Regional Park and Border Field State Park, Tijuana River Mouth Marine Protected Area (MPA), La Jolla Ecological Reserve ASBS, and San Diego Bay – would not occur. Without turf removal and the modular wetland components of the project, stormwater treatment would not occur and the

[18] San Diego RWMG and RAC. 2013. *2013 San Diego IRWM Plan*. Chapter 5: Watersheds.
[19] San Diego RWMG and RAC. 2013. *2013 San Diego IRWM Plan*. Chapter 5: Watersheds.
[20] San Diego RWQCB. Adopted February 2010. *Indicator Bacteria: Revised Project 1: Twenty Beaches and Creeks in San Diego Region (including Tecolote Creek) TMDL.*
[21] San Diego RWMG and RAC. 2013. *2013 San Diego IRWM Plan*. Chapter 5: Watersheds.
[22] San Diego RWQCB. Adopted February 2005. *Shelter Island Yacht Basin Dissolved Copper TMDL.*
[23] San Diego RWQCB. Adopted June 2007. *Chollas Creek Copper, Lead, and Zinc TMDL.*

existing concentration of non-point source pollutants, including bacteria and heavy metals, would continue to contaminate San Diego Bay.

Methods Used to Estimate the Physical Benefits

Primary Benefit – Water Supply

The primary benefit of this project is the 200 AFY of new non-potable water supply created through use of recycled water at the CUP Cooling Towers and reuse of HVAC condensate water for landscape irrigation at two campus buildings. Existing recycled water facilities will be expanded to blend the new supplies into the campus non-potable delivery system.

Component 1: When the CUP Reclaimed Water Cooling Tower Retrofit is completed, the recycled water will be blended into the system slowly over time starting at 10% recycled water to 90% potable water. By the end of 2016, 27.5 MG per year of potable water will be saved (84 AFY). It is anticipated that the water blend used in the cooling towers will consist of 70% recycled water and 30% potable water, saving 60 MG of potable water per year (184 AFY) in 2017 and beyond.[24] The recycled water demand of 60 MG/year (184 AFY) will serve the cooling towers in two phases: 27.5 MG/year in 2016 and 60 MG/year in 2017.

$$60\frac{MG}{year} * 3.07\frac{AF}{MG} = \mathbf{184.1\ AFY}$$

Component 2: The HVAC Condensate Collection and Reuse component will generate 5.3 MG/year (16.2 AFY) for reuse in the non-potable distribution system, which feeds both the cooling towers and landscape irrigation. The condensation harvesting will be implemented at two buildings at the UCSD campus, which currently send all of the proposed flow to the sewer. In total, these two buildings will collect over 2.8 million gallons of condensate per year, along with 2.4 million gallons of RO reject water:

1. Bonner Hall: 2.1 MG of condensate plus 2.4 MG of RO reject water from the RO/DI system, for a total of 4.5 MG/year; and
2. Natural Sciences Building: collect 775,494 gal/yr of condensate.[25]

The Basis of Design document[26] outlines calculation methodology for condensate and RO reject at Bonner Hall. RO-reject water volume is based on RO-product water meter data, and that the HVAC condensate water volume is estimated based on air temperatures (weather data from North Island Naval Air Station) and the AHU operating schedule. As noted in that document, the amount of available condensate varies seasonally as a reflection of weather changes, temperature, and moisture content in the air.

$$4.5\frac{MG}{yr} + 775{,}494\frac{gal}{yr} = 5.28\frac{MG}{yr} * 3.07\frac{AF}{MG} = \mathbf{16.2\ AFY}$$

Component 3: The Water Supply benefit also includes water conservation achieved through reduced irrigation demands for potable water via the Turf Removal component. As described in the California Urban Water Conservation Council (CUWCC) report *Turf Removal and Replacement: Lessons Learned*, turf removal is an important tool for moving towards more sustainable landscaping which offers irrigation efficiency, runoff reduction, green waste reduction, pesticide and fertilizer reduction, and habitat improvement.[27] The turf removal project will be implemented at the Revelle Parking Lot and the UCSD Entrance. Approximately 31,500 square feet (sq ft) of land area will be addressed, 3,700 sq ft of which is the existing parking lot and 27,800 sq ft of which is turf. Annual water savings were estimated at approximately 34 gallons per square foot, based on the CUWCC report on

[24] Pers. Comm. Kimberly O'Connell, UCSD, Environmental Health and Safety, Environmental Affairs. 7/30/15.
[25] Energy Systems Engineering, Inc. *University of California, San Diego Building Air Handling Unit Condensate Collection Feasibility Study*. September 2014.
[26] Energy Systems Engineering, Inc. *Condensate Collection at Bonner Hall – Basis of Design*. July 13, 2015.
[27] California Urban Water Conservation Council. Briana Seapy. March 2015. *Turf Removal and Replacement: Lessons Learned*.

lessons learned from turf removal.[28] Following the turf removal project, savings are anticipated to be 945,200 gallons per year or 2.9 AFY.

$$\frac{Water\ Savings}{Area} * Area\ Converted = Water\ Saved\ from\ Turf\ Removal$$

$$34\frac{gal}{sq\ ft * yr} * 27{,}800\ sq\ ft = 945{,}200\frac{gal}{yr} * \frac{1AF}{325{,}851\ gal} = \mathbf{2.9\ AFY}$$

Total water savings benefits from this project is the sum of the benefits realized by each of these three components, or 203.2 AFY.

Secondary Benefit - Water Quality

The project will improve water quality by installing a Modular Wetland System at the UCSD Nimitz Marine Facility and by replacing turf with stormwater treatment landscaping at two locations on the campus to reduce irrigation demand, prevent non-stormwater overflow, and treat stormwater runoff. At the Revelle Parking Lot and UCSD Entrance, turf will be replaced with drought tolerant landscaping and bioretention basins to reduce stormwater runoff and the discharge of pollutants.

The modular treatment wetlands includes three major components:

1. Pre-treatment will include separation of trash, sediment, and debris before entering the pre-filter cartridges;
2. Biofiltration will include horizontal subsurface flow through the treatment media; and
3. Discharge will include flow control to a level lower than the media capacity.[29]

Installation of the modular treatment wetland at the Nimitz Marine Facility will specifically reduce the zinc concentration by 0.124 mg/L in storm runoff.[30] As reported by UCSD, existing stormwater runoff from the Nimitz Marine Facility is calculated to have an average 1.02 mg/L of zinc (based on 18 sampling events 11/2002 – 02/2014).[31] The modular treatment wetland is designed to remove 69% of the inflow zinc concentration,[32] resulting in an effluent zinc concentration of 0.335 m/L after a removal of 0.746 mg/L of zinc. Heavy metals are usually found in water in low concentrations. However, 0.746 mg/L of zinc removal is significant, representing a large reduction in toxicity to fish. The modular wetland will also remove 50% of the inflow copper concentration (equates to 0.035 mg/L of removal), as well as reducing TSS, phosphorous, and nitrogen concentrations.

$$1.081\frac{mg}{L} * 69\% = \mathbf{0.746\frac{mg}{L}}$$

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

The physical benefits of the *UCSD Water Conservation and Watershed Protection Project* will require construction of all the project components. Recycled water lines will be extended across the UCSD campus to the CUP Cooling Towers and the cooling tower equipment and controls will be retrofitted. The UCSD HVAC Condensation Collection and Reuse element will install systems to collect and reuse water condensation from HVAC units, along with RO reject water from laboratory water purification systems, at two campus buildings. In addition to these project elements, UCSD will construct a feeder control system to ensure that the injection of the combined HVAC/RO water does not increase total dissolved solids (TDS) levels in the non-potable system above allowable limits.

The project will also install a modular wetland treatment system and replace turf with stormwater treatment landscaping at two locations on the campus. The modular treatment wetlands will be installed at Nimitz Marine

[28] CUWCC. 2015. *Turf Removal & Replacement: Lessons Learned*. March.
[29] Modular Wetlands. 2015. *Modular Wetland Stormwater Treatment System Product Information*.
[30] North American Lake Management Society. *Fundamentals of Urban Runoff Management – Technical and Institutional Issues.* 2007. Pg. 3-58.
[31] Pers. Comm. – Kimberley O'Connell, July 2015, UCSD Nimitz Strm Data.xls.
[32] MWS Linear. *Modular Wetlands Advanced Stormwater Biofiltration*.

Facility, and will need regular cleanout of the pre-treatment chambers (by hand or vac truck). The bioretention areas in the Revelle Parking Lot Retrofits and UCSD Entrance will need regular maintenance to ensure effective percolation and treatment of storm flows.

Potential Adverse Physical Effects of the Project and Mitigation

There are no anticipated adverse physical effects from this project. There may be temporary construction-related effects associated with installation of recycled water lines, HVAC condensation building retrofits, turf replacement, and stormwater treatment features. However, these effects are anticipated to be minor and temporary in nature. Such impacts could include noise, air quality, or odors associated with use of construction equipment. Any such construction would be completed in compliance with applicable local and State regulations. A Categorical Exemption was prepared for this project.

In the future, the City of San Diego intends to implement potable reuse projects that route wastewater flows for advanced treatment and ultimate delivery into the potable drinking water system. Continued expansion of the non-potable water distribution system could result in near-term construction-related adverse impacts, and then lie as stranded assets if tertiary treated water is no longer available to customers. However, the City of San Diego has committed to continue recycled water deliveries to current customers in order to offset potable demands during the drought and while potable reuse regulations are still being developed and adopted.

Long-Term Drought Preparedness

The project provides three of the drought-related benefits listed in Table 1 of the *2015 Guidelines*: water conservation, reuse, and recycling. The CUP cooling tower and HVAC reuse components dramatically increases UCSD's supply of non-potable water and reduces potable water usage by 203.2 AFY. The community outreach components help to achieve the long-term reduction of water use by improving the likelihood of success of regional water supply strategies and water conservation by promoting a more informed public.

Direct Water-Related Benefit to DACs

As shown in **Table 7-1** (see *Attachment 7 Disadvantaged Communities*), the cumulative *UCSD Water Conservation and Watershed Protection* project area is 39% DAC by population. The *UCSD Water Conservation and Watershed Protection* project will directly address two of the urban DAC needs identified in the 2013 IRWM Plan[33]: surface water quality and flooding/creek constriction. The project will improve surface water quality by reducing pollutant loading to San Diego Bay and the La Jolla ASBS, as well as reducing stormwater runoff. The San Diego Bay abuts many urban DAC neighborhoods, and pollution in the Bay has been identified in the *2013 IRWM Plan* as a threat to subsidence fishing that provides food to DACs.[34] The project also includes trash removal in the TRV, helping to reduce creek constriction, thereby reducing flooding risks in DACs along the creek.

[33] RWMG. 2013. *2013 San Diego Integrated Regional Water Management Plan*. September.
[34] RWMG. 2013. *2013 San Diego Integrated Regional Water Management Plan*. September.

Project Performance Monitoring Plan

Benefits of the *UCSD Water Conservation and Watershed Protection* project will accrue as described in **Tables 2-35** and **2-36** above. **Table 2-37** describes the methods that will be used to measure the quantified benefits of this project. UCSD will monitor water supply benefits by collecting and reporting monthly water meter data for the CUP Cooling Tower and HVAC Condensate Reuse components. UCSD will take "pre" and "post" construction photos of the Turf Removal component. UCSD will monitor water quality benefits by collecting and reporting annual water quality data for the Modular Wetland System component.

Table 2-37: Project Monitoring for *UCSD Water Conservation and Watershed Protection*

Proposed Physical Benefits	Measurement Tools and Methods	Targets
Water Supply	For the *CUP Cooling Tower* component: UCSD will provide monthly potable and non-potable water meter data for the CUP cooling tower make-up. For the *HVAC Condensate Reuse* component: UCSD will provide monthly data from the feeder control system into the non-potable water system. For the *Turf Removal* component: UCSD will provide "pre" and "post" construction photos of the turf areas that are removed. On-going photo documentation of the site will provide confirmation that the converted area and bioswale are functioning as designed.	203.2 AFY reduction in potable water use (184.1 AFY from the Cooling Tower, 16.2 from HVAC Reuse, and 2.9 from Turf Removal)
Water Quality	For the *Modular Wetlands* component: UCSD will provide water quality data for locations upstream and downstream from the modular wetlands treatment system once per year.	0.746mg/L reduction in zinc concentration

Cost Effectiveness Analysis

The *UCSD Water Conservation and Watershed Protection* project will achieve two quantifiable physical benefits described in detail in the sections above, and summarized in **Table 2-35 and 2-36**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-38** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-38: Cost Effective Analysis for *UCSD Water Conservation and Watershed Protection*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-35 and 2-36.* Benefit 1: Water Supply – 203.2 AFY from recycled water, HVAC condensate reuse, and turf removal Benefit 2: Water Quality – 0.746 mg/L reduction in zinc concentration to San Diego Bay
Question 2 Alternatives Considered	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why? If yes, list the methods (including the proposed project) and estimated costs. Various potential demands have been considered for expansion of the non-potable water system on campus (including cooling towers and irrigation). Once condensate was identified as a potential water supply source, alternatives were considered for how to use this new supply. Four alternatives were considered for use of collected condensate. These alternatives were: 1. Condensate make-up to lab ultra-pure water systems in lieu of RO system make-up 2. Reclaimed water self-generation by mixing collected condensate with RO-reject and injecting into the campus reclaimed water main line 3. Irrigation as controlled by building-local irrigation controllers 4. CUP steam system make-up No cost alternative information is available, as other considerations helped to identify the preferred alternative.
Question 3 Preferred Alternative	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* UCSD has been working hard to identify least-cost alternatives for the non-potable water system that serves the main campus. This proposed project is a collection of those least-cost solutions. Alternative 2 (listed above) is preferred for the Bonner Hall condensate due to the proximity to the campus' reclaimed water main. This alternative also allows for use of the collected condensate in the CUP cooling towers as this reclaimed water is blended with potable to meet the cooling tower needs. Alternative 3 is preferred for the Natural Sciences building, because recycled water lines do not extend to this area of campus, and nearby irrigation currently utilizes potable water.[35]

[35] Pers. Comm. Kimberly O'Connell. UCSD, Environmental Health and Safety, Environmental Affairs. Benefits analysis for UCSD grant projects (e-mail). 7/23/15.

Project 8: Escondido Advanced Water Treatment for Agriculture

Local Project Sponsor: City of Escondido
Partners: Escondido Growers for Agricultural Preservation (EGAP), Vista Irrigation District, City of San Diego, and Rincon Del Diablo Municipal Water District

Project Summary

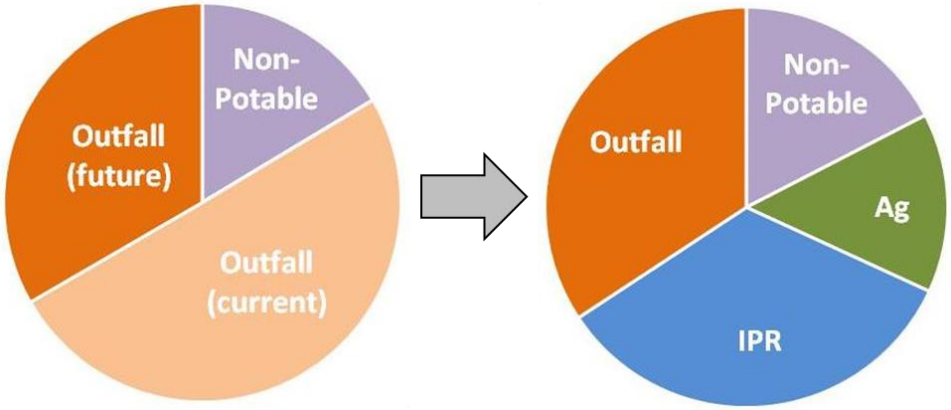
The project will construct a new advanced water treatment facility to improve the water quality of recycled water delivered to agricultural customers in Escondido.

Project Maps

Figure 2-16 shows the *Escondido Advanced Water Treatment for Agriculture* project area, the service areas of the project sponsor, the project facilities and the project's relation to groundwater basins and surface water, disadvantaged communities (DACs) and proposed monitoring locations. **Figure 2-17** shows the site plan for the proposal microfiltration reverse osmosis (MFRO) Facility.

Avocado orchards to be served by the MFRO Facility in eastern City of Escondido

Local avocado growers discuss water quality and irrigation needs of their groves



This project will diversify the City of Escondido's water reuse and discharge operations, and prepare the City for future indirect potable reuse

Project Description

The City of Escondido (Escondido) desires to become less reliant on imported water by improving the diversity and reliability of its water supply from local resources. Compared to imported supplies, recycling water provides a long-term sustainable, reliable, and drought proof water supply at a reasonable and more predictable cost to local agricultural users. The City of Escondido is also committed to a long-term program to implement potable reuse. On April 2, 2014, the City of Escondido's City Council endorsed a plan to develop an Indirect Potable Reuse (IPR) System. Rather than investing in a costly land and ocean outfall project that releases secondary effluent from Hale Avenue Resource Recovery Facility (HARRF) to the Pacific Ocean, the City Council has elected to invest in drought proof water supplies using advanced treated recycled water. Currently, the land outfall from HARRF is facing capacity issues. If wastewater discharges are not offset from the facility, the City will be required to invest in a costly upgrade to the land outfall. Through the Reuse Program, the City Council has elected to move water reuse forward and invest its resources in drought proof water supplies instead of investing additional funding in a business-as-usual manner.

The agricultural community in Escondido grows high value crops such as citrus and avocados which are very sensitive to salts (specifically chlorides) which are common in recycled water and consistently present in Escondido's existing recycled water supply. The Escondido was awarded Prop 84-Round 2 funds for a recycled water line extension to the agricultural users and a short reach of brine line (that will be constructed in a common trench with the recycled water line), but since that time, salt and salinity management issues have come into focus with the drought in California. The salt content in Escondido's recycled water has increased due to increased use of higher salinity Colorado River for potable demands; this additional salt loading is anticipated to significantly impact growers in Escondido that rely upon locally-produced recycled water for irrigation purposes.

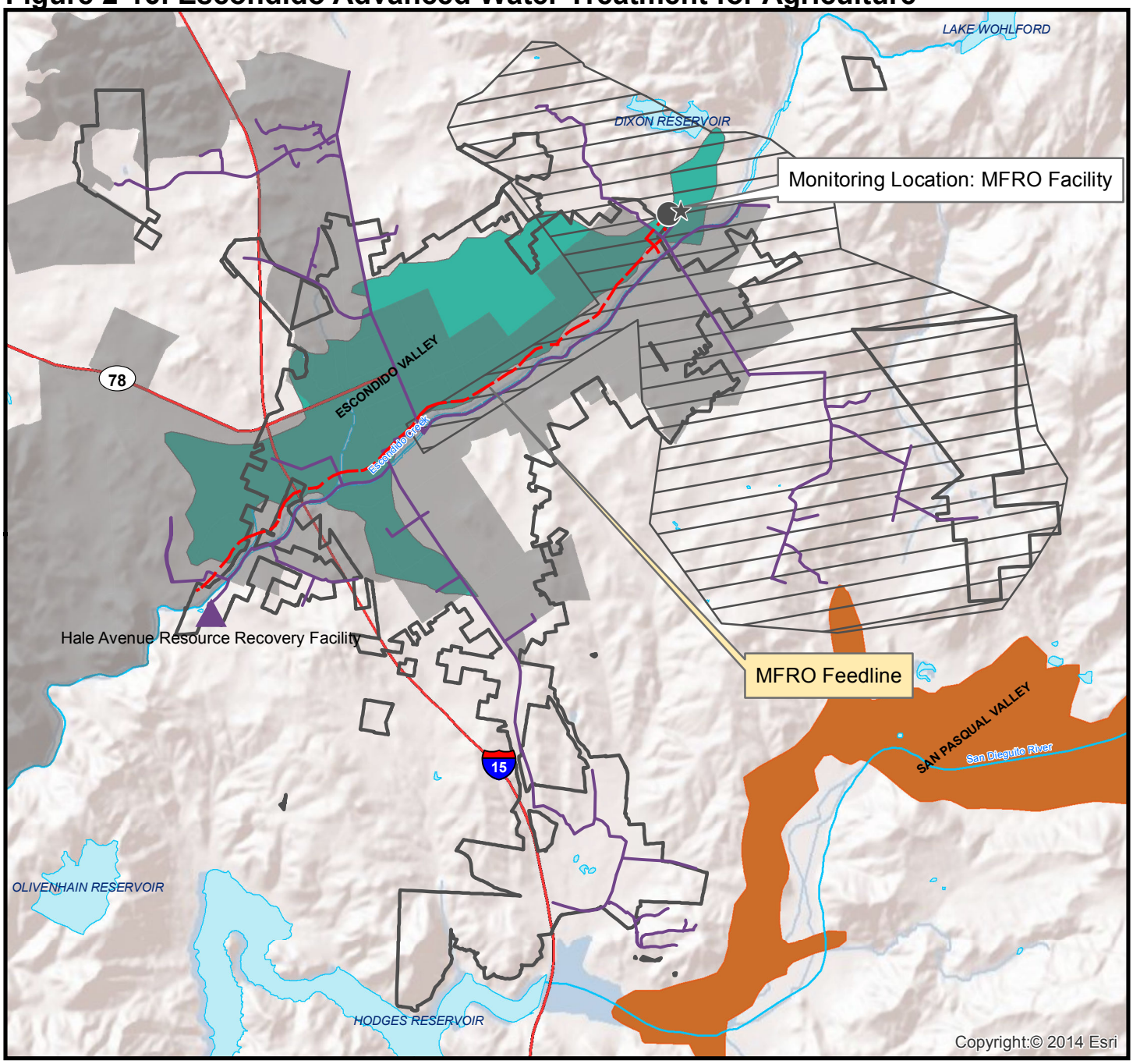
The *Escondido Advanced Water Treatment for Agriculture* project calls for Escondido to construct a microfiltration and reverse osmosis (MFRO) Facility to treat recycled water to agricultural customers' standards by reducing chloride concentrations. This will improve the quality of recycled water and allow growers to continue to use highly reliable and locally-produced recycled water for irrigation. Furthermore, improving the quality of recycled water will decrease overall irrigation water demands, because additional water needed for salt flushing will no longer be required. Data has shown that for some soil types, higher salinity recycled water requires approximately 20% more water to enable salt flushing.[36] As such, without the project, an additional 20% (approximately 880 AFY) over existing agricultural demands of 4,440 AFY would be required for salt flushing.

The MFRO Facility will provide advanced treatment for Title 22 quality reuse water that is produced at the HARRF. The facility will utilize membrane filtration to produce 2.0 mgd of treated water. Since MFRO treated water is a higher quality water supply than what is required for agriculture irrigation, Title 22 quality reuse water from HARRF will be blended with MFRO treated product water to produce water with a quality suitable for agricultural reuse. In order to distribute the MFRO water to agricultural users in the north and east areas of Escondido, Escondido is constructing the MFRO feed line from HARRF to the MFRO Facility, the brine pipeline from the MFRO Facility to HARRF, and distribution piping to the customers (all partially funded via Prop 84-Round 2 IRWM grant).

The *Escondido Advanced Water Treatment for Agriculture* project also is the important initial phase of a larger program by Escondido to develop approximately 8,000 AFY of new supply through IPR. The MFRO Facility is a key initial step in Escondido's larger IPR System that will promote water recycling and provide a long-term, reliable source of high quality water for the region's agricultural community. The MFRO Facility will meet the real, immediate needs of these agricultural users and provides a means to evaluate advanced treatment processes. The system is also set up to allow pilot testing for Escondido's planned IPR System; the pilot scale evaluations planned at the MFRO Facility will provide insight into the planned growth of the City's non-potable reuse and IPR systems.

[36] Water Quality for Agriculture by R. S. Ayers and D.W. Westcott, Food and Agriculture Organization of the United Nations Irrigation and Drainage Paper, 29 Rev.1, 1994

Figure 2-16: Escondido Advanced Water Treatment for Agriculture



Coordinates: 33.11786, -117.09172

Legend

- Freeway
- Waterbody
- DAC Area*
- Medium Priority Groundwater Basin
- Very Low Priority Groundwater Basins
- Benefit Area: 8 Escondido Advanced Water Treatment for Agriculture
- Proposed Microfiltration Reverse Osmosis (MFRO) Facility
- City of Escondido Service Area
- Hale Avenue Resource Recovery Facility
- Monitoring Location
- Brine Pipeline
- Existing Recycled Water Pipeline

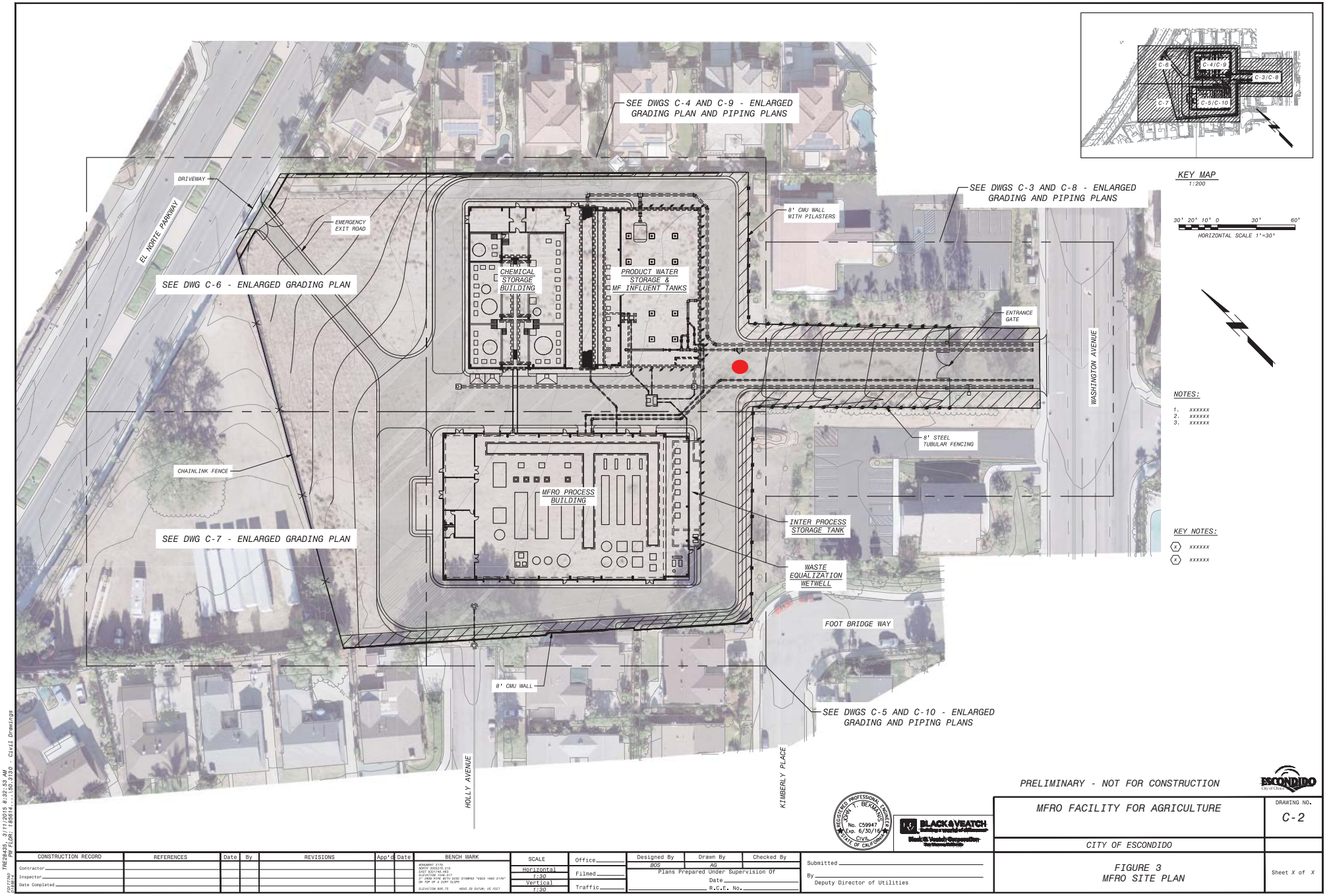
0 0.5 1 2
Miles

N

*Note: DAC as determined by census tract and block group data for the year 2013, from the American Community Survey 2009-2013 5-year results. DAC determined based on definition of median household incomes below 80% of the statewide MHI or $48,875.

Sources: U.S. Census 2013 ACS 5-year estimates; San Diego Association of Governments (SANDAG) - GIS Data Warehouse
Document Path: N:\Projects GIS\0188-003 SDIRWM Plan Update\Prop84_Rnd4\MXD\Project maps\2-9_EscondidoProject29072015_smallpipes.mxd

Figure 2-17: Escondido Advanced Water Treatment for Agriculture - MFRO Site Plan



Project Physical Benefits

The two quantified physical benefits are (1) Water Quality Improvement (mg/L) associated with salt removal and (2) Water Supply (acre feet per year [AFY]) conserved as a result of the water quality improvements. Creating a usable water supply for agricultural users is important given the current ongoing drought and the value of agricultural to the Region's culture and economy. The project would also decrease total salt loading to the local environment by removing this constituent from water that is applied for irrigation purposes.

The water quality improvement benefit comes from reducing the total dissolved solids (TDS) concentration of recycled water that is delivered to agricultural customers through MFRO treatment. The baseline water quality was the existing TDS levels of recycled water currently provided to customers from HARRF (943 mg/L) and the with-project water quality is the anticipated TDS levels of recycled water that will be provided once the project is implemented (486 mg/L). Both of these values were provided in the *Draft MFRO and AWT Facilities: Conceptual Design Memorandum.* **Table 2-39** provides a summary of the resulting change. Note that Escondido has committed to producing blended water with TDS concentration of 500 mg/L, but 486 mg/L was used for this calculation as the approximate average of the values presented in the *Conceptual Design Memorandum* and as described below.

Table 2-39: Primary Physical Benefit – Water Quality
Escondido Advanced Water Treatment for Agriculture

Project Name: *Escondido Advanced Water Treatment for Agriculture*
Type of Benefit Claimed: Water Quality - TDS removed from agricultural water supply
Units of the Benefit Claimed: mg/L
Anticipated Useful Life of Project (years): 60 years

(a)	(b)	(c)	(d)
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2017-2076	943 mg/L	486 mg/L	-457 mg/L

Comments: The magnitude of water quality benefits associated with the project are based on the difference between existing and post-project TDS levels. The anticipated useful life of the project is 60 years, beginning upon completion of the MFRO Facility in mid-2017. The baseline is TDS levels in existing HARRF recycled water supply and the with-project condition is projected TDS levels from the MFRO Facility.

Sources: City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014. Prepared by Black & Veatch.

The water supply benefit is a direct result of water quality improvements that will reduce water waste. Removal of salts from recycled water used for agricultural irrigation will reduce additional water demands associated with salt flushing, because the recycled water provided by the project will have improved water quality and therefore eliminate the need for flushing of the avocado trees' root zone. The water demand for salt flushing is based on a Food and Agriculture Organization of the United Nations Irrigation and Drainage Paper titled *Water Quality for Agriculture* and from a City of Escondido report titled *Water Quality Consideration for Irrigation of Avocados.* Per the City of Escondido report, "irrigation practice is to apply a leaching fraction of 10% to 30% to the crop evapotranspiration needs."[37] The baseline water use was therefore calculated as the amount of Title 22 recycled water supply required to meet the irrigation needs of the plants plus the additional leaching fraction. Plant irrigation needs total 4,440 AFY, and an average 20% leaching fraction (880 AFY) was applied to this value to account for salt flushing. In total, farmers would need to apply 5,320 AFY to their crops if using recycled water from HARRF, rather than 4,400 AFY of blended HARRF and MFRO product water. Cumulatively, over the 60-year life of this project, potable water use would be reduced by 52,580 AF.

[37] City of Escondido. 2015. *Water Quality Consideration for Irrigation of Avocados*. Prepared by Black & Vetch and Brown & Caldwell.

Table 2-40: Secondary Physical Benefit – Water Supply
Escondido Advanced Water Treatment for Agriculture Project

Project Name: *Escondido Advanced Water Treatment for Agriculture* **Type of Benefit Claimed:** Water Supply – water conserved by avoiding salt flushing **Units of the Benefit Claimed:** AFY **Anticipated Useful Life of Project (years):** 60 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2017	2,660 AFY	2,220 AFY	-440 AFY
2018-2076	5,320 AFY	4,440 AFY	-880 AFY
Comments: Water savings comes from TDS removal, thereby allowing for efficient use of irrigation water and avoidance of salt flushing. The project is anticipated to be completed in mid-2017, resulting in 50% the total water supply benefit for 2017, and full benefits for every year thereafter through the 60-year life of the project. The baseline is existing agricultural demands projected to be served by HARRF if salt flushing is necessary, and the with-project condition is the reduced demands necessary if TDS levels are reduced and additional supply is no longer needed for salt flushing (i.e., irrigation only used to meet plant's evapotranspiration needs). Sources: City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014. Prepared by Black & Veatch. City of Escondido. 2015. *Water Quality Consideration for Irrigation of Avocados*. Prepared by Black & Veatch and Brown & Caldwell.			

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

One of the major stressors to the agricultural community Escondido is salinity in their available water supplies. Salinity is known to impact certain salt-sensitive crops, including avocados.[38] Salt loading is an increasing issue in current drought conditions, wherein the Region's imported water sources are primarily comprised of high-salinity Colorado River water due to shortages and restrictions associated with State Water Project (SWP) water.[39] Salinity in local water sources threatens the longevity of agricultural operations in drought conditions, because additional water is required to flush soils. This soil flushing is particularly challenging in times when water is scarce, water rates have increased, and future water availability is uncertain. Research by the Food and Agriculture Organization of the United Nations demonstrates that when higher salinity water is applied to salt-sensitive crops, approximately 20% more water is applied to the crops to enable salt flushing. [40]

The second major stressor to the agricultural community is water availability. On May 14, 2015, the San Diego County Water Authority (SDCWA) implemented water supply restrictions associated with the drought. These restrictions included a supply allocation for agricultural users paying the Transitional Special Agricultural Water Rate (TSAWR). Agricultural users that participate in the TSAWR are exempt from paying storage and other charges from SDCWA, and in exchange receive a lower level of water service during water shortages or emergencies.[41] Most of the commercial growers located within Escondido pay the TSAWR and are therefore under allocation restrictions; the current allocation is 2,750 AFY, which is 15% less than deliveries received in

[38] Gustafson, C.D. 1962. *The Salinity Problem in Growing Avocados.* Available: http://www.avocadosource.com/CAS_Yearbooks/CAS_46_1962/CAS_1962_PG_100-105.pdf
[39] Murphy, Susan. 2014. *San Diego Diversifies Water Supplies, But Increases Reliance on Colorado River.* Available: http://www.kpbs.org/news/2014/mar/11/colorado-river/
[40] Water Quality for Agriculture by R. S. Ayers and D.W. Westcott, Food and Agriculture Organization of the United Nations Irrigation and Drainage Paper, 29 Rev.1, 1994
[41] San Diego County Water Authority. 2012. *Water Authority Extends Temporary Agricultural Water Rebate Program for Two Years.* Available: http://www.sdcwa.org/water-authority-extends-temporary-agricultural-water-rate-program-two-years

2014.[42] Given water reliability issues and associated water restrictions with water purchased from SDWCA (largely imported water), agricultural users in Escondido have become increasingly interested in using recycled water to increase water reliability. However, the use of recycled water presents the agricultural users with salinity issues, because recycled water generally contains greater levels of salts and chlorides compared to potable water. While recycled water can provide a reliable local water source for agricultural users, especially in times of drought, this water source is not sustainable on a long-term basis if it contains salinity levels that threaten the health of crops.

Escondido currently has a recycled water program, and delivers tertiary-treated recycled water that meets requirements of Title 22 of the California Code of Regulations to customers. Recycled water in the City of Escondido is currently produced at the HARRF, an 18 mgd wastewater treatment facility that currently produces 3 mgd of recycled water for landscape and industrial use.[43] The City has been actively undergoing efforts to expand its recycled water facilities and maximize reuse of water produced at HARRF.

In April 2014, the City of Escondido City Council voted to approve a $290 million project to implement the Recycled Water and Potable Reuse Program (Reuse Program) in the City of Escondido, which would dramatically increase reuse within the City's service area and maximize use of local supplies. The Reuse Program is multi-phased and planned to be implemented over a 20-year period.[44] In general, the Reuse Program includes the following components, which are summarized below and shown on the **Figure 2-18**:

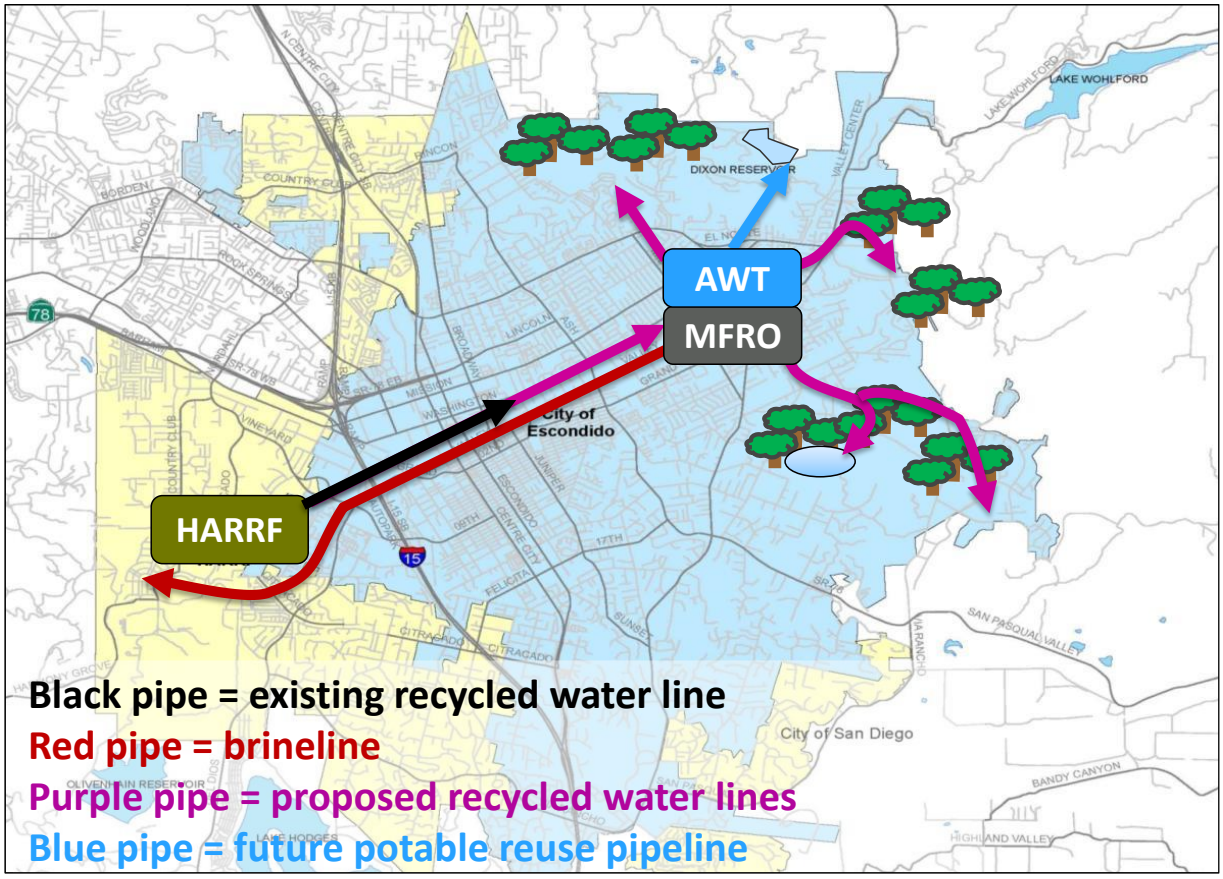
1. Pipeline extension from the existing recycled water system to a decentralized MFRO Facility
2. A brine reject waste return pipeline (brineline) from the MFRO Facility to HARRF
3. New recycled lines to deliver water from the MFRO Facility to agricultural users
4. Full-scale advanced water treatment (AWT) facility and distribution pipelines to Dixon Reservoir for future potable reuse

Given the long-term nature of this program, the City intends to implement the Reuse Program in multiple phases that build upon one another and address high-priority issues first. The initial phase includes implementation of the MFRO Facility for agricultural users. The AWT Facility will be implemented during a later phase after successful operation of the MFRO Facility and further development of potable reuse regulations for surface water augmentation.[45]

Construction and operation of the MFRO Facility to deliver advanced-treated recycled water to agricultural customers is considered a priority step of the Reuse Program, because it will help to ensure the longevity and sustainability of agricultural operations in Escondido. The San Diego Region has a long history of agriculture, which is an important part of San Diego's history and cultural and is also an important part of the local economy. In 2013 alone, it is estimated that the value of agriculture in San Diego County totaled $1,850,307,291.[46] Agricultural value is significant in the City of Escondido, which contains a large portion of the Region's avocado crops; local estimates demonstrate that avocado crop revenues in the City of Escondido exceeded $40 million and that a large portion of this revenue was spent locally, making agriculture a significant contributor to the City's economy and local food production.[47] The City recognizes the importance of agriculture to its local economy, and has partnered with a local agricultural group, the Escondido Growers for Agricultural Preservation (EGAP), to implement the *Escondido Advanced Water Treatment for Agriculture* project in a way that addresses the two major stressors to the agricultural community described above.

[42] Escondido Growers for Agricultural Preservation (EGAP). 2015. *SDCWA Water Cut Back & Penalties.* Available: http://growescondido.org/blog/
[43] City of Escondido. 2011. *City of Escondido 2010 Urban Water Management Plan.*
[44] City of Escondido. 2014. *City Council Update – Recycled Water and Potable Reuse Program, April 2, 2014.*
[45] City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014.
[46] County of San Diego. 2013. *2013 Crop Statistics and Annual Report.* Available: http://www.sandiegocounty.gov/content/dam/sdc/awm/docs/2013%20Crop%20Report%20-%20Copy.pdf
[47] Escondido Growers for Agricultural Preservation (EGAP). 2015. Escondido's Ag History. Available: http://growescondido.org/purpose/the-egap-mission/

Figure 2-18: City of Escondido Proposed Water Reuse Program Schematic



Graphic of City of Escondido Reuse Program from *City Council Update – Recycled Water and Potable Reuse Program.* The MFRO would be funded under this Proposal, while the other components of the Water Reuse Program would be funded separately.

Cumulatively, the issues of salinity and the need for reliable local water supplies have led the City to propose constructing the MFRO Facility as a first step in the Reuse Program. The MFRO Facility will be designed to meet long-term agricultural water demands of 4,440 AFY and also to reduce constituents of concern for agricultural users to improve productivity and reduce water waste.[48] A *Feasibility Study* was prepared for the Reuse Program, which evaluated water quality requirements for the City's agricultural users, with an emphasis on avocado production as one of the most important crops in Escondido. The Feasibility Study analyzed the quality of recycled water that is currently produced at HARRF and determined agricultural water quality objectives for the MFRO Facility, establishing limits for water quality parameters that, if exceeded, would diminish crop productivity.[49] Further, a *Conceptual Design Memorandum* analyzed the projected water quality that would be produced from implementation of MFRO considering the quality of product water (from HARRF). **Table 2-41** shows an overview of the existing water quality of recycled water from HARRF, target agricultural water quality objectives, and projected water quality results from implementation of MFRO technology.

[48] City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014. Prepared by Black & Veatch.
[49] City of Escondido. 2014. *Potable Reuse Program. Task 1: Feasibility Study*. August, 2014.

Table 2-41: Existing and Proposed Water Quality Parameters

Water Quality Constituent	Average Existing Quality at HARRF (mg/L)	Agricultural Water Quality Objectives (mg/L)	Projected MFRO Water Quality (mg/L)
Total Dissolved Solids (TDS)	923	540-600	38
Chlorides	188	80-100	8

Source: City of Escondido. 2014. *MFRO Facility Water Quality Data*. Available: http://growescondido.org/wp-content/uploads/mfro-facility-water-quality-data.pdf

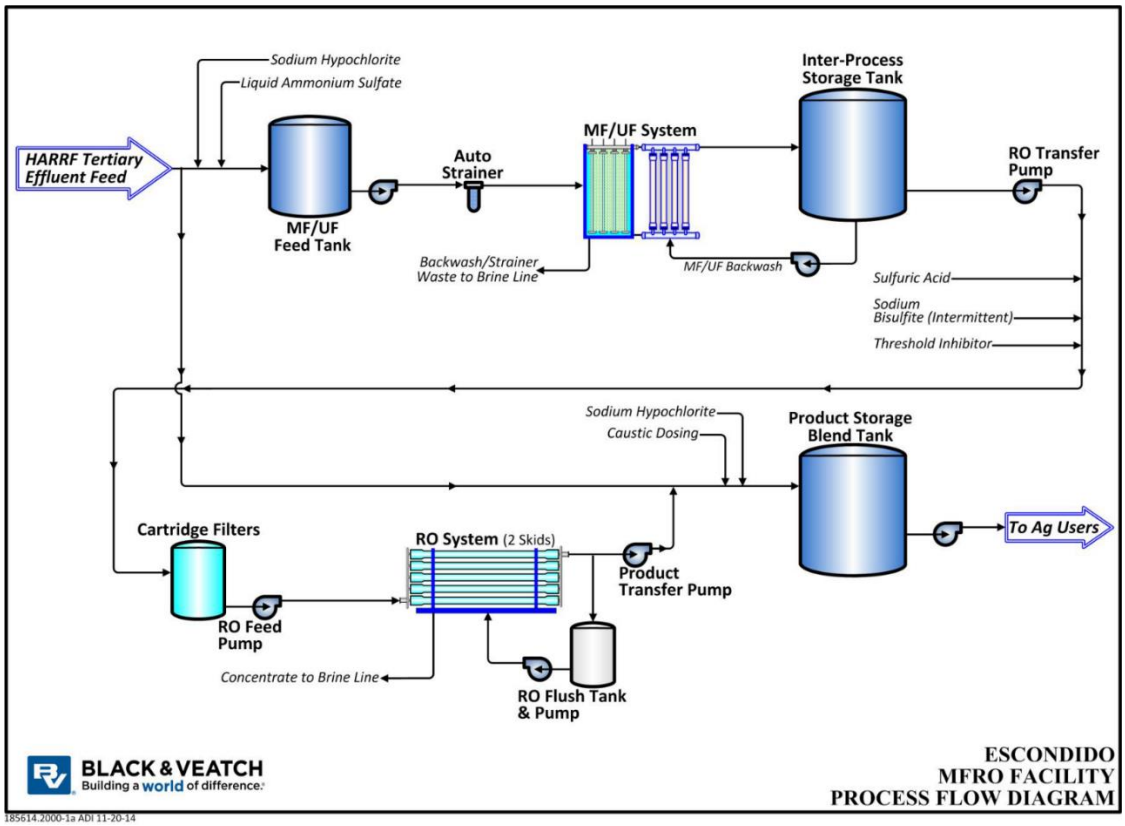
As shown in **Table 2-41**, due to the effectiveness of MFRO technology (and the ability of the RO process to remove salts), the MFRO system would be able to substantially reduce both TDS and chlorides from the HARRF product water, at levels well below what is required for agricultural operations. The treatment provided by the MFRO is highly effective, but is also expensive, as it requires a substantial amount of energy to operate. Therefore, the City will treat a portion of the water used for agricultural reuse with MFRO technologies and then blend that product water with HAARF tertiary treated water to a level that meets agricultural standards. In total, the facility will utilize MFRO technologies sized for a total production capacity of 2.0 million gallons per day (mgd), producing 2,240 AFY of water. The remaining 2,200 AFY of demands will be met with recycled water from HARRF to fulfill the total agricultural demand of 4,440 AFY. Recycled water from HARRF will be blended with MFRO treated product water on-site at the MFRO Facility prior to delivery; this operational strategy will maximize reuse of recycled water, ensure water quality objectives are met, and reduce operational costs.[50] **Figure 2-19** shows a schematic of a process flow diagram that illustrates the treatment train and blending proposed for the *Escondido Advanced Water Treatment for Agriculture* project.

While the MFRO Facility will provide immediate benefits associated with water supply, water quality, and support for the local agricultural community, it will also set the City of Escondido up for implementation of the full-scale Reuse Program that is anticipated to provide approximately 8,000 AFY of new supply through IPR via surface water augmentation at Dixon Reservoir. Water quality and systems testing at the MFRO Facility will allow the City of Escondido to monitor and project water quality for future use at the AWT and potential introduction into the Dixon Reservoir.[51]

On a long-term basis, the Reuse Program is anticipated to not only resolve local issues associated with water supply reliability, but is also designed to offload flows from HARRF. Currently, secondary-treated wastewater that is treated at HARRF and not recycled is disposed of to the Pacific Ocean via a 14-mile long land outfall pipeline that connects to an ocean outfall pipeline near San Elijo Lagoon (the San Elijo Ocean Outfall).[52] The average daily flow from HARRF is currently 15.6 mgd, and the land outfall pipeline has experienced ongoing capacity issues. One solution that was proposed to address capacity issues at the HARRF land outfall is to replace it with a larger land outfall along the entire 18-mile stretch from HARRF to the San Elijo Lagoon; however, this potential solution has not yet been implemented due to its substantial capital cost and issues associated with construction within environmentally sensitive areas along Escondido Creek.[53] Given the uncertainties associated with environmental approvals needed to expand the land outfall and capital anticipated costs, the City of Escondido has extensively analyzed ways to increase reuse to offload flows to HARRF and defer the need to upgrade the land outfall. One of the benefits of the overall Reuse Program is that it is anticipated to defer the need to upgrade the HARRF land outfall until 2050.[54] Therefore, through the Reuse Program, the City Council has elected to move water reuse forward and invest its resources in drought proof water supplies instead of investing additional funding in business-as-usual conditions.

[50] City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014. Prepared by Black & Veatch.
[51] City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014. Prepared by Black & Veatch.
[52] City of Escondido. 2015. *Hale Avenue Resource Recovery Facility.* Available: http://www.escondido.org/harrf.aspx
[53] City of Escondido. 2014. *City Council Update – Recycled Water and Potable Reuse Program, April 2, 2014.*
[54] City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014. Prepared by Black & Veatch.

Figure 2-19: MFRO Facility Process Flow



Process Flow Diagram for City of Escondido MFRO Facility from *Draft MFRO and AWT Facilities: Conceptual Design Memorandum.*

Without-Project Conditions

Without the *Escondido Advanced Water Treatment for Agriculture* project, agricultural users in the City of Escondido would continue to use high-salinity recycled water on crops. Therefore, agricultural operations would continue to use 20% more water than is needed to meet demands, because they would need additional water to flush salt from soils. To meet 4,440 AFY in actual crop-related water demands, 5,320 AFY of recycled water from HARRF would need to be delivered to farmers. Without advanced treatment, additional TDS and chlorides would not be removed from local water sources, and these constituents would continue to impact and potentially damage salt-sensitive crops, as well as watersheds downstream. TDS has been identified as a water quality issue in all watersheds in the San Diego IRWM Region, and the Carlsbad Watershed (where the project is located) has multiple waterbodies on the 303(d) list for TDS.[55] Under these conditions, desalted recycled water produced by the MFRO Facility would not be available and an additional 880 AFY of HARRF recycled water (beyond basic crop needs) would continue to be used for over-irrigation. Without the MFRO Facility, a local recycled water source would not be used efficiently, continuing reliance on imported water and overuse of water to mitigate salt build-up would continue. Furthermore, without the project, HARRF would continue to discharge an average of 15.6 mgd of treated wastewater to the Pacific Ocean and the City of Escondido would not move forward in its efforts to implement the Reuse Program and offset flows to HARRF.

[55] RWMG. 2013. 2013 San Diego Integrated Regional Water Management Plan. September.

Methods Used to Estimate the Physical Benefits

Primary Benefit – Water Quality

The primary benefit of the project is removal of constituents that are known to diminish the productivity of salt-sensitive crops, such as avocados. These constituents include TDS, chloride, sodium adsorption ratio, electrical conductivity, boron, and pH.[56] For purposes of this analysis, the physical benefit that has been quantified is a reduction in TDS; TDS was chosen because it is the primary constituent of concern for salt-sensitive crops. Furthermore, the removal of TDS that will occur from implementation of the project will also reduce salt loading to local groundwater and surface water sources, and will therefore provide broad water quality benefits to the region.

The quantification of this benefit was calculated by analyzing the existing TDS concentration in recycled water provided by HARRF (943 mg/L) and comparing that to the projected TDS concentration in MFRO Facility water that will be distributed to agricultural customers. The MFRO Facility water will be a combination of both recycled water produced at HARRF and desalted water produced by the MFRO Facility; therefore, the water quality of both water sources and their relative magnitude (AFY) were taken into consideration for this analysis.

Design of the facility shows that the capacity of the MFRO Facility will be 2 mgd, and will therefore produce a total of 2,240 AFY of water.[57] With implementation of MFRO treatment, it is anticipated that the product water from the MFRO Facility will have an average TDS concentration of 38 mg/L.[58] The remaining water necessary to meet with-project agricultural water demands of 4,440 AFY will be provided from recycled water produced at HARRF; it is anticipated that 2,200 AFY of recycled water with a TDS concentration of 943 mg/L will be provided for the project. Taking the concentration and water supply contributions of these water sources into account, it is anticipated that the overall TDS levels of water delivered to agricultural users will be 486 mg/L. This number is expected to vary seasonally, but the City has committed to maintaining water quality such that maximum TDS level is 500 mg/L.[59] The anticipated TDS concentration of 486 mg/L is within the range described in the *Conceptual Design Memorandum*, and is considered a reasonable estimate for this analysis. As explained previously, the water quality target for salt-sensitive crops for TDS is 540-600 mg/L, demonstrating that the project will provide water that is suitable for agricultural users and will not require salt flushing. The benefit is the difference between the TDS levels in existing supplies from HARRF (943 mg/L) and the with-project TDS levels of water that will be delivered to agricultural users (486 mg/L), for a total reduction of 457 mg/L.

$$\frac{\left((943\frac{mg}{L} * 2{,}200\ AFY)\ + (38\frac{mg}{L} * 2{,}240\ AFY)\right)}{4{,}440\ AFY} = 486\frac{mg}{L}$$

$$943\frac{mg}{L} TDS\ from\ HARRF - 486\frac{mg}{L} TDS\ from\ MFRO\ blended\ supply = \mathbf{457\frac{mg}{L} TDS\ reduction}$$

Secondary Benefit – Water Supply

The secondary benefit of the project is conservation of 880 AFY of recycled water. The project achieves these water savings through water quality improvements that eliminate the need for wasteful water practices, salt flushing, which are necessary to protect crop health. With implementation of the MFRO Facility, the salt (TDS) content of existing available recycled water supplies produced at HARRF will be reduced to meet water quality objectives established for salt-sensitive crops. Data has shown that for some soil types, application of high-salinity water sources requires approximately 20% more water than evapotranspiration demand to enable salt flushing. [60]

Recycled water system planning by Escondido shows that agricultural demands for crop irrigation are 4,440 AFY. Without the project, agricultural customers will irrigate salt-sensitive crops such as avocados with high-salinity

[56] City of Escondido. 2014. *MFRO Facility Water Quality Data*. Available: http://growescondido.org/wp-content/uploads/mfro-facility-water-quality-data.pdf
[57] City of Escondido. 2015. *Draft MFRO Facility for Agriculture: Basis of Design Report*. March 25, 2015.
[58] City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design* Prepared by Black & Veatch.*randum*. November 21, 2014.
[59] Pers. Comm. Jim Rasmus, Black and Veatch (consultant to City of Escondido on this project). 30 July 2015.
[60] R. S. Ayers and D.W. Westcot, Food and Agriculture Organization of the United Nations Irrigation and Drainage Paper, 29 Rev.1. 1994. *Water Quality for Agriculture*. And Brown and Caldwell. 2015. *Water Quality Consideration for Irrigation of Avocados*.

recycled water. Based on research for salt-sensitive crops, it is anticipated that an additional 20% over existing crop demands will be required for salt flushing to protect the productivity of salt-sensitive crops. Therefore, when agricultural users use high-salinity recycled water, they will require an additional 20% above existing demands, for a total demand of 5,320 AFY (4,440 AFY + ~20% 4,440 AFY).

Escondido's *Draft MFRO and AWT Facilities: Conceptual Design Memorandum* and *Draft MFRO Facility for Agriculture: Basis of Design Report* established water quality parameters the project, which will be met by blending MFRO product water with existing recycled water produced at HARRF, to reduce TDS, chlorides, and other constituents that require salt flushing. With implementation of the project, salt flushing will no longer be required and overall demands will remain at 4,440 AFY necessary to meet crop-related water needs. Implementation of the project will conserve approximately 880 AFY of additional recycled water that would have been required for salt flushing. The project will be implemented after the first quarter of 2017; therefore, in 2017 only 75% of total savings will be met. Full-scale project benefits of 880 AFY in conservation will be achieved from 2018 through the 60-year life of the project.

$$5{,}320\ AFY - 4{,}440\ AFY = \mathbf{880\ AFY}$$

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

The physical benefits of the *Escondido Advanced Water Treatment for Agriculture Project* will require several components to be constructed. As explained previously, HARRF is an existing wastewater treatment facility that currently produces tertiary-treated recycled water suitable for irrigation in accordance with Title 22 of the California Code of Regulations. The City of Escondido received a Prop 84-Round 2 IRWM grant (via the North San Diego Water Reuse Coalition) that is supporting construction of pipeline facilities for delivery of recycled water produced at HARRF to the farmers. Facilities that are being constructed with the Round 2 grant include: 1) the recycled water pipeline extension from HARRF to the MFRO Facility site, 2) the brineline from the MFRO Facility site to HARRF, and 3) recycled water distribution pipelines to supply water from the MFRO Facility site to agricultural water users. These facilities are currently being constructed and are therefore not included as part of the *Escondido Advanced Water Treatment for Agriculture* project.

The MFRO Facility site is currently owned by the City of Escondido. Additional work is required at this site and at HARRF to provide project-related benefits. Facilities that need to be constructed to deliver project-related benefits include the additional construction activities described in *Attachment 3, Work Plan* and include yard piping and sitework at the MFRO Facility site, the MFRO process building, an inter-process storage tank, a chemical storage building, product water storage and microfiltration feed tanks, and additional minor improvements at HARRF.

In addition to the proposed project, customers receiving recycled water from the project will need to complete on-site retrofits and permitting in order to connect to the recycled water system. These activities would occur on private property and are the responsibility of individual property owners; costs and work associated with these onsite retrofits are not included as part of the project.

Potential Adverse Physical Effects of the Project and Mitigation

There could be temporary adverse physical effects during construction of the pipelines and MFRO Facility required for implementation of the project. However, the project qualifies for evaluation under a Mitigated Negative Declaration (MND) for CEQA, and would therefore not have any significant and unavoidable physical impacts. 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 expected from project implementation.

In the future, the City of Escondido intends to implement potable reuse projects that route wastewater flows for advanced treatment and ultimate delivery into the potable drinking water system. Continued expansion of the non-potable water distribution system could result in near-term construction-related adverse impacts, and then lie as stranded assets if tertiary treated water is no longer available to customers. However, the City of Escondido has committed to continue MFRO product water deliveries to agricultural customers in order to offset potable demands during the drought and while potable reuse regulations are still being developed and adopted. In the future, this MFRO Facility will become part of the larger Reuse Program.

Long-Term Drought Preparedness

On April 2, 2014, the City of Escondido's City Council endorsed a plan to develop a Reuse Program, which will provide a long-term drought-proof source of water supply. The *Escondido Advanced Water Treatment for Agriculture Project* is an important first step in Escondido's Reuse Program that will provide immediate water conservation and water quality benefits through advanced treatment of recycled water to meet water quality objectives for salt-sensitive crops that are of high economic value to the Region. In addition to providing immediate benefits, the MFRO Facility will also allow Escondido to conduct pilot testing on product water and analyze ways in which Escondido can move forward with surface water augmentation at Dixon Reservoir.

The project directly provides long-term drought preparedness by achieving the following: 1) promote water conservation and recycling 2) improve landscape and agricultural irrigation efficiencies; and 3) achieve long-term reduction of water use. Through the implementation of advanced treatment, Escondido will produce recycled water for agricultural users that meets water quality parameters necessary to ensure the productivity of salt-sensitive crops. The MFRO product water will replace existing demands for recycled water, which has high levels of salinity and chlorides that have been proven to require soil flushing, and will therefore result in conservation of 20% of water over irrigation demands. The advanced treated water will result in long-term conservation and reduced water use as it will eliminate the need for soil flushing. Reducing the need for this water-wasteful practice will also improve agricultural irrigation efficiency. In total, the project will both ensure that a long-term, reliable source of water is available for agricultural users, and will ensure that the quality of this water meets the needs of salt-sensitive crops that are an important part of the Region's local economy.

Furthermore, implementation of this project will move Escondido forward in overall long-term plans to implement IPR, which is anticipated to provide up to 8,000 AFY of locally-produced, drought-proof potable water. The current proposal for IPR in Escondido's service area would be via surface water augmentation at Dixon Reservoir. Regulations are not currently in place for surface water augmentation; however, Escondido is still interested in exploring treatment alternatives and methodologies for meeting anticipated regulatory standards for potable reuse. The MFRO Facility will provide an opportunity for Escondido to conduct advanced treatment pilot testing and determine design parameters that would be necessary to move forward with surface water augmentation.

Direct Water-Related Benefit to DACs

As shown in **Table 7-1**, the *Escondido Advanced Water Treatment for Agriculture* project serves an area that is 49% DAC by population. The project directly addresses two of the urban DAC needs described in *Attachment 7 Disadvantaged Communities:* water rates and food security/irrigation costs[61]. Water rates for agricultural users can impact their ability to maintain farmland, while high irrigation costs can affect the types of foods that DAC residents have access to (either through their ability to grow themselves or through costs to consumers). While all customers are affected by water rates and irrigation costs, these impacts are felt more strongly by DAC residents who have fewer funds with which to accommodate cost increases. U

This project provides direct benefits to water rates, food security and irrigation costs by producing recycled water suitable for agricultural purposes. Recycled water is a drought-proof local supply, meaning it is highly reliable, even in times of drought. In addition, recycled water is generally cheaper for customers than potable water, and conversion to recycled water can result in cost savings to customers. Because the water produced by the *Escondido Advanced Water Treatment for Agriculture* project would be used to irrigate crops, this project will also address food security and irrigation cost issues that are of concern to urban DACs.

Project Performance Monitoring Plan

Benefits of the *Escondido Advanced Water Treatment for Agriculture* project will accrue as described in **Tables 2-39** and **2-40** above. **Table 2-42** describes the methods that will be used to measure the quantified benefits of this project. The City of Escondido will monitor water supply benefits by collecting and reporting monthly output and delivery data for the MFRO Facility. The City of Escondido will also monitor the water quality of the HARRF recycled water to be used for blending and the MFRO product water that is put into the distribution line and sent to agricultural customers.

[61] RWMG. 2013. 2013 San Diego Integrated Regional Water Management Plan. September.

Table 2-42: Project Monitoring for *Escondido Advanced Water Treatment for Agriculture*

Proposed Physical Benefits	Measurement Tools and Methods	Targets
Water Supply	The City of Escondido will collect monthly water production data of water delivered to customers from the MFRO Facility. All water delivered by the project will represent a 20% reduction in total agricultural demands, because this water will be of high enough quality that it does not require soil flushing. The City of Escondido will report to DWR when the MFRO Facility comes online, and will provide an estimation of the water conserved based on how much water is delivered to agricultural customers per year.	4,440 AFY of water delivered (indicating 880 AFY of water conserved)
Water Quality	The City of Escondido will collect monthly water quality data of water delivered to customers from the MFRO Facility; this water will be comprised of a blend of tertiary-treated recycled water produced at HARRF and MFRO product water. The City of Escondido will report to DWR when the MFRO Facility comes online, and will provide an estimation of the water quality improvements achieved from the project by comparing the quality of existing recycled water produced at HARRF and the blended water that will be delivered to agricultural customers. The City of Escondido will also assure that water quality of the blended water falls within the range established for salt-sensitive plants, thereby assuring that the need to flush soils is eliminated.	457 mg/L of TDS removed from product water

Cost Effectiveness Analysis

The *Escondido Advanced Water Treatment for Agriculture* project will achieve two quantifiable physical benefits described in detail in the sections above, and summarized in **Table 2-39 and 2-40**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-43** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-43: Cost Effective Analysis for *Escondido Advanced Water Treatment for Agriculture*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-39 and 2-40.* Water Supply – 880 AFY of water conserved Water Quality Improvement – 457 mg/L of TDS removed from product water
Question 2 Alternatives Considered	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes.
	If no, why? If yes, list the methods (including the proposed project) and estimated costs. The *Conceptual Design Memorandum* completed for the project included an analysis of alternative site plans for the MFRO Facility.[62] These alternatives were considered due to phasing associated with the overall Reuse Program and considering that in a future phase of the program, the AWT Facility (for potable reuse) will be co-located with the MFRO Facility. Alternative site plan layouts were based on preliminary equipment, storage and building footprint requirements and other site considerations.

[62] City of Escondido. 2014. *Draft MFRO and AWT Facilities: Conceptual Design Memorandum*. November 21, 2014. Prepared by Black & Veatch.

Cost Effective Analysis	
	Alternatives that were considered include: • Alternative 1A: locate the MFRO Facility on the east side of the site • Alternative 1B: locate the MFRO Facility on the west side of the site • Alternative 2A: demonstrates co-location of the MFRO Facility and AWT Facility with the MFRO Facility on the east side of the site • Alternative 2B: demonstrates co-location of the MFRO Facility and AWT Facility with the MFRO Facility on the west side of the site The purpose of the alternative analysis was not to compare costs, but rather, to determine potential feasibility options and evaluate pros and cons of the site location of the MFRO Facility, considering potential co-location with the AWT Facility in the future. The Final Design of the MFRO Facility, which will be completed in November 2015, will select a location for the MFRO Facility based upon cost, access, environmental impacts, and other considerations. The *Conceptual Design Memorandum* demonstrated that the relative costs of the alternative were very similar given the small size of the site. Therefore, the budget included in this Proposal assumes that either 1A or 1B will be constructed, and includes contingency figures to cover construction of either alternative. The *Feasibility Study* for the Reuse Program considered several treatment alternatives for reducing TDS and chloride to levels that would allow agricultural application for salt-sensitive crops. Three types of technologies are typically used for demineralization: ion exchange, RO, or electrodialysis reversal (EDR). The latter two are generally better-suited to reducing TDS than ion exchange. A combined MFRO facility allows for future expansion for potable reuse, and is only slightly more expensive than EDR. MFRO systems also have lower operation and maintenance (O&M) costs compared to EDR. Specific costs were not provided in the Feasibility Study for the selection of MFRO as the preferred alternative, because of the additional benefits provided of flexibility for future potable reuse and the lower O&M costs. The *Basis of Design Report* refined the potential treatment equipment alternatives, noting that the pressurized MFRO membrane configuration was selected due to lower construction cost for at least two reasons: 1) the systems will not require expensive coated steel or stainless steel membrane tanks and 2) for slab on grade construction, the system will not need a taller process structure to enclose the submerged membrane tanks.[63] Additionally, the report noted that new buildings will be designed to be utilitarian, low maintenance, and low in construction cost.
Question 3 Preferred Alternative	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* No, the proposed project is not the least cost alternative. The MFRO approach to TDS treatment was selected despite the slightly higher cost to the EDR alternative because of lower O&M costs and added flexibility for future expansion to potable reuse. Design is currently underway for construction of the MFRO Facility. The *Basis of Design Report* acknowledges that the low-cost alternative for the pressurized microfiltration/ultrafiltration (MF/UF) membrane configuration has been recommended. A site alternative has not yet been decided, but will be decided in the Final Design Plans. Based upon a preliminary assessment of the site, costs for the alternatives are anticipated to be relatively similar. Therefore, ultimate selection of an alternative will be based upon feasibility for access, long-term operation, and environmental considerations.

[63] City of Escondido. 2015. *Draft MFRO Facility for Agriculture: Basis of Design Report*. March 25, 2015. Pg 4-9.

Project 9: Padre Dam Advanced Water Treatment – Phase IA Expansion

Local Project Sponsor: Padre Dam Municipal Water District (Padre Dam MWD)
Partner: Helix Water District, County of San Diego, and City of El Cajon

Project Summary

The project will expand the Ray Stoyer Water Reclamation Facility by 4 mgd to deliver recycled water for irrigation and allow for future potable reuse.

Project Maps

Figure 2-20 shows the *Padre Dam Advanced Water Treatment – Phase IA Expansion* project area, the service areas of the project sponsor, the project facilities and the project's relation to groundwater basins and surface water, disadvantaged communities (DAC) and proposed monitoring locations. **Figure 2-21** shows the proposed layout of the expanded Ray Stoyer Water Reclamation Facility (WRF). **Figure 2-22** shows the recycled water distribution system serving the Fanita Ranch community.

Padre Dam MWD's Ray Stoyer WRF currently treats 2 mgd of wastewater

Project Description

The *Padre Dam Advanced Water Treatment – Phase IA Expansion* will construct an expansion of Padre Dam MWD's Ray Stoyer Water Reclamation Facility (WRF) to produce up to 6 mgd of recycled water, along with a pump station and distribution piping to deliver 0.9 mgd of recycled water for irrigation uses. Padre Dam MWD receives all of its potable water supplies from the San Diego County Water Authority (SDCWA). Water reliability for the San Diego region is threatened by a lack of sufficient local supply. The San Diego IRWM Region has made increasing local supplies a priority for the Region, and set a goal to diversify local water supply portfolio. Increasing recycled water production and use creates a new, drought proof local supply.

Padre Dam MWD currently produces 5 mgd of wastewater within its service area. Of this total, 2 mgd of wastewater is tertiary treated at the Ray Stoyer WRF to produce recycled water, while the rest is discharged into the City of San Diego's collection system to be treated at the Point Loma Wastewater Treatment Plant (WWTP), along with the solids generated at the WRF. The WRF treatment process consists of primary sedimentation, biological phosphorous and nitrogen removal, secondary clarification, and tertiary treatment to produce recycled water. Currently, 1 mgd of recycled water is discharged to the recreational Santee Lakes and 0.8 mgd is delivered to recycled water customers. Through this project, the Ray Stoyer WRF's treatment capacity will be expanded from 2 mgd to 6 mgd, enough to treat 100% of the projected wastewater within Padre Dam MWD's service area by 2040. Expansion of the Ray Stoyer WRF will include the following improvements, all located within the existing plant footprint:

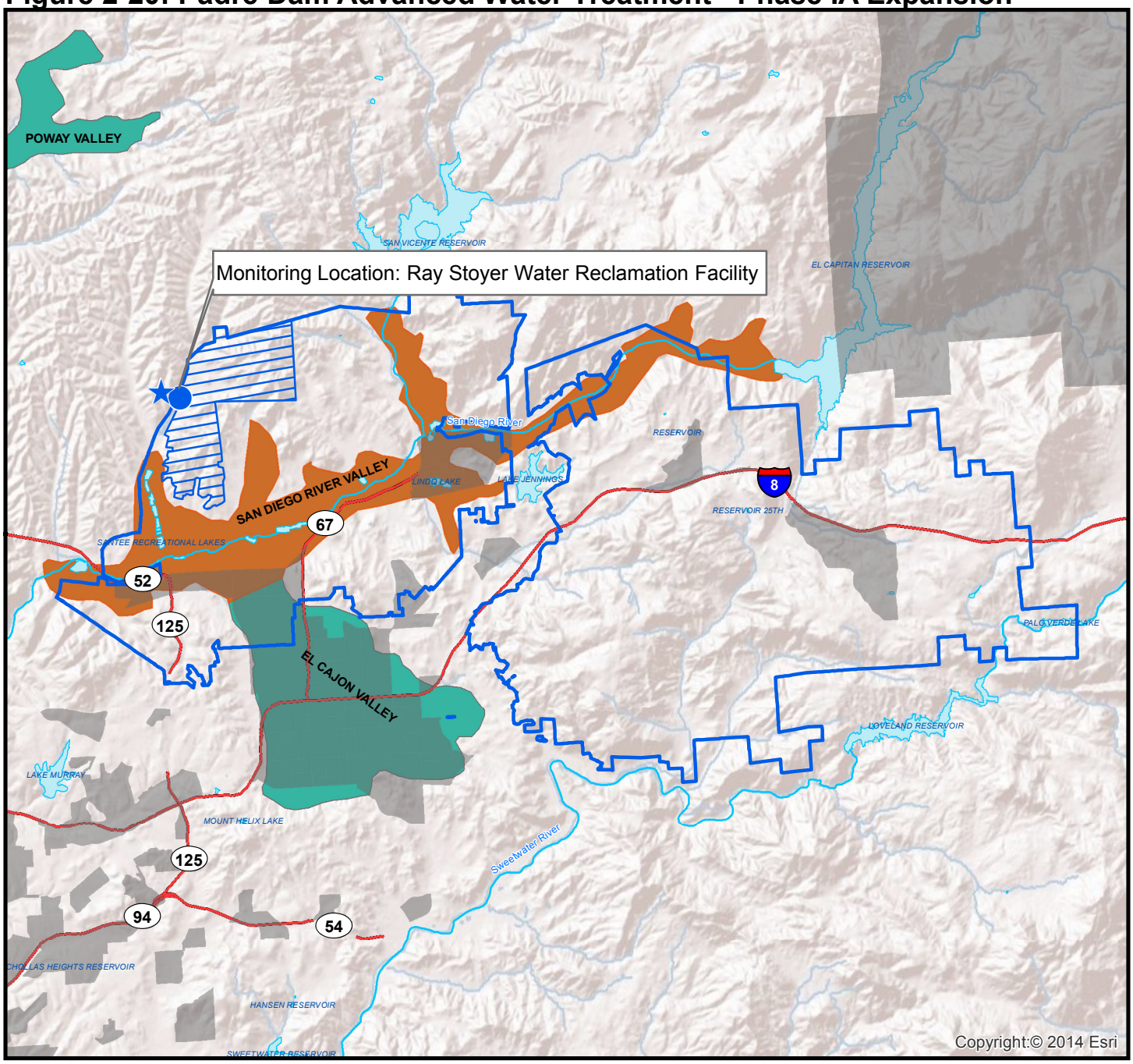
1. The existing Influent Pump Station (IPS) capacity will be increased from 2 mgd to 6 mgd by replacing existing pumps with higher capacity pumps and piping configuration.
2. A new headworks and grit facility will be constructed, and sized for the expansion. Three new primary clarifiers, identical to the two existing clarifiers, will be constructed.
3. The existing biological treatment process will be converted to provide nitrification and denitrification using a Modified Ludzack-Ettinger (MLE) process. The conversion will allow achieving 6 mgd of treatment within the existing secondary treatment process tanks.
4. Existing tertiary treatment train will be expanded by 1 mgd to have a total treatment capacity of to 6 mgd.
5. Sludge and brine produced at Ray Stoyer WRF will be trucked to nearby Sycamore Landfill for final disposal.

Upon completion of the WRF expansion, 0.9 mgd of additional recycled water will be used at Fanita Ranch, which is a 2,600-acre, multiuse planned development located in the northwest portion of the City of Santee, between Fanita Parkway and Cuyamaca Street. The development includes approximately 1,380 single-family residences, and a mix of other land uses including commercial, parks, open space, a 10-acre lake, and a fire station. Padre Dam MWD will provide water, recycled water, and wastewater collection services to the development. Recycled water will be used for the irrigation of the roadway medians, slopes, fire protection zones, and parks, and for lake recharge. Delivery of recycled water to the development will require additional new piping, storage reservoir, and pumping within the development boundary. Pumping capacity of the existing recycled water pump station located within Ray Stoyer WRF will need to be increased, along with pipeline connections to the pump station. These improvements are required to be covered by the developer according to Padre Dam MWD's Recycled Water Policy.[64] No improvements will be required to the existing recycled water pipelines.

Padre Dam MWD has partnered with Helix Water District, County of San Diego, and City of El Cajon to form the East County Regional Water Reuse Program. The objective of the program is to evaluate the feasibility of using the region's recycled wastewater for indirect potable reuse (IPR) as a new source for meeting future water demands. The program will be implemented in two phases. In Phase IA, the program will generate additional recycled water through a WRF expansion. In Phase IB, advanced water treatment will create a new source of potable water via groundwater recharge and extraction for potable use at Santee Basin; this will provide approximately 4% of the East County Regional Water Reuse Program partner's drinking water demand (2.2 mgd). Phase II of the program will increase that potable reuse supply to 24% by adding surface water augmentation at Lake Jennings Reservoir (11.6 mgd). This project also includes conducting a 3-dimensional hydrodynamic and water quality modeling of the reservoir at Lake Jennings. This model will be utilized to determine residence time and mixing for advanced treated water in the reservoir. Results will be used to assess the feasibility of Phase II of the East County Regional Water Reuse Program, which would utilize surface water augmentation for IPR.

[64] *Padre Dam MWD Rules and Regulations SECTION 3 CONSTRUCTION OF WATER AND SEWER SYSTEMS.*

Figure 2-20: Padre Dam Advanced Water Treatment - Phase IA Expansion



Coordinates: 32.88489, -116.99604

Legend

- Freeway
- Waterbody
- DAC Area*
- Medium Priority Groundwater Basin
- Very Low Priority Groundwater Basins
- Ray Stoyer Water Reclamation Facility
- Benefit Area: 9 Padre Dam Advanced Water Treatment - Phase IA Expansion
- Padre Dam Municipal Water District Service Area
- Monitoring Location

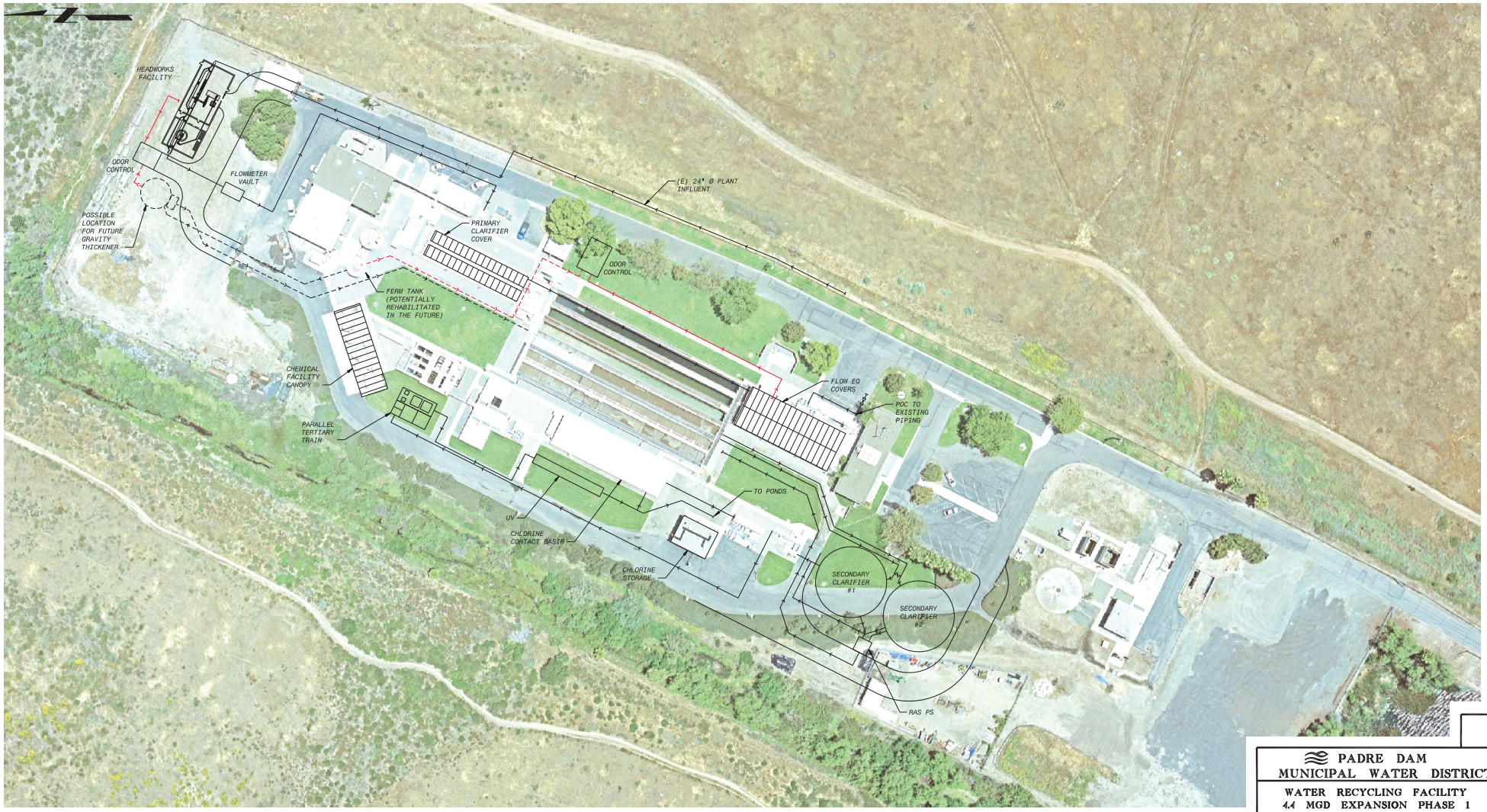
0 1.25 2.5 5
Miles

N

*Note: DAC as determined by census tract and block group data for the year 2013, from the American Community Survey 2009-2013 5-year results. DAC determined based on definition of median household incomes below 80% of the statewide MHI or $48,875.

Sources: U.S. Census 2013 ACS 5-year estimates; San Diego Association of Governments (SANDAG) - GIS Data Warehouse
Document Path: N:\Projects GIS\0188-003 SDIRWM Plan Update\Prop84_Rnd4\MXD\Project maps\2-10_PadreDProject28072015.mxd

Figure 2-21: Ray Stoyer Water Reclamation Facility Improvements - Phase IA



LEGEND:

- PROPOSED FOUL AIR PIPING
- FUTURE FOUL AIR PIPING
- PROPOSED LIQUID PROCESS PIPING
- FUTURE LIQUID PROCESS PIPING

50' 25' 0 50' 100'
1"=50'

Black & Veatch
San Marcos, California

DRAWING REFERENCES:

SIGNATURE OF THESE PLANS IS NOT A COMMITMENT TO SERVE

REV	DATE	DESCRIPTION	BY	APPD

DESIGN BY: SCALE:
DRAWN BY: CHECKED BY:
CONSTRUCTION MANAGER REVIEW: DIRECTOR OF OPERATIONS AND WATER QUALITY REVIEW:
RECOMMENDED BY:

PADRE DAM MUNICIPAL WATER DISTRICT

WATER RECYCLING FACILITY
4.4 MGD EXPANSION PHASE 1

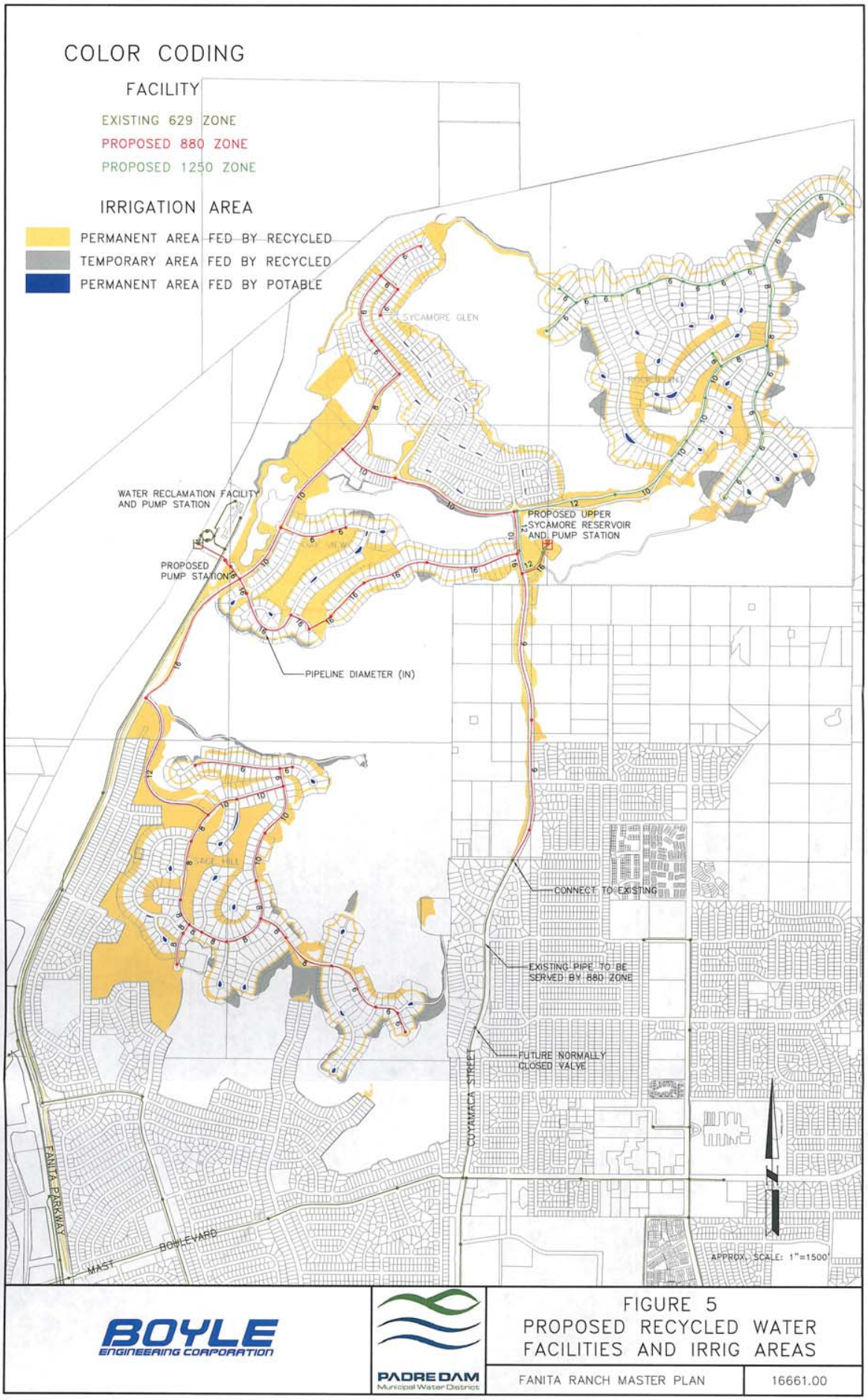
PARALLEL TRAIN MODE

DIRECTOR OF ENGINEERING AND PLANNING DATE
RCE # _____ EXP _____
PLANS VALID FOR ONE YEAR FROM SIGNATURE

210014
JOB NO ID
DRAWING NO
SHEET OF XXX XXX

$$$$$$$$$$$$$$DCNSPEC$$$$$$$$$$$$$$
$$$$$$SYTIME$$$$$$ $DATE$ $$$$$$USER$$$$$$ PEN TBL: $$$$PENTABLE$$$$$

Figure 2-22: Fanita Ranch Development Recycled Water Pipelines



Project Physical Benefits

The two quantified physical benefits are (1) Water Supply in acre feet per year (AFY) and (2) Water Quality improvement for effluent discharge in mg/L. Creating a new source of water is important given the current ongoing drought, in that it is a drought-proof water supply that would fulfill the irrigation water demands of 1,008 AFY. The project would also decrease the total suspended solids (TSS) loading discharged to the Pacific Ocean at Point Loma WWTP.

The water supply benefit results from the expansion of the Ray Stoyer WRF and subsequent delivery of 0.9 mgd to Fanita Ranch. The anticipated useful life of the treatment plant expansion and piping is 60 years. The value of the water supply benefit (1,008 AFY) is based on the *Draft Fanita Ranch Water, Recycled, Water, and Wastewater Master Plan.* Over the course of the project life, this project will supply a total of 60,488 AF of recycled water.

Table 2-44: Primary Physical Benefit – Water Supply
Padre Dam Advanced Water Treatment – Phase IA Expansion

Project Name: *Padre Dam Advanced Water Treatment – Phase IA Expansion* **Type of Benefit Claimed:** Water Supply – Recycled municipal wastewater **Units of the Benefit Claimed:** AFY **Anticipated Useful Life of Project (years):** 60 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2020-2079	0 AFY	1,008 AFY	1,008 AFY
Comments: The operation and delivery of 0.9 mgd of recycled water are anticipated to accrue when the Fanita Ranch development is complete and outdoor areas begin irrigation, which is planned for 2020. This analysis assumes that recycled water delivery to Fanita Ranch (Sycamore Glen, Oak View, and commercial areas) will begin in 2020 and extend for 60 years. Source: Boyle Engineering. *Draft Fanita Ranch Water, Recycled, Water, and Wastewater Master Plan*. October 2006. p10			

The water quality benefit results from the diversion of 0.9 mgd of wastewater effluent from the Point Loma WWTP and subsequent ocean discharge. This benefit is the water quality improvement for the 0.9 mgd that would have been sent to Point Loma WWTP, but is instead being used for irrigation and non-potable uses at Fanita Ranch development. The anticipated life of the project is the same 60 years as for the recycled water system operation. The value of the water quality benefit is based on the *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* (WDR/NPDES Permit).

Table 2-45: Secondary Physical Benefit – Water Quality
Padre Dam Advanced Water Treatment – Phase IA Expansion

Project Name: *Padre Dam Advanced Water Treatment – Phase IA Expansion* **Type of Benefit Claimed:** Water Quality **-** TSS reduction in wastewater discharge **Units of the Benefit Claimed:** mg/L **Anticipated Useful Life of Project (years):** 60 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2020-2079	75 mg/L	0 mg/L	-75 mg/L
Comments: 0.9 mgd of wastewater effluent will no longer reach the Point Loma WWTP once the Fanita Ranch recycled water system is operational, effectively reducing the concentration in that 0.9 mgd of flow from a maximum permitted concentration of 75 mg/L to 0 mg/L. The baseline is the maximum permitted concentration of TSS from the Point Loma WWTP under its current Waste Discharge Requirements (WDRs)/National Pollutant Discharge Elimination System (NPDES). This analysis assumes the diversion will offload Point Loma WWTP starting in 2020 and extend for 60 years. Source: San Diego-Regional Water Quality Control Board. 2009. *Order No. R9-2009-0001, NPDES No CA0107409, 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.* p13			

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

Padre Dam MWD receives 100% of its potable water from the San Diego County Water Authority (SDCWA). The District's total water supplies include 89% imported water from SDCWA and 11% recycled water.[65] All of the supplies from SDCWA are imported from the State Water Project (SWP) and Colorado River. The current drought has reduced allocations from the SWP to 20% for this year, up from 5% last year, and water reliability is a priority for the Region. The *2013 San Diego IRWM Plan* set a goal to diversify the Region's local water supply portfolio. Increasing recycled water production and use creates a new, drought-proof local supply.

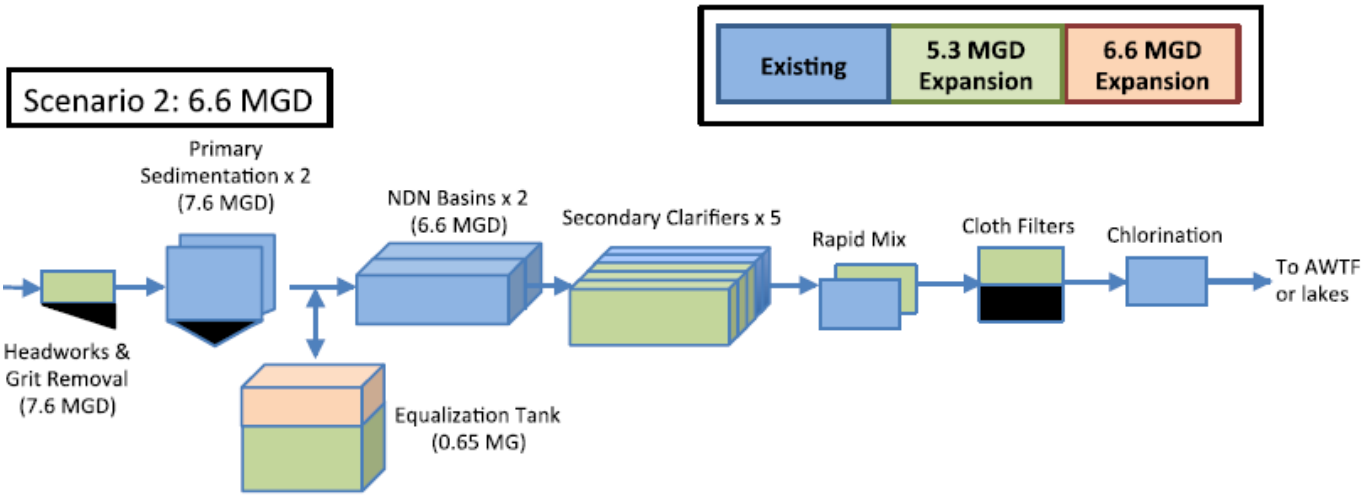
Wastewater collected within the Padre Dam MWD service area, which includes the City of Santee and portions of Lakeside and El Cajon, either flows to the Ray Stoyer WRF or passes through diversion structures that bypass flow to the City of San Diego's Metropolitan Sewer System (Metro System), where it is treated at the Point Loma WWTP and discharged to the Pacific Ocean. The City of San Diego is in the process of negotiating a revised WDR/NPDES permit with the RWQCB to maintain the existing waiver for discharge of primary effluent to the Pacific Ocean with the implementation of their Pure Water Program (potable reuse) that is anticipated to start by 2025. It will be critical for the City of San Diego to reduce wastewater flows to Point Loma WWTP and associated mass emissions to the Pacific Ocean within the timeline expected to be set by the RWQCB in order to avoid significant capital investment (for WWTP upgrades) and successfully implement the Pure Water Program, where up to 83 mgd of new water source would be generated through reservoir augmentation.

The expansion of the Ray Stoyer WRF will enable the Padre Dam MWD to produce and deliver up to 6 mgd of tertiary treated recycled water either to local non-potable customers or to a future IPR project. The *Ray Stoyer WRF Planning Study*,[66] prepared by Padre Dam MWD in 2014, evaluated how much additional flow could be treated by the Ray Stoyer WRF with minimal capital additions and increases in overall plant footprint. The Ray Stoyer WRF currently consists of primary sedimentation, biological nutrient removal (BNR), secondary clarification, and tertiary treatment. The tertiary effluent is discharged to the recreational Santee Lakes, and subsequently to the San Diego River, or sold to recycled water customers. The existing 2 mgd capacity of the facility is limited by strict nutrient removal requirements for live stream discharge. In the future, as Padre Dam MWD wishes to increase their production of IPR water, live stream discharge can be stopped and it may be

[65] Padre Dam MWD. 2011. *2010 Urban Water Management Plan*.
[66] Padre Dam MWD. 2014. *Ray Stoyer WRF Planning Study*. Prepared by Trussell Technologies, Inc.

possible to operate the existing biological basin without phosphorous removal. The two alternatives considered in the *Planning Study* included 1) expansion by retaining the existing BNR process and 2) expansion by converting the existing treatment process to nitrification/denitrification process. In both cases, the addition of bar screens and grit removal chambers prior to primary sedimentation is recommended. Additionally, flow equalization is recommended for both cases to provide constant flow to the BNR basins. The WRF expansion, as proposed in *Attachment 3 Work Plan*, will provide 6 mgd using the Scenario 2 treatment train. **Figure 2-23** shows a flow diagram of the proposed WRF expansion.

Figure 2-23: Flow Schematic of the Expanded Ray Stoyer WRF



Source: Padre Dam MWD. 2014. *Ray Stoyer WRF Planning Study*. Prepared by Trussell Technologies, Inc.

Padre Dam MWD has partnered with Helix Water District, County of San Diego, and the City of El Cajon to form the East County Regional Water Reuse Program. The objective of the program is to evaluate the feasibility of using the East County subregion's recycled wastewater for IPR as a new source for meeting future water demands. The program will be implemented in two phases. With Phase I, the program will generate a new source of potable water via groundwater recharge at Santee Subbasin (San Diego River Valley Groundwater Basin) to provide approximately 4% of the East County Regional Water Reuse Program partners' drinking water demands (2.2 mgd). This Proposal contains Phase IA of the program, which are the initial steps to developing a new source of advanced treated water for the East County. Phase II of the program will increase potable reuse supplies to meet 24% of the partners' demands by adding surface water augmentation at Lake Jennings Reservoir (10.8 mgd).

Although regulatory requirements governing groundwater replenishment with recycled water have been adopted (effective June 2014)[67], the regulatory framework for surface water augmentation is under development by the SWRCB's Division of Drinking Water, to be finalized by December 31, 2016.[68] The general form of the regulations has largely taken shape and provides important direction for potable reuse projects, such as future phases of the *Padre Dam Advanced Water Treatment – Phase IA Expansion*.

The Point Loma WWTP treats wastewater from the City of San Diego's Metro Wastewater System using primary treatment, and operates under a waiver. Given the past concerns regarding the permit, it is anticipated Point Loma WWTP will need to be upgraded to provide secondary treatment. To reduce the challenges and costs of a future upgrade, and/or delay the need for an upgrade, efforts are being made to reduce flows to Point Loma WWTP and to improve the quality of wastewater reaching the plant. This proposed project would offload 0.9 mgd of wastewater flow that is subject to ocean discharge under the waiver.

[67] State Water Resources Control Board. Division of Drinking Water's Recycled Water Information. http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RecycledWater.shtml
[68] State Water Resources Control Board. Division of Drinking Water's Recycled Water Information. http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RecycledWater.shtml

Without-Project Conditions

Without the *Padre Dam Advanced Water Treatment – Phase IA Expansion* project, the Ray Stoyer WRF would not be expanded. As such, the facility would remain at its tertiary capacity of 2 mgd, while continuing to discharge the remaining wastewater produced within the Padre Dam MWD service area into the City of San Diego's Metro System to be treated at the Point Loma WWTP for final discharge to the Pacific Ocean. Without this project, 0.9 mgd wastewater would continue to be conveyed to Point Loma WWTP, and would continue to be treated only to 75 mg/L TSS. Existing recycled water production would remain, with 1 mgd discharged to the recreational Santee Lakes and 0.8 mgd delivered to existing recycled water customers. 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 served by the project. The uncertainty associated with imported water supply reliability makes establishing local water sources imperative. Without this project, the benefits of having 100% recycled wastewater within the Padre Dam MWD service area could not be realized and other local water sources would need to be identified to meet future water needs.

Methods Used to Estimate the Physical Benefits

Primary Benefit – Water Supply

The primary benefit is creating and delivering recycled water supply (0.9 mgd or 1,008 AFY[69]) to be used for non-potable purposes. This recycled water will be created by the increase in capacity of the Ray Stoyer WRF from 2 mgd to 6 mgd of recycled water production.[70] The recycled water demand of 0.9 mgd comes from 641.5 gpm average annual demand for Fanita Ranch irrigation in the *Draft Fanita Ranch Water, Recycled Water, and Wastewater Master Plan*, thereby displacing potable water that would otherwise be used.

The *Master Plan* states that recycled water will be provided by the Ray Stoyer WRF, with a build-out irrigation demand of 2.5 AFY on roadway medians, slopes, fire protection zones, parks, and lake recharge. The proposed project includes recycled water service to the Sycamore pressure zone (880 Zone) only, as the Sycamore Glen, Oak View, and commercial areas will be completed first. The development will provide the required infrastructure improvements to directly connect into the existing recycled water distribution system. The connection will be at two points, one approximately a tenth of a mile from the development at a point off of the Fanita Parkway adjacent to the Ray Stoyer WRF and another on Cuyamaca Street. The Fanita Ranch developer will build the pipeline connections to the existing recycled water pump station located at the Ray Stoyer WRF.

$$0.9\ MGD * \frac{AF}{0.3259\ MG} * \frac{365\ days}{year} = \mathbf{1{,}008\ AFY}$$

Secondary Benefit – Water Quality

Based on the permitted TSS limits for Point Loma WWTP effluent discharge to the Pacific Ocean, the secondary benefit is a water quality improvement (-75 mg/L of TSS[71]) of 0.9 mgd wastewater effluent discharges from Padre Dam MWD to Point Loma WWTP. The 0.9 mgd of recycled water would be distributed to Fanita Ranch has an associated reduction in 0.9 mgd flow to the City of San Diego's Metro Wastewater System which ends up treated at the Point Loma WWTP for final discharge to the Pacific Ocean. According to the effluent limitations contained in the Point Loma WWTP's current WDR/NPDES Permit (Order No. R9-2009-0001), the monthly average TSS concentration in effluent to the Pacific Ocean is 75 mg/L and annual average TSS loading is 13,599 metric tons per year. Offloading 0.9 mgd of wastewater from Point Loma WWTP would reduce Padre Dam MWD's contribution of discharges to the Pacific Ocean by 0.9 mgd at a TSS concentration of 75 mg/L. This reduction is important for the region as the City of San Diego is in the process of negotiating a revised WDR/NPDES permit with the RWQCB to maintain the existing waiver for discharge of primary effluent to the Pacific Ocean with the implementation of their Pure Water Program (potable reuse). It will be critical for the City of San Diego to reduce wastewater flows

[69] Boyle Engineering Corporation. *Draft Fanita Ranch Water, Recycled Water, and Wastewater Master Plan*. October, 2006.
[70] Padre Dam MWD. *Padre Dam Water Recycling Facility Expansion Project, Phase 1: Basis of Design Workbook*. August, 2012. Prepared by Black & Veatch.
[71] San Diego-Regional Water Quality Control Board. 2009. *Order No. R9-2009-0001, NPDES No CA0107409, 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.*

to Point Loma WWTP and therefore to reduce TSS mass emissions to the Pacific Ocean within the timeline expected to be set by the RWQCB in order to successfully implement the Pure Water Program.

$$75\frac{mg}{L} reduction\ in\ TSS\ for\ 0.9\ mgd\ no\ longer\ discharged\ from\ Point\ Loma\ WWTP\ to\ the\ Pacific\ Ocean$$

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

The physical benefits of the *Padre Dam Advanced Water Treatment – Phase IA Expansion* will require construction of all the project components. The existing Influent Pump Station (IPS) pumping capacity will be increased from 2 mgd to 6 mgd by replacing existing pumps will be replaced with higher capacity pumps to provide total pumping capacity of 6 mgd. A new headworks and grit facility will be constructed, and sized for the expansion. Three new primary clarifiers, identical to the two existing clarifiers, will be constructed. The existing biological treatment process will be converted to provide nitrification and denitrification using a MLE process. Existing tertiary treatment train will be expanded to generate additional 1 mgd of recycled water. Screenings removed at the Ray Stoyer WRF will be trucked to nearby Sycamore Landfill for final disposal. Sludge produced at the facility will continue to be discharged in the City of San Diego's Metro Wastewater System and treated at the Point Loma WWTP. Design, permitting, and construction of these project components will be completed.

Delivery of recycled water to Fanita Ranch will require additional new piping and pumping within the development boundary. These improvements are required to be covered by the developer according to Padre Dam MWD's Recycled Water Policy.[72] Padre Dam MWD has completed the *Draft Fanita Ranch Water, Recycled Water, and Wastewater Master Plan* identifying needed system improvements to serve the development. All agreements and policies are in place for the water use agreements between Padre Dam MWD and Fanita Ranch.

Potential Adverse Physical Effects of the Project and Mitigation

There may be temporary environmental impacts during expansion of the Ray Stoyer WRF and other project components. Noise, air quality, and traffic impacts could result from construction activities. Mitigation measures included in the Mitigated Negative Declaration will address all of these potential concerns and ensure that the project will not have a significant impact on the environment.

Diversion of wastewater flows from the Metro System could have unforeseen impacts on the City of San Diego's Pure Water Program, however, as facility sizing is currently underway based on existing and projected flows in that system. Construction of reservoir augmentation facilities and conveyance piping will need to consider the future 10.8 mgd diversion expected with the East County Regional Water Reuse Program.

In the future, Padre Dam MWD intends to implement potable reuse projects that route wastewater flows for advanced treatment and ultimate delivery into the potable drinking water system. Continued expansion of the non-potable water distribution system could result in near-term construction-related adverse impacts, and then lie as stranded assets if tertiary treated water is no longer available to customers. However, Padre Dam has committed to continue recycled water deliveries to its customers in order to offset potable demands during the drought and while potable reuse regulations are still being developed and adopted. In the future, this Ray Stoyer WRF expansion will become part of the larger Reuse Program.

Long-Term Drought Preparedness

This project will promote long-term drought preparedness by helping to achieve three methods in Table 1 of the *2015 Guidelines*: recycling, reuse, and development of a potential new local potable water source via potential future surface water augmentation at Lake Jennings. The project will increase recycled water use by providing 0.9 mgd recycled water to the Fanita Ranch Development, offsetting potable demands for irrigation and other non-potable purposes. Both of these actions contribute to long-term drought preparedness by diversifying local water supplies and offsetting potable supplies, which are 100% imported supplies in the Padre Dam MWD service area. A diversified water supply helps to provide a buffer against impacts from potential reductions in imported water delivery. Unlike local surface water, recycled water is a drought-proof supply, and would be available even during times of drought.

[72] *Padre Dam MWD Rules and Regulations SECTION 3 CONSTRUCTION OF WATER AND SEWER SYSTEMS.*

Direct Water-Related Benefit to DACs

The *Padre Dam Advanced Water Treatment – Phase IA Expansion* project will indirectly address DAC needs in the areas of affordable water costs and lack of information about water, though the project area is only 11% DAC by population (see **Table 7-1** in *Attachment 7 Disadvantaged Communities*). Increases in water rates can disproportionately affect DACs compared to non-DACs within Padre Dam MWD's service area because they have fewer financial resources to accommodate increases to the costs of basic needs – in this case water. As identified in the *2013 IRWM Plan*, outreach efforts may not reach DACs, and extra effort should be made to ensure that outreach and education is also provided to DACs and their residents. Water rate benefits will be realized because the project will increase local water supply reliability, which helps to protect against water rate increases associated with the need for expensive water supply alternatives. Outreach efforts for this project will be directed to everyone served by Padre Dam MWD, including DAC residents. However, because this outreach will not be targeted specifically to DACs, the outreach benefit is considered indirect.

Project Performance Monitoring Plan

Benefits of the *Padre Dam Advanced Water Treatment – Phase IA Expansion* project will accrue as described in **Tables 2-44** and **2-45** above. **Table 2-46** describes the methods that will be used to measure the quantified benefits of this project. Padre Dam MWD will monitor water supply benefits by collecting and reporting monthly recycled water meter data for Fanita Ranch. Padre Dam MWD will report water quality benefits by calculating the reduction in wastewater effluent to Point Loma WWTP and the TSS concentration of ocean discharges.

Table 2-46: Project Monitoring for *Padre Dam Advanced Water Treatment – Phase IA Expansion*

Proposed Physical Benefits	Measurement Tools and Methods	Targets
Water Supply	Padre Dam MWD will provide monthly recycled water water meter data for Fanita Ranch common areas, including roadway medians, slopes, fire protection zones, parks, and lake recharge. Padre Dam MWD will report on when each new meter comes online and begins irrigation.	0.9 mgd (1,008 AFY)
Water Quality Improvement	Padre Dam MWD will provide effluent water quality (TSS) data for ocean discharges from Point Loma WWTP, along with flow monitoring data for wastewater effluent sent to the Metro System. This will be used, in concert with recycled water supplied to customers by the expanded Ray Stoyer WRF, to calculate the reduction in TSS concentration discharged to the Pacific Ocean attributable to this project.	75 mg/L reduction in TSS (Note: TSS concentration may fluctuate based on Point Loma WWTP treatment performance)

Cost Effectiveness Analysis

The *Padre Dam Advanced Water Treatment – Phase IA Expansion* project will achieve two quantifiable physical benefits described in the sections above, and summarized in **Table 2-44 and 2-45**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-47** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-47: Cost Effective Analysis for *Padre Dam Advanced Water Treatment – Phase IA Expansion*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-44 and 2-45.* Water Supply – 1,008 AFY of recycled water Water Quality – 75 mg/L TSS removed from ocean discharge
Question 2 Alternatives Considered	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why? If yes, list the methods (including the proposed project) and estimated costs. The *Ray Stoyer WRF Facility Planning Study* was completed in July 2014.[73] The purpose of this study was to determine the maximum expansion capacity of the WRF within its current footprint. Two WRF expansion alternatives were evaluated: 1) expansion by retaining the existing BNR process and 2) expansion by converting the existing treatment process to MLE process. No project cost estimate was performed as part of this study because this was a capacity/ footprint-focused feasibility study rather than a cost-based feasibility study.
Question 3 Preferred Alternative	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* The proposed project is the least cost alternative. The *Ray Stoyer WRF Facility Planning Study* determined that Alternative 1 achieves a maximum treatment capacity of 5.3 mgd, while Alternative 2 achieves 6.6 mgd within the existing WRF footprint. Alternative 2 was selected for the proposed project since 6 mgd of treated water required for the proposed project can be produced with Alternative 2 within the existing WRF boundary. Alternative 2 allows the Padre Dam MWD to expand treatment capacity of the existing WRF without expanding the treatment plant footprint by using the existing concrete structures with some mechanical modifications and adding more tankage. This is the more cost-effective option as compared to Alternative 1 where additional land purchase would be required in addition to comparable process improvements.

[73] Padre Dame MWD. 2014. *Ray Stoyer WRF Planning Study*. July. Prepared by Trussell Technologies.

Project 10: Safari Park Drought Response and Outreach

Local Project Sponsor: Zoological Society of San Diego
Partner: San Diego Unified School District and San Diego County Office of Education

Project Summary

The project will achieve potable water savings through turf conversion and expansion of existing wastewater treatment facility to reclaim and reuse wastewater at Safari Park.

Project Maps

Figure 2-24 shows the *Safari Park Drought Response and Outreach* project area, the service areas of the project sponsor, the project facilities and the project's relation to groundwater basins and surface water, disadvantaged communities (DACs) and proposed monitoring locations. **Figure 2-25** shows where each type of irrigation conversion will occur at the Safari Park, along with the location of the turf conversion.

Water education programs are provided to local schools at the Safari Park

Safari Parks' existing wastewater treatment plant

Irrigation conversions have been installed in much of the Safari Park already

Project Description

The *Safari Park Drought Response and Outreach* project will achieve potable water savings through turf conversion and associated irrigation efficiencies, and expand the existing wastewater treatment facility to reclaim and reuse wastewater for non-potable use at the Safari Park. The project will offset 72 acre-feet per year (AFY) potable water, and improve water quality returned to the San Pasqual Valley Groundwater Basin.

Founded in 1916, the not-for-profit Zoological Society of San Diego (Zoological Society) is a conservation organization dedicated to the science of saving endangered plant and animal species worldwide. As the largest zoo-based multidisciplinary research organization in the world, the Zoological Society operates three world-class facilities: San Diego Zoo; San Diego Zoo Safari Park; and San Diego Zoo Institute for Conservation Research. Together, these facilities are home to 4,000 rare and endangered animals representing more than 800 species and more than 700,000 exotic plants. More than 5 million people visited the Zoo and Safari Park in 2014, with an economic impact on the San Diego region at nearly $900 million in 2014.

The Safari Park is a 1,800 acre leasehold from the City of San Diego, generally surrounded by open space to the north end and agricultural-zoned land to the south.[74] The Safari Park contains several animal enclosures, botanical gardens, visitor attractions, and research facilities. The major attraction for Park visitors is the Africa Tram tour. A 30 minute expedition around the large African animal habitats in an open-air, covered vehicle along a 2.4 mile, 13-ft wide roadway. These free-range habitats house antelopes, giraffes, buffalo, cranes, and rhinoceros. The tram tour exposes the visitors to the natural habitat of the majority of the Park's diverse animal species.

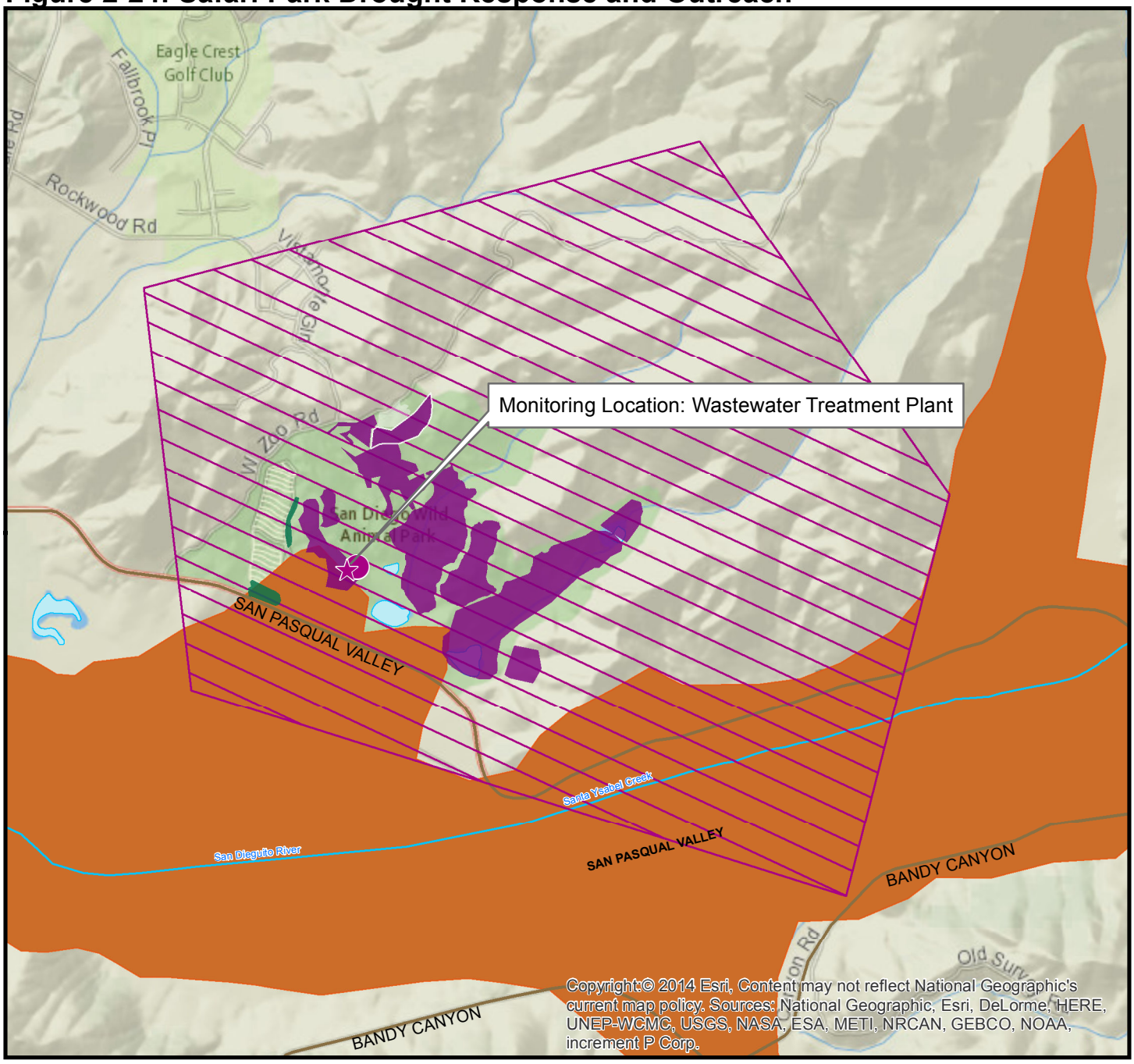
The Zoological Society is committed to protecting the San Diego Region's valuable water resources through the implementation of projects that will improve water quality and reduce local water consumption. The project goal is to eliminate the need for imported potable water at Safari Park to irrigate--a direct response to California Governor Jerry Brown's mandate to cut water consumption by 25%. This project will save 72 AFY at the Safari Park by:

1) *Removing 2.9 acres of irrigation intensive turf area and replacing it with themed water-wise landscaping* – turf removal will be focused in areas with high visibility to best communicate the Zoological Society's commitment to a conservation ethic.
2) *Upgrading the existing on-site wastewater treatment plant (WWTP) from secondary to tertiary treatment* – this upgrade would enhance process treatment for the current average discharge rate of 0.075 million gallons per day (mgd), with the ability to expand tertiary treatment capacity in the future to 0.150 mgd. Both domestic sewage and surface pond water would be treated using membrane treatment for exhibit and irrigation use.
3) *Connecting existing effluent producing areas to the upgraded system* – the WWTP expansion will be designed to accept pumped flows from the Heart of Africa (HOA) Pond and the South Africa Pond during "off-peak" periods for reducing solids and sulfates in the pond water.
4) *Constructing new pipelines and pumps to distribute tertiary-treated recycled water within the Park* – treated water will be reused either for irrigation on portions of the Park that currently use potable water, or for direct return back to the HOA and South Africa Ponds with the intent of improving the pond water quality and animal health.
5) *Increasing storage and management of the newly tertiary treated water* – the surface elevation of the Reclamation Pond will be increased to better manage recycled water for irrigation.

This project will enable the Safari Park to become more sustainable, cost-effective, and energy efficient. By tertiary treating wastewater at the Park, the project would improve the quality of water that flows back into the San Pasqual Valley Groundwater Basin and Hodges Reservoir by removing bacteria, dissolved, and suspended solids. This project will provide water conservation messaging and outreach to more than 5 million annual guests to the Safari Park, members of the Zoological Society, thousands of students and teachers at hundreds of disadvantaged San Diego County schools, and more than 23 million online visitors. The Zoological Society will partner with the San Diego Unified School District to provide hands-on water education and conservation programs to 48,850 students from disadvantaged schools throughout San Diego County through the Save Our Aquatic Resources (SOAR) Program and the Price Watershed Program. The Zoological Society also will offer an extensive outreach program, including tours, to various stakeholders, including disadvantaged community groups, non-profit organizations, water agencies, and community and agricultural groups.

[74] The Zoological Society of San Diego. 2006. *San Diego Wild Animal Park Draft Water Master Plan*.

Figure 2-24: Safari Park Drought Response and Outreach



Coordinates: 33.09649, -116.99831

Legend

- Waterbody
- Major Roads
- DAC Area*
- Medium Priority Groundwater Basin
- Benefit Area: 10 Safari Park Drought Response and Outreach
- Safari Park Wastewater Treatment Plant
- Safari Park Irrigation Conversions
- Safari Park Turf Replacement
- Monitoring Location

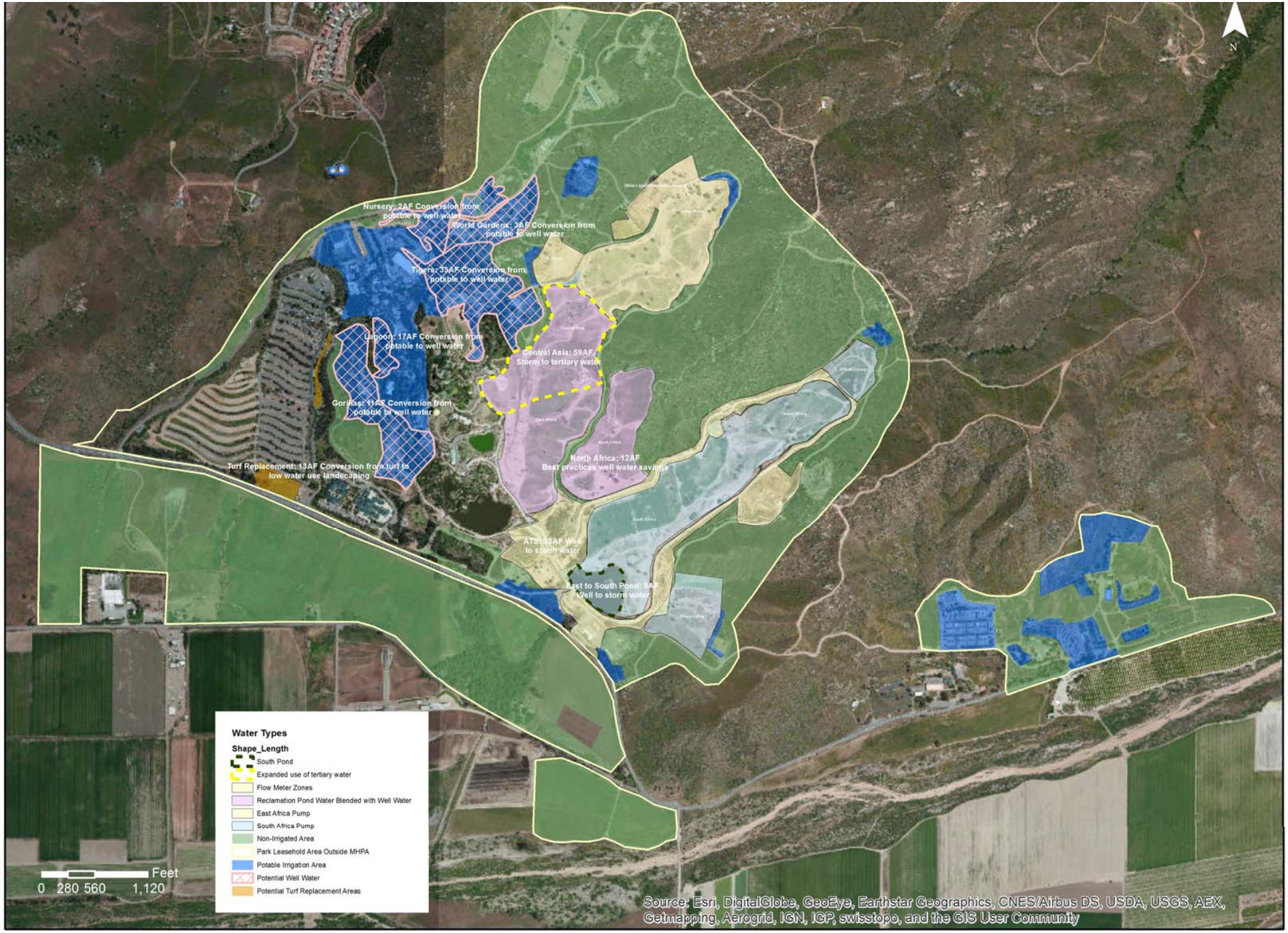
0 0.2 0.4 0.8
Miles

N

*Note: No DAC were found within or near the project area, therefore no DACs are displayed on this map.

Sources: U.S. Census 2013 ACS 5-year estimates; San Diego Association of Governments (SANDAG) - GIS Data Warehouse
Document Path: N:\Projects GIS\0188-003 SDIRWM Plan Update\Prop84_Rnd4\MXD\Project maps\2-11_SafariPProject29072015.mxd

Figure 2-25: Proposed Irrigation Changes at the San Diego Zoo Safari Park



Project Physical Benefits

The primary (Water Supply) and secondary (Water Quality improvement) benefits of the *Safari Park Drought Response and Outreach* project are described in Tables 2-5 and 2-6 below.

The primary benefit of this project is a drought-proof recycled water supply that will allow for more sustainable operation of the Safari Park. This is achieved through maximizing use of this new locally-produced recycled water source and implementing multiple irrigation conversions that shift existing Park demands from potable water sources. In addition, the water savings from conversion of turf to water-wise landscaping will increase supply resiliency through decreased demand on potable water sources. The baseline water use was calculated as amount of potable water currently being used in the Safari Park irrigation system. According to Safari Park staff, the Safari Park purchases 501.57 AFY potable water from the City of Escondido.[75] The anticipated useful life of the WWTP expansion is 60 years and the irrigation conversions is 20 years. For the purposes of this analysis, a useful life of 20 years was used. The value of the benefit (72 AFY) was based on information provided by Safari Park staff, calculated from a combination of flow meters, controller schedules, and fill valves. Over the 20-year project life, the *Safari Park Drought Response and Outreach Project* will offset 1,440 AF of potable water.

Table 2-48: Primary Physical Benefit – Water Supply
Safari Park Drought Response and Outreach Project

Project Name: *Safari Park Drought Response and Outreach*
Type of Benefit Claimed: Water Supply – Potable Water Saved
Units of the Benefit Claimed: AFY
Anticipated Useful Life of Project (years): 20 years

(a)	(b)	(c)	(d)
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2018	502 AFY	466 AFY	-36 AFY
2019-2037	502 AFY	430 AFY	-72 AFY
2038	502 AFY	466 AFY	-36 AFY

Comments: The project schedule shows completion of irrigation conversions and tertiary water production in mid-2018. This half-year benefit would occur at the end of life as well, assuming a 20 year life of project. Without project baseline is shown as total current potable water purchases by the Safari Park from the City of Escondido.

Sources: Pers. Comm. Robyn Badger and Charles Fleuret. Zoological Society of San Diego. "Water Grant Savings Worksheet_2015-06-26.xls"

The water quality benefit of decreased nitrate loading to the HOA and East Africa Ponds will significantly improve surface water quality, ensuring that neither nitrates nor sulfates harm the health of animals that have access to the water. Data collected by the Safari Park following the first major rain event of the year shows that during storm events, nutrient-loaded surface water can overflow from the East Africa Pond offsite to Santa Ysabel Creek and downstream to Hodges Reservoir, exacerbating eutrofication in those surface waters.[76] The baseline water quality was based on the existing nitrate concentration in the HOA Pond, as reported in the Safari Park's *Water Master Plan*. The anticipated useful life of this water quality improvement is 60 years, which is the assumed lifetime of the WWTP expansion. The value of the benefit (-7.1 mg/L) was calculated based on information from a reverse osmosis (RO) vendor, Severn Trent Services, on nitrate removal efficacy.[77]

[75] Pers. Comm. Robyn Badger and Michael Ahlering. Zoological Society of San Diego. Email. 24 July 2015.
[76] Pers. Comm. Robyn Badger. Zoological Society of San Diego. Email. 3 August 2015.
[77] Severn Trent Services. *Tetra® Denite®*. https://www.severntrentservices.com/Wastewater_Treatment_Tertiary_and_Wastewater_Treatment_Systems/TETRA__Denite__prod_379.aspx Note: Used a lower-bound estimate of performance based on case-studies.

Table 2-49: Secondary Physical Benefit – Water Quality
Safari Park Drought Response and Outreach Project

Project Name: *Safari Park Drought Response and Outreach* **Type of Benefit Claimed:** Water Quality - Nitrate Reduction **Units of the Benefit Claimed:** mg/L **Anticipated Useful Life of Project (years):** 60 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Without Project**	**With Project**	**Change Resulting From Project (c) – (b)**
2018-2077	8.64 mg/L	1.55 mg/L	-7.1 mg/L
Comments: Water quality benefit will go into effect mid-2018 upon completion of the WWTP expansion, and end mid-2077. The water quality improvement will be constant throughout that timeframe. Without project baseline water quality was based on the existing nitrate concentration in the HOA Pond, as reported in the Safari Park's *Water Master Plan*. Sources: Zoological Society of San Diego. 2006. *San Diego Wild Animal Park Draft Water Master Plan*. February 2006. pg. 3-10 *Penn State. Nitrates in Drinking Water.* http://extension.psu.edu/natural-resources/water/drinking-water/water-testing/pollutants/nitrates-in-drinking-water Severn Trent Services. *Tetra® Denite®*. https://www.severntrentservices.com/Wastewater_Treatment_Tertiary_and_Wastewater_Treatment_Systems/TETRA__Denite__prod_379.aspx Note: Used a lower-bound estimate of performance based on case-studies.			

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

The project is a targeted response to California Governor Jerry Brown's mandate to reduce potable water use by 25% statewide. The Safari Park receives potable water from the City of Escondido in the City's 900 Zone. The City of Escondido's water supply is 15% local surface water, 10% recycled water, and 75% from San Diego County Water Authority (SDCWA), which sells primarily imported water.[78] As part of the State Water Resources Control Board's emergency conservation regulations, in response to the Governor's mandate, the City of Escondido was directed to reduce potable water use by 20% through February 2016. Both recycled water development and conservation would contribute to an offset of potable use and would help the City of Escondido achieve compliance with State mandates. Matching quality of water to appropriate types of use throughout the Safari Park (and the Region) is imperative to saving potable water for more critical use by the Region's population.

The Safari Park's existing WWTP is located northwest of the NOA exhibit, hidden from Park visitors. The WWTP is permitted by the *Waste Discharge Requirements (WDRs) for the Zoological Society of San Diego , San Diego Wild Animal Park, San Diego County* (Order No. 99-04, Addendum #1) to discharge up to 0.150 mgd of "disinfected secondary-23 recycled water" to restricted use sites. Current treatment averages about 0.075 mgd, with a peak rate of about 0.100 mgd. The WWTP consists of a headworks facility, a flow equalization basin, extended aeration and sedimentation basins, chlorine contact tank, sludge holding tank, and a sludge drying bed.[79] Raw wastewater enters the WWTP through the headworks, then enters the aeration tank. Effluent from the aeration tank passes over weirs to the settling basins. After clarification in the settling basins, the effluent flow is measured in a weir box before entering the chlorine contact tank for chlorine solution disinfection. Disinfected secondary effluent is conveyed to a manhole, then to the Reclamation Pond for storage before being disposed by spray irrigation in specific areas in the East and North Africa Plains animal exhibits. This spray use is area restricted from public access per the WDRs.

[78] City of Escondido. 2011. *2010 Urban Water Management Plan*.
[79] The Zoological Society of San Diego. 2006. *San Diego Wild Animal Park Draft Water Master Plan*.

Sludge from the aeration tank is wasted to the sludge aeration tank for aerobic digestion. The aeration blowers for the digester are periodically stopped so that the effluent can be routed to the chlorine contact tank and excess sludge pumped to the sludge drying beds. After drying, the sludge is disposed by a waste hauler to a landfill.[80]

Many of the existing Safari Park ponds are unsightly with, at times, associated unpleasant odors. The dense dark green pond water is indicative of the large algae population caused by high nutrient loadings from animal waste. The HOA Pond and South Africa Pond currently perform as a treatment lagoon to stabilize organic wastewater loads.[81] Biological degradation of settled organic solids occurs in the anaerobic pond bottoms, and nutrients released by bacteria are then used by algae in photosynthesis. However, the ponds were not designed to provide wastewater treatment and, therefore, operate poorly giving rise to odors and high coliform levels. Although animal water troughs are replenished with potable water, the animals routinely drink from the ponds. As a result, improving water quality in the ponds and streams is of high priority for the Safari Park staff.

Surface water quality within the San Dieguito River watershed is impacted by runoff from residential, commercial, industrial, and transportation land uses. Pollutants of concern within the watershed include nutrients, pathogens, salinity, pesticides, metals/metalloids, and other organics.[82] The San Pasqual Valley groundwater basin is typically recharged via infiltration of precipitation and excess irrigation waters. Data collected by the Safari Park following the first major rain event of the year shows that during storm events, nutrient-loaded surface water can overflow from the East Africa Pond offsite to Santa Ysabel Creek and downstream to Hodges Reservoir, exacerbating eutrofication in those surface waters.[83] Hodges Reservoir is on the Clean Water Act 3030(d) list for color, manganese, nitrogen, pH, phosphorus, mercury, and turbidity. Proposed treatment and storage improvements will allow the Zoological Society to filter stored water in onsite ponds, thereby improving the quality of water that percolates through onsite drainages back into the groundwater basin and ultimately to downstream surface waters.

The San Diego IRWM Region recognizes the importance of protecting water quality in Santa Ysabel Creek/San Dieguito River and Hodges Reservoir, because of its purpose as a drinking water reservoir and its ongoing water quality issues. The Zoological Society has a proven track record with the California Department of Water Resources (DWR) and SDCWA through construction of the *Safari Park Biofiltration Wetland and Education Project*, funded through a Prop 50 IRWM grant, which also contributed to water quality improvement from the Park's onsite ponds.

Without-Project Conditions

Without the *Safari Park Drought Response and Outreach Project*, the Safari Park's WWTP would continue to produce 0.075 mgd of secondary-23 recycled water. Currently, the quality of the treated water dictates that it only be used for irrigation within a limited area and the amount of treated water exceeds the irrigation needs for the limited area in which this water can be used. All remaining animal exhibit and landscape areas would continue to be irrigated with potable water and groundwater. Additionally, during wet weather events, the Reclamation Pond storing the treated water can overflow into the watershed, causing nitrogen loading to the groundwater basin and local surface waters (including Hodges Reservoir). Turf areas would not be replaced with water-wise landscaping, and would continue to require large amounts of potable water for irrigation. The current water conservation outreach education would not be expanded to reach more people, including school groups from DACs.

Without expansion of the WWTP, the Zoological Society would need to identify an alternate solution to managing the water quality of the HOA and East Africa Ponds. Blending of pond water with groundwater (pumped from onsite wells) or potable water (from City of Escondido) could help to dilute pollutants within the ponds; however, this solution would not remove nutrients and pathogens like RO treatment will. Additionally, this potential alternative would increase potable demands for the Park. The Zoological Society would continue to purchase potable water from the City of Escondido, to the tune of at least 502 AFY, which does not incorporate the potential increase in potable demands that could be required for alternative solutions to manage water quality of the HOA and East Africa Ponds. Over the 25-year project life, this totals 12,539 AF.

[80] The Zoological Society of San Diego. 2006. *San Diego Wild Animal Park Draft Water Master Plan*.
[81] The Zoological Society of San Diego. 2006. *San Diego Wild Animal Park Draft Water Master Plan*.
[82] San Diego RWMG and RAC. 2013. *2013 San Diego IRWM Plan*.
[83] Pers. Comm. Robyn Badger. Zoological Society of San Diego. Email. 3 August 2015.

Methods Used to Estimate the Physical Benefits

Primary Benefit – Water Supply

The primary physical benefit is 72 AFY of conserved water and recycled water supply, which is the sum of 66 AFY of recycled water to be used for animal exhibits and landscape irrigation and 6 AFY of conservation from turf conversions. Expansion of the WWTP and production of tertiary-treated recycled water will offset the use of potable water purchased through City of Escondido for irrigation and exhibit uses.

The project will convert multiple landscape and exhibit areas from groundwater or pond water to recycled water, then convert other exhibit areas from potable sources to groundwater, along with a suite of other irrigation efficiency measures. Following all of these conversions, the Safari Park will achieve a potable water reduction of 66 AFY by reconfiguring its onsite irrigation system and maximizing the new recycled water supply. The following table identifies each of the irrigation conversions that are planned, as provided by Safari Park staff.[84]

Table 2-50: Proposed Irrigation Conversions for *Safari Park Drought Response and Outreach Project*

	Gallons	AFY	Data Source
Pond Water Saved (To be Served by Recycled Water)			
Central Asia – Pumzika Point, Electric Road	16,264,800	59	Controller Schedules
Total Recycled Water Served		*59 AFY*	
Groundwater Saved (Offset by Conservation or Pond Water)			
Turf Reduction – reduced irrigation demands	4,395,060	13	Controller Schedules
African Tram System – to be served by East Africa Pond	12,321,612	38	Flow meter
East to South Pond – to be served by South Africa Pond	2,880,000	9	Fill Valve
North Africa – implement irrigation efficiencies	3,834,000	12	Controller Schedules
Total Groundwater Saved		*72 AFY*	
Potable Water Saved (To to be Served by Groundwater)			
Tigers – Tiger Trail, Protea Garden, Condor Ridge, Conifer	10,731,882	33	Flow meter/ Controller Schedule
Gorillas – Aloe Hill, Bird Show, Chidren's Playground, Samburu, Upper HOA	3,628,155	11	Controller Schedules
Nursery – Nursery, Shade House, Greenhouse	750,850	2	Controller Schedules
World Gardens – Baja, Native Plant, OW Succulent, Mum Racks	954,450	3	Controller Schedules
Lagoon-Main Lagoon	5,419,629	17	Flow meter/estimate
Total Potable Water Saved		*66 AFY*	

The conservation savings achieved through replacement of turf with water-wise (xerophytic) landscaping will offset groundwater pumped from onsite wells. The Safari Park estimates that approximately 167,000 square feet (sq ft) of turf will be replaced with waster-wise plantings. Following the turf removal project, savings are anticipated to be 4,395,060 gallons per year or 13.0 AFY, based on estimates from Park staff.[85] This is slightly lower than, but within reasonable range of, the annual water savings that are estimated in the CUWCC report on lessons learned from turf removal[86] (approximately 34 gallons per square foot, which would be 17.5 AFY).

[84] Pers. Comm. Robyn Badger and Charles Fleuret. Zoological Society of San Diego. "Water Grant Savings Worksheet_2015-06-26.xls"
[85] Pers. Comm. Robyn Badger and Charles Fleuret. Zoological Society of San Diego. "Water Grant Savings Worksheet_2015-06-26.xls"
[86] CUWCC. 2015. *Turf Removal & Replacement: Lessons Learned*. March.

With the production of a new recycled water supply and implementation of the irrigation conversions described above, the Safari Park will ultimately offset 66 AFY in potable water demands from the City of Escondido and 6 AFY in groundwater pumping.

$$(72\ AFY\ Groundwater\ Savings - 66\ AFY\ New\ Groundwater\ Demand) = \mathbf{6\ AFY\ Net\ Groundwater\ Savings}$$

$$66\ AFY\ Potable\ Water\ Savings\ + 6\ AFY\ Net\ Groundwater\ Savings\ = \mathbf{72\ AFY\ Water\ Supply\ Conserved}$$

Secondary Benefit - Water Quality

The secondary physical benefit of the *Safari Park Drought Response and Outreach* project is removal of 7.1 mg/L of nitrate (NO_3) in the Heart of Africa (HOA) Pond. This benefit comes from the treatment of HOA Pond water with RO in the upgraded WWTP treatment train. RO technology is reported to achieve at least 82%[87] of nitrate-nitrogen removal through membrane filtration. Upgrading the WWTP to tertiary treatment will also improve water quality by removing additional bacteria, dissolved and suspended solids, and sulfates, in addition to nutrients, thereby allowing it to be discharged to the HOA and East Africa Ponds and applied in areas currently irrigated by potable water and/or groundwater.

According to the Safari Park's *Water Master Plan*, the historical HOA Pond water nitrogen concentration was 1.95 mg/L as nitrate-nitrogen[88] or 8.64 mg/L as nitrate. The RO treatment would reduce the HOA Pond water nitrate concentration to 1.55 mg/L of nitrate-nitrogen, removing 7.1 mg/L of nitrate.

$$8.64\frac{mg}{L}NO3 * 82\%\ RO\ removal\ efficiency = \mathbf{7.1\frac{mg}{L}\ NO3\ reduction}$$

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

The physical benefits of the *Safari Park Drought Response and Outreach* project will require construction of all the project components. New equipment and facilities to be constructed include upgrading the existing secondary WWTP to tertiary include an RO membrane treatment system, a new 120,000 sq ft evaporation pond, and a 4-inch linear foot (LF) PVC brine line. A new 1 horsepower (HP) pump, two 4-inch 600 LF PVC piping will be installed from the WWTP to the HOA Pond, as well as an intake structure. A new 0.5 HP low-head pump will be installed from the East Africa Pond to the HOA Pond. Irrigation conversions include a total of 4,860 LF of conduit to be converted to accommodate recycled water for irrigation. The Safari Park will need to obtain an updated WDRs for distribution of tertiary treated recycled water onsite, but that is also included in *Attachment 3 Work Plan*. No additional facilities, policies, or actions are necessary to obtain the project's physical benefits.

Potential Adverse Physical Effects of the Project and Mitigation

Implementation of the *Safari Park Drought Response and Outreach* project may produce temporary adverse impacts associated with construction and expansion of the treatment facility and other project components. However, these are anticipated to be minor and short-term in nature. The *Safari Park Drought Response and Outreach* project is incorporated in the Safari Park Future Construction Program Resource Protection Ordinance (RPO) Permit LDRNO: 99-0153 SCH#99081105; the certified Environmental Impact Report (EIR) includes implementation of BMPs included in the Park's WDRs to ensure that downstream water quality impacts are minimized.

[87] Severn Trent Services. *Tetra® Denite®*. https://www.severntrentservices.com/Wastewater_Treatment_Tertiary_and_Wastewater_Treatment_Systems/TETRA__Denite__prod_379.aspx Note: Used a lower-bound estimate of performance based on case-studies.
[88] Zoological Society of San Diego. 2006. *San Diego Wild Animal Park Draft Water Master Plan*. February 2006.

Long-Term Drought Preparedness

The *Safari Park Drought Response and Outreach* project will help to achieve long-term drought preparedness by employing three methods from Table 1 of the *2015 Guidelines*: conservation, reuse and recycling, and long-term reduction of water use. Conversion from turf to water-wise landscaping will directly conserve water by reducing irrigation needs. Upgrades to the Safari Park's WWTP will increase the level of treatment for recycled water production, enabling additional applications and use of the recycled water produced at the WWTP, and expanding the Safari Park's delivery of recycled water. Coupled with the outreach and education that will be implemented by this project, a long-term reduction in water use will be achieved. This long-term reduction will be achieved by influencing individuals to change their water-use behaviors, making water conservation a habitat and instilled value (which makes it likely to become long-term behaviors). Further, the Safari Park's converted landscaping is anticipated to be protected into perpetuity, and no changes are anticipated that would lead to an increase in water use.

Direct Water-Related Benefit to DACs

Although this project does not meet the definition of a DAC project as provided by DWR in the *2015 PSP* (see *Attachment 7 Disadvantaged Communities*), it does provide some benefits to DACs, indirectly meeting three of the urban DAC needs identified in the *2013 IRWM Plan*:[89] funding, water rates, and outreach. As described in the *2013 IRWM Plan*, outreach to DACs is critical to affecting water conservation behaviors of residents of DACs, who do not always receive the same level of appropriate outreach and education opportunities as non-DACs. The *Safari Park Drought Response and Outreach* project's outreach and education will reach DACs through school programs and visits to the Safari Park and its website by DAC residents. The project will also reach a large number of non-DAC individuals and communities. There is no reasonable method for breaking down the visitor population to DAC and non-DAC populations due to the large volume of non-local visitors. Further, the outreach portion of the project, which will reach DACs, would be indirect because it is not specifically targeted to DACs, and will reach many more non-DACs than DACs. In addition to DAC Outreach, the Safari Park Drought Response and Outreach project will indirectly provide protection against water rate increases by improving water supply reliability in the Region, which helps to buffer against water rate hikes associated with securing additional water supplies. Funding will be provided for educational programs that will reach students from DACs. These students attend schools that may not be able to pay additional fees to attend such programs. Providing funding for programs through this grant reduces the need to charge, or amount of, participation fees for schools who would like to attend the education programs.

Project Performance Monitoring Plan

Benefits of the *Safari Park Drought Response and Outreach* project will accrue as described in **Tables 2-48** and **2-49** above. **Table 2-51** describes the methods that will be used to measure the quantified benefits of this project. The Zoological Society will monitor water supply benefits by collecting and reporting monthly non-potable water meter data for the landscape irrigation. The Zoological Society will collect and report water quality data from the influent and effluent piping at the WWTP.

[89] RWMG. 2013. 2013 San Diego Integrated Regional Water Management Plan. September.

Table 2-51: Project Monitoring for *Safari Park Drought Response and Outreach*

Proposed Physical Benefits	Measurement Tools and Methods	Targets
Water Supply	The Zoological Society will monitor water supply benefits by collecting and reporting monthly non-potable water meter data for the landscape irrigation that has been converted from potable sources (Tigers, Gorillas, Nursury, World Gardens, and Lagoon). The Zoological Society will also provide before and after water meter records for the irrigated areas where turf will be replaced, along with 10 years of meter records showing the maintenance of lower water demands.	66 AFY of non-potable use from irrigation conversions 13 AFY of conservation from turf conversions
Water Quality Improvement	The Zoological Society will collect and report monthly water quality data from the influent and effluent piping at the WWTP, consistent with the reporting submitted to the Regional Water Quality Control Board per the WDRs.	7.1 mg/L reduction in NO_3 concentration

Cost Effectiveness Analysis

The *Safari Park Drought Response and Outreach* project will achieve two quantifiable physical benefits described in detail in the sections above, and summarized in **Table 2-48 and 2-49**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-52** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-52: Cost Effective Analysis for *Safari Park Drought Response and Outreach*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-48 and 2-49.* Water Supply – 72 AFY of potable water offset Water Quality - 7.1 mg/L NO_3 reduction
Question 2 Alternatives Considered	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why? If yes, list the methods (including the proposed project) and estimated costs. The Safari Park's *Water Master Plan* (Chapter 5) contains a list of 25 projects that would address water resource issues within the Park. Projects were identified to: reduce potable water consumption, improve water quality in exhibit ponds, enhance water circulation to maintain a dry season flow in streambeds, decrease erosion on plains, improve reliability of the irrigation system, and improve animal welfare. Each of the projects met one or a combination of these objectives. Both the WWTP expansion (estimated $2.05 million) and South Africa Pond water quality improvements (estimated $470,000; includes additional measures not in this project) were determined to be high priority projects. Project costs for the 25 projects ranged from $30,000 to $2.05 million.
Question 3 Preferred Alternative	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* No, the proposed project is not the least cost alternative. However, the WWTP expansion will provide the Safari Park with 1) the ability to provide supplemental source of irrigation and reduce potable water consumption, 2) reduced dependency on the groundwater-fed irrigation system, 3) potential water savings of up to 150,000 gpd at full treatment plant capacity and will provide unrestricted use of recycled water, and 4) improved water quality in the Reclamation Pond will enhance the visitor experience, as well as improve animal health. All of these benefits make the project a clear priority for the Park.