Water Quality and Habitat Program

Project 11: San Diego River Healthy Headwaters Restoration

Local Project Sponsor: U.S. Forest Service (USFS)
Partners: American Conservation Experience (ACE), City of San Diego, Back Country Land Trust (BCLT), San Diego River Park Foundation (SDRPF), San Diego River Conservancy, Animal and Plant Health Inspection Service (APHIS), and County of San Diego

Project Summary

The project includes invasive species removal, restoration, and rehabilitation of impacted sites in the San Diego River watershed to improve habitat, water supply, and quality.

Project Maps

Figure 2-26 shows the *San Diego River Healthy Headwaters Restoration* 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 2-27** shows the level of infestation and precise reaches that invasive species are known or presumed to exist that will be treated through this project.

Erosion (left) and invasive weeds (right) at impacted sites in the El Capitan Catchment

Pre- (left) and post- (right) invasive weed removal by USFS

Project Description

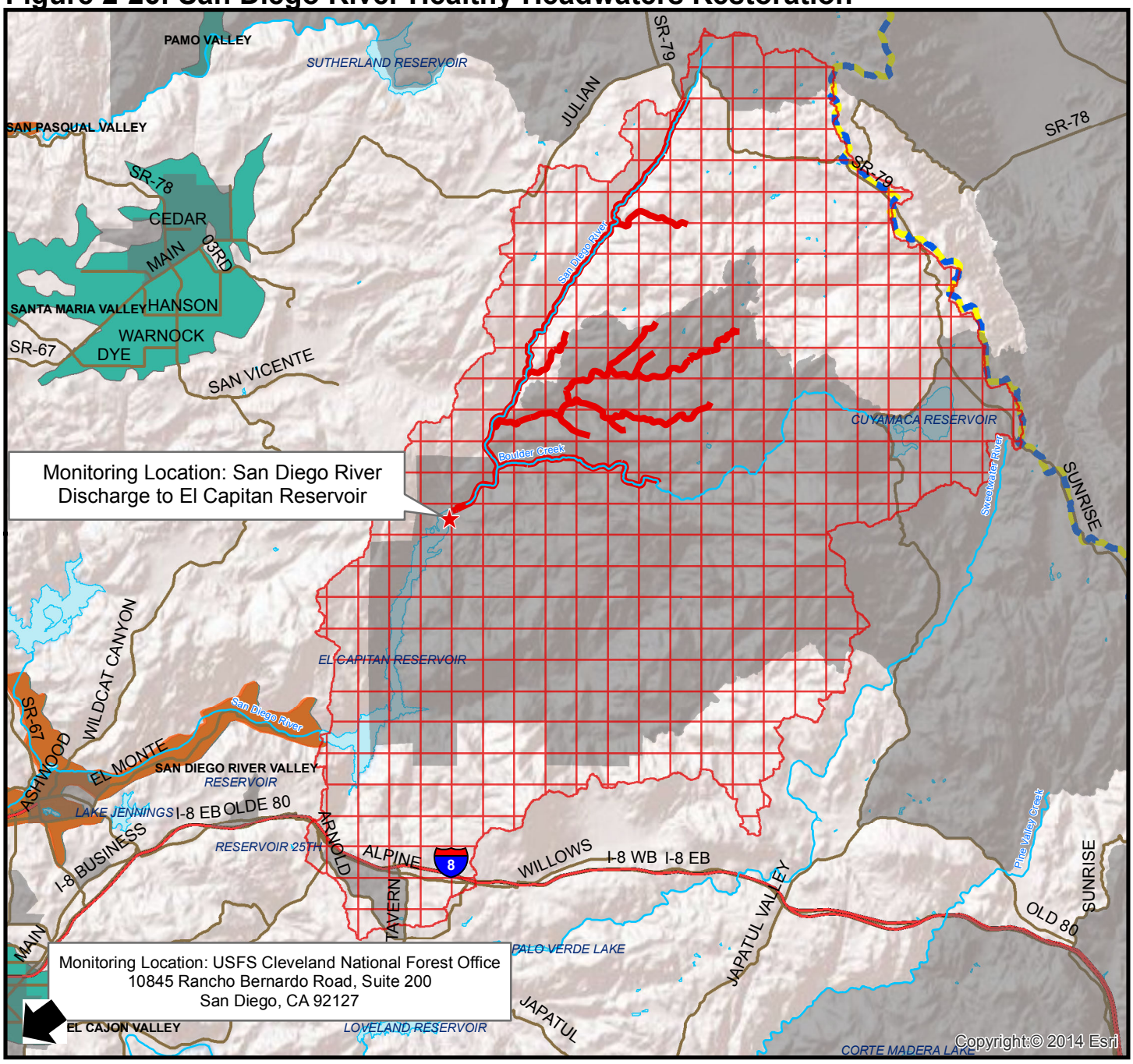
The *San Diego River Healthy Headwaters Restoration* project includes invasive species removal and addresses unauthorized trails, routes, and sites. These activities will improve water quality, enhance riparian habitats, restore hydrologic function, reduce fire hazard, and reduce anthropogenic sediment contribution from sites within the El Capitan Reservoir catchment of the larger San Diego River (SDR) watershed. Since the invasive species that will be removed consume and evapotranspirate significantly higher volumes of water than native species, the project will have a significant water supply benefit.

The first project component is invasive weed removal in the El Capitan Reservoir catchment across land owned by the City of San Diego (City), cooperating private and Tribal entities, and USFS. The goal is to eliminate invasive plant seed sources. Invasive weeds can decrease water supply, are highly flammable, provide poor habitat and food for native species, and can be easily spread. Weed populations are known to exist throughout the catchment, although their specific location and density are less known. The City of San Diego will lead the effort to conduct a basin-wide assessment so as to strategically treat weeds throughout the catchment. A known arundo (*Arundo donax*) population of about 2.5 acres at the reservoir will be treated. Because of the terrain, USFS will simultaneously record and treat weed populations utilizing field crews and/or partnering with the American Conservation Experience (ACE) crews. The City will work with SDRPF to conduct weed treatments (primarily arundo) around El Capitan Reservoir. SDRPF will use volunteers to conduct much of the work, engaging the local population through stewardship opportunities. It will also conduct outreach to the various communities within the El Capitan Reservoir catchment. Methods will include one-on-one connections, information tables at community events, flyers, and targeted mailings. The main focus of SDRPF's education/outreach efforts will be to increase awareness, public knowledge, and participation in long-term watershed health and restoration efforts. BCLT will continue outreach, coordination, and treatment efforts within the Alpine community. They have been successful in engaging private landowners to treat invasive weeds, reduce fire hazards and restore impacted sites. To achieve long-term success and sustainability, it is imperative to engage the public and gain its support.

The second project component is invasive terrestrial and aquatic species removal. Invasive species such as feral pigs (*Sus scrofa*) destroy habitat through wallowing and rooting in riparian areas. The foraging and wallowing behavior of pigs can markedly increase the turbidity of water supplies, but more importantly, the pigs can transmit and excrete a number of infectious waterborne organisms that are pathogenic to humans. Feral pigs have a wide range of travel and have been observed from as far north as the SDR watershed down to the U.S.-Mexico border, across a variety of political jurisdictions. Potential problems for the SDR watershed include water contamination, trampling riparian habitat, bank destabilization, and increased sedimentation and detritus. The project will include oversight of treatment efforts to ensure treatments are being implemented and managed cooperatively. The aquatic species removal effort will include removal of detrimental, invasive aquatic species (e.g., bullfrogs [*Lithobates catesbeianus*] and green sunfish [*Lepomis cyanellus*]) above natural aquatic organism barriers. This is especially important because there are both threatened and endangered species and USFS sensitive species in the SDR watershed.

The third project component addresses unauthorized routes, hiking trails, and recreation sites located in the SDR watershed that are chronic sediment contributors, alter runoff, and have denuded slopes and sanitation issues. Restoration of impacted sites, decommissioning, and improving drainage on routes would improve hydrologic processes affected by the sites, reduce sedimentation and improve water quality and habitat. In total, there are 10 miles of routes and two acres of impacted area that will be addressed through this work plan, which total approximately 62 acres of habitat improved. The USFS will also improve public information kiosks at 4 sites (16 panels) to include information on water-wise gardening using native plants, tips on recreating to minimize watershed impacts, fire history of the SDR Watershed, and wilderness values in the SDR watershed.

Figure 2-26: San Diego River Healthy Headwaters Restoration



Coordinates: 32.88479, -116.7902

0 1.5 3 6
Miles

N

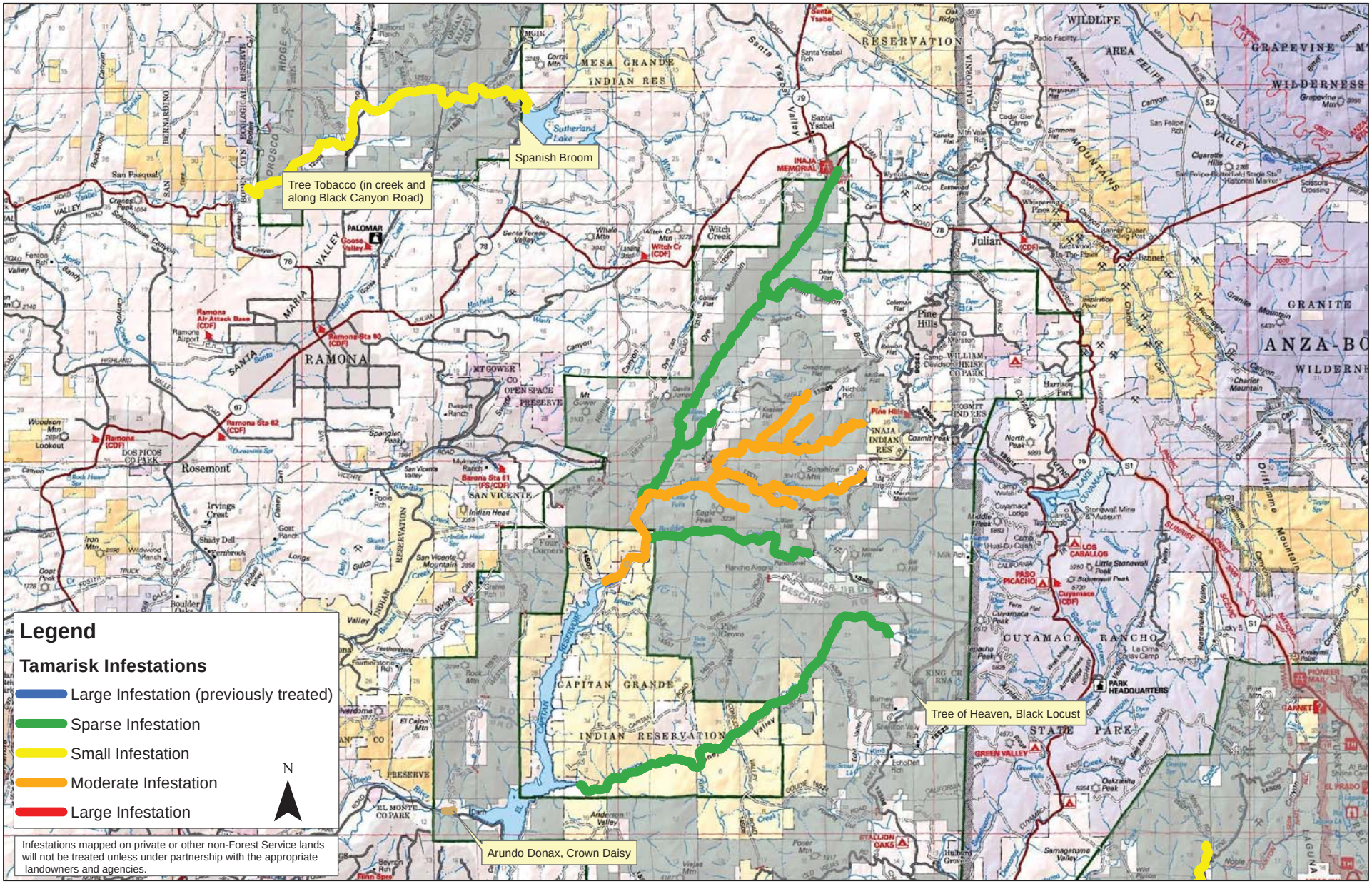
Legend

- San Diego IRWM Region
- Funding Area Boundary
- Freeway
- Waterbody
- DAC Area*
- Medium Priority Groundwater Basin
- Very Low Priority Groundwater Basin
- Benefit Area: 11 San Diego River Healthy Headwaters Restoration
- Monitoring Location
- Riparian Habitat Restoration

*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\2-12_USDAProject30072015.mxd

Figure 2-27: Cleveland National Forest Invasive Weed Management Planning Map - Palomar Ranger District



Project Physical Benefits

Tables 2-53 and **2-54** provide summaries of the primary (Habitat Improved) and secondary (Water Supply) physical benefits anticipated to be achieved through implementation of the *San Diego River Healthy Headwaters Restoration* project. The *San Diego River Healthy Headwaters Restoration* project will improve 335 acres of habitat, and increase water available for capture in El Capitan Reservoir by 1,988 AFY. These benefits will protect native species (including potential threatened and endangered species) and improve water supply reliability, while reducing conflicts between native species and human needs.

The primary physical benefit of the project is 335 acres of improved riparian and transitional habitat within the El Capitan Reservoir catchment of the San Diego River watershed. Improved native riparian habitat will occur through weed treatment and removal (primarily arundo (*Arundo donax*) and tamarisk (*Tamarix spp*.)), as well as restoration of unauthorized trails and related sites (addressing erosion and sedimentation) and removal of terrestrial and aquatic invasive species (such as feral pigs (*Sus scrofa*) and green sunfish (*Lepomis cyanellus)* and bullfrogs (*Lithobates catesbeianus*). The removal of weeds and other invasive species will allow for the rehabilitation of riparian habitat within the El Capitan Reservoir catchment, providing habitat for native species. Restoration of unauthorized sites will improve drainage and hydrologic processes, reduce sedimentation, and improve overall water quality and habitat. The anticipated useful life of the habitat improvements is greater than 50 years, assuming the partners will return within the first 2 years for retreatment (as is their practice). Previous restoration efforts by USFS have demonstrated that once weed seeds are removed from an area, reestablishment is avoided in the long-term. The value of this benefit (335 acres) was based on USFS and partner estimates of the land area that will be improved by invasive weed removal. Note that an additional 62 acres of Cleveland National Forest habitat will be improved through unauthorized site rehabilitation, which improves erosion and sedimentation within drainages, but they are *not* included in the Habitat Improved benefit in **Table 2-53** because they would not contribute to the Water Supply benefit in **Table 2-54**.

The baseline for this benefit was calculated as the acreage of riparian habitat improved to date by the project partners in the El Capitan Reservoir catchment; the benefit would then be the increase in habitat improved by this project. Thus far, three efforts have been identified that have removed invasive plant species on a total of 777 acres in the Cleveland National Forest: 1) USFS Cleveland National Forest division has removed 771 acres from 2008-2013,[1] 2) SDRPF is committed to improving 4.4 acres through removal of invasive plants adjacent to El Capitan Reservoir via a Prop 84-Round 2 IRWM grant,[2] and 3) BCLT has treated 2 acres of arundo on 15 different parcels of land. This baseline of 777 acres is currently our best estimate, given our knowledge of recent invasive species removal projects in the catchment.

[1] Cleveland National Forest. *Land Management Plan Monitoring and Evaluation Report-Fiscal Year 2013*. October 2014.
[2] RMC Water and Environment. *San Diego Integrated Regional Water Management: Implementation Grant Proposal – Round 2: Attachment 7-Technical Justification of Projects*. 3/27/2013.

Table 2-53: Primary Physical Benefit – Habitat Improved
San Diego River Healthy Headwaters Restoration

Project Name: San Diego River Healthy Headwaters Restoration
Type of Benefit Claimed: Habitat Improved – Through invasive weed removal
Units of the Benefit Claimed: Acres
Anticipated Useful Life of Project: >50 years

(a)	(b)	(c)	(d)
Year	**Annual Without Project**	**Annual With Project**	**Annual Change Resulting from Project (c) – (b)**
2011	777 acres	777.5 acres	0.5 acres
2012	777 acres	778 acres	1 acres
2013	777 acres	778.5 acres	1.5 acres
2014	777 acres	779 acres	2 acres
2015	777 acres	779.5 acres	2.5 acres
2016	777 acres	888 acres	111 acres
2017	777 acres	998 acres	221 acres
2018	777 acres	1,107 acres	330 acres
2019-2068	777 acres	1,112 acres	335 acres

Comments: The total area of improved habitat comes from direct and indirect habitat improvement from invasive weed treatment. The anticipated useful life of the project activities is greater than 50 years, assuming the partners will return within the first 2 years for retreatment (as is their practice). The baseline is calculated from the USFS Cleveland National Forest efforts to-date to manage invasive weeds, along with known partner commitments to manage invasive weeds. The City of San Diego weed removal (Task 12.1A; 11.4 acres) is phased in over 3 years beginning in 2017 (33% per year). The BCLT weed removal (Task 12.1B; 7 acres) began in 2011 with about 0.5 acre per year until 2015. Beginning in 2016, work is phased in over 4 years (1.5 acres in 2016 and 1 acre per year in 2017-2019). The USFS weed removal (Task 12.1C; 314 acres) is phased in over 3 years beginning in 2016 (33% per year. The SDRPF weed removal (Task 12.1D; 2.5 acres) is planned for 2016 (100% per 2016). There will be no phasing out of benefits.

Source: Cleveland National Forest. *Land Management Plan Monitoring and Evaluation Report-Fiscal Year 2013*. October 2014.

The secondary physical benefit of the project is 1,988 acre feet per year (AFY) of water conserved. Native weeds such as Arundo and Tamarisk are significantly more water intensive (uptake and evapotranspiration) than native vegetation. According to research conducted by USFS, arundo uses 20 AFY/acre and tamarisk uses 5 AFY/acre more water than native vegetation. The baseline is from these sources: *Tamarisk Control in the Desert of Southern California* and *Arundo donax Distribution and Impact Report*. Known invasive weed removal efforts included in the baseline are: 1) 771 acres by USFS, assumes tamarisk with 5 AFY/acre savings; 2) 4.4 acres by SDRPF, assumes arundo with 20 AFY/acre savings, and 3) 2 acres by BCLT, assumes 20 AFY/acre savings. Total baseline water use by the 777 acres of habitat already improved is 3,983 AFY. Total baseline water use by the additional 335 acres of habitat currently populated with invasive weeds is 3,328 AFY (21 acres arundo with 20 AFY/acre savings and 314 acres tamarisk with 5 AFY/acre savings). The replacement of these invasive weeds with native vegetation will, therefore, conserve water and result in increased runoff into El Capitan Reservoir. The water conservation benefit (1,988 AFY) is calculated from the 335 acres of invasive weed removal that are proposed by this project. Over the useful life of the project, a total of 11,920 acre feet (AF) of water would be available for capture in the El Capitan Reservoir.

Table 2-54: Secondary Physical Benefit – Water Supply
San Diego River Healthy Headwaters Restoration

Project Name: San Diego River Healthy Headwaters Restoration **Type of Benefit Claimed:** Water Supply – water conserved through invasive removal **Units of the Benefit Claimed:** AFY **Anticipated Useful Life of Project:** >50 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project**	**Annual With Project**	**Annual Change Resulting from Project**
2011	3,995 AFY	3,985 AFY	10 AFY
2012	4,007 AFY	3,987 AFY	20 AFY
2013	4,019 AFY	3,989 AFY	30 AFY
2014	4,031 AFY	3,991 AFY	40 AFY
2015	4,043 AFY	3,993 AFY	50 AFY
2016	5,081 AFY	4,428 AFY	653 AFY
2017	6,138 AFY	4,866 AFY	1,273 AFY
2018	7,195 AFY	5,303 AFY	1,892 AFY
2019-2068	7,311 AFY	5,323 AFY	1,988 AFY
Comments: The baseline is calculated from the USFS Cleveland National Forest efforts to-date to manage invasive weeds, along with known partner commitments to manage invasive weeds, multiplied by estimated water savings. The amount of water conserved was determined by the amount of acres of arundo and tamarisk to be removed by the project. Per the Lovich et. al. and California Invasive Plant Council reports, arundo uses 20 AFY per acre more water than native vegetation and tamarisk uses 5 AFY per acre more water than native vegetation, therefore that amount of water is conserved when replaced with native vegetation. The water savings benefits are phased in accordance with the invasive weed treatment activities described in the previous table. Sources: Lovich et al. 1994. *Tamarisk Control in the Desert of Southern California*. California Invasive Plant Council. March 2011. *Arundo donax Distribution and Impact Report*. Page 47-48.			

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

The upper San Diego River (SDR) watershed contains water bodies that provide source water for the City's El Capitan Reservoir, the largest local water supply source in San Diego County. The El Capitan Reservoir catchment drains 188 square miles, provides valuable resources to multiple beneficial uses, and has multiple lands owners (City of San Diego, Tribal Lands, private land owners, USFS Cleveland National Forest, State, etc.). Beneficial uses include municipal, agricultural, and industrial water supply; recreation; and use by aquatic, wildlife, and rare and endangered species. These beneficial uses are negatively affected by widespread non-native invasive species (terrestrial, aquatic, weeds) and non-point source sedimentation off impacted sites throughout the catchment.

El Capitan Reservoir is on the Clean Water Act 303(d) list for color, manganese, pH, phosphorus, and nitrogen.[3] The streams and creeks that drain into El Capitan Reservoir are relatively healthy, but are under continued threat of degradation from both natural and man-made sources. This project will unite affected agencies in taking action to remove invasive species, a problem that extends across property boundaries and affects all water users. Over the years many organizations (nonprofit, Federal, State, private, etc.) have worked to eradicate invasive species in this watershed. The goal of this project is to unify efforts to eliminate seed sources (invasive weeds) and non-native remnant populations (feral pigs, invasive aquatics). The foraging and wallowing behavior of pigs can markedly increase the turbidity of water supplies, but more importantly, they can transmit and excrete a number

[3] San Diego RWMG and RAC. 2013. *2013 San Diego IRWM Plan*.

of infectious waterborne organisms that are pathogenic to humans. Their persistence in drinking water catchments also makes them potentially significant reservoirs for zoonotic pathogens. Significant feral pig populations pose a threat to water quality by reducing the health of waters and potentially serving as a vector for contamination of surface water supply and associated risks to human health. Feral pigs have a wide range of travel and have been observed from as far north as SDR watershed down to the border, across a variety of political boundaries. Potential problems for the SDR watershed include water contamination, trampling riparian habitat, bank destabilization, and increased sedimentation and detritus. Invasive species are degrading riparian habitat, negatively impacting water quality, increasing fire hazard, and competing with natives for scarce resources.

Feral pigs (above) cause substantial damage to local ecosystems (left) through their rooting behaviors

El Capitan Reservoir is the largest reservoir in San Diego County, and as such, represents an important component of local water supply reliability and storage, especially as regards the Emergency Storage Project (ESP). The ESP is designed to connect key water storage, treatment, and conveyance facilities to move water supplies around in the event of an emergency. The current drought has resulted in reduced delivery of SWP water (5% of allocations in 2014, and 20% of allocations in 2015), at a time when local supplies are diminished due to reduced rainfall. In the past, SDCWA, the Region's water wholesaler, has been able to supplement SWP and allocated Colorado River supplies with additional Colorado River water acquired through agreements with other agencies. However, under the current drought, SDCWA has been unable to acquire additional Colorado River supplies, and overall imported water supplies have been limited. Increasing ability to capture local supplies can improve water supply reliability by providing a buffer against potential cutbacks on imported water deliveries. Even in times of drought, when rainfall is limited, removing thirsty invasive species can still provide additional water supply, because more water will reach the reservoir, even if it is less than in normal years.

The 2003 Cedar Fire burned the entire El Capitan Reservoir watershed management area, and the *San Diego River Watershed Management Plan* concludes that water quality issues associated with sediment loading and nutrient cycling will persist for many years.[4] Several actions in this project would help minimize accelerated erosion and sediment contribution to streams, improve riparian habitat and water quality, and restore channel systems to more natural conditions, thereby improving habitat. Additionally, there are multiple unauthorized routes, hiking trails, and recreation sites located in the upper San Diego River watershed that are chronic sediment contributors, alter runoff, and have denuded slopes and sanitation issues. Restoration of impacted sites, decommissioning, and improving drainage on routes would improve hydrologic processes affected by the sites and reduce anthropogenic sedimentation.

San Diego County is one of the most biodiverse areas in the country, making habitat improvement an important benefit in the Region.[5] A California Natural Diversity Database (CNDDB) query for the project area found a total of 59 species (36 plants and 22 animals) reported within or near the project area.[6] These species may utilize the restored habitat created by the project, and are presented in **Table 2-55** as species whose populations could

[4] San Diego River Watershed Working Group. 2005. *San Diego River Watershed Management Plan*. Prepared by Anchor Environmental, et al. Section 2.3 Surface Water Quality, page 15.
[5] Regional Water Management Group. 2013. 2013 San Diego Integrated Regional Water Management Plan. September.
[6] California Natural Diversity Database. Rarefind 5. Database query within Project Area. Accessed 23 July 2015. Available with subscription: https://map.dfg.ca.gov/rarefind/view/RareFind.aspx

benefit from the habitat improvements implemented by this project. Because weed removal will enable native plants and animals both to repopulate the restored areas, both animals and plants are shown in **Table 2-55**.

Table 2-55: Wildlife Species Listed in CNDDB Within or Near the Project Area

Animals		
Federal- or State-Listed Threatened, Endangered, or Candidate Species		
Townsend's Big-Eared Bat	Least Bell's Vireo	Coastal California Gnatcatcher
Arroyo Toad	Southwestern Willow Flycatcher	
Non-Listed Species		
American Badger	Large-Blotched Salamander	Red-Diamond Rattlesnake
California Mountain Kingsnake (San Diego Population)	Northwestern San Diego Pocket Mouse	Rosy Boa
Coast Horned Lizard	Orangethroat Whiptail	Southern California Rufous-Crowned Sparrow
Coast Range Newt	Pallid Bat	Western Mastiff Bat
Coastal Whiptail	Prairie Falcon	Western Pond Turtle
Dulzura Pocket Mouse	Purple Martin	
Plants		
Non-Listed Species		
Baja Navarretia	Long-Spined Spineflower	San Diego Button-Celery
Chaparral Nolina	Mission Canyon Bluecup	San Diego Goldenstar
Cuyamaca Larkspur	Moreno Currant	San Diego Gumplant
Cuyamaca Raspberry	Orcutt's Brodiaea	San Diego Milk-Vetch
Dean's Milk-Vetch	Parish's Meadowfoam	San Diego Thorn-Mint
Delicate Clarkia	Prairie Wedge Grass	Short-Sepaled Lewisia
Dunn's Mariposa-Lily	Purple Stemodia	Southern Jewelflower
Felt-Leaved Monardella	Ramona Horkelia	Southern Mountains Skullcap
Gander's Ragwort	Robinson's Pepper-Grass	Tecate Cypress
Hammitt's Clay-Cress	Round-Leaved Filaree	Tecate Tarplant
Laguna Mountains Jewelflower	Salt Spring Checkerbloom	Vanishing Wild Buckwheat
Lakeside Ceanothus	San Bernardino Aster	Velvety False Lupine
Lemon Lily		

Source: California Natural Diversity Database (CNDDB). RareFind 5 query within Project Area (23 July 2015).

Without-Project Conditions

Without the *San Diego Healthy Headwaters Restoration* project, invasive species would continue to negatively affect the El Capitan Reservoir catchment, the largest local surface water supply source in the County. The streams and creeks that drain into El Capitan Reservoir are relatively healthy, but are under continued threat of degradation from both natural and man-made sources. Without the restoration activities of this project, the catchment would continue to suffer the impacts of invasive species (specifically invasive weeds, feral pigs, and non-native aquatic species), which can include decreased species diversity, degraded riparian habitat, increased sedimentation impacting water quality, high water demands and evapotranspiration reducing inflows into El Capitan reservoir, and a lower groundwater table. Without this project, the existing 335 acres of known invasive weed populations would remain, and could even grow in size. These invasive weeds would continue to consuming excess surface water, and without this project, 3,328 AFY in surface water that could drain to El Capitan Reservoir to support the Region's drinking water supply, would continue to be consumed by these weed populations.

Additionally, the unauthorized routes, hiking trails, and recreation sites located in the San Diego River watershed that are chronic sediment contributors, alter runoff, and have denuded slopes and sanitation issues would remain. Continued existence and use of unauthorized recreation could expand these trails and sites and worsen existing erosional areas. The impacts of invasive species, degraded habitat, and unauthorized use of trails would continue to degrade water quality in the El Capitan Reservoir.

Methods Used to Estimate the Physical Benefits

Primary Benefit – Habitat Improved

The primary physical benefit of the project is 335 acres of improved habitat resulting from invasive weed treatment and removal. USFS uses a one-to-one calculation of habitat restored per acre of invasive weed treatment. The project will treat 50 miles of stream corridor (primarily within 50 feet of the channel) for a benefit of 300 acres of restored habitat. An additional 14 acres of known tamarisk population will also be treated, for a total of 314 acres of habitat improvement. The City has committed to 11.4 acres of invasive weed removal, BCLT has committed to 7 acres of invasive weed removal, and SDRPF has committed to 2.5 acres of invasive weed removal. In total, 335 acres of wetland and riparian habitat will be improved as a result of the project.

USFS uses a standard calculation of 6 acres of habitat restored per every mile of route and trail improvement. Thus, an additional 62 acres of upland habitat will improved by USFS (Task 12.2) through 10 miles of trails and routes to be restored and an 2 acres of impacted sites to be improved. Some of the proposed storm-proofing and decommissioning sites are adjacent to streams (ephemeral, intermittent), have stream crossings, or contribute drainage to streams via gullies. Forest roads are the biggest contributors of sediment to streams in the headwaters, as they can significantly alter hydrologic processes in streams, such as peak flows by increasing the number of connected concentrated flow paths (road ditches, gullies). However, these additional 62 acres were not included in the Habitat Improved benefit in **Table 2-53** because they wouldn't contribute to the Water Supply benefit in **Table 2-54**.

$$11.4\ acres + 7\ acres + 314\ acres + 2.5\ acres = \mathbf{335\ acres}$$

Secondary Benefit – Water Supply

The secondary physical benefit of the project is 1,988 AFY of water conserved. The California Invasive Plant Council reports that arundo uses approximately 24 AFY/acre.[7] Lovich et al. reports that tamarisk uses approximately 9 AFY/acre.[8] Based on the California Invasive Plant Council report, this analysis assumes that riparian vegetation and replacement of weeds on treated lands will use approximately 4 AFY/acre.[9] As such, treatment of invasive weed stands will conserve approximately 20 AFY/acre for arundo and 5 AFY/acre for tamarisk. The City (Task 12.1A) will treat 11.4 acres, primarily arundo. BCLT (Task 12.1B) will treat 7 acres, primarily arundo. The USFS (Task 21.1C) will treat up to 314 acres; to be conservative, this analysis assumes conservation savings at the tamarisk uptake rate. SDRPF (Task 12.1D) will remove 2.5 acres, primarily Arundo. A total of 21 acres of arundo will be removed, for a conservation savings of 418 AFY. The USFS's removal of up to 314 acres of Tamarisk will conserve 1,570 AFY.

$$\left(21\ acres\ arundo * 20\frac{AFY}{acre}\right) + \left(314\ acres\ tamarisk * 5\frac{AFY}{acre}\right) = \mathbf{1,988\ AFY}$$

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

No facilities, policies or actions are necessary to obtain the expected benefits provided by the *San Diego River Healthy Headwaters Restoration* project, beyond those permits and CEQA compliance included in *Attachment 3 Work Plan*. The benefits will begin to be realized as soon as the invasive weed treatment, species removal, and unauthorized site rehabilitation begins.

Potential Adverse Physical Effects of the Project and Mitigation

The *San Diego River Healthy Headwaters Restoration* project may result in temporary environmental impacts during project implementation. Potential impacts to special-status vegetation communities or species may occur during treatment or removal, but mitigation measures are included as part of the USACE Regional General Permit to reduce those impacts. Any impacts associated with the project are anticipated to be short-term in nature. It is not anticipated that any significant, long-term adverse physical effects would result from implementation of this project.

[7] California Invasive Plant Council. March 2011. *Arundo donax Distribution and Impact Report*. Page 48.
[8] Lovich et al. 1994. *Tamarisk Control in the Desert of Southern California*.
[9] California Invasive Plant Council. March 2011. *Arundo donax Distribution and Impact Report*. Page 48.

Long-Term Drought Preparedness

The *San Diego River Healthy Headwaters Restoration* project will achieve long-term drought preparedness in two ways: 1) Achieve long-term reduction of water use, and 2) Promote water conservation, conjunctive use, reuse, or recycling. Invasive weeds such as Arundo have been shown to use significantly more water than native species (20 AFY/acre more than native vegetation). Tamarisk also uptakes more water than native vegetation (5 AFY/acre more than native vegetation). Removing Arundo and Tamarisk will expand the volume of surface runoff draining into El Capitan Reservoir, which serves as a drinking water supply source for the City. Invasive plants create a host of adverse environmental effects, including displacement of native plants and reduction in habitat and forage for wildlife (including federally listed threatened and endangered species); reduction in water quantity; potential reduction in soil productivity; and potential increase in the intensity and frequency of wildfires.

The educational components of the project (USFS and SDRPF) will include information on water conservation, water-wise landscaping, weed eradication, and native plants. The focus will be on long-term watershed health and how to achieve those goals. Education efforts by SDRPF are expected to connect with 20% of the population in the upper San Diego River watershed (Upper San Diego River, Boulder Creek, Cedar Creek subwatersheds).

Direct Water-Related Benefit to DACs

Per the analysis in *Attachment 7, Table 7-1*, the *San Diego River Healthy Headwaters Restoration* project site is 56% DAC by area. This project directly addresses two of the urban DAC issues identified in the 2013 IRWM Plan,[10] and summarized in *Attachment 7 Disadvantaged Communities*: surface water quality and flooding/impervious surfaces. The direct surface water quality benefit is achieved through invasive species removal and restoration of unauthorized recreation trails that contribute to water quality issues in the San Diego River watershed. It directly provides flooding/creek constriction benefits through removal of invasive species which could cause creek constriction.

Project Performance Monitoring Plan

Benefits of the *San Diego River Healthy Headwaters Restoration* project will accrue as described in **Tables 2-53** and **2-54** above. **Table 2-56** describes the methods that will be used to measure the quantified benefits of this project.

USFS and its project partners will monitor habitat improvement benefits by identifying and mapping invasive plant species populations, sediment management activities, and nuisance wildlife populations that are addressed during the project, as well as conduct follow-up surveys to understand regrowth/repopulation and to evaluate success of treatments. Polygons of successfully treated areas will be used to estimate water savings. The SDRFP will conduct surveys within the outreached communities to assess and monitor outreach success.

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

Table 2-56: Project Monitoring for *San Diego River Healthy Headwaters Restoration*

Proposed Physical Benefits	Measurement Tools and Methods	Targets
Habitat Improved	USFS will compile monitoring information from its activities within the Cleveland National Forest and its project partners (BCLT, City of San Diego, and SDRPF) activities on watershed and reservoir lands. USFS and its partners will identify and map treated invasive plant species populations, sediment management activities, and nuisance wildlife populations using GIS and aerial photography. USFS and its project partners will conduct follow-up surveys annually (either in person or via aerial photography) to understand regrowth/repopulation.	335 acres of invasive weed removal (plus 62 acres of unauthorized site rehabilitation)
Water Supply	USFS and partners will map treated areas, creating a GIS based record of site characteristics (type of weeds/density). Mapped treatment areas and follow-up treatment/site visits will help the USFS determine the actual number of acres where invasive weeds were successfully eradicated. Based on the final acres, the USFS will use the same formulas discussed in the application for estimating final water savings from the project.	1,988 AFY

Cost Effectiveness Analysis

The *San Diego River Healthy Headwaters Restoration* project will achieve two quantifiable physical benefits described in detail in the sections above, and summarized in **Table 2-53 and 2-54**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-57** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-57: Cost Effective Analysis for *San Diego River Healthy Headwaters Restoration*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-53 and 2-54.* Benefit 1: Habitat Improved – 335 acres through invasive removal and sediment management Benefit 2: Water Supply – 1,988 AFY water conserved through invasive removal
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?* No
	If no, why? If yes, list the methods (including the proposed project) and estimated costs. No alternatives were explicitly considered. The USFS *Land Management Plan Monitoring and Evaluation Report: Cleveland National Forest FY 2013* includes multiple strategies undertaken by USFS to manage forest lands for water quality, habitat, fire management, and public use goals. The watershed management activities included in this project (invasive removal and unauthorized trail rehabilitation) are proven methods that were established in the USFS *Land Management Plan* and are implemented to varying degrees in each fiscal year. Implementation is based on available funding, typically from grants or agreements with partners. No alternatives were explicitly considered.
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.* There is no least cost alternative identified for this project. The Forest Hydrologist (Emily Fudge) from the Cleveland National Forest selected the suite of activities within this Proposal to best leverage State grant dollars to address key water quality impairments in San Diego River, upstream tributaries, and downstream El Capitan Reservoir resulting from Forest and headwater lands.

Project 12: Sweetwater Reservoir Wetlands Habitat Recovery

Local Project Sponsor: Sweetwater Authority (SWA)
Partner: California Conservation Corps and Urban Corps of San Diego County

Project Summary

The project will restore and enhance habitat near Sweetwater Reservoir, including 75 acres Least Bell's Vireo habitat, enabling full use of Sweetwater Reservoir for storage.

Project Maps

Figure 2-28 shows the *Sweetwater Reservoir Wetlands Habitat Recovery* project area, the service area 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 2-29** shows the areas that will be restored and the areas that will be protected in place through this project.

Views of Habitat Recovery Project area at Sweetwater Reservoir

Project Description

The *Sweetwater Reservoir Wetlands Habitat Recovery Project* (HRP) is an integrated, multi-benefit project that achieves the San Diego IRWM Program's goals of protecting and enhancing our natural resources, protecting and enhancing water quality, and improving the reliability of regional water supplies. The project supports the recovery and long-term improvement of habitat function and value for the endangered least Bell's vireo (LBV) in Sweetwater Reservoir, a public drinking water supply reservoir. After the 2007 Harris Fire burned approximately 90 acres of existing LBV habitat within the upper limits of the reservoir, Sweetwater Authority (SWA) initiated a recovery strategy to correct the site's underlying limitations and reclaim riparian wetlands for LBV. The project will provide a natural environmental buffer for flow attenuation and bioremediation to maximize wetland function for water quality benefits within Sweetwater Reservoir and subsequent treatment as the public drinking water supply. The HRP will also enable additional imported water storage capacity at Sweetwater Reservoir, positively affecting the regional water supply.

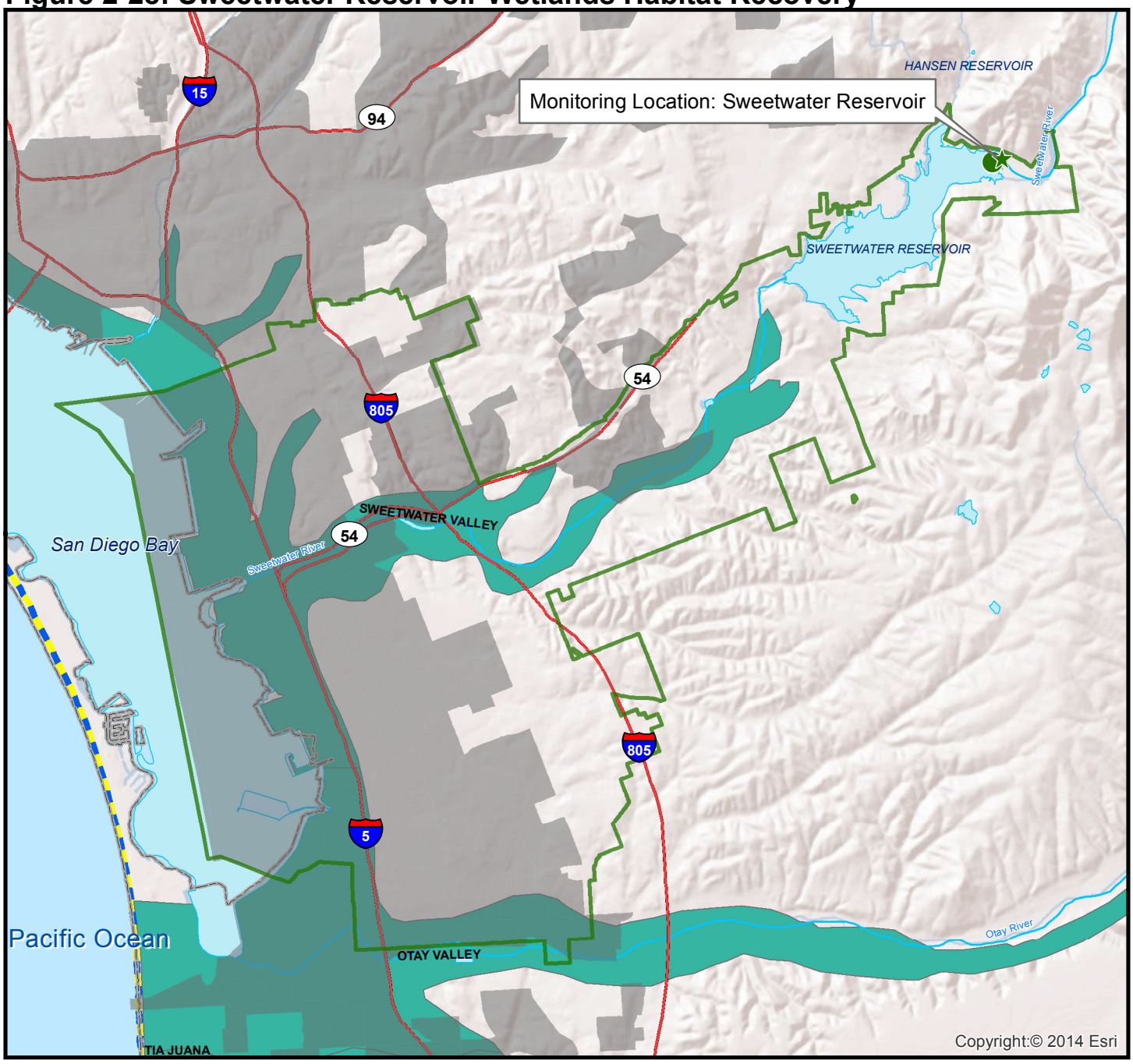
Technical studies conducted in 2009-2010 produced a conceptual design for the HRP in 2011. Grading design, plans and specifications, environmental compliance, and regulatory permitting also commenced in 2011. HRP construction is scheduled to begin in 2016 and will include major site grading, temporary irrigation, and planting. A five-year maintenance and monitoring period after construction will be followed by perpetual site management by SWA to ensure project success, although work pursuant to this Proposal will end by October 31, 2019.

The HRP involves mass grading within the Sweetwater River/Sweetwater Reservoir floodplain to create a braided channel system and improve hydrologic functionality. The multichannel design and bridge installation will spread river flow more evenly to improve habitat quality in areas lacking sufficient hydrology. Within the 112.7-acre project area, the HRP will restore and enhance approximately 112.5 acres of riparian and 0.2 acre of transitional habitats and will result in a net increase of 74.6 acres of habitat, specifically for the endangered LBV, over current conditions. The expanded preserve will be recorded, protected, and managed under a Conservation Easement.

In addition to habitat restoration and water quality benefits, HRP implementation will enhance imported water storage capabilities in Sweetwater Reservoir and contribute to regional water reliability. The project will allow for periods of storage in the reservoir above the 230-foot elevation when excess imported water is available. Currently, SWA is restricted from storing any imported water above this elevation because of potential impacts to LBV habitat. The operational limit was required by the permitting agencies in 1994 and effectively removes reservoir storage capacity equivalent to 7,873 acre-feet (AF) at Sweetwater Reservoir. Implementation of the HRP will permit normal Sweetwater Reservoir storage operations (total capacity of 28,079 AF) and allow storage of imported water when supply is plentiful. This additional 7,873 AF of storage capacity represents up to one half of the water processed through the Perdue Water Treatment Plant annually and will provide additional water supply reliability during drought conditions.

The *Sweetwater Reservoir Wetlands Habitat Recovery Project* will: 1) re-establish the river-floodplain connection to create hydrology that is in dynamic equilibrium with the Sweetwater River and Sweetwater Reservoir inundation area; 2) restore and enhance large areas of LBV habitat, thereby improving habitat function and value for the species; 3) allow for normal Sweetwater Reservoir storage operations and ensure the ability to store additional imported water when regionally available; and 4) maximize wetland function for water quality benefits within Sweetwater Reservoir.

Figure 2-28: Sweetwater Reservoir Wetlands Habitat Recovery



Coordinates: 32.70707, -116.97062

Legend

- San Diego IRWM Region
- Funding Area Boundary
- Freeway
- Waterbody
- County
- DAC Area*
- Very Low Priority Groundwater Basin
- Benefit Area: 12 Sweetwater Reservoir Wetlands Habitat Recovery
- Sweetwater Authority Service Area
- Monitoring Location

0 0.75 1.5 3
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\2-13_SweetwaterProject30072015.mxd

Figure 2-29: Sweetwater Reservoir Wetlands Habitat Recovery Areas

HMP Riparian Habitat Limits - Proposed (212.6 acres)

HMP Protect in place (99.9 acres)

HRP Restoration (112.7 acres) *

* Acreage does not include restoration of the staging area outside of the HMP boundary

Project Physical Benefits

Tables 2-58 and **2-59** provide summaries of the primary (Habitat Improved) and secondary (Water Supply) benefits anticipated to be achieved through implementation of the *Sweetwater Reservoir Wetlands Habitat Recovery* project.

The primary physical benefit of the project is the restoration and enhancement of 112.7 acres of habitat (**Table 2-58**), with an emphasis on LBV habitat. Of this 112.7 acres, 0.2 acres will be transitional habitat, and 112.5 acres will be riparian habitat. An additional 99.9 acres will be protected in place by this project, and will be covered by the overall Conservation Easement of 212.6 acres.[11] This additional 99.9 acres are not claimed as a benefit of the project because they are existing habitat that will be legally protected, but not improved or restored. It is anticipated that the entire preserve area (212.6 acres) would be maintained into perpetuity, although unforeseen circumstances may impact the life of the project, so a 50-year anticipated useful life has been used for this analysis. Habitat benefits will begin accruing immediately after project completion because species are unlikely to utilize the new habitat while construction is underway due to disturbances from equipment and human activities.

The baseline was calculated as the existing habitat with connectivity to the project area. In addition to the 99.9 acres that will be protected in place, the project area is also adjacent to two conservation areas that currently provide habitat for a variety of native species. SWA protects lands adjacent to and south of the reservoir, while both this land and the eastern portion of the project area are adjacent to the San Diego National Wildlife Refuge (SDNWR). SDNWR is managed by the U.S. Fish and Wildlife Service, and spans 11,470 acres.[12] Only a portion of SDNWR is physically connected to Sweetwater Reservoir (either directly or through connection with locally-conserved areas). For the baseline, only the 6,500 acres of SDNWR that has connectivity to the project area was considered as "existing habitat". A geographic information system (GIS) analysis of the locally-conserved area adjacent to the reservoir was also completed, and was determined to be approximately 625 acres. Together, the existing habitat with connectivity to the reservoir is estimated at approximately 7,225 acres.

Table 2-58: Primary Physical Benefit – Habitat Improved
Sweetwater Reservoir Wetlands Habitat Recovery

Project Name: Sweetwater Reservoir Wetlands Habitat Recovery **Type of Benefit Claimed:** Habitat Improved – Restoration **Units of the Benefit Claimed:** Acres **Anticipated Useful Life of Project**: 50 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project**	**Annual With Project**	**Annual Change Resulting from Project**
2019-2068	7,225 acres	7,337.6 acres	112.7 acres
Comments: The project life is assumed to be 50 years. Benefits would begin accruing immediately following project completion. Per *Attachment 5 Schedule*, construction would be complete in August 2019, with benefits beginning to accrue in September 2019. 100% of the project benefit would therefore be realized from 2019-2068. Without project baseline was calculated as the estimated existing open space/habitat with physical connectivity to the project area ("protect in place" acreage within the project area, locally-conserved land adjacent to the reservoir, and SDNWR land adjacent to the reservoir). Sources: USFWS. 2014. *San Diego National Wildlife Refuge Draft Comprehensive Conservation Plan/Environmental Assessment*. June.			

[11] Pers. Comm. Peter Famolaro, Watershed Manager, Sweetwater Authority (revised project scope).
[12] USFWS. 2014. *San Diego National Wildlife Refuge Draft Comprehensive Conservation Plan/Environmental Assessment*. June.

The secondary physical benefit of the project is Water Supply from the Sweetwater Reservoir's increased operational storage capacity of 7,873 AF (**Table 2-59**). The *Sweetwater Reservoir Water Storage and Habitat Management Program Risk Assessment* notes that it takes three to five years for restored riparian habitat to develop enough to support nesting LBV.[13] Although habitat benefits, which include species beyond LBV, would be realized immediately following project completion, the water supply benefit would not be realized until LBV are able to begin to utilize the restored habitat, so that the LBV population will not be harmed as water levels in the reservoir rise. Water supply benefits are therefore assumed to begin a little more than three years after the project is complete, approximately 3 years into the project's 50-year life. The baseline "without project" for this benefit is the reservoir capacity available at the current maximum depth of 230-foot elevation of the reservoir. Per SWA's capacity curves for Sweetwater Reservoir, at 230-foot elevation, the surface area of the reservoir is 794.7 acres, and capacity is 20,225 AF.[14] The significant increase in the imported water storage capacity of the reservoir by 7,873 AF represents approximately 30-50% of the water processed through the Perdue Water Treatment Plant annually and will provide an additional 4 to 6-month supply. SWA could purchase up to the full 7,873 AF annually from San Diego County Water Authority (SDCWA), as available, to replenish the Sweetwater Reservoir. The additional usable storage volume will provide a greater buffer to the region when hydrologic cycles induce rapid drought conditions.

Table 2-59: Secondary Physical Benefit – Water Supply
Sweetwater Reservoir Wetlands Habitat Recovery

Project Name: Sweetwater Reservoir Wetlands Habitat Recovery
Type of Benefit Claimed: Water Supply – Imported water storage
Units of the Benefit Claimed: AFY
Anticipated Useful Life of Project: 50 years

(a)	(b)	(c)	(d)
Year	**Annual Without Project**	**Annual With Project**	**Annual Change Resulting from Project**
2019	20,225 AFY	20,225 AFY	0 AFY
2020	20,225 AFY	20,225 AFY	0 AFY
2021	20,225 AFY	20,225 AFY	0 AFY
2022-2068	20,225 AFY	28,098 AFY	7,873 AFY

Comments: The increased imported water storage capacity will be created by the increased allowable water level of Sweetwater Reservoir to 239-foot elevation from 230-foot elevation. This increase would be allowed because LBV would have alternate habitat available as a result of this project. The project life is assumed to be 50 years, but the benefit will only begin accruing after the first three years because the habitat needs to mature enough to provide appropriate structure for LBV to nest before reservoir levels could rise above the 230-foot elevation. The baseline was calculated as the existing maximum allowable imported water storage capacity of the reservoir, which is the reservoir capacity at 230-foot elevation, or 20,225 AF.

Sources: SWA. 1983. *Existing Stage / Area / Capacity Curves for the Sweetwater Reservoir*. November.
SWA. 2011. *2010 Urban Water Management Plan*.

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

The *Sweetwater Reservoir Wetlands Habitat Recovery Project* will contribute to local and regional species protection and water management goals utilizing an integrated approach. Sweetwater Reservoir was constructed in 1888 and has an approximate capacity of 28,098 AF. The Sweetwater River watershed is approximately 230 square miles and Sweetwater Reservoir receives flows from Loveland Reservoir, located approximately 17 miles upstream.[15] SWA operates the Robert A. Perdue Water Treatment Plant (Perdue Plant) located adjacent to

[13] SWA. 2010. *Sweetwater Reservoir Water Storage and Habitat Management Program Risk Assessment*. June.
[14] SWA. 1983. *Existing Stage/Area/Capacity Curves for the Sweetwater Reservoir*. November.
[15] SWA. 2011. *2010 Urban Water Management Plan*.

Sweetwater Reservoir. The Perdue Plant has a treatment capacity of 30 million gallons per day (MGD) and is capable of treating surface runoff stored at Sweetwater Reservoir or imported raw water from SDCWA.

Sweetwater Reservoir is located adjacent to large protected areas and has become habitat for LBV. The Sweetwater Reservoir Habitat Management Program (HMP) was developed in 1994 as a means to balance Sweetwater Reservoir operating requirements with environmental protection and management of the endangered LBV and its habitat.[16] Since that time, SWA has been restricted from storing any imported water above the 230-foot elevation in Sweetwater Reservoir because of potential impacts to LBV habitat.

The upper end of Sweetwater Reservoir had historically been subjected to sand mining, and is still characterized by a deeply incised channel, mine pits, soil mounds, and haul roads. These topographic changes have affected the hydrology in the project area, and the dynamic nature of a riparian area has been lost or diminished.[17] In 2007, the Harris Fire burned a substantial amount of LBV habitat in the project area. This habitat was located in an area whose hydrology was altered by past mining activities, which lowered the groundwater table and altered inundation patterns. These changes to the natural hydrology of the project area have made it more difficult for this area to recover from the impacts of the fire.[18] Implementation of the HRP will improve river flow and groundwater conditions, creating a healthier and self-sustainable riparian habitat system in the Sweetwater Reservoir.

Habitat improvements are important in San Diego County because the county is one of the most biodiverse areas in the country.[19] A California Natural Diversity Database (CNDDB) query for the project area and the area immediately surrounding the reservoir found a total of 67 species (30 plants and 37 animals) reported within or near the project area.[20] These species may utilize the restored habitat created by the project, and are presented in **Table 2-60** as wildlife species whose populations could benefit from the habitat improvements implemented by this project. Note that the area included in the CNDDB query only included those areas of the existing habitat that were closest to the project area, and did not encompass all 7,225 acres of existing habitat because species furthest from the project area are least likely to utilize the habitat created by the project.

Table 2-60: Wildlife Species Listed in CNDDB Within or Near the Project Area

Animals		
Federal- or State-Listed Threatened, Endangered, or Candidate Species		
Arroyo Toad	Quino Checkerspot Butterfly	Swainson's Hawk
Coastal California Gnatcatcher	San Diego Fairy Shrimp	Townsend's Big-Eared Bat
Least Bell's Vireo	Southwestern Willow Flycatcher	
Non-Listed Species		
American Badger	Hoary Bat	Western Beach Tiger Beetle
Bell's Sage Sparrow	Long-Eared Myotis	Western Mastiff Bat
Big Free-Tailed Bat	Orangethroat Whiptail	Western Red Bat
California Horned Lark	Pocketed Free-Tailed Bat	Western Small-Footed Myotis
Coast Horned Lizard	Red-Diamond Rattlesnake	Western Spadefoot
Coastal Cactus Wren	San Diego Black-Tailed Jackrabbit	Western Tidal-Flat Tiger Beetle
Coastal Whiptail	San Diego Ringneck Snake	Yellow Warbler
Cooper's Hawk	So Ca Rufous-Crowned Sparrow	Yellow-Breasted Chat
Double-Crested Cormorant	Thorne's Hairstreak	Yuma Myotis
Hermes Copper Butterfly	Tricolored Blackbird	

Source: California Natural Diversity Database (CNDDB). RareFind 5 query within Project Area (23 July 2015).

In addition to habitat restoration, implementation of the HRP will enhance imported water storage capabilities in Sweetwater Reservoir and contribute to regional water reliability. Implementation of the HRP will permit normal Sweetwater Reservoir storage operations and allow storage of imported water when supply is plentiful. Currently,

[16] SWA. 2011. *Habitat Recovery Plan for the Sweetwater Reservoir Wetland Habitat Recovery Project*. April.
[17] SWA. 2011. *Habitat Recovery Plan for the Sweetwater Reservoir Wetland Habitat Recovery Project*. April.
[18] SWA. 2011. *Habitat Recovery Plan for the Sweetwater Reservoir Wetland Habitat Recovery Project*. April.
[19] Regional Water Management Group. 2013. 2013 San Diego Integrated Regional Water Management Plan. September.
[20] California Natural Diversity Database. Rarefind 5. Database query within Project Area. Accessed 23 July 2015. Available with subscription: https://map.dfg.ca.gov/rarefind/view/RareFind.aspx

imported water storage in the reservoir cannot exceed the 230-foot elevation because the inundation of riparian habitat was presumed to decrease the amount of available habitat and result in detriment to LBV. The increase in high quality riparian habitat will allow for the increase in storage capacity without negative impacts to the LBV. The *Sweetwater Reservoir Water Storage and Habitat Management Program Risk Assessment*[21] concluded that periodic inundation of LBV habitat due to reservoir operations will not significantly affect the long-term viability of the habitat or species. As such, adaptive management of reservoir operations could support removal of the 230-foot imported water restriction and conversion of the previously cleared managed reservoir to LBV habitat, thus increasing conserved and managed HMP lands. This will allow for periods of storage in the reservoir above the 230-foot elevation to a 239-foot elevation when excess imported water is available, contributing to regional water reliability.

Water supply reliability is a critical issue in California, to protect against drought and potential climate change impacts. Increased storage is a means to increase supply reliability and reduce impacts of drought because agencies would be able to store excess water from wet years to hold in reserve for dry years. By restoring additional habitat for LBV, SWA could lift the 230-foot elevation limit on Sweetwater Reservoir and help provide water supply reliability by increasing storage capacity.

Without-Project Conditions

The HRP has been an ongoing process, and significant effort has gone into developing the invasive species control, technical studies, a conceptual design, preparation of final grading design, plans and specifications, environmental compliance, regulatory permitting, and securing funds to perform the work. All of this work was completed to ensure the project would be successful and would not harm LBV, while still enabling improved reservoir management. Without this project, the work completed in Phase I and Phase II of the HRP would not come to fruition and the functions and values of regionally significant habitat for the endangered LBV and associated riparian species would not be reclaimed. The altered topographic landscape and faulty floodplain system left by historic sand mining operations would not be restored. Riparian and transition habitats in the Sweetwater Reservoir would remain degraded and dominated by invasive species, and would continue to struggle to recover from the 2007 Harris Fire. River flow and groundwater conditions would remain poor and the additional 7,873 acre-feet of storage capacity in the Sweetwater Reservoir would not be available for use.

Methods Used to Estimate the Physical Benefits

Primary Benefit – Habitat Improved

The primary physical benefit of the project is the restoration and enhancement of 112.7 acres of habitat. The project will restore and enhance 0.2 acres of transitional habitat and 112.5 acres of riparian habitat. The amount of habitat corresponds to the specific area defined by the topography and fluvial geomorphology in the project site. The proposed project has been scaled down from the *Sweetwater Reservoir Wetlands Habitat Recovery Project – Conceptual Restoration Plan*[22] and the *Sweetwater Reservoir Storage and Habitat Management Program Risk Assessment*[23] to 112.7 acres restored and 99.9 acres protect-in-place[24], for a total of 212.6 acres covered by the Conservation Easement.

$$112.5\ acres\ riparian\ habitat + 0.2\ acres\ transitional\ habitat = \mathbf{112.7\ acres}$$

Secondary Benefit – Water Supply

The secondary physical benefit of the project is water supply acquired through increased operational storage capacity of 7,873 AF. Under current conditions, SWA cannot increase Sweetwater Reservoir storage above 230-foot elevation without endangering LBV populations. This project will create habitat suitable for LBV, which will enable SWA to increase use of the reservoir to the 239-foot elevation. The increased storage capacity was

[21] Sweetwater Authority. 2010. *Sweetwater Reservoir Water Storage and Habitat Management Program Risk Assessment*. June.
[22] SWA. 2014. *Sweetwater Reservoir Wetlands Habitat Recovery Project – Conceptual Restoration Plan*. October 30.
[23] SWA. 2010. *Sweetwater Reservoir Water Storage and Habitat Management Program Risk Assessment*. June.
[24] SWA. 2015. *Sweetwater Reservoir Wetlands Habitat Recovery Project – Reduced Version 1*.

calculated using the "*Existing Stage/Area/Capacity Curves for Sweetwater Reservoir".*[25] According to SWA, the current total reservoir capacity at the 230-foot elevation is 20,225 AF. Capacity is provided in 2-foot elevation increments, so no capacity is given for 239-feet elevation. An average of the capacity at 238-foot elevation (27,118.9 AF) and 240-foot elevation (29,077.2 AF) was used to estimate capacity at 239-foot. At 239-foot elevation, total capacity of the reservoir is estimated at 28,098 AF, creating the additional capacity of 7,873 AF over a current maximum capacity at 230-foot elevation. According to SWA's *2010 Urban Water Management Plan*, SWA has no contracted volume limit for imported water purchased from SDCWA[26]; therefore, up to the full 7,873 AF could be purchased annually to replenish the Sweetwater Reservoir.

$$Capacity\ at\ 239\ feet - Capacity\ at\ 230 feet = Increase\ in\ storage\ capacity$$

$$28{,}098\ AFY - 20{,}225\ AFY = \mathbf{7{,}873\ AFY\ additional\ storage}$$

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

To realize the physical benefits of habitat improvement and water supply from this project would require implementation of the project as described in the Work Plan (see *Attachment 3 Work Plan*). Project planning documents found that the project was feasible and would not result in a "take" of LBV. All permits required to complete the project are included in the Work Plan. This project would require major site grading to improve stream hydrology, planting of the new riparian habitat, and temporary irrigation for the restored areas to help establish vegetation. Restoration efforts will include a multi-channel design and bridge installation to improve hydrology and spread river flow more evenly to improve habitat quality. Once restoration is complete, habitat benefits will be realized, while water supply benefits will require some additional time to allow vegetation to establish sufficiently to provide nesting habitat for LBV.

Potential Adverse Physical Effects of the Project and Mitigation

The project may result in temporary environmental impacts during restoration activities required for implementation of the project. Potential impacts include those associated with sensitive vegetation communities, jurisdictional waters and wetlands, and special-status species. To evaluate these potential impacts, a Mitigated Negative Declaration (MND) was prepared for this project. Potential impacts were found for biological resources, cultural resources, noise, and mandatory findings of significance.[27] Due to the presence of special-status species (LBV) in the project area, there are potential impacts associated with restoration activities, including grading and vegetation removal. Mitigation measures will include coordination with a qualified biologist to minimize impacts to species of concern, strict adherence to construction footprint limits, pre-construction habitat assessments for certain species, temporary relocation of specific species of concern, and avoidance of breeding bird season for vegetation removal, clearing, and grubbing activities.

Cultural resources were found to potentially exist within the Area of Potential Effects(APE), and mitigation measures will include coordination with a qualified archaeologist to ensure sensitivity to cultural resources, monitoring by both a qualified archaeologist and a Native American observer during ground disturbing activities, stopping work in the event that cultural or paleontological resources are encountered until the archaeologist or a qualified paleontologist can determine the significance and how to handle the discovery, handling of human remains in accordance with California state law if human remains are found and in coordination with Native American Heritage Commission (NAHC) if said remains are found to be Native American.

The project would also create potentially significant noise impacts, due to the use of construction equipment and construction-related activities such as transporting workers, grading, recontouring of the channels and floodplain, and other construction activities. Mitigation measures that will be implemented include limiting construction activities to the hours allowed in San Diego County's noise standards, use of equipment that have working mufflers, turning off equipment when not in use, shielding or redirecting noises away from nearby residences, establishing staging areas away from sensitive receptors, and coordination with local property owners to provide information on construction times and how to file complaints.

Implementation of the mitigation measures as described in the MND would reduce any potential impacts of this project to less than significant. As such, any impacts associated with the project are anticipated to be short-term

[25] SWA. 1983. *Existing Stage/Area/Capacity Curves for the Sweetwater Reservoir*. November.
[26] SWA. 2011. *2010 Urban Water Management Plan*.
[27] ESA. 2014. *Sweetwater Reservoir Wetlands Habitat Recovery Project Final Initial Study/Mitigated Negative Declaration*.

in nature, and mitigated to less-than-significant levels. It is not anticipated that any significant, long-term adverse physical effects would result from implementation of this project.

Long-Term Drought Preparedness

The HRP will effectively address long-term drought preparedness in two ways: 1) increases water supply reliability, and 2) efficient groundwater basin management. This project will permit normal Sweetwater Reservoir storage operations (which have been limited by LBV protection), which will ensure the ability to store 7,873 AF of additional imported water when excess supply is available. This significant increase in water storage capacity represents approximately 30-50% of the amount of water processed through the Perdue Water Treatment Plant annually.[28] Having additional storage capacity will provide an additional buffer against potential supply shortages during periods of drought. The project also provides for efficient groundwater management because this project would improve water quality in the reservoir. Nutrient and pollutant uptake is expected to increase once riparian vegetation is established. Sweetwater Reservoir is upgradient of the San Diego Formation (SDF), a large, brackish aquifer that underlies several coastal alluvial aquifers and extends north to the San Diego River Valley and south to the United States/Mexico border.[29] The SDF is used as a water supply source by SWA and the City of San Diego through the Reynolds Groundwater Desalination Facility, which is currently being expanded to a capacity of 8,800 AFY.[30] The National City Wells also use SDF water as a supply. According to SWA's *2010 Urban Water Management Plan*, groundwater pumping from the SDF in 2010 was 5,351 AF, or 26% of total supply.[31] Protection of groundwater quality through improved water quality upstream of the aquifer will help manage groundwater for this important supply source to these two agencies.

Direct Water-Related Benefit to DACs

A DAC analysis was completed and is presented in *Attachment 7 Disadvantaged Communities*. This analysis determined which of the projects included in this proposal meet the criteria of a DAC project, as defined in the *2015 PSP* and the *2015 Guidelines*. The *Sweetwater Reservoir Wetlands Habitat Recovery* project is located adjacent to Sweetwater Reservoir, and so falls outside residential areas that can be classified as DAC or non-DAC. To address this disconnect between the project area and the benefit area, SWA's service area was used as a proxy for determining DAC status. **Table 7-1** (see *Attachment 7 Disadvantaged Communities*) shows that the majority (54%) of SWA's service area comprises DACs in National City and Chula Vista (refer to **Figure 2-13**). The project will benefit all customers served by SWA, including those customers that are in DACs. This project directly addresses two DAC needs in **Table 7-2** (see *Attachment 7 Disadvantaged Communities*): surface water quality and DAC outreach. Surface water quality will be improved through restoration of the area around the Sweetwater Reservoir that was burned during the Harris Fire. As described above, riparian areas are anticipated to increase uptake of nutrients and pollutants, improving water quality in the reservoir and groundwater basins. All outreach conducted for this project would address all SWA customers, including its DACs, which, as stated above, comprise the majority of the service area.

Project Performance Monitoring Plan

Benefits of the *Sweetwater Reservoir Wetlands Habitat Recovery* project will accrue as described in **Tables 2-58** and **2-59** above. **Table 2-61** describes the proposed methods that will be used to measure the quantified benefits of this project. The methods used here are the proposed methods and are intended as an example of how the project would be monitored. Final methods would be delineated in the Project Performance Monitoring Plan created under Task 9 of the Work Plan (see *Attachment 3 Work Plan*), which will further document how the habitat improvement and water supply benefits will be measured.

SWA and its project partners will monitor habitat improvement benefits through annual focused surveys and documentation of LBV populations. SWA will monitor water supply benefits by reporting imported water supply and/or local runoff volumes stored in the expanded Sweetwater Reservoir, and documenting reservoir elevations.

[28] Sweetwater Authority. 2015. *HRP Benefit: Increased Imported Water Storage Capacity in SWR*. July 2.
[29] MWD. 2007. *Groundwater Assessment Study: A Status Report on the Use of Groundwater in the Service Area of the Metropolitan Water District of Southern California*. Report Number 1308. September. Chapter 4: San Diego County Basins – South San Diego County Basins.
[30] RMC Water and Environment. 2014. *2014 IRWM Drought Solicitation Implementation Grant Proposal – San Diego IRWM Region*. July.
[31] Sweetwater Authority. 2011. *2010 Urban Water Management Plan*. June.

Because the actual volume of water stored in the reservoir will vary depending on season and supply availability (e.g., actual storage is less a few years into a drought when supplies are limited), SWA will use habitat monitoring data to also determine the potential maximum elevations allowable in the reservoir. As described above, it takes three to five years for riparian habitat to develop sufficient structure for LBV nesting activities. Should habitat surveys indicate that LBV are utilizing the restored habitat earlier or later than anticipated, or that portions of restored habitat are establishing at a different rate than other areas, SWA staff, in consultation with wildlife agencies as necessary, will determine how this affects the allowable elevation of the reservoir. Due to the time required for riparian habitat to grow and establish sufficiently for LBV nesting activities, interim targets have been developed based on riparian growth rates, and are presented in **Table 2-61**.

Table 2-61: Project Monitoring for *Sweetwater Reservoir Wetlands Habitat Recovery*

Proposed Physical Benefits	Measurement Tools and Methods	Targets		
		Years 1-3	Years 3-5	Years 5+
Habitat Improved	SWA will complete focused surveys and photo documentation for LBV and suitable habitat. The baseline for this benefit was described in planning documents, and no additional pre-project surveys are required to establish baseline. The annual focused surveys and photos will document presence of LBV and availability of habitat suitable to LBV nesting activities.	Continued growth and establishment of habitat (photo documentation of habitat health and development)	0-74.6 acres of LBV habitat	112.7 acres of total habitat, including 74.6 acres of LBV habitat
Water Supply	SWA staff will utilize habitat data to determine the maximum allowable capacity of the reservoir, based on availability of LBV habitat in the project area. These allowable elevations will be supplemented with actual reservoir measurements to document how much of the expanded capacity is utilized. The annual reports will compare this data with supply availability data (e.g., SWP allocations or restrictions).	230-foot allowable reservoir elevation (no increase in storage capacity)	230-239-foot allowable reservoir elevation (0 – 7,873 AFY additional storage)	239-foot allowable reservoir elevation (7,873 AFY additional storage)

Cost Effectiveness Analysis

The *Sweetwater Reservoir Wetlands Habitat Recovery* will achieve two quantifiable physical benefits described in detail in the sections above, and summarized in **Table 2-58 and 2-59**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-62** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-62: Cost Effective Analysis for *Sweetwater Reservoir Wetlands Habitat Recovery*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-58 and 2-59.* Benefit 1: Habitat Improved – 112.7 acres restored and improved Benefit 2: Water Supply – 7,873 AFY increased storage capacity
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. As described in the *Habitat Recovery Plan for the Sweetwater Reservoir Wetland Habitat Recovery Project*,[32] four design alternatives were considered, which were required to meet the following feasibility and LBV suitability criteria: • Grading to create access to adequate groundwater for establishing vegetation • Creating a streambed gradient that is in dynamic equilibrium through the site • Creating flow channels sized appropriately to convey stormflow without excessive erosion or vegetation loss • Maintaining adequate LBV habitat acreage per HMP and subsequent mitigation requirements • Feasible cost to SWA for both implementation and management • Soil import-export balance (as much as is feasible) The four alternatives were 1) Minimum Channel Design, 2) Tiered Shallow Basins Design, 3) Downstream Grade Structure Design, and 4) Multi-Channel Design. The preferred alternative was 4) Multi-Channel Design due to the project benefits and cost effectiveness. A cost effective analysis was not included in the final plan.
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.* There is no least cost alternative identified for the project. However, the proposed project is a slight modification of the preferred alternative from the *Habitat Recovery Plan for the Sweetwater Reservoir Wetland Habitat Recovery Project*, and was selected, in part, due to cost effectiveness. SWA is committed to restoring the imported water storage capacity within the Sweetwater Reservoir, which can only be achieved by restoring LBV habitat. This proposed project accomplished those goals within a scaled down, lower cost, footprint.

[32] SWA. 2011. *Habitat Recovery Plan for the Sweetwater Reservoir Wetland Habitat Recovery Project*. April.

Project 13: Hodges Reservoir Natural Treatment System

Local Project Sponsor: City of San Diego (City)
Partners: Santa Fe Irrigation District (SFID), San Dieguito Water District (SDWD), San Dieguito River Valley Conservancy (SDRVC), and San Diego County Water Authority (SDCWA)

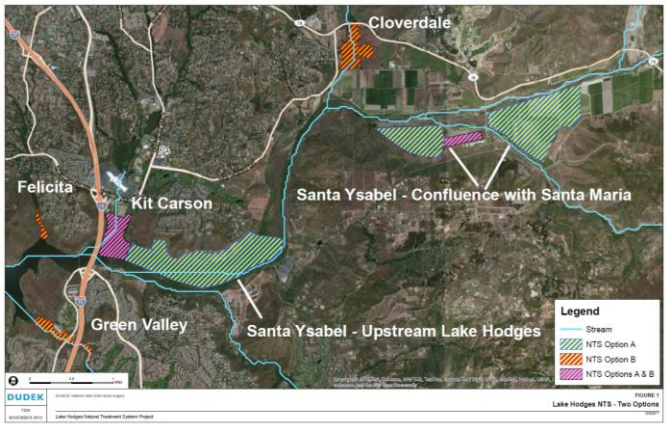
Project Summary

The project will implement a constructed biofiltration wetland at the Hodges Reservoir to treat seasonally degraded water quality in the reservoir.

Project Maps

Figure 2-30 shows the *Hodges Reservoir Natural Treatment System* 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. Project location and details are provided in **Figure 2-31**.

The natural treatment system will improve water quality in Hodges Reservoir to maximize use of the reservoir for regional water supply



Conceptual design options from Hodges Reservoir Natural Treatment System Implementation Action Plan

Project Description

The *Hodges Reservoir Natural Treatment System* project, which builds on work funded by previous San Diego Region IRWM grants, will include the design and construction of a natural treatment system (NTS) to improve reservoir water quality. Hodges Reservoir, owned and operated by the City of San Diego, serves the San Dieguito Water District, Santa Fe Irrigation District, and the City of San Diego. Due to SDCWA's Emergency Storage Project, Hodges Reservoir is now connected to Olivenhain Reservoir and SDCWA's regional aqueduct system. However, seasonally degraded water quality in Hodges Reservoir has severely limited the reservoir's use as a regional water supply. Improving water quality in Hodges will allow for optimal water pumping and delivery flexibility in conjunction with the connectivity to the SDCWA's imported water system. Hodges Reservoir is identified as a Clean Water Act 303(d) impaired water body for nitrogen, phosphorus, color, manganese, turbidity, pH, and mercury. Pollution sources emanate from upstream urban development and from agricultural runoff, which is the dominant land use in its 250-square mile watershed. Declining water quality in Hodges Reservoir has placed increasing treatment challenges and costs on present users.

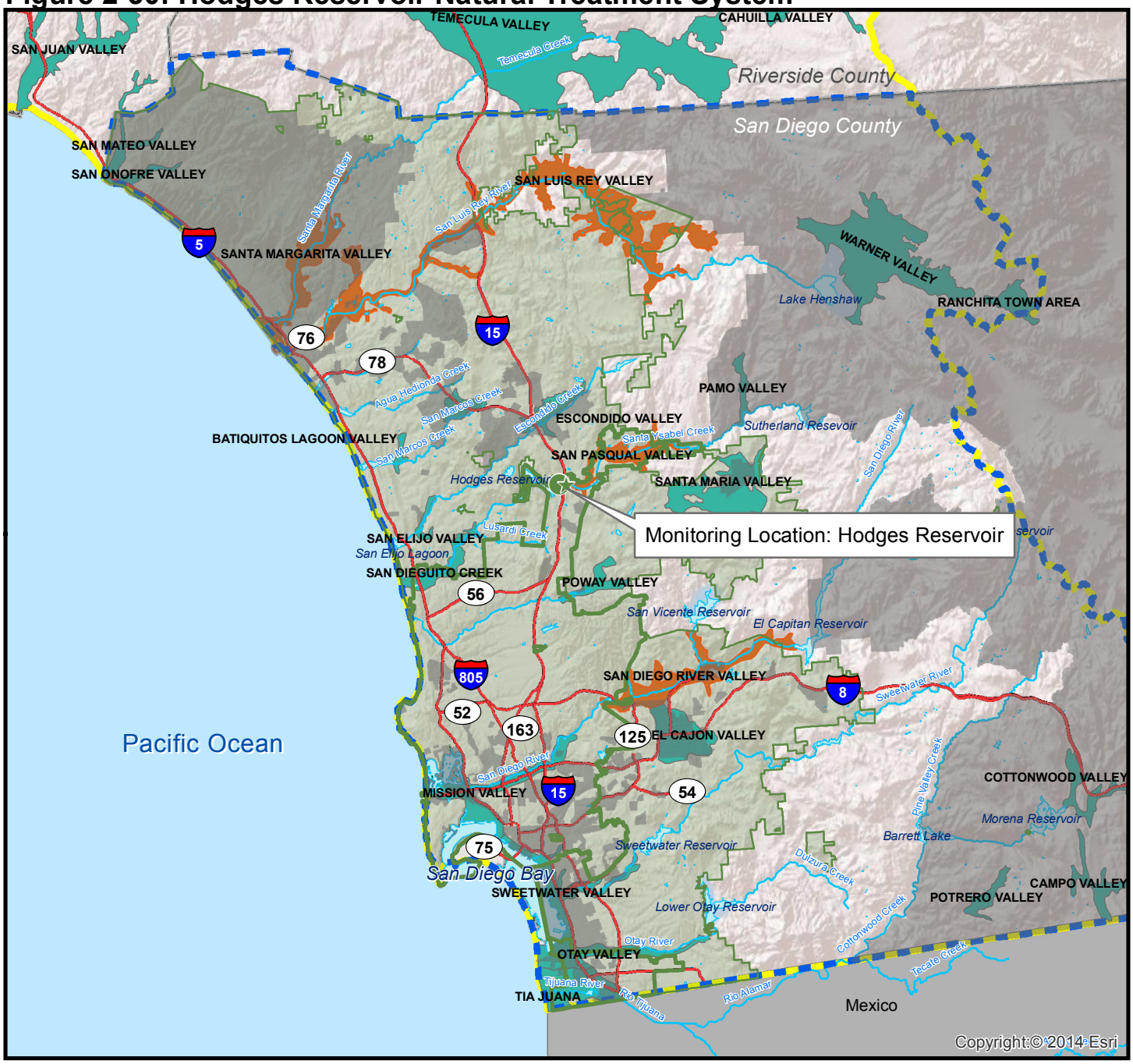
The project partners have pursued two studies associated with water quality in Hodges Reservoir. The *Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan*,[33] prepared by SDRVC and funded by a Prop 50 IRWM grant, recommended a NTS consisting of three constructed treatment wetlands near the confluences of Felicita, Kit Carson, and Green Valley Creeks and Hodges Reservoir. The *Hodges Reservoir Water Quality Assessment Study: Conceptual Planning Report*,[34] prepared by the City and funded by a Prop 84-Round 1 IRWM grant, identified three recommendations for reducing nutrient loading and cycling in the reservoir, one solution being a constructed treatment wetlands that could be developed on the northern shore of Hodges Reservoir and used to filter nutrients from within the reservoir. The *Conceptual Planning Report* identified the three recommendations as: 1) hypolimnetic oxygenation system (construction funded via a Prop 84-Drought Round IRWM grant), 2) upper wetlands NTS (proposed herein), and 3) mid-lake vigorous epilimnetic mixing. The project partners share the following common goals that will be advanced by this project: to improve water quality, water supply reliability, habitat and species conservation, and open space and recreational resources.

The primary goal of the NTS is to improve water quality, specifically reducing nutrient loading, within Hodges Reservoir for the purposes of making the water impounded in the reservoir more treatable at downstream water treatment plants, thus making the water available as a water supply with reduced treatment costs. The project will involve construction of a NTS, which requires site grading and evacuation, installation of water control structures to establish desired hydraulic flow patterns, and placement and sealing of liners (if necessary), and installation of vegetation, irrigation, and hydraulic equipment.

The *Hodges Reservoir Natural Treatment System* project is currently being defined in a study that will combine the recommendations of the two aforementioned technical studies previously funded by IRWM grants to find the most productive and cost-effective NTS for the watershed. Therefore, this Proposal includes the development of design criteria, final design, and construction of a NTS. Construction of the *Hodges Reservoir Natural Treatment System* project will complement the *Regional Emergency Storage and Conveyance System Intertie Optimization* project (solution number one from the *Conceptual Planning Report* described above) funded by a Prop 84-Drought IRWM grant which will manage and control excessive algal productivity, internal nutrient cycling, and improve water quality in the reservoir by injecting pure oxygen to the deep portions of the reservoir. The project partners are now seeking funding for solution number two to compliment the first project. The project will also improve habitat and recreational opportunities in the reservoir as water quality improves.

[33] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.
[34] City of San Diego. 2014. *Lake Hodges Reservoir Water Quality Assessment Study: Final Conceptual Planning Report.* June.

Figure 2-30: Hodges Reservoir Natural Treatment System



Coordinates: 33.0577, -117.0796

0 4.75 9.5 19
Miles

N

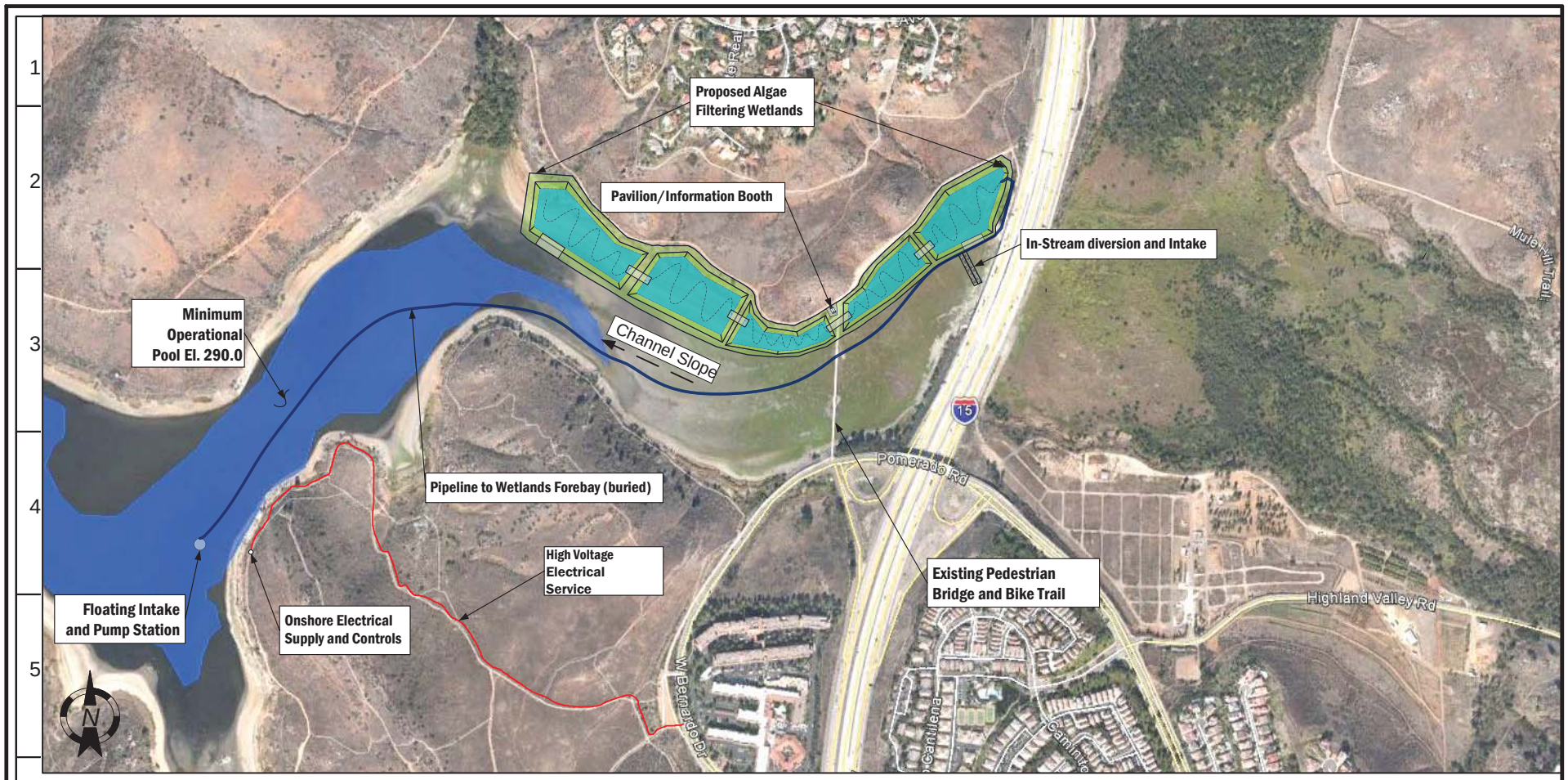
Legend

- San Diego IRWM Region
- Funding Area Boundary
- Freeway
- Waterbody
- County
- DAC Area*
- Medium Priority Groundwater Basin
- Very Low Priority Groundwater Basin
- Hodges Reservoir Natural Treatment System
- City of San Diego - Project Proponent
- Monitoring Location
- Benefit Area: 13 Hodges Reservoir Natural Treatment System (corresponds to San Diego County Water Authority)

*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\2-14_HodgesProject30072015.mxd

Figure 2-31: Potential Schematic of Hodges Reservoir Natural Treatment System



CHANNEL NOTES:
HIGH FLOW CHANNEL:
240 FT WIDE AT BOTTOM
SIDE SLOPE 3:1
0.05 % SLOPE
FREEBOARD OF APPROXIMATELY 2 FT

WETLAND NOTES:
POTENTIAL WETLANDS AND BYPASS CHANNEL
TOTAL AVAILABLE AREA, 207 ACRES
NET WETLAND AVAILABLE AREA, 175 ACRES FOR
ALGAE FILTER WETLANDS AREA - 30 ACRES NET
ALGAE FILTER WETLANDS = 25 ACRES

PLAN

Approximate Scale
0 500 feet 1000 feet

CITY OF SAN DIEGO
PUBLIC UTILITIES PROJECT, WATER BRANCH

City of San Diego Public Utilities Department
Lake Hodges Reservoir Water Quality Study
UPPER WETLANDS - ALGAE FILTRATION
SHEET 5 OF 9

Project Physical Benefits

Tables 2-63 and **2-64** provide summaries of the primary (Water Quality) and secondary (Habitat Improved) physical benefits anticipated to be achieved through implementation of the *Hodges Reservoir Natural Treatment System*.

The primary physical benefit of the project is the removal of 10.7 mg/L of total suspended solids (TSS) in surface water flowing through the constructed 5-acre NTS (**Table 2-63**). The baseline for TSS concentration in Hodges Reservoir water was from the City of San Diego's *2010 Watershed Sanitary Survey*. Based on best management practice (BMP) efficacy rates reported in the *Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan,* treatment of surface water by the constructed wetland will result in a discharge concentration of 5.1 mg/L TSS. Mass loading of 23,752 kg of TSS will be removed by the project annually, at a 1,792 acre feet per year (AFY) flow rate (per conceptual design criteria). The project is also expected to remove nitrogen and phosphorous, which will lessen algal production within the reservoir.

Table 2-63: Primary Physical Benefit – Water Quality
Hodges Reservoir Natural Treatment System

Project Name: Hodges Reservoir Natural Treatment System
Type of Benefit Claimed: Water Quality - TSS reduction
Units of the Benefit Claimed: mg/L
Anticipated Useful Life of Project: 30 years

(a)	(b)	(c)	(d)
Year	**Annual Without Project**	**Annual With Project**	**Annual Change Resulting from Project (c) – (b)**
2020-2049	15.8 mg/L	5.1 mg/L	-10.7 mg/L

Comments: The anticipated useful life of the NTS is 30 years, based on the *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* According to *Attachment 5 Schedule*, post-construction activities would conclude in late 2019 with full operation of the NTS by 2020. The TSS removal derives from the filtration of water through the NTS and assumes a 1,729 AFY flow rate, also from the Action Plan. Without project baseline water quality data (15.8 mg/L) is from the City's *2010 Watershed Sanitary Survey* for streams draining into Hodges Reservoir.

Sources: City of San Diego. 2011. *2010 Watershed Sanitary Survey*. (CDPH System Number 37-10020).

San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan*. July. Pg 18.

The secondary physical benefit of the project is 3.75 acres of wetland habitat available in any given year at the NTS (**Table 2-64**). The benefits of habitat creation include habitat for native species such as the tricolored blackbird (*Agelaius tricolor*) and western pond turtle (*Actinemys marmorata*).[35] The fringes and slopes of the wetland basin will be designed to support riparian and coastal sage scrub vegetation communities, respectively. The area's baseline habitat of freshwater marsh is reported in the City of San Diego's Multiple Species Conservation Program *Habitat Management Plan Lake Hodges/San Pasqual Valley Open Space* report. The report notes 67 acres of freshwater marsh in Hodges Reservoir and San Pasqual Valley.[36] The existing freshwater marsh is near the boat ramp in Hodges Reservoir, near Sikes Adobe, and around the large pond next to Cloverdale Creek. The freshwater marsh is typified by perennial species including cattail, bulrush, and willows. Maintenance of the NTS in the form of vegetation removal would occur every 3–5 years and could be staggered so that approximately 25% of the available habitat is removed each year.[37] Therefore, construction of the NTS will make approximately 3.75 acres of freshwater marsh available to local wildlife species in any given year.

[35] City of San Diego. 2015. *Lake Hodges Natural Treatment System Conceptual Design*. March 2, 2015.
[36] Conservation Biology Institute. *Habitat Management Plan: Lake Hodges/San Pasqual Valley Open Space-Administrative Draft*. August 8, 2003.
[37] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan*. July.

Table 2-64: Secondary Physical Benefit – Habitat Improved
Hodges Reservoir Natural Treatment System

Project Name: Hodges Reservoir Natural Treatment System **Type of Benefit Claimed:** Habitat Improved – constructed wetlands **Units of the Benefit Claimed:** Acres **Anticipated Useful Life of Project:** 30 years			
(a)	**(b)**	**(c)**	**(d)**
Year	**Annual Without Project**	**Annual With Project**	**Annual Change Resulting from Project (c) – (b)**
2020-2049	67 acres	70.75 acres	3.75 acres
Comments: The anticipated useful life of the NTS is 30 years, based on the *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* According to *Attachment 5 Schedule*, post-construction activities would conclude in late 2019 with full operation of the NTS by 2020. The proportion of the NTS available as habitat in any given year is based on the Action Plan's projected O&M program. Without project baseline freshwater marsh acreage (67 acres) was calculated from the City of San Diego's Multiple Species Conservation Program *Habitat Management Plan Lake Hodges/San Pasqual Valley Open Space* report. Sources: Conservation Biology Institute. 2003. *Habitat Management Plan: Lake Hodges/San Pasqual Valley Open Space-Administrative Draft*. August 8, 2003. San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan*. July. Pg 18.			

Technical Analysis of Physical Benefits Claimed

Project Need and Conditions

The Hodges Reservoir watershed comprises 300 square miles extending from the reservoir east to Mesa Grande, north to Guejito Ranch, and south to Ramona. Flows from the upper 50 square miles of the watershed are interrupted at Sutherland Reservoir; as such, the effective watershed for Hodges Reservoir comprises 250 square miles from Sutherland Reservoir to Hodges Reservoir. Owned by the City of San Diego, Hodges Reservoir has a maximum capacity of 30,250 acre feet (AF) and provides surface water supply to the San Dieguito Water District, Santa Fe Irrigation District, and the City of San Diego. In 2012, SDCWA's Emergency Storage Project (ESP) connected Hodges Reservoir to Olivenhain Reservoir and SDCWA's regional aqueduct system. However, seasonally degraded water quality in Hodges Reservoir has severely limited the reservoir's use as a regional water supply. Improving water quality in Hodges will allow for optimal water pumping and delivery flexibility in conjunction with the connectivity to the SDCWA's imported water system.

Hodges Reservoir is identified as a Clean Water Act 303(d) impaired water body for nitrogen, phosphorus, color, manganese, turbidity, mercury and pH. Pollution sources emanate from upstream urban development and from agricultural runoff, which is the dominant land use in its 250-square mile watershed. The fundamental water quality issue in Hodges Reservoir is excessive algal production or eutrophication. High algal productivity impairs the reservoir's usability as a drinking water source because of taste and odor events, high levels of disinfection by-product precursors, filter clogging, high turbidity, and contribution to anoxic conditions in the reservoir's deeper water. Excessive loading of nutrients (in forms of nitrogen and phosphorous) and organic carbon—both external nutrient loading from the catchment and internal nutrient cycling within the reservoir—fuel high algae productivity.[38] SDRVC reports that in the 2010-11 and 2012-13 water years, the majority of the nutrient loading into Hodges Reservoir occurred during 2010-11 (a wet year) from Santa Ysabel Creek.[39] During that water year, Santa Ysabel Creek was estimated to have contributed approximately 18,330 pounds (lbs) of total phosphorous and 60,210 lbs

[38] City of San Diego. 2014. *Lake Hodges Reservoir Water Quality Assessment Study: Final Conceptual Planning Report.* June.
[39] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.

of nitrogen to the reservoir. Declining water quality in Hodges Reservoir has placed increasing treatment challenges and costs on present users.

In June 2014, the City of San Diego produced a *Lake Hodges Reservoir Water Quality Assessment Study: Conceptual Planning Report*. The *Conceptual Planning Report* identified three alternatives, one of which is a constructed wetlands and is proposed at the upper section of the reservoir. A floating pump station located along the south shoreline would pump water skimmed from the reservoir's top half meter through a pipeline laid on the reservoir bottom, to the eastern, upstream end of a constructed wetland located just west of the Interstate-15 bridge. Wetland depth would be about 2 feet and would provide about two days of residence time so that wetland plants, likely bulrushes, would filter out the algae. Smaller organisms living together with the plants would decompose the algae and filtered water would discharge back into the reservoir.[40] **Figure 2-31**, above, shows the wetlands conceptual design from the *Conceptual Planning Report*.

Hodges Reservoir is an important component of the regional water supply system and an important wildlife corridor for species located within the urbanized portions of San Diego County

In July 2014, the San Dieguito River Valley Conservancy produced a *Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan* (Action Plan). The Action Plan identified and evaluated two potential conceptual NTS alternatives (see "Cost Effectiveness Analysis" below), noting that one of the primary constraints to development of an effective watershed treatment NTS is the availability of perennial water to support a constructed wetlands. The *Action Plan* evaluated construction of a large constructed wetland (designed to capture and treat up to the 2.5-year storm event) located upstream of Hodges Reservoir versus a series of small constructed wetlands (designed to treat base flow and smaller storm events) located at the confluences of the three tributaries draining urban watersheds (Kit Carson, Green Valley, and Felicita).[41]

The *Action Plan* and *Conceptual Planning Report* both concluded that the preferred alternative is a combined in-reservoir treatment wetlands (from the City's *Conceptual Planning Report*) with the Felicita and Kit Carson treatment wetlands (from the SDRVC's *Action Plan*). Hodges Reservoir provides a unique opportunity for development of a NTS because: 1) there is a large amount of public ownership along the stream courses feeding the lake; 2) there are wetland restoration projects underway in the watershed that establish the general feasibility of the area for NTS projects: and 3) the area's predominately rural character, with moderate urban development, increases the water quality improvement potential of a NTS. The project will complement programs underway to encourage the application of BMPs to agricultural activities in the watershed (see *Regional Drought Resiliency Program* in this Proposal).

The project will provide the framework for extending the water quality benefits anticipated from multiple watershed and water quality projects previously funded through the San Diego IRWM program. "Fixing" Hodges Reservoir

[40] City of San Diego. 2014. *Lake Hodges Reservoir Water Quality Assessment Study: Final Conceptual Planning Report.* June.
[41] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.

will not happen by one agency alone, but by a concerted effort by all stakeholders together. IRWM funded projects in the Hodges Reservoir watershed include:

1) *Lake Hodges Natural Treatment System Conceptual Design* (produced *Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan*), SDRVC – Prop 50
2) *Biofiltration Wetland Creation and Education Program* (funded biofiltration wetlands at the upstream San Diego Zoo Safari Park), Zoological Society of San Diego – Prop 50
3) *Lake Hodges Water Quality and Quagga Mitigation Measures* (produced *Hodges Reservoir Water Quality Assessment Study: Conceptual Planning Report*), SDCWA – Prop 84-Round 1
4) *Regional Emergency Storage and Conveyance System Intertie Optimization*, City of San Diego (funded installation of reservoir oxygenation system) – Prop 84-Drought IRWM grant
5) *Safari Park Drought Response and Outreach Program,* Zoological Society of San Diego – this Proposal
6) *Hodges Reservoir Natural Treatment System,* City of San Diego – this Proposal

San Diego County is one of the most highly biodiverse areas of the country, with more endangered, threatened, and rare species than any other comparable area in the nation.[42] Wetland habitat created by this project could provide habitat for species that thrive in these areas, as well as species that forage or hunt in or around wetlands. This project will also improve water quality in Hodges Reservoir, providing higher quality habitat for aquatic species downstream of the constructed wetland. A California Natural Diversity Database (CNDDB) query for the project area had 37 species (22 plants and 15 animals) recorded as existing or with the potential to exist in the area surrounding Hodges Reservoir. Habitat improvements from the *Hodges Reservoir Natural Treatment System* project could help to support populations of the wildlife species listed in **Table 2-65**.

Table 2-65: Species Listed in CNDDB Within or Near the Project Area

Animals		
Federal- or State-Listed Threatened, Endangered, or Candidate Species		
Coastal California Gnatcatcher	Least Bell's Vireo	San Diego Fairy Shrimp
Swainson's Hawk		
Non-Listed Species		
Coast Horned Lizard	Nuttall's Scrub Oak	Southern California Rufous-Crowned Sparrow
Coastal Cactus Wren	Orangethroat Whiptail	Western Mastiff Bat
Dulzura Pocket Mouse	Red-Diamond Rattlesnake	Western Pond Turtle
Northwestern San Diego Pocket Mouse	San Diego Desert Woodrat	

Source: California Natural Diversity Database (CNDDB). RareFind 5 database query within Project Area (21 July 2015).

Without-Project Conditions

Without the *Hodges Reservoir Natural Treatment System* project, a wetland NTS would not be constructed to improve water quality of Hodges Reservoir. Currently, SDCWA's ESP allows connectivity between Hodges Reservoir and Olivenhain Reservoir, however, seasonally degraded water quality in Hodges Reservoir is not ideal for pump-back to Olivenhain Reservoir nor delivery to the regional water supply system. Treatment of Hodges Reservoir water (reduction of TSS and nutrients) will allow for easier and lower cost management of water supplies within the pumped storage operation and at downstream water treatment plants. Reservoir water quality would continue to impair the reservoir's usability as a drinking water source because of taste and odor events, high levels of disinfection by-product precursors, filter clogging, high turbidity, and contribution to anoxic conditions in the reservoir's deeper water. Without this and complimentary projects already completed or currently underway, the degraded water quality of Hodges Reservoir would continue to prevent water supplies from being optimally utilized

[42] San Diego RWMG and RAC. 2013. *2013 San Diego Integrated Regional Water Management Plan*. September.

for the region. Without the 5-acre NTS, wetlands habitat would also not be provided for wetland-associated species such as the tricolored blackbird (*Agelaius tricolor*) and the western pond turtle (*Actinemys marmorata*).

Methods Used to Estimate the Physical Benefits

Primary Benefit – Water Quality

The primary physical benefit of the project (Water Quality) is the removal of 10.7 mg/L of TSS from NTS discharges into Hodges Reservoir. Constructed wetlands are among the most effective BMPs for runoff pollutant removal, and they can also offer aesthetic and habitat value. Constructed wetlands use natural ecosystems to remove sediment, nutrients, pathogens, and other contaminants from low-flow natural and urban runoff, as well as smaller storm runoff. As runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the constructed wetland.[43] The *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan* concludes that the constructed wetlands NTS will provide substantial pollutant removal for urban and stormwater runoff entering Hodges Reservoir.

According to the City of San Diego's *2010 Watershed Sanitary Survey*, the TSS concentration of source waters draining to Hodges Reservoir (which would be captured and treated by the NTS) is 15.8 mg/L.[44] Based on extensive review of BMP efficacy, the *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan* estimates a 68% decrease in TSS concentration as a result of treatment through a constructed wetlands. Treatment through the 5 acres of constructed wetland will result in a water quality improvement of -10.7 mg/L of TSS, assuming a flow rate of 1,792 AFY (per the conceptual design criteria). The treated water will have a resulting concentration of 5.1 mg/L. Mass loading of 23,752 kg of TSS will be removed by the project annually.

$$15.8\frac{mg}{L}\ TSS * 68\%\ TSS\ removal\ via\ NTS = \mathbf{10.7\frac{mg}{L}\ TSS\ reduction}$$

The project will also result in a significant reduction in nitrogen and phosphorus concentrations in runoff entering Hodges Reservoir, albeit smaller reductions that in TSS. The Action Plan reports existing Total Nitrogen concentrations in the urban watersheds draining to Hodges Reservoir (Kit Carson, Felicita, and Green Valley) ranging from 0.65-3.60 mg/L.[45] At an estimated 33% removal rate (per the Action Plan), Total Nitrogen concentrations would be reduced by 0.21-1.19 mg/L. Similarly, the Action Plan reports Total Phosphorus concentrations in those same urban watersheds as ranging from 0.17-0.19 mg/L.[46] At an estimated 53% removal rate (per the Action Plan), Total Phosphorus concentrations would be reduced by 0.09-0.10 mg/L. These reductions are critical to managing the eutrophication issues faced by Hodges Reservoir managers; however, as they are slightly lower reductions, TSS removal has been presented herein as the primary benefit.

Secondary Benefit – Habitat Improved

The secondary physical benefit of the project is 3.75 acres of habitat created by the constructed wetland. The City (the local project sponsor) anticipates construction of a minimum 5-acre NTS, based on the two previous studies and scaled down due to funding limitations. Although a constructed wetlands would require maintenance in the form of vegetation and sediment removal and disposal, if properly managed with protection of wildlife (particularly nesting birds and amphibians), this habitat could provide substantial benefits to native wildlife species. Wetlands habitat could provide sufficient habitat for a nesting colony of tricolored blackbird (*Agelaius tricolor*), as well as habitat for western pond turtle (*Actinemys marmorata*).[47]

In general, it would be expected that freshwater marsh would require maintenance in the form of vegetation removal every 3–5 years and could be staggered so that approximately 25% of the available habitat is removed

[43] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.
[44] City of San Diego. 2011. *2010 Watershed Sanitary Survey*. (CDPH System Number 37-10020).
[45] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.
[46] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.
[47] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.

each year.[48] Therefore, approximately 3.75 acres of constructed wetlands habitat would be available to local wildlife species in any given year.

$$5\ acres\ habitat - \left(5\ acres * 25\% \frac{habitat\ mgmt}{year}\right) = \mathbf{3.75\ \frac{acres\ habitat}{year}}$$

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

To obtain the benefits from the *Hodges Reservoir Natural Treatment System* project, the NTS consisting of one 5-acre wetland will be engineered, constructed, monitored, and maintained. This will include the installation of irrigation and hydraulic equipment as needed to maintain perennial flow and provide constant TSS and nutrient removal to reservoir waters. No additional facilities, policies or actions will be required to obtain the physical benefits from this project. However, ongoing maintenance in the form of vegetation and sediment removal and disposal will be necessary to ensure the pollutant removal efficacy of the NTS is maintained over time.

Potential Adverse Physical Effects of the Project and Mitigation

The project may result in temporary environmental impacts during the construction of the NTS, including air quality emissions, noise, and traffic from hauling, grading, and excavation activities. Potential impacts include changes in stream or reservoir hydrology, along with resulting flooding risks, and impacts to special-status vegetation communities and species. Significant permitting (from U.S. Army Corp of Engineers, California Department of Fish and Wildlife, and Regional Water Quality Control Board) will be necessary because the NTS will affect jurisdictional wetland and riparian areas. Construction of the wetland will likely require the replacement of existing native upland or riparian habitat as mitigation. *Attachment 3 Work Plan* includes the permitting and CEQA compliance tasks necessary to avoid, mitigate, or compensate for potential adverse physical effects of the project.

Long-Term Drought Preparedness

This project will help to achieve long-term drought preparedness by enabling the use of a system intertie between local runoff from the Hodges Reservoir catchment and the regional imported water supply system. The intertie also allows imported water to be stored and later withdrawn from Hodges Reservoir for the first time. SDCWA's ESP is a system of reservoirs, interconnected pipelines, and pumping stations designed to make water available to the San Diego region in the event of a disaster or an interruption in imported water deliveries. Improving water quality in the reservoir will provide immediate regional drought preparedness by enhancing local water supply reliability by making local supplies more readily available for use. However, it's important to note that this proposed project is one more contribution to an overall systematic solution to the water quality issues in Hodges Reservoir. The *2013 IRWM Plan* clearly outlined the water quality issues Hodges Reservoir and the projects proposed and underway to help resolve the issues.[49] The reservoir issues will be resolved through collaboration by all stakeholders and implementation of the multiple projects and actions.

Direct Water-Related Benefit to DACs

Although the *Hodges Reservoir Natural Treatment System* project will be implemented directly adjacent to Hodges Reservoir and will benefit the Region through improved emergency storage functionality, and the City through increasing water storage capacity. The direct benefits will be realized across the Region, specifically areas that are served by local water agencies. For this reason, SDCWA's service area has been used here as the appropriate proxy for DAC determination. SDCWA's service area is 26% DAC by area, and 30% DAC by population (see *Attachment 7*, **Table 7-1**). This project directly addresses one urban DAC issue identified in the 2013 IRWM Plan:[50] surface water quality. Surface water quality benefits are realized because the constructed wetland will remove pollutants, including TSS, from surface water inflow to Hodges Reservoir that contribute to water quality issues in the reservoir. Over time, the water quality benefit realized directly by this flow will improve overall water quality in the reservoir itself..

[48] San Dieguito River Valley Conservancy. 2014. *Draft Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan.* July.
[49] San Diego RWMG and RAC. 2013. *2013 San Diego IRWM Plan*.
[50] RWMG. 2013. *2013 San Diego Integrated Regional Water Management Plan*. September.

Project Performance Monitoring Plan

Benefits will begin accruing as soon as NTS construction is complete. **Table 2-66**, below, describes the methods that will be used to measure the quantified benefits of this project. Note that these methods may change, pending development of the Project Performance Monitoring Plan under Task 9 of the Work Plan (see *Attachment 3 Work Plan*), and are presented as one option for measuring progress towards achieving the claimed benefits. Measurable targets for each benefit are also presented in the table.

As owner and operator of Hodges Reservoir, the City of San Diego will be responsible for monitoring and reporting water quality flowing into and out of the NTS, as well as vegetation/sedimentation maintenance activities that might impact habitat availability for wetland-dependent species.

Table 2-66: Project Monitoring for *Hodges Reservoir Natural Treatment System*

Proposed Physical Benefits	Measurement Tools and Methods	Targets
Water Quality Improvement	The City of San Diego will collect pre- and post-construction water quality data, at sampling points near the inlet and outfall of the NTS. Monitoring is needed to measure whether the NTS is meeting its objective(s) and to indicate biological integrity. The monitoring program will characterize the baseline hydrology and water quality of the proposed NTS area and its contributing watersheds. Water quality monitoring will consist of continuous flow and water level measurement, sampling to determine influent and effluent concentration of pollutants, and field measurement of general water quality parameters.	10.7 mg/L reduction in TSS concentration of flow through the constructed wetland (along with nutrient concentrations)
Habitat Improved	The City of San Diego will monitor post-construction wetlands habitat areas, in light of vegetation and sediment maintenance activities. During the establishment period, the City's contractor will be responsible for monitoring the landscape and providing routine maintenance. After establishment, the City will monitor and report on the acreage of vegetation management and/or removal within the 5 acre NTS.	3.75 acres of wetlands habitat availability within any given year

Cost Effectiveness Analysis

The *Hodges Reservoir Natural Treatment System* will achieve two quantifiable physical benefits described in detail in the sections above, and summarized in **Table 2-63 and 2-64**. During project development, alternatives to the preferred project included in this application were considered and, ultimately, rejected. **Table 2-67** provides a cost effectiveness analysis consistent with Table 7 of the *2015 PSP*.

Table 2-67: Cost Effective Analysis for *Hodges Reservoir Natural Treatment System*

Cost Effective Analysis	
Question 1 Physical Benefits Summary	*Types of benefits provided as shown in Table 2-63 and 2-64.* Water Quality – 10.7 mg/L TSS reduction Habitat Improved – 3.75 acres constructed wetland habitat
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 *Hodges Reservoir Watershed Natural Treatment System Implementation Action Plan* considered detention basins, constructed wetlands, and swales as possible forms

Cost Effective Analysis	
	for a watershed NTS. Swales were eliminated from consideration because of their small treatment scale (maximum 10-50 acres), high geographic distribution, and high lifecycle costs (frequency of maintenance). Two options were further developed for water quality evaluation and hydrologic modeling. Option 1 consists of a large constructed wetland (designed to capture and treat up to the 2.5-year storm event) located upstream of Hodges Reservoir and a series of detention basins located along the main stem of Upper Santa Ysabel Creek and Santa Maria Creek. In order to sustain the constructed wetlands throughout the year, water would need to be pumped from Hodges Reservoir into the constructed wetland during dry periods. Option 1 was estimated to have a $115-240 million construction cost and $1.3-2.7 million annual maintenance cost. Option 2 consists of a series of smaller constructed wetlands located at the confluences of the three tributaries draining the urban watersheds directly into Hodges Reservoir. This NTS option would be designed to capture and treat the urban base flow and smaller storm events discharging from the Kit Carson, Green Valley, and Felicita urban watersheds. Option 2 was estimated to have a $1.3-2.7 million construction cost and $26,000-55,000 annual maintenance cost. The Action Plan concluded that Option 1 may provide substantially greater nutrient reduction during wet years when multiple storm events occur, whereas Option 2 would help reduce nutrient loading from base flow and small storm events. Option 2 was identified as the preferred alternative, primarily due to the substantial cost-benefit savings (less cost and complexity). The *Lake Hodges Reservoir Water Quality Assessment Study: Final Conceptual Planning Report* proposed an in-reservoir constructed wetland to improve water quality. A floating pump station with an algae-skimming intake would collect water from the surface of the reservoir which has the highest concentrations of algae. Water would be pumped to a constructed wetland along the shallow northern shore of the reservoir and then pass through a series of "cells" within the wetland at a minimum 2-day hydraulic residence time for optimal nutrient removal before discharging to the reservoir. The design concept developed for this constructed wetlands consists of a series of five wetland basins along the north shore of the reservoir, with an in-stream diversion/intake immediately downstream of I-15, and discharge located immediately east of Felicita Creek. The wetlands would occupy approximately 25 acres and have an estimated construction cost of $7.5-9.8 million. The Action Plan and Conceptual Planning Report both concluded that combining the in-reservoir treatment wetlands (from the City's Conceptual Planning Report) with the Felicita and Kit Carson treatment wetlands (from the SDRVC's Action Plan) is the selected 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.* No, this is not the least cost alternative for the project – Option 2 from the Action Plan has lower costs, but does not achieve the nutrient reduction goals of stakeholders as well. Extensive water quality and hydrologic analysis has been completed by stakeholders within the Hodges Reservoir catchment to identify a preferred NTS for best treating nutrient loading to the reservoir. During preparation of the Action Plan (by SDRVC) and the Conceptual Planning Report (by the City), a committee of SDRVC, City of San Diego, SFID, and SDCWA was established to reach consensus about a preferred approach. This Proposal includes that preferred approach.