UC San Diego
Water Conservation and Watershed ProtectionProject

Project Completion Report

Project 7
DWR IRWM Grant 4600011516

October 2021

UC San Diego

Executive Summary

UC San Diego, one of the largest water users in the City, partnered with San Diego Coastkeeper (Coastkeeper), WILDCOAST, Urban Corps of San Diego, and Tijuana River National Estuarine Research Reserve (TRNERR) and Border Field State Park staff to implement the UC San Diego Water Conservation and Watershed Protection Project (Project 7). This project included community-based water conservation and watershed protection on the UC San Diego campus in La Jolla (upstream from an Area of Special Biological Significance, or ASBS); in Point Loma, adjacent to the San Diego Bay; and in theTijuana River Valley (TRV), a broad floodplain situated between Imperial Beach and the international border that encompasses 5,200 acres including the Tijuana River National Estuarine Research Reserve, the Tijuana River Regional Park and Border Field State Park. The Peñasquitos, San Diego, Pueblo and Tijuana watersheds benefitted from this project.

Water Conservation efforts included potable water use reduction projects on the campus and stakeholder education and outreach on water conservation to support the region's response to drought. Watershed protection efforts included non-point source pollution reduction and habitat restoration.

This project provided benefits to the sensitive natural resources of the Tijuana River National Estuarine Research Reserve, Tijuana River Regional Park and Border Field State Park, Tijuana River Mouth Marine Protected Area, the Jolla/Scripps ASBS and San Diego Bay.

The Tijuana River Valley (TRV) area is heavily impacted by cross-border trash, pollution, and invasive species. This project supported small-scale volunteer-driven restoration to help mitigate these impacts and to engage the surrounding low-income communities in stewardship of these protected areas. The project also helped meet the needs of local disadvantaged communities for workforce development and employment opportunities by providing paid job training for underserved young adults in the Urban Corps youth development program.

AGREEMENT AMENDMENTS

DWR Agreement Amendment No. 1

- DWR Agreement Amendment No. 1 amended Exhibit C, Schedule, to include dates for Task 8 Design, which were not included in the original agreement.

DWR Agreement Amendment No. 3

- DWR Agreement Amendment No. 3 amended Exhibit A, Work Plan, to change one of two turf removal sites identified in Component 4, due to new redevelopment plans at the campus.

- Also amended was Exhibit C, Schedule, to extend the end dates of most of the tasks, due to delays in execution of agreements with project partners.

WORK ACCOMPLISHED

All work as set forth in Exhibit A Work Plan was performed, including all tasks under Budget Category A (Project Management) (i.e., quarterly invoicing, reporting, labor compliance, etc.) and all tasks under Budget Categories C and D. The following describes the work accomplished and deliverables produced in implementing the project's six components to achieve the water conservation and watershed protection benefits included in the original grant application.

Component 1 Central Utilities Plant (CUP) Reclaimed Water Cooling Tower Retrofit

This component extended recycled water lines across the UC San Diego campus to the Central Utilities Plant Cooling Towers. By bringing recycled water to the Plant and retrofitting the coolingtower equipment and controls, the University was able to replace a significant portion of potablewater use in the towers with recycled water, reducing potable water use by 60 million gallons per year.

Phase I of the CUP Cooling Tower Retrofits to enable recycled water use was completed in March 2016. For this project, a 12-inch private recycled water main was installed to bring recycled water to the CUP from the north campus connection to the City of San Diego's recycled water distribution system. After Phase I was completed, the CUP was able to operate at 35% recycled water and 65% potable water. By December 2016, the CUP saved 30 million gallons of potable water compared to the annual average potable water use for 2013 - 2015.

Phase II of the main pipeline expansion created a loop in the campus reclaimed water systemand connected to the infrastructure that was installed in Phase I. This provided additional capacity for the CUP to increase the use of recycled water and decrease the use of potable water. Phase II was completed in July 2017. The CUP is now able to operate at 65% recycled water and 35% potable water.

The completion of Phase I and Phase II provided the infrastructure for the CUP to replace 60 million gallons of potable water per year (184 AFY) with recycled water.

In the grant application, it was anticipated that approximately 80% of potable water use could be replaced with recycled water in the cooling towers, however, it was found that a blend of 65% recycled water and 35% potable water is best to prevent damage/corrosion to the centralplant equipment from the chemistry of the recycled water. The blend is carefully monitored and adjusted as needed when there are problems with the quality of the water.

The anticipated potable water savings in the grant application of 60 million gallons per year (184 AFY) was achieved with this project. The water savings associated with this project is summarized under Project Benefits.

Deliverables:

- Recycled Water Feasibility Study
- Draft and Final CEQA Notices of Exemption
- No Legal Challenges letter
- Copies of required permits
- Engineering Report for Recycled Water System
- Complete preliminary and final design drawings
- As-builts for Phase II
- Approved City & County Recycled Water Main Drawings
- Bid documents
- Proof of Advertisement
- Award of Contract
- Notice to Proceed
- Construction and Post-construction pictures
- Notice of Completion
- Calculated water savings

Component 2 Air Handling Unit Condensate Collection and Reuse

This element included retrofitting four buildings on campus to reuse Heating-Ventilation-Air Conditioning (HVAC) condensation water for irrigation, saving more than 1 million gallons of potable water a year (3.07 AFY).

At Bonner Hall, Urey Hall, Mayer Hall, and York Hall, plumbing retrofits were made to collect: (1) air handling condensate; (2) Reverse Osmosis treatment system reject water; and (3) water softener reject water. The collected water was piped to the campus recycled water distribution system and used for irrigation, offsetting the need to use potable water. The project was completed in May 2019

In the grant application, two buildings were proposed to be retrofitted and the potable water savings was estimated to be one million gallons a year (3.07 AFY). UC San Diego retrofitted four buildings as part of this project, generating more than 1.5 million gallons of recycled water per year (4.6 AFY) to offset potable water use. The water savings associated with this project are summarized under Project Benefits.

Deliverables:

- Air Handling Unit Condensate Collection and Reuse Feasibility Study
- Complete draft and final air handling unit condensate collection drawings and designs

- Bid documents
- Proof of Advertisement
- Award of Contract
- Notice to Proceed
- Construction and Post-construction pictures
- Notice of Completion
- Calculated water savings

Component 3 Water Conservation Community Outreach

To engage stakeholders and increase public awareness of ways to conserve water, San Diego Coastkeeper conducted education and outreach to inform residents (including UCSD students), businesses and decision makers about the region's water supply, the need for and benefits of conservation, and the actions that can be taken to reduce water use in the region. The following tasks were completed by Coastkeeper:

- Wrote and published **24 educational media articles** on: residential conservation, commercial conservation,statewide conservation, climate change and the water-energy nexus
- Conducted **Two targeted water conservation workshops and tours**; one targeting residential conservation and one targeting commercial conservation
- Led **Volunteer trainings for approximately 40 individuals** to detect and report water waste,and to provide information to peers about best practices to conserve water
- Distributed **500 Door hangers and 50 posters** to inform individuals about the need for and resourcesavailable to achieve water conservation

San Diego Coastkeeper wrote and published the following **24 blog posts**:

- "Making Water conservation a Way of Life," published by News Deeply on 8/2/2017
- "What are San Diego Businesses Doing to Conserve Water?"
- "Water Conservation, One Kid at a Time"
- "New Year's Resolutions for the Conscientious Homeowner"
- "Using Conservation to Combat Pollution"
- "A Return to Drought"
- "San Diego's Dwindling Conservation"
- "How California's Conservation Legislation Faltered"
- "Where Water and Energy Collide"
- "Understanding Your Water Footprint"
- "Can San Diegans Save Water by Riding Bikes and Turning Off Lights?"

- "Beyond the Beach Cleanup: How Conserving at Home Protects the Ocean."
- "You are Watering Your Lawn with Drinking Water"
- "A Foodie Talks Water"
- "The Water-Energy Nexus: A Deeper Look"
- "The Water in Your Plastic"
- "Keeping an Eye on Conservation"
- "The Water You Wear"
- "Pure Project: In Pursuit of a More Sustainable Brew"
- "The Water in Your Energy"
- "California's Water Use: How Do We Compare?"

Coastkeeper also wrote and published a blog post on the water-energy nexus describing best management practices used by local industrial facilities that Coastkeeper worked with thathave not only reduced the risk of polluted urban runoff but have also provided on-site water supplies for industrial processes, thereby reducing the need for imported water.

https://www.sdcoastkeeper.org/blog/water-conservation/industrial-bmps-and-water-energy- nexus

In addition, Coastkeeper wrote and published a blog post on the water-energy nexus that discusses the energy intensity of different types of water supply acquisition and makes a case for integrated water management as being the region's best path forward.

https://www.adcoastkeeper.org/blog/san-diego-water-supply/integrated-water-management- and-the-water-energy-nexus

Coastkeeper also wrote and published a blog post highlighting some of the ways that people can reduce their water footprint throughout the holidays, and featuring alternatives to supportingwater-intensive commercial practices and products.

https://www.sdcoastkeeper.org/blog/uncategorized/in-a-season-of-more-support-industries- that-use-less

On 10/7/2017, San Diego Coastkeeper hosted a training for volunteers on how to report water waste. Coastkeeper received **three reports about water being wasted** that were submitted by the public through its online form "Pollution and Water Waste Incident Report."

Coastkeeper hosted a training and lecture to the CA Naturalist certificate program class (UC Extension) on 1/31/2018 to **22 students** on how to detect and report water waste.

Coastkeeper worked with designer Joseph Converse to develop water conservation

outreach materials including an outreach poster and a door hanger version of the poster. Coastkeeper printed **50 copies of the poster and 500 door hangers** and distributed them throughout the San Diego community at events, in classrooms, and at after school programs such as: Palomar College; the Elementary Institute ofScience in southeast San Diego; "Spring Into STEAM" events at the Mira Mesa, Carmel Valley,and the North University libraries; at the Balboa Park Earth Day Fair; three classrooms at CesarChavez Elementary; and after school programs focused on STEM education. Coastkeeper alsopresented the poster to 200 plus attendees at Coastkeeper's annual event, Seaside Soiree.

Coastkeeper provided a water conservation presentation and water waste reporting training on 11/6/2018 to **41 volunteer naturalists** at the San Diego Natural History Museum.

Coastkeeper planned and hosted a residential water conservation outreach tour on 3/23/2019 from 9am to 1:30pm. "Ride the Tide" was designed as anall-level bike ride through the neighborhoods of Golden Hill, South Park, and North Park, stopping at six homes along the tour's route to explore backyard rainwater capture and greywaterreuse projects and to discuss water use efficiency, localized water supply, and other conservation strategies. In addition to Coastkeeper's advocacy and outreach staff, local water conservation experts from San Diego Sustainable Living Institute and Catching H2o were on hand to discuss specific projects as well as regional conservation and efficiency strategies. Refreshments and prizes for on-site drawings were donated by local makers and sustainability-minded companies. **Over 40 individuals attended the tour**, and post-tour evaluations were unanimously positive.

10/26/2019, San Diego Coastkeeper hosted a second residential water conservation outreach "Ride the Tide" bike tour from 9am - 1:30pm. Approximately **50 participants** rode bikes through the neighborhoods of mid-city San Diego (Kensington and Talmadge), stopping at eighthomes along the tour route where they explored backyard rainwater capture and greywater reuse projects. Coastkeeper's advocacy and outreach staff discussed water use efficiency, localized water supply, and other conservation strategies and local water conservation experts from San Diego Sustainable Living Institute and Catching H2O discussed specific projects and regional conservation and efficiency strategies. Refreshments and prizes for on-site drawings were donated by local makers and sustainability-minded companies.

Deliverables:

- Links to blog posts
- Photographic documentation
- Copies of public outreach materials
- Documentation of volunteers at events

Component 4 Turf Removal and Stormwater Treatment

A total of 19,000 square-feet of water-thirsty turf was replaced with stormwater treatment landscaping at two campus locations (Grove and North Torrey Pines/Scholars Lane) to: (1) reduce irrigation; (2) prevent non-stormwater discharges; and (3) treat stormwater runoff from roads and a parking lot reducing pollutants such as sediment and bacteria from discharging into the Peñasquitos Watershed and the La Jolla Shores ASBS. In the original grant agreement, the Revelle parking lot and North Torrey Pines/Scholars Lane were identified as the two locations for this project.

DWR Agreement Amendment No. 3 authorized a change to one of the locations originally proposed in the grant application. New re-development plans for the campus included constructing buildings on the Revelle parking lot location (one of the two turf removal/stormwater treatment sites for this project). UC San Diego identified the Grove location as an alternative location for turf removal and stormwater treatment to prevent non- stormwater flows and to treat stormwater runoff from roads and a parking lot. The new location at the Grove provided the same project benefits as the Revelle Parking Lot location. Upon approval of this amendment to Exhibit A, UC San Diego prepared the necessary planning documentation for the Grove location (e.g. CEQA documentation).

For the Grove Stormwater Treatment location, an asphalt road used for parking and a turf area were replaced with a stormwater treatment detention basin, drought tolerant/low water landscaping, and a pervious walking path with two educational signs on watershed protection,stormwater treatment, and drought tolerant landscaping/water conservation. This project was completed in July 2021.

For the North Torrey Pines/Scholars Lane location, a median with turf between North Torrey Pines Road and Scholars Lane was replaced with drought tolerant plants and trees as well as a stormwater treatment swale and basin to treat stormwater runoff from Scholars Lane. This project was completed in June 2021.

Deliverables:

- Draft and Final CEQA Notices of Exemption
- No Legal Challenges letter
- Complete preliminary and final drawings, identifying the area of work and the stormwater system to be installed and as-built drawings for both sites
- Bid documents
- Proof of Advertisement
- Award of Contract
- Notice to Proceed
- Construction and Post-construction photographs
- Notice of Completion

Component 5 Modular Wetland Treatment System and Monitoring

A Modular Wetland Stormwater Treatment System was installed at the UC San Diego Nimitz Marine Facility in PointLoma to treat stormwater runoff from a concrete swale that discharges directly into the San Diego Bay. The installation of the treatment system was completed in January 2016.

To evaluate the effectiveness of the modular wetland stormwater treatment system at removing pollutants from stormwater runoff, stormwater runoff grab samples were collected upstream and downstream from the treatment system at least twice per year in 2018, 2019, 2020, and 2021. Eleven storm events were monitored during this time frame. The facility did not receive rain during facility operating hours from July to December 2017, so effectiveness monitoring could not be performed in 2017.

The stormwater grab samples were analyzed for the following constituents by an EPA certifiedlaboratory:

- Total Copper (method EPA 200.8)
- Total Zinc (method EPA 200.8)
- Total Suspended Solids (method SM 2540-D)

The results from the effectiveness monitoring are included as Attachment A.

Based on the results of the effectiveness monitoring, the system performs very well at removing zinc and generally performs well at removing sediment (measured as total suspended solids) and copper; all three are common stormwater pollutants. The effectiveness monitoring was completed in March 2021 and the data evaluation was completed in May 2021.

Deliverables:

- Draft and Final CEQA Notices of Exemption
- No Legal Challenges letter
- Complete preliminary and final design drawings, identifying the area of work and themodular wetland treatment system to be installed
- Bid documents
- Proof of Advertisement
- Award of Contract
- Notice to Proceed
- Construction and Post-construction pictures
- Notice of Completion
- Effectiveness monitoring pictures
- Analytical results from effectiveness monitoring

Component 6 Tijuana River Valley (TRV) Non-Point Source Pollution Reduction and Habitat Restoration

To reduce non-point source pollution and support habitat restoration, WILDCOAST/Urban Corps/TRNERR removed trash, debris, and invasive non-native species in the TRV to reduce or eliminate the discharge of pollutants into the Tijuana Watershed. This project engaged underserved community members and youth in stewardship and restoration of habitat in the TRV and prevented pollutants from entering coastal ecosystems.

Approximately **one acre of Baccharis salicifolia ("mulefat") scrub habitat was restored** through invasive species removal and planting of native species and approximately **4 acres of habitat were enhanced** through trashand tire removal events as summarized below.

Habitat restoration activities performed at the Border Field State Park included **irrigation system installation**, manually **removing 10 cubic yards of invasive weeds**, and **planting 620 native plants** as detailed below.

- August - December 2016: A drip irrigation system consisting of a PVC mainline 5/8" polytube laterals, and adjustable emitters was installed by TRNERR staff incrementally. There are 17 total lateral lines in the site. Materials were re-used from competed restoration projects at Boarder Field State Park.
- September 2016: Recon Native Plants delivered **620 one-gallon native plants** to BorderField State Park.
- 9/24/2016: Three TRNERR staff and 3 long-term volunteers **installed 100 plants** for National Public Lands Day.
- 11/16/2016: Two TRNERR staff and 2 long-term volunteers **installed 112 plants**.
- 12/2/2016: Three TRNERR and 5 long-term volunteers **installed remaining irrigation lines and 15 plants**.
- 2/3/2016: **314 plants were installed** by 17 California State Parks Foundation volunteers and 2 TRNERR staff. The workday was coordinated through the Park Champions program, which a partnership designed to provide consistent, sustainable volunteer support for state parks.
- 12/7/2016: One TRNERR staff member and 5 long-term volunteers **weeded and installed 40 plants**.
- April 2017: Two TRNERR staff members and three long-term volunteers weeded and uncovered buried irrigation lines from winter rain events.
- May 2017: Two TRNERR staff members and three long-term volunteers **removed 10 cubic yards of invasive species** (e.g., tree tobacco, mustard, globe daisy, castor bean.)
- June 2017: Two TRNERR staff members and three long-term volunteers weeded and mowed in-between irrigation lines. Began watering site once/month for one hour.

TRV Non-Point Source Pollution Reduction Activities with **20 clean-up events** was completed as follows:

The trash and watershed cleanup work performed by TRAN, WILDCOAST, and TRNERR (Tijuana River National Estuarine Research Reserve) staff members who engaged the underserved communities around the park in stewardship activities and supplemented Urban Corps cleanups with volunteers. Originally 12 cleanup events were proposed but 20 were conducted. This included 11 Tijuana River Action Month (TRAM) cleanup events and 6 cleanup events outside of TRAM. TRAM is a series of education and stewardship events held each September and October to benefit the Tijuana River watershed. The goal of the TRAM is to mobilize community volunteers and groups to become stewards of the Tijuana River Valley.

September 2017: Approximately **238+ volunteers** participated in three TRAM events at (1) Border Field State Park on 9/16/17; (2) Tijuana River Estuary Visitor Center on 9/23/17; and (3) at Dairy Mart Road on 9/30/17:

- 9/16/2017 Border Field State Park Event - 115 volunteers **removed 296 pounds of trash**.
- 9/23/2017 Tijuana Estuary Visitor Center Event - 10 volunteers **restored one acre of habitat**.
- 9/30/2017 Dairy Mart Road (east of bridge) Event - 113 volunteers **removed 2,600 pounds of trash, 5,000 pounds of recyclables, and 144 tires**.

On 9/20/2017, Urban Corps participated in a cleanup event with I Love a Clean San Diego, WILDCOAST, and Border Field State Parks and Recreation. Urban Corps pulled **184 tires** from the Tijuana River Valley riverbed.

October 2017: Tijuana River Action Month (TRAM) continued through the month of October. Urban Corps, WILDCOAST, I Love a Clean San Diego, Border Field State Parks and Recreation, and community volunteers participated in the following two TRAM events:

- 10/7/17 at Dairy Mart Road Bridge - 15 participants **removed 200 tires** from the main channel of the Tijuana riverbed.
- 10/14/17 at the Border Field State Park - 101 participants **removed a total of 350 pounds of trash**.

September - October 2018 TRAM: Urban Corps, WILDCOAST, I Love a Clean San Diego, TRNERR, Border Field State Park and Recreation, and community volunteers participated inthe following TRAM events:

- 9/15/2018 - Coastal Cleanup Day: Border Field State Park - 138 participants removed **348 pounds of trash and 74 pounds of recyclables**.
- 9/2018 - Tijuana River Valley Regional Park - 10 participants **removed 59 tires** and trash from the park.
- 9/21/2018 - National Public Lands Day: Tijuana River National Estuarine Research Visitor Center - 50 participants removed dry weeds from the area (**approximately 2,000 square feet was cleared**).

- 9/25/2018 - Goat Canyon, Border Field State Park - 9 participants **removed 5 tires and 15 bags of trash** (50 gallon bags).
- 9/26/2018 - Goat Canyon, Border Field State Park - 6 participants **removed 10 tires and 56 bags of trash** (50 gallon bags).
- 9/29/2018 - TRNERR Public Tour: Tijuana River National Estuarine Research Visitor Center - 13 visitors participated on a public tour along the international border and through a diversity of coastal habitats within the Reserve.

WILDCOAST and TRNERR co-hosted a cleanup at the TJ Slough beach in the Tijuana River Valleyon 10/6/2018. There were **91 volunteers and 50 pounds of trash** were collected.

WILDCOAST and TRNERR co-hosted two cleanup events at Imperial Beach in the Tijuana RiverValley on 4/13/2019 and 6/15/2019. During the two cleanups, there were **190 volunteers and 200 pounds of trash** were collected.

WILDCOAST and TRNERR co-hosted a cleanup at Border Field State Park in the Tijuana River Valley on 9/21/2019. During the cleanup, there were **48 volunteers and 541 pounds of trash** were collected.

On October 5, 2019, WILDCOAST hosted a Tijuana Sloughs Cleanup event in the Tijuana River watershed. During this cleanup, there were **27 volunteers and 700 pounds of trash** were removed.

In the grant application, it was anticipated that this project would engage an estimated 5,000 volunteers in removing 80 tons of waste and 1,000 tires and restoring one acre of habitat in the TRV. In reality, one acre of habitat was restored through the efforts of 977 volunteers collecting 572 tires and 13,709 pounds of trash over the course of 20 clean-up events (exceeding the 12 events described in Exhibit A, Work Plan). The issues that resulted in a reduced number of volunteers engaged and amounts of waste and tires collected are explained below under “Lessons Learned.”

Deliverables:

- Photographic documentation
- Copies of public outreach materials
- Documentation of volunteers at events
- Tallies of the number of volunteers, number of tires collected, and pounds of trash ornumber of bags of trash collected.

PROJECT BENEFITS

Water Conservation

Component 1 - Central Utilities Plant (CUP) Reclaimed Water Cooling Tower Retrofits

Potable Water Savings

Quarter	Recycled Water	Potable Water	Potable Water Savings (million gallons per year)	Acre-feet per year (AFY) equivalent
March – June 2017	30%	70%	36	132.68
July – September 2017	65%	35%	60	221.13
October – December 2017	65%	35%	60	221.13
January – March 2018	65%	35%	60	221.13
April – June 2018	65%	35%	60	221.13
July – September 2018	73%	27%	70	257.99
October – December 2018	73%	27%	70	257.99
January – March 2019	61%	39%	60	221.13
April – June 2019	66%	34%	60*	221.13
July – September 2019	66%	34%	60*	221.13
October – December 2019	66%	34%	60*	221.13
January – March 2020	62%	38%	59**	217.45
April – June 2020	57%	43%	55	202.71
July – September 2020	66%	34%	60	221.13
October – December 2020	73%	27%	70	257.99
January – March 2021	70%	30%	64	235.88
April – June 2021	85%	25%	71	261.68
July – September 2021	76%	24%	77	283.79

Component 2 - Air Handling Unit Condensate Collection and Reuse

Water Collected for Reuse

Quarter	Gallons collected
May – June 2019	438,328
July – September 2019	1,010,822
October – December 2019	393,456
January – March 2020	515,372
April – June 2020	523,600
July – September 2020	141,372
October – December 2020	540,804
January – March 2021	587,928
April – June 2021	554,298
July – September 2021	1,039,683

Component 3 Water Conservation Community Outreach

Community education and outreach on water conservation completed through 24 blog post articles, water conservation workshops and tours, volunteer trainings on how to report water waste, and distribution of outreach materials to the public and local businesses about the need for and resources available to achieve water conservation.

Watershed Protection

Component 4 Turf Removal and Stormwater Treatment

19,000 square-feet of water-thirsty turf was replaced with stormwater treatment/drought tolerant landscaping at two locations on campus to: (1) reduce irrigation; (2) prevent non-stormwater discharges; and (3) treat stormwater runoff from roads and a parking lot reducing pollutants such as sediment and bacteria from discharging into the Peñasquitos Watershed and the La Jolla Shores ASBS. Two educational signs were installed that describe the water conservation, stormwater treatment and water quality benefits associated with the project.

Component 5 Modular Wetland Treatment System and Monitoring

Concentrations of zinc, copper, and sediment are now reduced in stormwater runoff going into the San Diego Bay. (See results in Attachment A).

Component 6 Tijuana River Valley (TRV) Non-Point Source Pollution Reduction & Habitat Restoration

This project engaged underserved community members and youth in habitat stewardship andrestoration in the TRV and prevented pollutants from entering coastal ecosystems. One acre of mulefat scrub habitat was restored by removing ten cubic yards of invasive weeds and planting 620 native plants. Four acres of habitat were enhanced by removing pollutants during 20 clean-up events.

Number of Volunteers	Tires Collected	Pounds of Trash Collected
977	572	13,709

LESSONS LEARNED

The following project challenges provided lessons learned over the course of this project:

- The blend of reclaimed water and potable water used in the cooling towers must be carefully monitored and adjusted when there are problems with the quality of the water to prevent damage/corrosion to equipment. For example, from April through June 2020,the amount of recycled water used in the cooling towers had to be reduced to 57% because of the chemistry of the water. When the quality of the recycled water is good, the cooling towers can operate using between 65% to 75% recycled water.
- Health and safety at volunteer events should be carefully monitored. At a Tijuana RiverAction Network (TRAN) meeting to discuss the results from TRAM 2017, it

was discovered that some staff and volunteers felt unwell after a tire and trash clean-up event in Goat Canyon during TRAM 2017. This could have been caused by pollutants in the area. Out of an abundance of caution, this location (a big source of waste tires) was removed from future clean-up events, which reduced the number of tires and overall weight of trash that could be collected during TRAM 2018 and 2019 for this project.

- For future grant applications, the number of volunteers per event (e.g., clean-up events) should be estimated between 45-50 per event. The number of volunteers originally estimated for Component 6 in the grant application for this project was much higher and could not be achieved.
- During the grant application process, construction project costs should have an annual escalation rate to account for the increase in labor and material costs over time. Due to the number of years between the time the grant application was submitted, the grants were awarded and contracts were executed with Local Project Sponsors, and the projects went out to bid, construction costs increased resulting in higher cost share requirements. The bids for the Turf Removal and Stormwater Treatment at the North Torrey Pines/Scholars Lane site, for example, came back higher than the available construction funds. Adjustments had to be made to the scope to keep the construction costs within the estimated amount,and the project had to go out for rebid.

PROJECT SCHEDULE

The Local Project Sponsor Agreement was signed by University of California San Diego (UCSD) on April 11, 2017, and signed by the County Water Authority on April 27, 2017. UC SanDiego established agreements with local project partners (San Diego Coastkeeper, Urban Corps of San Diego, and WILDCOAST/TRNERR) in May 2017 and awarded construction contracts to multiple contractors. The Project Schedule showing the planned schedule from the grant agreement, the updated schedule from DWR Amendment No. 3, and the actual schedule is included in Attachment B.

COSTS AND DISPOSITION OF FUNDS

The total project cost was $3,998,142.55. Increases in construction, material, and labor costs between the time of grant application submittal in 2015 and execution of the LPS grant agreement and local project partners and contractors' agreements resulted in a project cost 27% higher than the original budget. Additional costs were documented as "Additional Cost Share/Unbilled" in quarterly reporting. UC San Diego maintains project invoice records and confirms project expenses were separate and tracked internally.

Budget Category		Funding Match	Grant	Additional Cost	Total
(A)	Project Administration	$0	$0	$7,228.00	$7,228.00
(C)	Planning/Design/ Engineering/Environmental	$193,743	$0	$136,130.13	$329,873.13
(D)	Construction/ Implementation	$1,188,971	$1,435,000	$1,037,070.42	$3,661,041.42
	Grand Total	**$1,382,714**	**$1,435,000**	**$1,180,428.55**	**$3,998,142.55**
Budget Category (A): Project Administration					
Vendor					
Nolte Associates		-	-	$7,103.00	$7,103.00
RBF Consulting		-	-	$125.00	$125.00
	Category A Totals	**$0**	**$0**	**$7,228.00**	**$7,228.00**
Budget Category (C): Planning/Design/Engineering/Environmental Documentation					
Discovery Engineering		$2,700	-		$2,700.00
Energy Systems Engineering Inc.		$103,275	-		$103,275.00
Nasland Engineering		-	-	$8,930.88	$8,930.88
Nolte Assoc.		$58,269	-	$36,365.00	$94,634.00
NOVA Services		-	-	$19,100.00	$19,100
RBF		$29,499	-	$250.00	$29,749.00
Spurlock Landscape		-	-	$52,644.25	$52,644.25
TBD Consultants		-	-	$18,840.00	$18,840.00
	Category C Totals	**$193,743**	**$0**	**$136,130.13**	**$329,873.13**
Budget Category (D) Construction/Implementation					
Brightview				$138,760.00	$138,760.00
NEWest Construction		$434,720.41	$970,226.03	$510,472.56	$1,915,419.00
University Mechanical & Engineering Contractors, Inc.		$754,250.59	$277,637.91	201,705.58	$1,233,594.08
Marathon Construction Corp.		-	$113,469.00		$113,469.00
San Diego Coastkeeper		-	$34,551.25	$25,681.28	$60,232.53
TRNEER			$11,052.00		$11,052.00
Urban Corps San Diego County		-	$9,500.00		$9,500.00
Western Rim				$152,835.00	$152,835.00
Wildcoast		-	$18,563.81	$7,616.00	$26,179.81
	Category D Totals	**1,188,971**	**1,435,000**	**$1,037,070.42**	**$3,661,041.42**

Project Invoice Summary Table

Invoice Period	UCSD Invoice #	DWR Invoice #	Invoice Amount (100%)	Retention Amount	Amount Paid by DWR	Date Received by UCSD	Payment Type
6/4/14 - 6/30/17	1	3	$1,083,695.03	$54,184.75	$1,029,510.28	2/23/18	Check #5356
7/1/17 - 9/30/17	2	4	$20,869.95	$1,043.50	$19,826.45	3/22/18	Sent via ACH
10/1/17- 12/31/17	3	5	$12,760.50	$1,276.05	$11,484.45	8/27/18	Sent via ACH
1/1/18 - 3/31/18	4	6	$7,270.47	$727.05	$6,543.42	10/18/18	Sent via ACH
4/1/18- 6/30/18	5	7	$12,105.00	$1,210.50	$10,894.50	2/18/19	Sent via ACH
7/1/18- 9/30/18	6	8	$11,480.64	$1,148.06	$10,332.58	6/25/19	Sent via ACH
10/1/18- 12/31/18	7	9	$9,180.50	$918.05	$8,262.45	9/18/19	Sent via ACH
1/1/19- 3/31/19	8	10	$277,637.91	$27,763.79	$249,874.12	5/14/20	Sent via ACH
TOTAL			**$1,435,000.00**	**$88,271.75**	**$1,346,728.25**		

CERTIFICATION OF PROJECT COMPLETION

The Certification of Project Completion, dated 7/26/2021, is included in Attachment C.

POST-PERFORMANCE REPORTS

Three annual Post-Performance Reports will be submitted per this schedule and outline.

Report Year	Performance Period	Submit on or before
1	10/1/2021 – 9/30/2022	11/30/2022
2	10/1/2022 – 9/30/2023	11/30/2023
3	10/1/2023 – 9/30/2024	11/30/2024

Post-Performance Report Outline

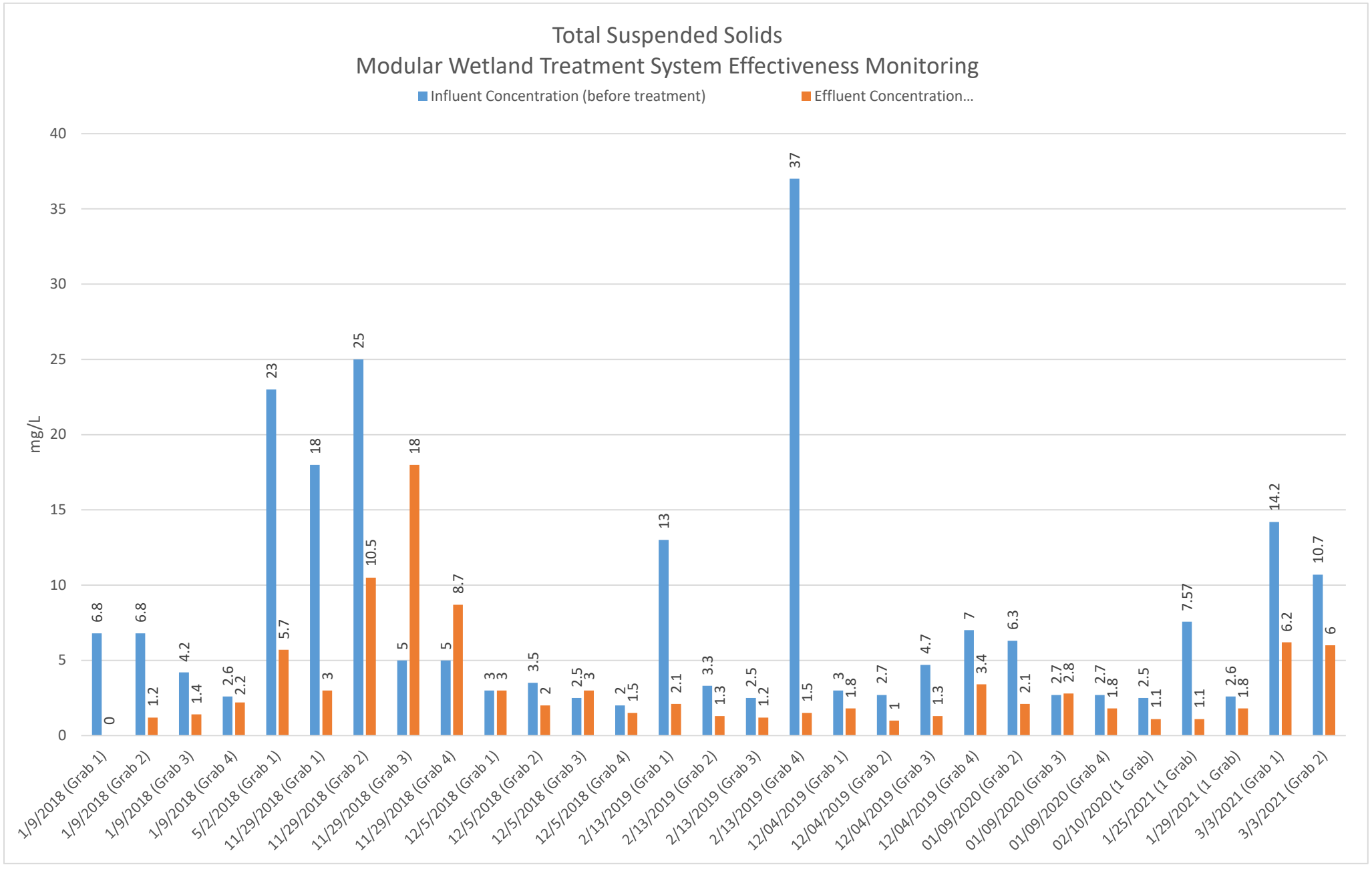
1. Project title
2. Time period of annual report
3. Project component description and benefits
4. Comparison of performance output indicators and targets to those of the project monitoring plan
5. Summary of additional costs or benefits derived from project since completion
6. Any additional relevant information including photographs

Attachment A

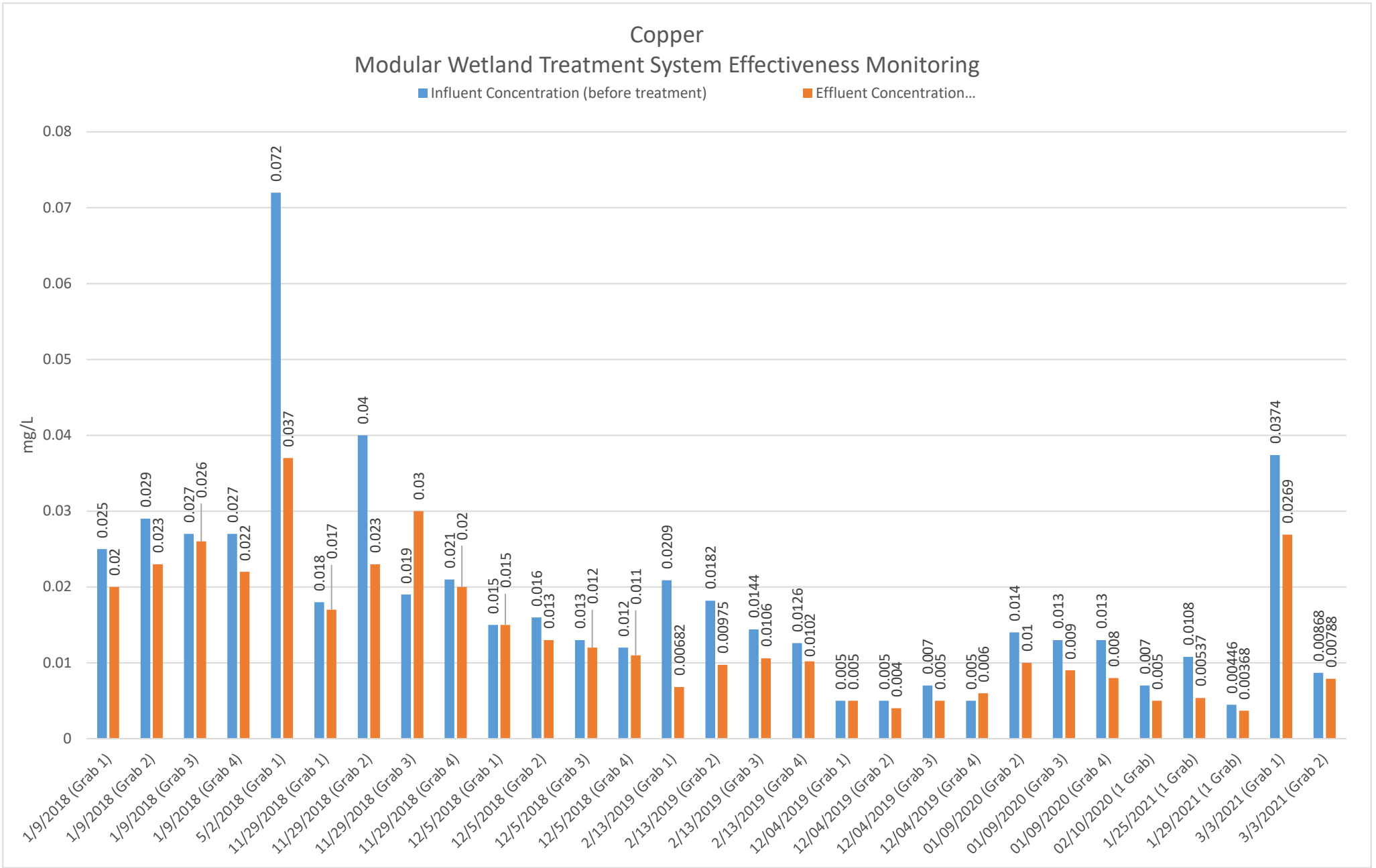
Modular Wetland Treatment System Effectiveness Monitoring

Constituent	Event	Sample Date	Unit	Influent Concentration (before treatment)	Effluent Concentration (after treatment)
Total Suspended Solids	Event 1	1/9/2018 (Grab 1)	mg/L	6.8	ND
Total Suspended Solids	Event 1	1/9/2018 (Grab 2)	mg/L	6.8	1.2
Total Suspended Solids	Event 1	1/9/2018 (Grab 3)	mg/L	4.2	1.4
Total Suspended Solids	Event 1	1/9/2018 (Grab 4)	mg/L	2.6	2.2
Total Suspended Solids	Event 2	5/2/2018 (Grab 1)	mg/L	23	5.7
Total Suspended Solids	Event 3	11/29/2018 (Grab 1)	mg/L	18	3
Total Suspended Solids	Event 3	11/29/2018 (Grab 2)	mg/L	25	10.5
Total Suspended Solids	Event 3	11/29/2018 (Grab 3)	mg/L	5	18
Total Suspended Solids	Event 3	11/29/2018 (Grab 4)	mg/L	5	8.7
Total Suspended Solids	Event 4	12/5/2018 (Grab 1)	mg/L	3	3
Total Suspended Solids	Event 4	12/5/2018 (Grab 2)	mg/L	3.5	2
Total Suspended Solids	Event 4	12/5/2018 (Grab 3)	mg/L	2.5	3
Total Suspended Solids	Event 4	12/5/2018 (Grab 4)	mg/L	2	1.5
Total Suspended Solids	Event 5	2/13/2019 (Grab 1)	mg/L	13	2.1
Total Suspended Solids	Event 5	2/13/2019 (Grab 2)	mg/L	3.3	1.3
Total Suspended Solids	Event 5	2/13/2019 (Grab 3)	mg/L	2.5	1.2
Total Suspended Solids	Event 5	2/13/2019 (Grab 4)	mg/L	37	1.5
Total Suspended Solids	Event 6	12/04/2019 (Grab 1)	mg/L	3	1.8
Total Suspended Solids	Event 6	12/04/2019 (Grab 2)	mg/L	2.7	1
Total Suspended Solids	Event 6	12/04/2019 (Grab 3)	mg/L	4.7	1.3
Total Suspended Solids	Event 6	12/04/2019 (Grab 4)	mg/L	7	3.4
Total Suspended Solids	Event 7	01/09/2020 (Grab 2)	mg/L	6.3	2.1
Total Suspended Solids	Event 7	01/09/2020 (Grab 3)	mg/L	2.7	2.8
Total Suspended Solids	Event 7	01/09/2020 (Grab 4)	mg/L	2.7	1.8
Total Suspended Solids	Event 8	02/10/2020 (1 Grab)	mg/L	2.5	1.1
Total Suspended Solids	Event 9	1/25/2021 (1 Grab)	mg/L	7.57	1.1
Total Suspended Solids	Event 10	1/29/2021 (1 Grab)	mg/L	2.6	1.8
Total Suspended Solids	Event 11	3/3/2021 (Grab 1)	mg/L	14.2	6.2
Total Suspended Solids	Event 11	3/3/2021 (Grab 2)	mg/L	10.7	6

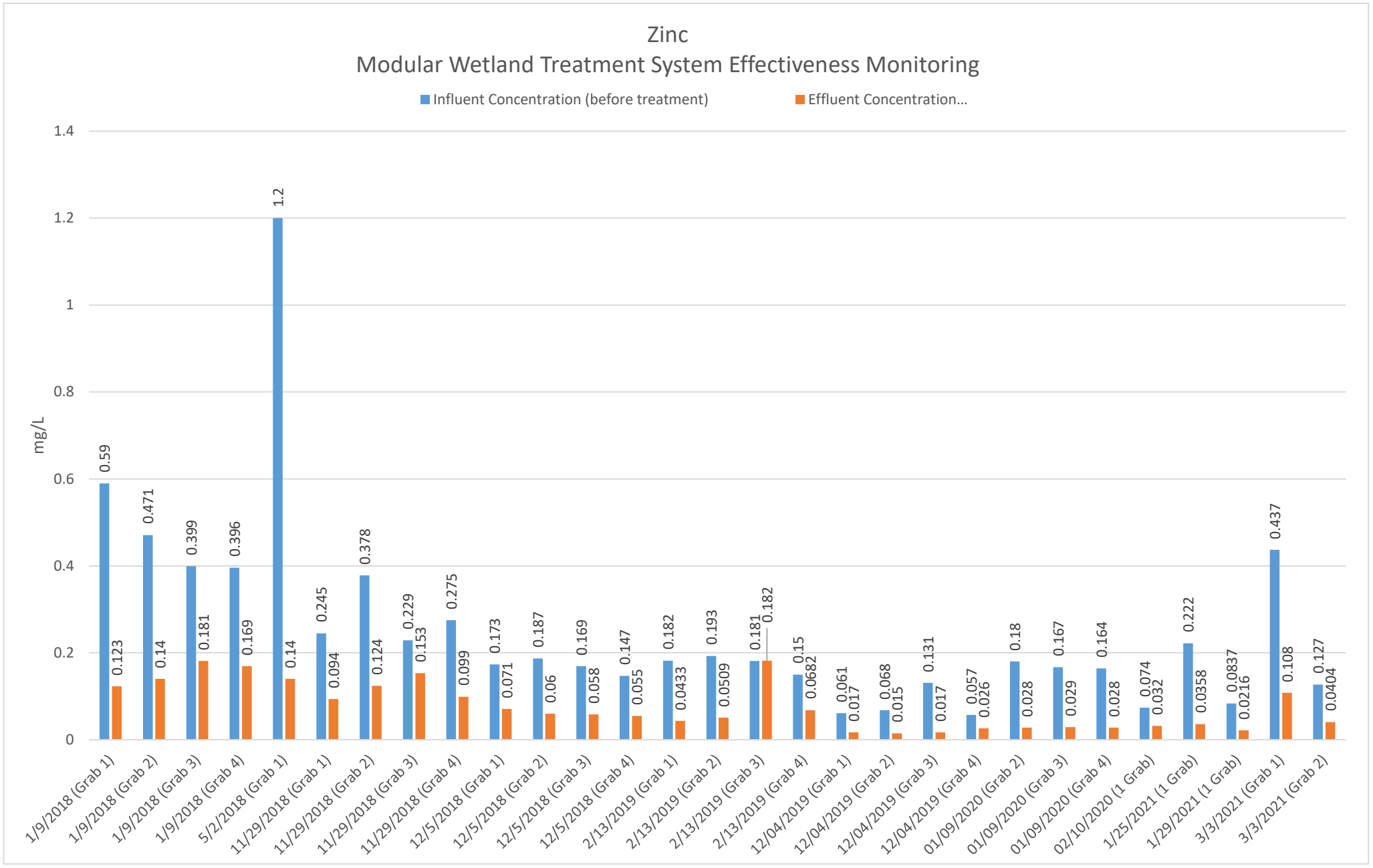
ND = Not Detected


Total Suspended Solids
Modular Wetland Treatment System Effectiveness Monitoring
Influent Concentration (before treatment)
Effluent Concentration...
mg/L
40
35
30
25
20
15
10
5
0
6.8
0
6.8
1.2
4.2
1.4
2.6
2.2
23
5.7
18
3
25
10.5
5
18
5
8.7
3
3
3.5
2
2.5
3
2
1.5
13
2.1
3.3
1.3
2.5
1.2
37
1.5
3
1.8
2.7
1
4.7
1.3
7
3.4
6.3
2.1
2.7
2.8
2.7
1.8
2.5
1.1
7.57
1.1
2.6
1.8
14.2
6.2
10.7
6
1/9/2018 (Grab 1)
1/9/2018 (Grab 2)
1/9/2018 (Grab 3)
1/9/2018 (Grab 4)
5/2/2018 (Grab 1)
11/29/2018 (Grab 1)
11/29/2018 (Grab 2)
11/29/2018 (Grab 3)
11/29/2018 (Grab 4)
12/5/2018 (Grab 1)
12/5/2018 (Grab 2)
12/5/2018 (Grab 3)
12/5/2018 (Grab 4)
2/13/2019 (Grab 1)
2/13/2019 (Grab 2)
2/13/2019 (Grab 3)
2/13/2019 (Grab 4)
12/04/2019 (Grab 1)
12/04/2019 (Grab 2)
12/04/2019 (Grab 3)
12/04/2019 (Grab 4)
01/09/2020 (Grab 2)
01/09/2020 (Grab 3)
01/09/2020 (Grab 4)
02/10/2020 (1 Grab)
1/25/2021 (1 Grab)
1/29/2021 (1 Grab)
3/3/2021 (Grab 1)
3/3/2021 (Grab 2)

Constituent	Event	Sample Date	Unit	Influent Concentration (before treatment)	Effluent Concentration (after treatment)
Copper	Event 1	1/9/2018 (Grab 1)	mg/L	0.025	0.02
Copper	Event 1	1/9/2018 (Grab 2)	mg/L	0.029	0.023
Copper	Event 1	1/9/2018 (Grab 3)	mg/L	0.027	0.026
Copper	Event 1	1/9/2018 (Grab 4)	mg/L	0.027	0.022
Copper	Event 2	5/2/2018 (Grab 1)	mg/L	0.072	0.037
Copper	Event 3	11/29/2018 (Grab 1)	mg/L	0.018	0.017
Copper	Event 3	11/29/2018 (Grab 2)	mg/L	0.04	0.023
Copper	Event 3	11/29/2018 (Grab 3)	mg/L	0.019	0.03
Copper	Event 3	11/29/2018 (Grab 4)	mg/L	0.021	0.02
Copper	Event 4	12/5/2018 (Grab 1)	mg/L	0.015	0.015
Copper	Event 4	12/5/2018 (Grab 2)	mg/L	0.016	0.013
Copper	Event 4	12/5/2018 (Grab 3)	mg/L	0.013	0.012
Copper	Event 4	12/5/2018 (Grab 4)	mg/L	0.012	0.011
Copper	Event 5	2/13/2019 (Grab 1)	mg/L	0.0209	0.00682
Copper	Event 5	2/13/2019 (Grab 2)	mg/L	0.0182	0.00975
Copper	Event 5	2/13/2019 (Grab 3)	mg/L	0.0144	0.0106
Copper	Event 5	2/13/2019 (Grab 4)	mg/L	0.0126	0.0102
Copper	Event 6	12/04/2019 (Grab 1)	mg/L	0.005	0.005
Copper	Event 6	12/04/2019 (Grab 2)	mg/L	0.005	0.004
Copper	Event 6	12/04/2019 (Grab 3)	mg/L	0.007	0.005
Copper	Event 6	12/04/2019 (Grab 4)	mg/L	0.005	0.006
Copper	Event 7	01/09/2020 (Grab 2)	mg/L	0.014	0.01
Copper	Event 7	01/09/2020 (Grab 3)	mg/L	0.013	0.009
Copper	Event 7	01/09/2020 (Grab 4)	mg/L	0.013	0.008
Copper	Event 8	02/10/2020 (1 Grab)	mg/L	0.007	0.005
Copper	Event 9	1/25/2021 (1 Grab)	mg/L	0.0108	0.00537
Copper	Event 10	1/29/2021 (1 Grab)	mg/L	0.00446	0.00368
Copper	Event 11	3/3/2021 (Grab 1)	mg/L	0.0374	0.0269
Copper	Event 11	3/3/2021 (Grab 2)	mg/L	0.00868	0.00788


Copper
Modular Wetland Treatment System Effectiveness Monitoring
Influent Concentration (before treatment)
Effluent Concentration...
mg/L
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0.025 0.02
0.029 0.023
0.027 0.026
0.027 0.022
0.072 0.037
0.018 0.017
0.04 0.023
0.019 0.03
0.021 0.02
0.015 0.015
0.016 0.013
0.013 0.012
0.012 0.011
0.0209 0.00682
0.0182 0.00975
0.0144 0.0106
0.0126 0.0102
0.005 0.005
0.005 0.004
0.007 0.005
0.005 0.006
0.014 0.01
0.013 0.009
0.013 0.008
0.007 0.005
0.0108 0.00537
0.00446 0.00368
0.0374 0.0269
0.00868 0.00788
1/9/2018 (Grab 1)
1/9/2018 (Grab 2)
1/9/2018 (Grab 3)
1/9/2018 (Grab 4)
5/2/2018 (Grab 1)
11/29/2018 (Grab 1)
11/29/2018 (Grab 2)
11/29/2018 (Grab 3)
11/29/2018 (Grab 4)
12/5/2018 (Grab 1)
12/5/2018 (Grab 2)
12/5/2018 (Grab 3)
12/5/2018 (Grab 4)
2/13/2019 (Grab 1)
2/13/2019 (Grab 2)
2/13/2019 (Grab 3)
2/13/2019 (Grab 4)
12/04/2019 (Grab 1)
12/04/2019 (Grab 2)
12/04/2019 (Grab 3)
12/04/2019 (Grab 4)
01/09/2020 (Grab 2)
01/09/2020 (Grab 3)
01/09/2020 (Grab 4)
02/10/2020 (1 Grab)
1/25/2021 (1 Grab)
1/29/2021 (1 Grab)
3/3/2021 (Grab 1)
3/3/2021 (Grab 2)

Constituent	Event	Sample Date	Unit	Influent Concentration (before treatment)	Effluent Concentration (after treatment)
Zinc	Event 1	1/9/2018 (Grab 1)	mg/L	0.59	0.123
Zinc	Event 1	1/9/2018 (Grab 2)	mg/L	0.471	0.14
Zinc	Event 1	1/9/2018 (Grab 3)	mg/L	0.399	0.181
Zinc	Event 1	1/9/2018 (Grab 4)	mg/L	0.396	0.169
Zinc	Event 2	5/2/2018 (Grab 1)	mg/L	1.2	0.14
Zinc	Event 3	11/29/2018 (Grab 1)	mg/L	0.245	0.094
Zinc	Event 3	11/29/2018 (Grab 2)	mg/L	0.378	0.124
Zinc	Event 3	11/29/2018 (Grab 3)	mg/L	0.229	0.153
Zinc	Event 3	11/29/2018 (Grab 4)	mg/L	0.275	0.099
Zinc	Event 4	12/5/2018 (Grab 1)	mg/L	0.173	0.071
Zinc	Event 4	12/5/2018 (Grab 2)	mg/L	0.187	0.06
Zinc	Event 4	12/5/2018 (Grab 3)	mg/L	0.169	0.058
Zinc	Event 4	12/5/2018 (Grab 4)	mg/L	0.147	0.055
Zinc	Event 5	2/13/2019 (Grab 1)	mg/L	0.182	0.0433
Zinc	Event 5	2/13/2019 (Grab 2)	mg/L	0.193	0.0509
Zinc	Event 5	2/13/2019 (Grab 3)	mg/L	0.181	0.182
Zinc	Event 5	2/13/2019 (Grab 4)	mg/L	0.15	0.0682
Zinc	Event 6	12/04/2019 (Grab 1)	mg/L	0.061	0.017
Zinc	Event 6	12/04/2019 (Grab 2)	mg/L	0.068	0.015
Zinc	Event 6	12/04/2019 (Grab 3)	mg/L	0.131	0.017
Zinc	Event 6	12/04/2019 (Grab 4)	mg/L	0.057	0.026
Zinc	Event 7	01/09/2020 (Grab 2)	mg/L	0.18	0.028
Zinc	Event 7	01/09/2020 (Grab 3)	mg/L	0.167	0.029
Zinc	Event 7	01/09/2020 (Grab 4)	mg/L	0.164	0.028
Zinc	Event 8	02/10/2020 (1 Grab)	mg/L	0.074	0.032
Zinc	Event 9	1/25/2021 (1 Grab)	mg/L	0.222	0.0358
Zinc	Event 10	1/29/2021 (1 Grab)	mg/L	0.0837	0.0216
Zinc	Event 11	3/3/2021 (Grab 1)	mg/L	0.437	0.108
Zinc	Event 11	3/3/2021 (Grab 2)	mg/L	0.127	0.0404


Zinc
Modular Wetland Treatment System Effectiveness Monitoring
Influent Concentration (before treatment)
Effluent Concentration…
mg/L
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.59
0.123
0.471
0.14
0.399
0.181
0.396
0.169
1.2
0.14
0.245
0.094
0.378
0.124
0.229
0.153
0.275
0.099
0.173
0.071
0.187
0.06
0.169
0.058
0.147
0.055
0.182
0.0433
0.193
0.0509
0.181
0.182
0.15
0.0682
0.061
0.017
0.068
0.015
0.131
0.017
0.057
0.026
0.18
0.028
0.167
0.029
0.164
0.028
0.074
0.032
0.222
0.0358
0.0837
0.0216
0.437
0.108
0.127
0.0404
1/9/2018 (Grab 1)
1/9/2018 (Grab 2)
1/9/2018 (Grab 3)
1/9/2018 (Grab 4)
5/2/2018 (Grab 1)
11/29/2018 (Grab 1)
11/29/2018 (Grab 2)
11/29/2018 (Grab 3)
11/29/2018 (Grab 4)
12/5/2018 (Grab 1)
12/5/2018 (Grab 2)
12/5/2018 (Grab 3)
12/5/2018 (Grab 4)
2/13/2019 (Grab 1)
2/13/2019 (Grab 2)
2/13/2019 (Grab 3)
2/13/2019 (Grab 4)
12/04/2019 (Grab 1)
12/04/2019 (Grab 2)
12/04/2019 (Grab 3)
12/04/2019 (Grab 4)
01/09/2020 (Grab 2)
01/09/2020 (Grab 3)
01/09/2020 (Grab 4)
02/10/2020 (1 Grab)
1/25/2021 (1 Grab)
1/29/2021 (1 Grab)
3/3/2021 (Grab 1)
3/3/2021 (Grab 2)

Attachment B

Project Schedule

PROJECT SCHEDULE (Projected and Actual)

Project 7: UCSD Water Conservation and Watershed Protection Project				
Budget Category/Task		**Start Date**	**Projected End Date / LPS Amendment**	**Actual End Date**
(a)	**Direct Project Administration**	**1/1/2016**	**~~9/30/2019~~ 7/15/2021**	**10/15/21**
Task 1	Project Management	1/1/2016	~~9/30/2019~~ 7/15/2021	10/15/21
Task 2	Labor Compliance Program	3/1/2016	~~7/31/2019~~ 7/1/2021	7/26/21
Task 3	Reporting	1/1/2016	~~9/30/2019~~ 7/15/2021	10/15/21
(b)	**Land Purchase/Easement**	**N/A**	**N/A**	**N/A**
Task 4	Land Purchase/Easement	N/A	N/A	N/A
(c)	**Planning/Design/Engineering/ Environmental Documentation**	**1/1/2014**	**~~6/1/2016~~ 7/31/2019**	
Task 5	Feasibility Studies and Planning Efforts	6/3/2015	9/30/2015	9/30/2015
Task 6	CEQA Documentation	4/1/2014	~~2/28/2015~~ 7/31/2019	9/30/18
Task 7	Permitting	1/1/2014	11/1/2015	11/1/2015
Task 8	Design	1/1/2014	7/31/2019	7/31/2020
Task 9	Project Monitoring Plan	1/1/2016	~~2/28/2016~~ 4/15/2017	4/15/2017
(d)	**Construction/Implementation**	**1/17/2014**	**~~7/31/2019~~ ~~5~~/31/2021**	**7/31/2021**
Task 10	Construction Contracting	1/17/2014	~~12/31/2017~~ 5/31/2021	12/31/2020
Task 11	Construction Administration	1/17/2014	~~12/31/2017~~ 5/31/2021	7/31/2021
Task 12	Construction/Implementation	7/1/2015	~~7/31/2019~~ 5/31/2021	7/31/2021
12.1	CUP Reclaimed Water Cooling Tower Retrofit	7/1/2015	~~9/29/2016~~ 9/29/2017	7/31/2017
12.2	Air Handling Unit Condensate Collection and Reuse	3/1/2016	~~10/31/2018~~ 5/31/2021	5/31/2019
12.3	Water Conservation Community Outreach	9/1/2016	~~6/1/2018~~ 5/31/2021	12/31/2020
12.4	Turf Removal and Stormwater Treatment	3/1/2016	~~10/31/2017~~ 5/31/2021	7/31/2021
12.5	Modular Wetland Treatment System and Monitoring	12/1/2015	~~6/1/2018~~ 5/31/2021	5/31/2021
12.6	TRV Non-Point Source Pollution Reduction and Habitat Restoration	9/1/2016	~~12/31/2018~~ 5/31/2021	12/31/2020

Attachment C

Certification of Project Completion

CERTIFICATE OF PROJECT COMPLETION

I, Ross Kunishige , a California Registered Civil Engineer (RCE), hereby certify that the UCSD Water Conservation and Watershed Protection project has been completed in accordance with the final plans and specifications as defined in Contract Number 84-4-7-80045 between the State of California and University of California, San Diego.

Date: 7/26/21

Engineer's Signature: Ross Kunishige Date: 2021.09.28 12:25:28-07'00'

RCE Number : 73628 Expiration Date: 12/31/22