

**WaterSMART: Water Reclamation Research under the Title XVI
Water Reclamation and Reuse Program for Fiscal Year 2016**

***Mission Basin Groundwater Purification Facility
Third Stage Reverse Osmosis Pilot Testing***

**Technical Proposal
(FOA No. R16-FOA-DO-011)**

Prepared for:

United States Bureau of Reclamation

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Abbreviations

AF	Acre-feet
AFY	Acre-feet per year
CDA	Chino Desalter Authority
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CIP	Clean-in-Place
CNDDDB	California Natural Diversity Database
EDR	Electrodialysis reversal
GHG	Greenhouse gas
GWUDI	Groundwater under the direct influence
HCl	Hydrochloric acid
IRWM	Integrated Regional Water Management
MBGPF	Mission Basin Groundwater Purification Facility
MGD	Million gallons per day
MWRF	Mesa Water Reliability Facility
NEPA	National Environmental Policy Act
NF	Nanofiltration
NPDES	National Pollutant Discharge Elimination System
NWWF	Northwest Wellfield
OCWD	Orange County Water District
psi	Pounds per square inch
WASD	Water and Sewer Department
RWQCB	Regional Water Quality Control Board
WTP	Water Treatment Plant

Section 1 Technical Proposal and Evaluation Criteria

1.1 Executive Summary

The City of Oceanside (City) is applying to the *WaterSMART: Water Reclamation Research under the Title XVI Water Reclamation and Reuse Program* for **\$35,905.28** to conduct a pilot project that will investigate adding a third stage reverse osmosis (RO) system to the City’s Mission Basin Groundwater Purification Facility (MBGPF) to recover up to 45 percent of the brine that is currently discharged to an ocean outfall. Project activities will include development of a pilot test plan, installation of a RO pilot unit at MBGPF, running of the pilot unit to determine whether water quality goals can be met at the desired recovery rate, decommissioning of the pilot plant, and development of a final report. If successful, this project could result in recovery of an additional 1 million gallons per day (MGD) of potable water without an increase in the amount of pumping from the Mission Basin of the larger San Luis Rey Valley Groundwater Basin.

The proposed research study is expected to require 200 days, and is estimated to be completed by April 19, 2017.

Date: April 20, 2016
Applicant: City of Oceanside
City: Oceanside
County: San Diego County
State: California

1.2 Technical Research Study Description

The City of Oceanside is conducting a pilot test to add a third stage RO system to the City’s MBGPF to determine whether additional water supply can be recovered from the facility’s wastewater stream. The MBGPF is a desalting treatment facility that treats brackish groundwater extracted from the Mission Basin via eight wells, including four “on-site” wells located at the MBGPF site and four “off-site” wells. The MBGPF was put into service in 1992 with a capacity of 2.0 MGD, and expanded to its current capacity of 6.37 MGD (or 7,130 acre-feet per year [AFY]) in 2002.

The primary MBGPF treatment process utilizes RO membranes to reduce salt concentrations present in the brackish groundwater. A secondary treatment process, added in 2009, utilizes granular activated carbon to remove 1, 2, 3-trichloropropane (TCP) from six of the wells. A side-stream treatment system is employed to reduce iron and manganese, and is made up of Hydranautics Model ESPA1 RO membranes that operate at a feed pressure of approximately 150 pounds per square inch (psi). The facility is capable of removing many impurities from the groundwater, including particles, iron, manganese, TCP, and sodium, to meet drinking water standards. Iron and manganese are present in the on-site wells, and manganese is present in the off-site wells. After the minerals and other impurities are removed through RO, the product is then blended with a 20 percent share of water direct from the well field and subjected to additional post-blend treatment to result in a finished, potable water supply.

The brine waste stream produced by the MBGPF is currently discharged to a brine line that conveys the waste from the MBGPF to the City’s ocean outfall, and discharges at a rate of

approximately 2.2 MGD. An analysis was conducted by Carollo Engineers (Carollo) in January 2015 to review the most common and established concentrate reduction processes currently practiced and their suitability for use at the MBGPF, including:

- Additional (third) RO stage to process concentrate from the existing 2-stage RO systems
- Chemical softening of the existing RO brine followed by additional RO treatment
- Treatment using electrodialysis reversal (EDR)

Based on analysis of these brine concentrate removal processes, the simplest and least costly option to recover more potable water and reduce the volume of brine requiring disposal is to add a third stage RO system to recover up to 45 percent of the brine that is currently discharged (or 1 MGD). Chemical softening of the existing RO brine followed by additional RO treatment was concluded to only be cost effective when the cost of alternative disposal is extremely high or there is a requirement to achieve zero or near zero liquid discharge, based on experience with the Chino II Desalter in Mira Loma, California. EDR was determined not to provide significant recovery benefits over a third stage RO, does not meet the finished water total dissolved solids (TDS) goal, and would require extensive pretreatment for iron and manganese removal (Carollo, 2015).

The analysis concludes that, based on operating data from desalters in the Inland Empire area of California, silica concentrations in the range found in Mission Basin are manageable with scale inhibitors and periodic chemical cleanings to achieve a 45 percent reduction in brine volume. Demonstration-scale pilot testing of a third RO stage was recommended at the MBGPF to validate performance given the site-specific water quality conditions, particularly to confirm that iron and manganese concentrations are within treatable limits (Carollo, 2015).

The RO system to be tested is a packaged treatment plant that will be provided by Carollo. The RO pilot plant was purchased from Harn R/O Systems, Inc. (Harn) by Carollo and will be leased to the City. The skid measures approximately 192 inches in length by 60 inches in width by 72 inches in height. A schematic and photograph of the pilot skid are presented on Figures 1 and 2, respectively. Key components of the RO pilot test will include pretreatment acid and scale inhibitor chemical injection, 5-micrometer (μm) cartridge filters, booster pump, high-pressure feed pump, stage 1 permeate backpressure valve, pressure vessels, RO membrane elements, instrumentation, controls, and a Clean-in-Place (CIP) system for membrane cleaning.

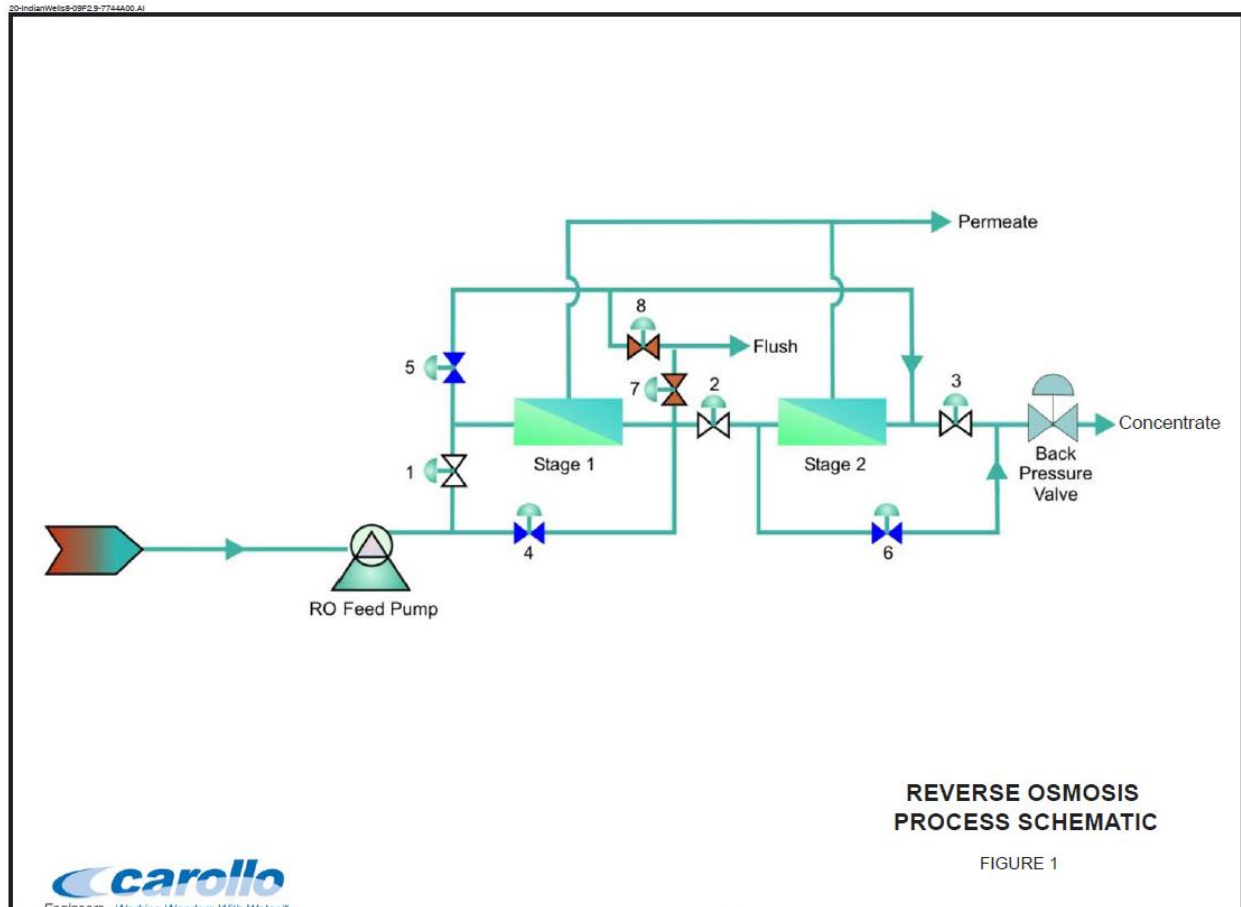
The skid-mounted pilot unit consists of two stages of RO membranes, organized in a 2:1 array of three- and four-element pressure vessels operated in series. The particular array was selected to mimic full-scale applications. The first stage consists of two parallel vessels, each containing seven 4-inch diameter membrane elements. The second stage consists of one vessel also with seven 4-inch elements. To minimize space demands, each vessel (for both stages) was divided into two and the pieces manifolded in a manner so that they would behave, in effect, as a typical single vessel. This will result in a modification of the configuration to a 2:2:1:1 array capable of achieving the desired recovery. A summary of the RO system parameters is shown in Table 1 (Carollo, 2015).

Table 1: Reverse Osmosis System Parameters

	Number	Units
Feed Flow Rate	25	gpm
Chemical Pretreatment		
Sodium Bisulfite Dose	4	mg/L
Anti-Scalant Dose	4	mg/L
Number of Stages	2	
Pressure Vessel Array	2:2:1:1	
Membrane Type	Dow FILMTEC™ BW30-4040	
Membrane Elements per Vessel	7	
Membrane Surface Area	78	sf

Source: Carollo, 2015

Figure 1: Reverse Osmosis Process Schematic



Source: Carollo, 2015

Figure 2: Reverse Osmosis System Photographs



Source: Carollo, 2015

Proposed Scope of Work

The following describes the tasks and methods to validate the projected sustainable operating recovery of a third stage RO system at the MBGPF.

Task 1 – Pilot Test Plan

In consultation with the City, a consultant will develop a Draft Pilot Test Plan that states the objectives of the proposed tests, how the tests will be conducted, duration of testing, samples to be collected during the pilot test and their frequency, and the analytical tests to be performed on the samples.

Task 2 – Set up Pilot Equipment at MBGPF

Under Task 2, RO pilot test will be set up as follows:

- Deliver the RO pilot unit and its CIP skid to the MBGPF site.
- Unload and place the pilot unit and CIP skid at the existing MBGPF site.
- Carry out any needed maintenance on the RO pilot unit to prepare it for operation.
- Plumb the pilot unit into the existing brine line and permeate line with temporary piping, and connect the electrical feed to the unit.

Task 3 – Pilot Operation and Performance Monitoring

During the pilot testing operating period, the pilot RO plant will be operated in single stage operating mode at the selected recovery (i.e. 45 percent). City staff will monitor system operation, ensure that chemical feed systems are operating properly, and communicate with the consultant regularly regarding pilot operating data and water quality sampling. The pilot will be operated for up to 3 months, or until the first CIP is required.

The pilot test will include the following:

1. After the unit is set up, commission the unit and get it operational per the Test Plan.
2. Once all systems are operating correctly, shut the unit down and install new membranes. A consultant will provide training to the City staff so that they are able to shut-down or adjust the pilot unit as needed.
3. Set the pilot unit to obtain the desired recovery (around 45-percent) in accordance with the Pilot Test Plan.
4. Monitor the pilot unit performance on a daily basis and make pilot plant adjustments, as needed.
5. Conduct the membrane CIP when it is required.
6. Review analytical data provided by the City's laboratory for samples collected by the City staff and submitted to the laboratory for analysis
7. Prepare a brief performance summary every two weeks that includes water quality analyses, as available.
8. When the first CIP is required, determine if pilot plant settings should be adjusted based on performance at that time.

9. At the end of the pilot test, remove the used RO membranes (lead element and tail end element) to be sent for external testing and autopsy.

Task 4 – Pilot Test Report

Upon completion of RO pilot test, a report will be prepared with recommendations based on the observed performance. The pilot test report will include the following:

- Compilation and review of the performance data and analytical data from the pilot operation
- Recommendations to the City based on the outcome of the pilot testing.

Task 5 – Pilot Unit Decommissioning

Following the completion of Task 4, and assuming additional pilot testing is not required, decommissioning of the pilot unit will commence, including arranging for shipping back to storage, flushing and draining of the RO unit and chemical lines, disconnection of water and power lines, disposal of unused chemical, and proper packaging for shipment.

1.3 Evaluation Criteria

Evaluation Criterion 1: Statement of Problems and Needs (10 Points)

Points will be awarded based on the presence of watershed-based water resource management problems and needs for which water reclamation and reuse may provide a solution.

(1) If the proposed research study aims to address the needs of a specific applicant or locale, describe in detail the water resource management problems and needs in the local area and explain how water reclamation and reuse may address those problems and needs.

The City of Oceanside currently serves potable and nonpotable water to meet demands of approximately 29,900 AFY that include primarily residential, commercial, and agricultural customers. The City is largely dependent on imported water from the San Diego County Water Authority (SDCWA) via the California State Water Project (SWP) and the Colorado River Aqueduct (CRA), and supplements with brackish groundwater treated at the MBGPF and recycled water. Diversification of the City's water supplies, particularly of non-imported water supply, has become critical as California endures the ongoing drought and prepares for expected long-term climate changes. The ongoing drought resulted in a 15 percent allocation of imported water from SDCWA, while climate change is expected to reduce imported water supplies by 20 to 25 percent to the San Diego region in addition to making the region more sensitive to drought. Local groundwater and recycled water are viewed as more reliable supplies; according to the City of Oceanside's draft 2015 UWMP, groundwater and recycled water supplies are not anticipated to be reduced in dry years. Should the pilot test be successful, production at the MBGPF will become more efficient and increase local supply available to meet demand in the future.

In addition to seasonal and climatic concerns, the City has identified the groundwater supply treated at the MBGPF as a critical supply to be used should a catastrophic event temporarily reduce or cut off imported water supplies. Various scenarios in the City's 2015 *Water Master Plan* (Carollo 2015a) explored imported water aqueduct outages. The Master Plan concluded that should a major earthquake eliminate imported water from SDCWA, there will be a water supply shortage. Implementation of this pilot project will move the City towards addressing this

reliability concern. If successful, this project could result in recovery of an additional 1 MGD of potable water by simply making the existing MBGPF treatment process more efficient.

(2) Identify the water supply imbalance that the research study will address for the area of responsibility of the applicant. Additional consideration will be given to proposals that explain how water supply imbalances in the area may be impacted by climate change, and/or if the research study will attempt to address projected climate change impacts in the area.

Table 2 demonstrates the water supply imbalance that could be improved by the proposed research study, according to projected water use and supply estimates in the City of Oceanside’s internal draft 2015 UWMP. As shown below, a supply shortage between 1,027 AFY and 4,847 AFY is estimated in the future. Should the proposed research study show that third stage RO can be successfully implemented, the City can construct permanent third stage RO treatment to obtain 400 AFY of additional supply from the MBGPF without additional pumping from the Mission Basin.

This water imbalance is theoretical in that without implementation of the project, the City of Oceanside would either increase imported water purchases from SDCWA or implement mandatory conservation actions in its Drought Response Plan to balance supplies and demands, and would likely not face a water shortage. While the water supply imbalance is considered theoretical, due to legal, climatic, environmental, competition, and other reliability issues surrounding imported water supplies, offsetting imported water demands is a critical local need that will help increase local water supply reliability for the City of Oceanside and the San Diego region.

Table 2: Projected Water Supply Imbalance Without Project (acre-feet per year)

	2020	2025	2030	2035	2040
Projected Water Use	33,470	36,112	37,337	38,114	38,869
Purchased or Imported Water from SDCWA	25,443	25,041	23,400	23,778	23,922
Groundwater (Mission Basin)	3,300	3,300	3,300	3,300	3,300
Recycled Water (Non-Potable Reuse)	400	1,700	2,900	3,060	3,500
Advanced Treated Water (Potable Reuse)	3,300	3,300	3,300	3,300	3,300
Total Water Supplies	32,443	33,741	33,300	33,838	34,422
Water Supply Shortage Without Proposed Research Study	-1,027	-2,771	-4,437	-4,676	-4,847

The 2013 San Diego Integrated Regional Water Management (IRWM) Plan (SDCWA 2013) identifies water supply as one of the water resources management areas most vulnerable to climate change. By increasing supplies from the MBGPF, the proposed research study helps to adapt to climate change as the Mission Basin is considered to be a drought-proof source of local water supply and is less vulnerable to supply interruptions from infrastructure damage caused by natural disasters related to climate change (e.g., increased storm intensity). It is also more efficient to pump and treat groundwater locally than to import it from the Sacramento-San Joaquin Bay-Delta (SWP) or Colorado River (CRA) systems, reducing net greenhouse gas (GHG) emissions.

(3) If the proposed research study aims to address broader needs of the industry in terms of technology or practices, describe these needs as they occur on a watershed, regional, and/or national scale.

The proposed research study will help to address broader needs of the region because other groundwater basins in the San Diego County coastal area have similar treatment needs as the Mission Basin. Should the proposed research study show that recovery from the MBGPF can be improved, similar technologies can be investigated for use at other groundwater treatment facilities, such as the Haybarn Canyon facility at USMC Camp Pendleton to the north of the City of Oceanside and the Richard A. Reynolds facility owned by the Sweetwater Authority in southern San Diego County. The need for increasing local supply development has been identified in the *2013 San Diego IRWM Plan* (SDCWA, 2013), which identifies region-wide needs and objectives for San Diego County watersheds. The proposed research study will help to address this broader need to expand local supply development and reduce imported water reliance through expanded knowledge of treatment capabilities of groundwater treatment facilities.

Evaluation Criterion 2: Water Reclamation and Reuse Opportunities (15 Points)

Points will be awarded based on the extent to which the proposal demonstrates that the research study will explore opportunities for water reclamation and reuse within and outside the research study area.

(1) Describe the source(s) of water that will be investigated for potential reclamation, including impaired surface or ground waters.

The project will improve treatment efficiency at the MBGPF, which treats impaired groundwater from the Mission Basin underlying the City of Oceanside. The Mission Basin is currently designated as a subbasin to the San Luis Rey Valley Groundwater Basin. The San Luis Rey Valley Groundwater Basin has been designated a medium priority basin under the California Statewide Groundwater Elevation Monitoring (CASGEM) program, meaning that the state considers it a priority basin for monitoring. The City has volunteered as a monitoring entity for the basin, in conjunction with the County of San Diego.

The Mission Basin is an alluvial basin extending from the Pacific Ocean in the west to just beyond the City's eastern border. The basin is unadjudicated, but is estimated to have a natural safe yield of 7,000 to 10,000 AFY. Due to high levels of TDS, ranging between 500 mg/L and 2,000 mg/L, desalting is required prior to distribution and use. Iron and manganese levels are also of concern in the Mission Basin, but are treated to safe levels at the MBGPF (MWD, 2007).

(2) Describe how the research study will help to eliminate obstacles for using reclaimed water as a supply within and/or outside the area of responsibility of the applicant.

The proposed research study will provide the information needed to know whether it's feasible to recover up to 45 percent of the brine that is currently discharged to the ocean. This reclaimed supply will be potable quality following treatment, which will allow the City to overcome obstacles such as institutional and public perception concerns that typically slow down reclaimed water projects, primarily due to their lower quality of water. This reclaimed supply is not expected to be required to undergo as stringent of permitting and regulatory requirements as reclaimed water from wastewater treatment plants because the water being treated is originally groundwater, and the existing National Pollutant Discharge Elimination System (NPDES) permit from the San Diego Regional Water Quality Control Board (RWQCB) can be modified to include the additional treatment process and supply.

(3) Describe how the research study will expand a water market and promote implementation of new uses or expand existing uses for reclaimed water (e.g., environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, and recreation).

Should the pilot test be successful, the City of Oceanside expects to install a permanent third stage RO system at the MBGPF. This will allow the City to permanently recover additional water from the brine discharge, and provide an additional 400 AFY for residential, commercial, and agricultural uses by adding the new supply to the existing potable supply distribution system. This project is expected to have wide-reaching impacts in terms of both reducing imported water demand, which benefits the Bay-Delta, and improving knowledge of the ability of third-stage RO to reclaim water from brine waste streams that is typically discharged for other agencies that depend on desalters to provide water supply from groundwater.

(4) Describe how the research study will help establish or expand a water market to use reclaimed water outside your specific locale, including providing regional or West-wide benefits.

The research study will provide far-reaching benefits by expanding the practice of reclaiming water from brine waste streams. Typically, brine waste streams are discharged to evaporation ponds or to the ocean. Agencies, particularly those in southern California, could benefit from reclaiming additional water from these waste streams and reduce dependency on imported water.

Evaluation Criterion 3: Description of Potential Alternatives (15 Points)

Points will be awarded based on the extent to which the proposal demonstrates that the research study will evaluate water supply alternatives or technology implementation options that support water reclamation and reuse of non-traditional water supplies.

(1) Describe objectives of the proposed research study and how the proposed research is innovative in advancing water reclamation knowledge and/or practices relative to existing knowledge and/or standard practices. References and literature citations should be provided, as applicable.

The primary objective of the proposed research study is to validate the projected sustainable operating recovery of a third stage RO system at the MBGPF. In January 2015, Carollo Engineers presented a report to the City describing multiple options for increasing recovery of the MBGPF for the City of Oceanside's residents. The brine waste stream produced by the MBGPF is currently discharged to a brine line that conveys the waste to the City's ocean outfall. Based on the preliminary analysis of potential brine treatment options, the simplest and least costly option was to investigate adding a third stage RO system to recover up to 45 percent of the brine that is currently discharged. This option included the recommendation to perform pilot testing of this process, given the high iron and manganese concentrations in the MBGPF brine. This research is considered to be innovative in that the City is attempting to reduce its risk related to advanced membrane fouling due to manganese levels by pilot testing ahead of full-scale implementation. Once implemented, the full scale project will increase the City's water supply without additional drawdown of the groundwater basin.

(2) If applicable, describe alternative water reclamation measures or technologies that will be investigated as part of the research study.

Only third stage RO will be investigated as part of the research study's pilot project because an analysis was already completed that examined alternative treatment options for increasing

recovery at the MBGPF. The alternative reclamation measures analyzed as part of the Carollo report include:

- Additional (third) RO stage to process concentrate from the existing 2-stage RO systems
- Chemical softening of the existing RO brine followed by additional RO treatment
- Treatment using EDR

Based on analysis of these brine concentrate removal processes, the simplest and least costly option to recover more potable water and reduce the volume of brine requiring disposal is to add a third stage RO system to recover up to 45 percent of the brine that is currently discharged (or 1 MGD). Chemical softening of the existing RO brine followed by additional RO treatment was concluded to only be cost effective when the cost of alternative disposal is extremely high or there is a requirement to achieve zero or near zero liquid discharge, based on experience with the Chino II Desalter in Mira Loma, California. EDR was determined not to provide significant recovery benefits over a third stage RO, does not meet the finished water TDS goal, and would require extensive pretreatment for iron and manganese removal. (Carollo, 2015)

(3) Describe any collaborators involved with the research and their respective roles.

No collaborators are involved with this research, therefore this item does not apply.

(4) Please describe the credentials, experience, and past performance of the research team. Alternatively, describe the process and criteria that will be used to select an appropriate, experienced research team.

The City of Oceanside has a research team that includes a principal investigator who is City staff, and a professional consultant team. The City's principal investigator will be Ron Lutge, the Chief Plant Operator with the Mission Basin Groundwater Purification Facility.

The City of Oceanside has selected Carollo Engineers to implement the proposed research study. Carollo has extensive experience in the implementation of pilot studies for testing treatment systems. Example projects include:

- **Mesa Water Reliability Facility (Mesa Water District, California):** Mesa Water District's original Colored Water Treatment Facility (later renamed the Mesa Water Reliability Facility (MWRF)) used ozone and biologically active carbon (BAC) to treat highly colored groundwater. Due to increasing groundwater color and bromide levels, the original 4,000-gpm treatment capacity processes at the MWRF were unable to meet the desired treatment goals. In addition, recent modifications required by the Orange County Water District (OCWD) that dictated Mesa Water to install supply well packers or sleeves resulted in the need to draw water from deeper aquifers where color levels are higher, which would further stress the ozone treatment system. This, and elevated color levels, resulted in higher ozone doses and energy costs, and also increased downstream bromate control costs by more frequent carbon media replacement and higher ammonium chloride doses. Carollo, as the prime consultant, began parallel pilot testing and preliminary design of a new 6,000-gpm, state-of-the-art nanofiltration (NF) treatment plant for the treatment of highly colored groundwater to replace the existing treatment system under the MWRF Technology Replacement and Expansion project.
- **Concentrate Reduction Facility (Chino Basin Desalter Authority, Ontario, California):** The Chino Basin Desalter Authority (CDA), a multi-member agency comprised of eight

utilities, operates the Chino I and II Desalters to treat high TDS and nitrate contaminated groundwater. CDA selected Carollo to perform a strategic follow-up to its \$12 million RO/IX facilities expansion project. The goal of this project was to minimize the RO concentrate. Expanded capacity was essential to achieve regional groundwater management goals, demanding an innovative and cost-effective approach to concentrate treatment and minimization given the limited capacity of the existing concentrate disposal system. Carollo successfully pilot tested and designed pelletized softening, filtration, and secondary RO, which will reduce concentrate volume by up to 70 percent and provide a net recovery of over 95 percent. This results in 1.2 MGD of additional finished water to increase the net capacity to 21.7 MGD and reduce the volume of concentrate from 1.8 to 0.6 MGD. This \$46.7 million project will be operational by Spring 2016.

- **Preston and Hialeah Water Treatment Plant Improvements (Miami-Dade County, Florida):** The Miami-Dade County (County) Water and Sewer Department (WASD) 225-MGD Hialeah and Preston WTPs treat raw water from a combination of four groundwater wellfields, including the Northwest Wellfield (NWWF). Nearby mining activities may trigger the reclassification of the NWWF from groundwater to groundwater under the direct influence of surface water (GWUDI). This potential reclassification has significant implications for the WTPs by requiring the existing facilities to meet more stringent water quality standards than were intended in the original designs. Portions of the existing conventional lime-softening treatment facilities date back from the mid-1920s to the most recent additions in the early 2000s. Faced with the pending reclassification of the NWWF, the Miami-Dade Water & Sewer Department selected Carollo to complete what will become one of the largest drinking water treatment projects in the County's history. To confront the challenges of GWUDI and to dramatically improve treated water quality, County WASD elected to proceed with design of the world's largest NF facility (165-MGD) located on a new site in their NW Wellfield. Carollo tailored the design to meet all treatment goals while controlling capital costs, retaining flexibility for future cost savings, limiting operator burden, and controlling O&M costs. Carollo used 3D design capabilities to facilitate review meetings with WASD managers and regulators, while improving clarity of design drawings. Pilot testing of innovative concepts to overcome the conventional barrier of 85 percent recovery and facilitate sustained treatment at recoveries up to 93 percent demonstrated that this unique approach is practical, reliable, and cost-effective. As a result, the County will preserve 8 MGD of a crucial water supply that would otherwise be discarded into deep injection wells, and reduce the final concentrate (by product) volumes injected by approximately 60 percent.

The Carollo Engineers project team includes the following key people:

- **Jim Meyerhofer, Principal-in-Charge:** Mr. Meyerhofer is a licensed Civil Engineer in California with 27 years of experience focused on water treatment, including pilot plant design and operation, water quality studies, treatment plant evaluation and design, and construction management. Mr. Meyerhofer has extensive experience in pilot studies, including a pilot study for Palmdale Water District, California to evaluate disinfection by-product control strategies, the evaluation of a downtown well field and the subsequent preliminary and final design of a centralized water treatment plant for the City of Santa

Barbara, California, and a pilot study for the City of Bellingham, Washington to evaluate three different filter media designs for the 24-MGD in-line filtration plant.

- **Jeff Weishaar, Project Manager/Process Lead:** Mr. Weishaar is a licensed Civil Engineer in California with 10 years of experience working on various wastewater projects including elements of analysis, design and construction. Project experience includes wastewater treatment plant improvements for the City of Barstow, California; upgrades to the Regional Treatment Plant Headworks for the South Orange County Wastewater Authority, California; analysis of return activated sludge (RAS) flow control analysis for the South Orange County Wastewater Authority's Coastal Treatment Plant to determine methods of improving the existing RAS system, as well as additional analyses for the Coastal Treatment Plant.
- **Andrew Weisner, Task Support (Pilot Operation):** Mr. Weisner is a licensed Civil Engineer in California with ten years of experience in a variety of water and wastewater engineering projects. Relevant experience includes pilot plant operator for the USBR Desalination and Water Purification Research and Development Project, pilot testing and conceptual design of an electrochemical reactor for the Water Research Foundation, Colorado, pilot study to evaluate water softening technologies and reverse osmosis to increase water production at the Chino II Desalter in Chino, California; pilot plant operator for the zero-liquid discharge project in Indian Wells Valley Water District California, and numerous other projects.
- **Brandon Yallaly, Technical Advisor/Quality Assurance:** Mr. Yallaly is a licensed engineer with 15 years of experience in all areas of membrane WTP design, including membrane softening, reverse osmosis, micro/ultrafiltration, and concentrate disposal. He has executed all phases of membrane related projects, including process selection, conceptual design, pilot testing, detailed design and construction-phase and startup services. Additionally, Mr. Yallaly has executed process and detailed designs implementing lime softening and ion (anion) exchange processes.

Evaluation Criterion 4: Stretching Water Supplies (15 Points)

Points will be awarded based on the extent to which the proposal demonstrates that the research study will address activities that will help to secure and stretch water supplies.

(1) At your specific locale and/or on a regional or West-wide scale, if applicable, describe how the research study could promote the establishment or expansion of a market for water reclamation and reuse that will reduce, postpone, or eliminate the development of new or expanded water supplies.

The proposed research study will investigate the feasibility for increasing recovery at the MBGPF by adding third stage RO. Should the study be successful in increasing water supplies without extracting additional groundwater, a permanent third stage RO system could be installed that would expand water reclamation in the City of Oceanside. This additional local supply reduce the need to purchase additional imported water from SDCWA, which provides water from the CRA and SWP.

(2) Describe how the research study could or will streamline the implementation of a project that will reduce or eliminate the use of existing diversions from natural watercourses or withdrawals from aquifers and improve available supplies during droughts.

Implementation of the proposed research study will confirm the feasibility of extracting additional potable water supply from the MBGPF's brine effluent, and in turn will support the implementation of a permanent third stage RO system at the facility and permanently provide up to an additional 400 AFY of potable water supply. This supply will directly offset the use of imported water from the SWP and CRA, which are both highly susceptible to drought. Given that the Mission Basin is considered a drought proof supply and the fact that the water supply being evaluated through this study is derived from the waste stream of the MBGPF, as opposed to additionally pumped groundwater, the additional 400 AFY of water that could be provided through implementation of a third stage RO system would also be considered a drought proof supply, thus improving available supplies during drought.

(3) Describe how the research study could or will streamline the implementation of a project that will reduce the demand on existing Federal water supply facilities.

Implementation of the proposed research study would allow the City of Oceanside to determine whether it's feasible to generate additional local water supply by treating effluent from the MBGPF. Should the pilot study demonstrate feasibility of increasing water supply from the MBGPF, the City of Oceanside will have the ability to move forward with implementing a permanent third stage RO system to produce up to 400 AFY of local water supply and directly offset imported water. The City receives an average of 64 percent of its purchased/imported supply from the Colorado River system, along with 20 percent from the SWP and 16 percent from local supplies, provided by SDCWA. When directly applied to the 400 AFY that may be generated through implementation of a permanent RO system, it's estimated that the project could reduce demand on the CRA, a federal facility, by up to 256 AFY.

Evaluation Criterion 5: Environment and Water Quality (15 Points)

Points will be awarded based on the extent to which the proposal demonstrates that the research study will address the potential or provide results that improve surface, ground water, or effluent discharge quality; restore or enhance habitat for nonlisted species; or provide water or critical habitat for federally listed threatened or endangered species.

(1) Describe the potential for the research study to identify methods or produce results that improve the quality of surface or groundwater, including description of any specific issues that will be investigated or information that will be developed as part of the research study.

The proposed research study is not expected to identify methods or produce results that improve the quality of surface or groundwater, therefore this item does not apply.

(2) Describe the potential for the research study to identify methods or produce results that improve flow conditions in a natural stream channel that benefit the environment, including a description of any specific issues that will be investigated or information that will be developed as part of the research study.

As described above, the proposed research project will reduce the City of Oceanside's demands from the Colorado River (CRA) and Sacramento-San Joaquin Bay-Delta (SWP) systems by a total of 400 AFY. Imported water currently represents the second highest cost water supply for the City, the first being seawater desalination. Due to the cost of imported water compared to other supplies, the entire 400 AFY that could potentially be produced should the pilot project be successful will directly offset imported water purchases. As described above, the City receives an average of 64 percent of its purchased/imported supply from the Colorado River system, 20 percent from the SWP, and 16 percent from local supplies, provided by SDCWA. Colorado

River imports will be reduced by an average of 256 AFY, while SWP imports will be reduced by an average of 80 AFY. These flows would remain available for environmental uses in the Colorado River and Bay-Delta systems. In addition, the results of this study may be applicable to other areas that could benefit from further supply development through recovery of water from waste streams.

Table 3: Offset Imported Water Demand from the Proposed Research Study¹

	2020	2025	2030	2035	2040
Without Project	21,372	21,370	19,992	20,310	20,430
State Water Project	5,089	5,088	4,760	4,836	4,864
Colorado River	16,284	16,282	15,232	15,474	15,566
With Project	21,372	21,034	19,656	19,974	20,094
State Water Project	5,089	5,008	4,680	4,756	4,784
Colorado River	16,284	16,026	14,976	15,218	15,310
Percent Change	2%	2%	2%	2%	2%

1. Note that these values do not include local water purchased from SDCWA

(3) Describe the potential for the research study to identify methods or produce results that provide water or habitat for non-listed, sensitive, or federally-listed threatened or endangered species, including description of any specific issues that will be investigated or information that will be developed as part of the research study.

The proposed research study could produce results that provide water or habitat for non-listed, sensitive or federally-listed threatened or endangered species within the Colorado River or Bay-Delta through imported water offsets, as described in the previous question (Evaluation Criterion 5, Question 2). As described in the Bay Delta Conservation Plan, the Bay-Delta is a vast and vitally important ecosystem and water source. As an estuary, the Bay-Delta and its islands create a habitat for hundreds of aquatic and terrestrial species, many of which are considered threatened or endangered (Natural Resource Agency, 2013), and the Colorado River ecosystem is home to a diverse array of plants and animals such as the humpback chub and the southwestern willow flycatcher, both of which are federal listed as endangered (USGS, 2005). By reducing imported water usage, the City of Oceanside will be contributing to the improvement of these species and habitats.

Evaluation Criterion 6: Legal and Institutional Requirements (10 Points)

Points will be awarded based on the extent to which the proposal demonstrates that the research study will address legal or institutional requirements or barriers to implementing a project, including water rights issues and any unresolved issues associated with implementation of a water reclamation and reuse project.

(1) For planning related research, describe how the research study will to identify methods or produce results that help to eliminate obstacles for using reclaimed water as a supply in the research study area.

The Project is a pilot project intended to be tested in the field, therefore this does not apply.

(2) For field research studies focused on state of the art technology deployment describe the readiness to proceed in terms of:

a. The type and level of preliminary research investigations that have been completed.

As described previously, an analysis was conducted by Carollo Engineers in January 2015 to review the most common and established concentrate reduction processes currently practiced and their suitability for use at the MBGPF. The analysis concludes that, based on operating data from desalters in the Inland Empire area of California, silica concentrations in the range found in Mission Basin are manageable with scale inhibitors and periodic chemical cleanings to achieve 45 percent reduction in brine volume. Demonstration-scale pilot testing of a third RO stage was recommended at the MBGPF to validate performance given the site-specific water quality conditions, particularly to confirm that iron and manganese concentrations are within treatable limits. (Carollo, 2015)

b. The type and level of preliminary research plans or testing designs that have completed.

The proposed research study includes installation of a packaged RO pilot unit that is intended to be delivered to the treatment plant site and installed without the need for plans or design. A Pilot Test Plan will be prepared as part of the proposed research project that will state the objectives of the proposed tests, how the tests will be conducted, the duration of testing, the samples to be collected during the pilot test and their frequency, and the analytical tests to be performed on the samples.

c. Uncertainties that could affect the timing of research completion associated with environmental compliance, permitting, etc. as applicable to the research study?

The timing of research completion could be impacted should the proposed research study require more than a categorical exemption to meet California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) requirements. However, given that pilot unit installation would not require excavation or related construction impacts, a categorical exemption is assumed to be adequate.

d. How will the testing of new state of the art technology aid in produce results that help address institutional requirements to implement a project?

The testing of third stage RO at the MBGPF is expected to demonstrate that recovery of up to 45 percent of the brine that is currently discharged to the City's ocean outfall can be used as a potable water supply. By showing the feasibility of this system, the City will be able to provide justification to its City Council to include implementation of the full-scale project in its next Capital Improvement Plan.

Evaluation Criterion 7: Renewable Energy and Energy Efficiency (10 points)

Points will be awarded based on the extent to which the proposal demonstrates that the research study will evaluate methods to incorporate the use of renewable energy or will otherwise address energy efficiency aspects of the water reclamation and reuse project being investigated.

(1) For research studies that include evaluation or incorporation of renewable energy, please describe the proposed or existing renewable energy system and the research objectives proposed to evaluate the integration of renewable energy into the research study area or project.

In 2009, the City of Oceanside began a local renewable energy project at the San Luis Rey Wastewater Treatment Plant (WWTP). Through this project, methane gas created at the WWTP is used to produce approximately 580 kilowatt hours (kWh) of energy. Power service for the City

of Oceanside is provided in part from the cogeneration facility and therefore, the proposed research study will utilize portions of this locally-generated renewable energy.

(2) For research studies focused on improving energy efficiency, describe the full scale plant energy requirements, if applicable, proposed efficiency improvements, and reduced carbon footprint. Provide calculations and describe assumptions and methodology.

The project does not focus on improving energy efficiency, therefore this does not apply.

(3) Please quantify the energy savings that are expected to be identified in the research study through renewable energy or improved facility efficiencies. Include support for how energy savings were calculated.

This project would offset imported water demand with approximately 400 AFY of water reclaimed from the MBGPF wastewater stream. Using energy assumptions set forth within the California Energy Commission (CEC) report entitled *California's Water – Energy Relationship*; Table 4 demonstrates the anticipated energy use of all current and projected water supplies for the City of Oceanside (CEC 2005). The values within this table are reported in terms of kWh.

Table 4: Energy Intensity of City of Oceanside Water Supplies – With Project (kWh)

Supply	2020	2025	2030	2035	2040
Purchased or Imported Water from SDCWA	160,225,766	157,694,195	147,360,096	149,740,528	150,647,360
SWP	39,039,739	38,422,910	35,904,960	36,484,963	36,705,917
CRA	99,948,246	98,369,061	91,922,688	93,407,593	93,973,271
Local Supply	21,237,781	20,902,224	19,532,448	19,847,972	19,968,172
Groundwater (Mission Basin)	9,619,500	10,786,336	10,786,336	10,786,336	10,786,336
Recycled Water (Non-Potable Reuse)	491,200	2,087,600	3,561,200	3,757,680	4,298,000
Recycled Water (Potable Reuse)	4,052,400	4,052,400	4,052,400	4,052,400	4,052,400
Total Water Supply Energy Use	174,388,866	174,620,531	165,760,032	168,336,944	169,784,096

Table 4 assumes the water supply values presented above in Table 2, which is equivalent to the City of Oceanside's future projected water supplies. The CEC report demonstrates different energy intensities for imported water supplies from the SWP and the CRA. This analysis utilized the internal draft 2015 UWMP for the City of Oceanside to determine the make-up of SDCWA imported water supplies in terms of CRA and SWP break-downs. The UWMP demonstrates that the ratio of SWP to CRA has historically averaged 64 percent for CRA supplies and 20 percent for SWP supplies. These ratios were applied to Oceanside imported water values from 2010 to 2035 to calculate an approximate amount of the City of Oceanside water supply that is generated from both the CRA and the SWP. In accordance with the CEC report, this analysis assumed that the energy intensity of CRA water is 6,138 kWh/mg, and that the energy intensity of SWP water

is equivalent to that of the West Branch of the SWP, or 7,672 kWh/mg. This analysis also assumed values reported in the CEC report for groundwater and recycled water, which are 2,915 kWh/mg and 1,228 kWh/mg, respectively. In addition, the third stage RO treatment would require an additional 835.85 kWh/hr to obtain Mission Basin groundwater. Lastly, this report assumed that the “Local Supply” provided by SDCWA is primarily desalinated water, and is assumed to be equivalent to desalter water sources reported by the Inland Empire Utilities Agency, which are 5,217 kWh/mg.

Without implementation of this project, and therefore without an additional 400 AFY extracted from the MBGPF waste stream, the City of Oceanside would continue to rely on imported water supply sources to meet local water demands. Therefore, it is assumed that without the project imported water supplies would increase by 400 AFY to offset reclaimed water supplies, Table 5 below demonstrates the anticipated energy use of water supplies (in kWh) for the City of Oceanside without the proposed project.

Table 5: Energy Intensity of City of Oceanside Water Supplies – Without Project (kWh)

Supply	2020	2025	2030	2035	2040
Purchased or Imported Water from SDCWA	160,225,766	160,213,171	149,879,072	152,259,504	153,166,336
SWP	39,039,739	39,036,670	36,518,720	37,098,723	37,319,677
CRA	99,948,246	99,940,389	93,494,016	94,978,921	95,544,599
Local Supply	21,237,781	21,236,112	19,866,336	20,181,860	20,302,060
Groundwater (Mission Basin)	9,619,500	9,619,500	9,619,500	9,619,500	9,619,500
Recycled Water (Non-Potable Reuse)	491,200	2,087,600	3,561,200	3,757,680	4,298,000
Recycled Water (Potable Reuse)	4,052,400	4,052,400	4,052,400	4,052,400	4,052,400
Total Water Supply Energy Use	174,388,866	175,972,671	167,112,172	169,689,084	171,136,236

A comparison of Table Table 4 and Table 5 demonstrates that without the proposed project, the energy intensity of City of Oceanside water supplies would be substantially higher. Table 6 demonstrates that without the project, in 2020 the energy intensity of Oceanside water supplies would increase by 1,352,140 kWh by 2040. Therefore, this analysis demonstrates that the City of Oceanside’s water supply sources with the inclusion of permanent third stage RO at MBGPF would require substantially less energy than the alternative available water sources, which are imported water sources from SDCWA.

Table 6: With and Without Project Energy Intensity Comparison (kWh)

	2020	2025	2030	2035	2040
With Project Energy Intensity	174,388,866	174,620,531	165,760,032	168,336,944	169,784,096
Without Project Energy Intensity	174,388,866	175,972,671	167,112,172	169,689,084	171,136,236
Difference	0	1,352,140	1,352,140	1,352,140	1,352,140

Evaluation Criterion 8: Watershed Perspective (10 points)

Points will be awarded based on the extent to which the proposal demonstrates that the research study will promote and apply a regional or watershed perspective to water resource management.

(1) Describe whether or the extent to which the research study is based off of recommendations from an existing plan that is sponsored or otherwise recommends research needs on a regional or national scale.

The proposed research study supports the goals and objectives of the *2013 San Diego IRWM Plan* (SDCWA, 2013). The City of Oceanside sits on the 32-member advisory council for the San Diego IRWM Program, representing water suppliers throughout the region. The *2013 San Diego IRWM Plan* has 11 objectives designed to promote regional water supply reliability, water quality improvement, habitat protection and restoration, and integrated water resources planning.

The IRWM Plan includes 11 objectives, four of which are supported by the proposed research study. These include:

- *Further the scientific and technical foundation of water management*". The proposed research study increases scientific knowledge and understanding of water management issues through implementation of the pilot project as it will increase knowledge of the ability to treat brackish groundwater.
- *Develop and maintain a diverse mix of water resources, encouraging their efficient use and development of local water supplies.* The proposed research study will increase production of local water supplies and directly offset imported water. It is also a more efficient system than recycled water because it can be delivered directly to customers using the existing potable water distribution system as opposed to requiring construction of a non-potable distribution system.
- *Construct, operate and maintain a reliable water management infrastructure system.* The project will construct additional, reliable, water supply infrastructure through improvement of the treatment system at the MBGPF. The new water is a drought-proof source and significantly less vulnerable to service interruptions from seismic events than non-local sources. Because the project will not disconnect the system from imported water, it will add local water supply while maintaining the agency's ability to import water as needed to meet shortages, providing flexibility to the system.
- *Effectively address climate change through greenhouse gas reduction, adaptation, or mitigation in water resource management.* Water supply is one of the water resources management areas most vulnerable to climate change. By improving treatment at the

MBGPF, the proposed research study helps to adapt to climate change as the Mission Basin is considered to be a drought-proof source of local water supply and is less vulnerable to supply interruptions from infrastructure damage caused by natural disasters related to climate change (e.g., increased storm intensity). It is also more efficient to pump and treat groundwater locally than to import it from the Bay-Delta or Colorado River systems, reducing net GHG emissions.

(2) Explain any additional benefits of, or specific need for, the proposed research study within the sponsors watershed, regional area, and nationally.

As discussed above, the proposed research study supports the goals and objectives of the *2013 San Diego IRWM Plan* (SDCWA, 2013), a planning study that encompasses the coastal watersheds of San Diego County. The City of Oceanside sits on the 32-member advisory council for the San Diego IRWM Program, representing water suppliers throughout the region. The IRWM Plan includes 11 objectives, four of which are supported by the proposed research study and that support additional needs in the San Diego region, and are described in question 1 under Evaluation Criterion 8, above.

In addition to helping achieve the regional goals and objectives of the IRWM Plan, the project will contribute towards achieving objectives in the State's *2013 California Water Plan Update* (DWR, 2013). The study helps to meet six California Water Plan Objectives, as follows:

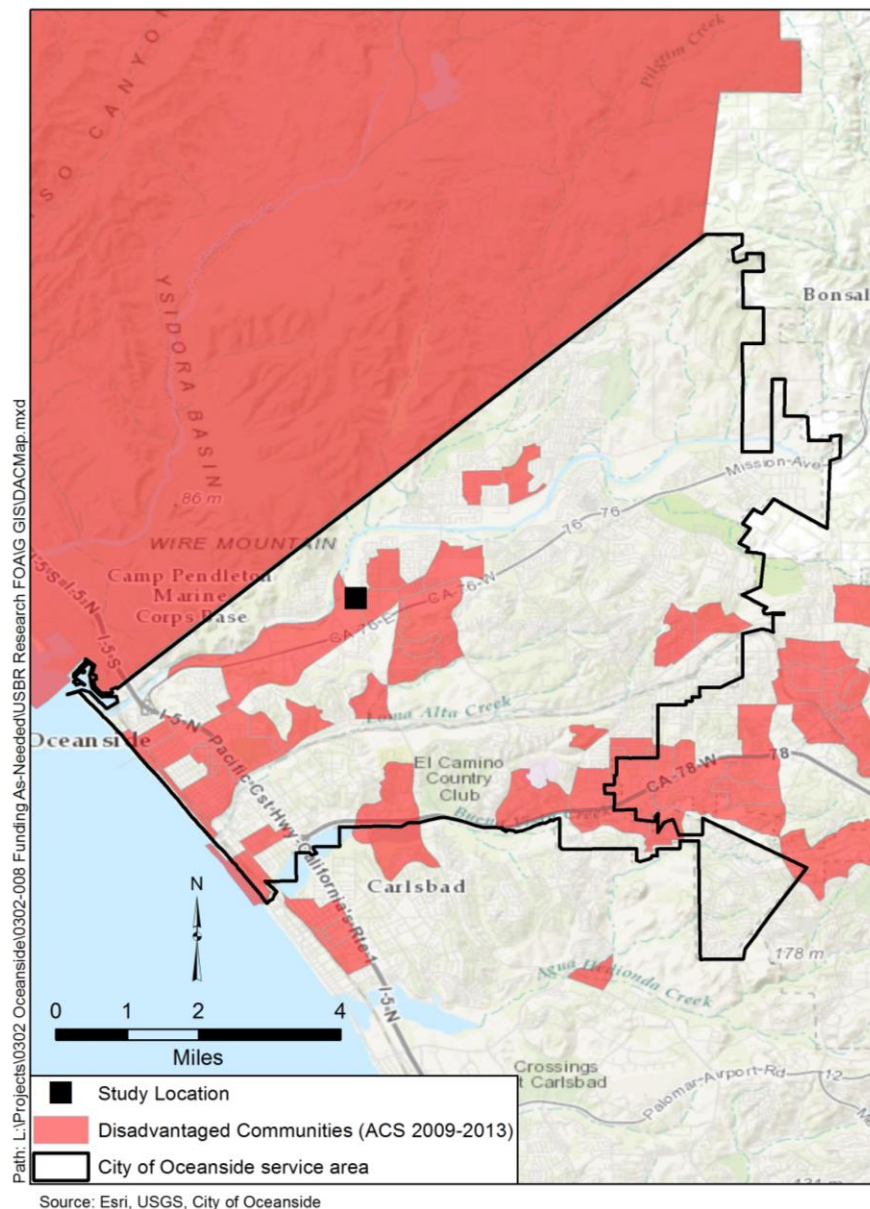
- *Strengthen Integrated Regional Water Management:* The proposed research study increases regional self-sufficiency by reducing the amount of imported water needed to meet demands. It also supports and is consistent with the San Diego IRWM Plan.
- *Use and Reuse Water More Efficiently:* The project expands the City of Oceanside's ability to produce potable water more efficiently by treating an otherwise unusable supply of brackish effluent from the MBGPF.
- *Expand Conjunctive Management of Multiple Supplies:* Desalination of brackish water is included in the California Water Plan as a way to prepare for future droughts, floods, and climate change and improve water supply reliability and quality.
- *Manage the Delta to Achieve the Coequal Goals for California:* The project will reduce demand for imported water from the Bay-Delta by up to 400 AFY, supporting the sustainability of the Bay-Delta.
- *Reduce the Carbon Footprint of Water Systems and Uses:* The project is more energy efficient than importing the water that will be offset by the water produced by the project, as shown in Table 6, above.
- *Ensure Equitable Distribution of Benefits:* Figure 3 shows the location of disadvantaged communities (DACs) within the City of Oceanside's service area. Water produced by the project will be delivered to local customers, so DACs will benefit from the new supply.

(3) Describe how the research objectives will benefit other locations and the technical, economic, or institutional questions that will be answered by the research study.

The primary objective of the proposed research study is to validate the projected sustainable operating recovery of a third stage RO system at the MBGPF. Should the study show that it's possible to recover a greater portion of water from the MBGPF waste stream, it could be possible to apply similar methods to other groundwater treatment facilities to increase water supply

production without increasing pumping from the groundwater basin, particularly for the smaller, coastal groundwater basins that exist in San Diego County.

Figure 3: City of Oceanside Disadvantaged Communities



(4) Explain how the research study includes or promotes and encourages collaboration among parties. Identify if there is widespread support for the research study.

Though the project is sponsored solely by the City of Oceanside, it promotes the region-wide objectives of the 2013 San Diego IRWM Plan (SDCWA, 2013), a plan developed by a 32-member advisory council for the San Diego IRWM Program, representing water suppliers throughout the region. Given that this planning document and its objectives were developed by a diverse group of stakeholders within the San Diego Region, it can be assumed that the proposed research study is supported by the stakeholders in the region.

Environmental Compliance

To allow Reclamation to assess the probable environmental impacts and costs associated with each application, all applicants must respond to the following list of questions focusing on the requirements of NEPA, ESA, and NHPA. Please answer the following questions to the best of your knowledge. If any question is not applicable to the research study activities, or if necessary environmental compliance has been completed, please explain.

Currently there has been no formal environmental review conducted for the proposed research study in accordance with NEPA, ESA, or NHPA. However, given that it's a pilot project, this study is anticipated to be categorically exempt from CEQA (under Class 6; §15306 Information Collection) and NEPA.

1. Will the research study activities impact the surrounding environment (i.e., soil [dust], air, water [quality and quantity], animal habitat, etc.)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the research study area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

The proposed research study is not expected to significantly impact the surrounding environment given that the study utilizes a packaged treatment system that will be brought on-site on skids and will be utilizing wastewater from the MBGPF which is disposed of in the ocean. The study requires no construction and therefore is not predicted to involve any earth-disturbing work or related physical impacts. The project is not predicted to affect the air, water, or animal habitat in the research study area, therefore no mitigation measures will be necessary.

2. Are you aware of any species listed, or proposed to be listed as a Federal endangered or threatened species, or designated Critical Habitat in the research study area? If so, how would they be affected by activities associated with the proposed research study activities?

A cursory review of the California Natural Diversity Database (CNDDB) indicates the presence of nineteen Federally-listed threatened or endangered species within the San Luis Rey Quadrangle, which contains the proposed research study site. The Critical Habitat Mapper provided by the United States Fish and Wildlife Service indicates the presence of least Bell's vireo and Coastal California gnatcatcher habitat overlapping the site of the MBGPF. The site on which the packaged treatment system will be placed is on-site at the existing MBGPF site, which has already been disturbed and therefore is not expected to affect any of the potentially-present Federally-listed threatened or endangered species or designated Critical Habitat.

3. Are there wetlands or other surface waters inside the research study boundaries that potentially fall under Federal Clean Water Act jurisdiction as "waters of the United States?" If so, please describe and estimate any impacts the research study activities may have.

There are no wetlands or other surface waters inside the research study boundaries that potentially fall under Federal Clean Water Act jurisdiction as "waters of the United States."

4. Are there any known archeological sites in the research study activities area? If so, please describe and estimate any impacts the research study may have.

There have been no directed surveys for archaeological sites in the proposed project area. The proposed pilot project will not involve any earth-disturbing work that would uncover or disturb archeological resources.

5. Will the proposed research study activities have a disproportionately high and adverse effect on low income or minority populations? If so, please describe and estimate any impacts the research study may have.

American Community Survey data from 2009-2013 demonstrates that portions of the project area contain low income and minority populations (see Figure 3 above). The research study would not include construction, however, and is not expected to impact nearby residents, including low income and minority populations. Therefore, the project is not anticipated to have disproportionately high and adverse effects on low income or minority populations.

6. Will the research study activities limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands? If so, please describe and estimate any impacts the research study activities may have.

The project is not located on or within proximity to Indian sacred sites or tribal lands, and would therefore not be expected to impact or limit access to these resources.

7. Will the research study activities contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area? If so, please describe and estimate any impacts the research study activities may have.

The research study will not include any ground-disturbance activities nor will it affect surrounding habitats, and therefore is not expected to contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area.

Section 2 Required Permits and Approvals

Applicants must state in the application whether any permits or approvals are required for developing the proposed research study and explain the plan for obtaining such permits or approvals.

As described in Section 2, the proposed research study will not include construction nor is it expected to impact the surrounding area or environment. Therefore, it is not anticipated that construction permits will be needed. In addition, given that this is a pilot project, it's anticipated that it can be operated under the existing MBGPF permit for supplying water to the City of Oceanside. The discharge from the ocean outfall, to which the MBGPF discharges its wastewater, must comply with a NPDES permit from the San Diego RWQCB. The NPDES permit requires that the discharge complies with California Ocean Plan water quality standards. The City will ensure that wastewater from the MBGPF continues to meet these standards even as the project concentrates constituents in the wastewater in order to extract additional potable water.

1 SECTION 4. The City Manager or his/her designee of the City of Oceanside is hereby
2 authorized to work with the Bureau of Reclamation to meet established deadlines for entering
3 into a cooperative agreement,

4 PASSED AND ADOPTED by the City Council of the City of Oceanside,
5 California, this _____ day of _____, 2016, by the following vote:

6 AYES:

7 NAYS:

8 ABSENT:

9 ABSTAIN:

10

11

MAYOR OF THE CITY OF OCEANSIDE

12

13 ATTEST:

APPROVED AS TO FORM:

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CITY CLERK

CITY ATTORNEY

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Section 4 Research Study Budget Proposal

4.1 Funding Plan and Letters of Commitment

The City of Oceanside will provide their share of funding for the proposed research study from Capital Improvement Program funds for Fiscal Year 2016-2017. Capital Improvement Program funds for Fiscal Year 2016-2017 have not yet been allocated by the City of Oceanside. This process is anticipated to take place in June 2016, during which time the City of Oceanside is anticipated to approve \$141,000 to fund the project. This project will not include any financial partners, will not require money from other parties, and will not require any other grant or loan funds to complete. As demonstrated in Table 7, the project is not requesting any other sources of funding, including other sources of Federal funding.

The City of Oceanside has not yet incurred costs associated with implementation of the proposed research study addressed within this grant application. Table 7 provides detailed cost estimates for the proposed research study, as provided by Carollo Engineers and estimated by City staff (Carollo, 2016). The table indicates cost assumptions for each phase of work described in *Section 1, Subsection 1.2 Technical Research Study Description*.

A formal funding commitment from the City of Oceanside is not complete at this time, but will be complete and submitted to the U.S. Bureau of Reclamation by July 1, 2016. In conjunction with the City of Oceanside's budget cycle, the money needed for this project will be available by July 1, 2016. These funds are contingent upon acceptance of the City of Oceanside's Capital Improvement Program by the Oceanside City Council. Because it is highly unlikely that the City Council will not approve the Fiscal Year 2016-2017 Capital Improvement Program budget, it is highly unlikely that funding for this project will be denied. However, if the 2016-2017 Capital Improvement Program budget for this project is not approved, the City of Oceanside will continue to seek out grants and other non-Federal funding methods to continue implementation of the pilot project.

Table 7: Summary of Non-Federal and Federal Funding Sources

Funding Sources	Funding Amount
Non-Federal entities	
City of Oceanside	\$107,719.26
<i>Non-Federal subtotal</i>	<i>\$107,719.26</i>
Other Federal entities:	
Not applicable	\$0
<i>Other Federal subtotal</i>	<i>\$0</i>
Requested Reclamation funding	\$35,905.28
<i>Total research study funding</i>	<i>\$143,624.54</i>

4.2 Budget Proposal

The project budget is detailed in Table 9, which provides a complete project budget proposal for all costs anticipated for implementation of the proposed research study. Table 8 and Table 9 clearly delineate between Reclamation and applicant contributions, indicating that the City of Oceanside (applicant) will be responsible for at least **\$107,719.25**, or approximately 75 percent of the total project cost.

This section also includes a copy of Budget Form SF-424A, which is the Budget Information form for Non-Construction Programs. All information included within the Budget form corresponds to information presented herein, including information within Table 2.

Table 8: Funding Sources

Funding Sources	Percent of total research study cost	Total cost by source
Recipient funding	75%	\$107,719.26
Reclamation funding	25%	\$35,905.28
Other Federal funding	0%	\$0
Totals	100%	\$143,624.54

Table 9: Project Budget Proposal

Budget Item Description	Computation		Recipient Funding	Reclamation Funding	Total Cost
	\$/Unit and Unit	Quantity			
Salaries and Wages*	n/a	n/a	\$15,535.40	\$0	\$15,535.40
<i>City Chief Plant Operator</i>	<i>\$39.47/hr</i>	<i>116 hours</i>	<i>\$4,578.52</i>	<i>\$0</i>	<i>\$4,578.52</i>
<i>City Water Operator III</i>	<i>\$35.38/hr</i>	<i>256 hours</i>	<i>\$9,057.25</i>	<i>\$0</i>	<i>\$9,057.28</i>
<i>City Electrician</i>	<i>\$31.66/hr</i>	<i>60 hours</i>	<i>\$1,899.60</i>	<i>\$0</i>	<i>\$1,899.60</i>
Fringe Benefits	\$0	0	\$0	\$0	\$0
Travel	\$0	0	\$0	\$0	\$0
Equipment	\$0	0	\$0	\$0	\$0
Supplies/Materials	n/a	n/a	\$392.23	\$130.74	\$522.97
<i>Energy</i>	<i>\$0.1529/kwh</i>	<i>835.85 kwh</i>	<i>\$95.85</i>	<i>\$31.95</i>	<i>\$127.80</i>
<i>HCl</i>	<i>\$0.09666/gallon</i>	<i>1,580 gallons</i>	<i>\$114.54</i>	<i>\$38.18</i>	<i>\$152.72</i>
<i>Avista Vitec 1100/minibulk inhibitor</i>	<i>\$1.05840/lb</i>	<i>229.07 lbs</i>	<i>\$181.84</i>	<i>\$60.61</i>	<i>\$242.45</i>
Contractual/Construction	\$124,750.00		\$89,679.50	\$35,070.50	\$124,750.00
<i>Carollo Engineers</i>	<i>\$124,750.00</i>	<i>1</i>	<i>\$89,679.50</i>	<i>\$35,070.50</i>	<i>\$124,750.00</i>
Environmental and Regulatory Compliance	\$2,816.17	0	\$2,112.13	\$704.04	\$2,816.17
Other Expenses	\$0	\$0	\$0	\$0	\$0
Total Direct Costs			\$107,719.26	\$35,905.28	\$143,624.54
Indirect Costs	<i>Not Applicable</i>				
TOTAL PROJECT COSTS	\$143,624.54				

*Denotes in-kind contributions of goods and services. See Section 5.3 for details.

4.3 Budget Narrative

Submission of a budget narrative is mandatory. An award will not be made to any applicant who fails to fully disclose this information. The budget narrative provides a discussion of, or explanation for, items included in the budget proposal. The types of information to describe in the narrative include, but are not limited to, those listed in the following subsections.

Salaries and Wages

Indicate the principal investigator and other key personnel by name and title. Other personnel may be indicated by title alone. For all positions, indicate salaries and wages, estimated hours or percent of time, and rate of compensation proposed. The labor rates should identify the direct labor rate separate from the fringe rate or fringe cost for each category. All labor estimates, including any proposed subcontractors, shall be allocated to specific tasks as outlined in the recipient's technical study description. Labor rates and proposed hours shall be displayed for each task. Include estimated hours for compliance with reporting requirements, including final research study report. Please see Section VI.D.2 Program Performance Reports for information on types and frequency of reports required. Clearly identify any proposed salary increases and the effective date.

The Chief Plant Operator, who is serving as the Principal Investigator, and other personnel for the City of Oceanside include those employees and positions listed in Table 10, as well as their salaries, estimated hours and rate of compensation. The Principal Investigator will complete Program Performance Reports on an on-going basis under the task being completed. Salaries and wages totals \$15,535.40.

Table 10: Salaries and Wages

Name and Title	Computation		Total
	\$/Unit and Unit	Quantity	
<i>Task 1: Pilot Test Plan</i>			
Ron Lutge, Chief Plant Operator	\$39.47/hour	8 hours	\$315.76
Water Operator III	\$35.38/hour	16 hours	\$566.08
<i>Task 2: Setup Pilot Equipment at MBGPF</i>			
Ron Lutge, Chief Plant Operator	\$39.47/hour	12 hours	\$473.64
Water Operator III	\$35.38/hour	48 hours	\$1,698.24
Electrician	\$31.66/hour	40 hours	\$1,266.40
<i>Task 3: Pilot Operation and Performance Monitoring</i>			
Ron Lutge, Chief Plant Operator	\$39.47/hour	40 hours	\$1,578.80
Water Operator III	\$35.38/hour	160 hours	\$5,660.80
<i>Task 4: Pilot Test Report</i>			
Ron Lutge, Chief Plant Operator	\$39.47/hour	24 hours	\$947.28
Water Operator III	\$35.38/hour	8 hours	\$283.04

Name and Title	Computation		Total
	\$/Unit and Unit	Quantity	
<i>Task 5: Pilot Unit Decommissioning</i>			
Ron Lutge, Chief Plant Operator	\$39.47/hour	32 hours	\$1,263.04
Water Operator III	\$35.38/hour	24 hours	\$849.12
Electrician	\$31.66/hour	20 hours	\$633.20
Total			\$15,535.40

Fringe Benefits

Identify the costs included in this category and indicate rates/amounts for each, and the basis of the rate computations. Indicate whether these rates are used for application purposes only or whether they are fixed or provisional rates for billing purposes. Federally approved rate agreements are acceptable for compliance with this item.

The City of Oceanside is not seeking funding for, nor intending to use as cost sharing, any costs related to fringe benefits. Therefore, no information relating to the cost of fringe benefits is included here.

Travel

Include purpose of trip, destination, number of persons traveling, length of stay, and all travel costs including airfare (basis for rate used), per diem, lodging, and miscellaneous travel expenses. For local travel, include mileage and rate of compensation.

The City of Oceanside is not seeking funding for, nor intending to use as cost sharing, any costs related to travel. Therefore, no information relating to the cost of travel is included here.

Equipment

Itemize costs of all equipment having a value of over \$5,000 and include information as to the need for this equipment, as well as how the equipment was priced if being purchased for the agreement. If equipment is being rented, specify the number of hours and the hourly rate. Local rental rates are only accepted for equipment actually being rented or leased for the research study. If equipment currently owned by the applicant is proposed for use under the proposed research study, and the cost to use that equipment is being included in the budget as in-kind cost share, provide the rates and hours for each piece of equipment owned and budgeted. These should be ownership rates developed by the recipient for each piece of equipment. If these rates are not available, the U.S. Army Corp of Engineer’s recommended equipment rates for the region are acceptable. Blue book, Federal Emergency Management Agency (FEMA), and other data bases should not be used.

Any equipment required for implementation of the proposed research project is included under the “contractual” category as the consultant, Carollo, will be providing the pilot plant. Therefore, no equipment costs are included in this grant application.

Materials and Supplies

Itemize supplies by major category, unit price, quantity, and purpose, such as whether the items are needed for office use, research, or construction. Identify how these costs were estimated (e.g., quotes, past experience, engineering estimates, or other methodology).

The materials and supplies cost of \$522.97, and includes costs for energy, hydrochloric acid (HCl) and Avista Vitec 1100/minibulk inhibitor (an antiscalant). These costs are listed in Table 11.

Table 11: Materials and Supplies

Materials	Computation		Total
	\$/Unit and Unit	Quantity	
Energy	\$0.15290/kWh	835.85 kWh/yr	\$127.80
HCl	\$0.09666/gallon	1,580 gallons	\$152.72
Avista Vitec 1100/minibulk inhibitor	\$1.05840/pound	229.07 pounds	\$242.45
Total			\$522.97

Contractual

Identify all work that will be accomplished by subrecipients, consultants or contractors, including a breakdown of all tasks to be completed, and a detailed budget estimate of time, rates, supplies, and materials that will be required for each task. If a subrecipient, consultant or contractor is proposed and approved at time of award, no other approvals will be required. Any changes or additions will require a request for approval. Identify how the budgeted costs for subrecipients, consultants and/or contractors were determined to be fair and reasonable.

The contractual project cost of \$124,750 includes forecasted costs for Carollo Engineers. The tasks to be performed include pilot test plan preparation and review, setup of pilot equipment, pilot operation and performance monitoring, pilot test report and pilot unit decommissioning. For additional details, refer to the consultant’s fee estimate dated February 16, 2016 in the amount of \$124,750, as shown in Table 12.

Table 12: Contractual Costs – Carollo Fee Estimate

Tasks	Labor						Total Labor Costs	Expenses	Total
	Jim Meyerhofer	Jeff Weishaar	Risa Guysi	Andrew Weisner	Brandon Yallaly	Clerical			
	Principal-in-charge	PM/Process Lead	Project Engineer	Task Support (Pilot Operation)	Technical Advisor/QA				
	\$255	\$220	\$160	\$195	\$255	\$105			
Task 1: Pilot Test Plan									
Draft Test Plan Development	0	2	20	4	2	2	\$5,140		\$5,140
Final Test Plan Development		2	8		2	2	\$2,440		\$2,440
Subtotal Task 1:	0	4	28	4	4	4	\$7,580	\$0	\$7,580
Task 2: Setup Pilot Equipment at MBGPF									
Pilot Unit Coordination		2	12	4			\$3,140	\$5,000	\$8,140
Field Investigation and Installation Support		2	36	16	8		\$11,360	\$2,000	\$13,360
Subtotal Task 2:	0	4	48	20	8	0	\$14,500	\$7,000	\$21,500
Task 3: Pilot Operation and Performance Monitoring									
Post Installation Membrane Loading and Training			12	12			\$4,260	\$1,000	\$5,260
Remote Monitoring and Site Visits			80	12			\$15,140	\$31,500	\$46,640
Membrane CIP			8	8			\$2,840		\$2,840
Review Analytical Data			24	2	2		\$4,740		\$4,740
Weekly Performance Summary			16		4		\$3,580		\$3,580
Membrane Removal			8	8			\$2,840	\$500	\$3,340
Subtotal Task 3:	0	0	148	42	6	0	\$33,400	\$33,000	\$66,400

Tasks	Labor						Total Labor Costs	Expenses	Total
	Jim Meyerhofer	Jeff Weishaar	Risa Guysi	Andrew Weisner	Brandon Yallaly	Clerical			
	Principal-in-charge	PM/Process Lead	Project Engineer	Task Support (Pilot Operation)	Technical Advisor/QA				
	\$255	\$220	\$160	\$195	\$255	\$105			
Task 4: Pilot Test Report									
Draft Pilot Test Report Preparation	2	2	36	4	6	8	\$9,860		\$9,860
Pilot Test Results Workshop	2	2	8		8		\$4,270	\$1,500	\$5,770
Final Pilot Test Report Preparation		2	24		4	4	\$5,720	\$500	\$6,220
Subtotal Task 4:	4	6	68	4	18	12	\$19,850	\$2,000	\$21,850
Task 5: Pilot Unit Decommissioning									
Pilot Unit Decommissioning		2	20	4			\$4,420	\$3,000	\$7,420
Subtotal Task 5:	0	2	20	4	0	0	\$4,420	\$3,000	\$7,420
									\$124,750

Environmental and Regulatory Compliance Costs

Applicants must include a line item in their budget to cover environmental compliance costs. “Environmental compliance costs” refer to costs incurred by Reclamation and the recipient in complying with environmental regulations applicable to Title XVI research study activities, including costs associated with any required documentation of environmental compliance, analyses, permits, or approvals. Applicable Federal environmental laws could include NEPA, ESA, NHPA, and the CWA, and other regulations depending on the research study.

Such costs may include, but are not limited to:

- The cost incurred by Reclamation to determine the level of environmental compliance required for the research study*
- The cost incurred by Reclamation, the recipient, or a consultant to prepare any necessary environmental compliance documents or reports*
- The cost incurred by Reclamation to review any environmental compliance documents prepared by a consultant*
- The cost incurred by the recipient in acquiring any required approvals or permits, or in implementing any required mitigation measures*

The amount of the line item should be based on the actual expected environmental compliance costs for the research study, including Reclamation’s cost to review environmental compliance documentation. However, the minimum amount budgeted for environmental compliance should be equal to at least 1 to 2 percent of the total research study costs. If the amount budgeted is less than 1 to 2 percent of the total research study costs, you must include a compelling explanation of why less than 1 to 2 percent was budgeted.

How environmental compliance activities will be performed (e.g., by Reclamation, the applicant, or a consultant) and how the environmental compliance funds will be spent, will be determined pursuant to subsequent agreement between Reclamation and the applicant. The amount of funding required for Reclamation to conduct any environmental compliance activities, including Reclamation’s cost to review environmental compliance documentation, will be withheld from the Federal award amount and placed in an environmental compliance account to cover such costs. If any portion of the funds budgeted for environmental compliance is not required for compliance activities, such funds may be reallocated to the Title XVI research study, if appropriate.

Environmental costs associated with development and approval of the CEQA categorical exemption are estimated to be 2 percent of the project cost of \$140,808.37, equaling \$2,816.17.

Other Expenses

Any other expenses not included in the above categories shall be listed in this category, along with a description of the item and why it is necessary for the research study. Profit and fees are not allowable.

The City is not seeking funding for, nor intending to use as cost sharing, any costs related to other expenses. Therefore, no other expenses are included in this grant application.

Indirect Costs

Show the proposed rate, cost base, and proposed amount for allowable indirect costs based on the applicable cost principles in 2 CFR Subpart E. It is not acceptable to simply incorporate indirect rates within other direct cost line items.

If the applicant has separate rates for recovery of labor overhead and general and administrative costs, each rate shall be shown. The applicant should propose rates for evaluation purposes, which will be used as fixed or ceiling rates in any resulting award. Include a copy of any federally approved indirect cost rate agreement. If a federally approved indirect rate agreement is not available, provide supporting documentation for the rate. This can include a recent recommendation by a qualified certified public accountant (CPA) along with support for the rate calculation.

If the applicant has never received a Federal negotiated indirect cost rate, the budget may include a de minimis rate of 10 percent of modified total direct costs. For further information on modified total direct costs, refer to 2 CFR §200.68 available at www.ecfr.gov.

The City is not seeking funding for, nor intending to use as cost sharing, any costs related to indirect costs. Therefore, no indirect costs are included in this grant application.

Section 5 References

- California Department of Water Resources (DWR), 2013. *California Water Plan Update 2013*. Bulletin 160-13.
- California Natural Resources Agency (CRNA), 2013. “About the Delta”. *Bay Delta Conservation Plan*. Website:
<http://baydeltaconservationplan.com/AboutTheDelta/AbouttheDelta.aspx>. Accessed April 11, 2016.
- Carollo Engineers (Carollo), 2015a. *Integrated Master Plan Volume 1 Water Master Plan*. Prepared for the City of Oceanside. June.
- Carollo, 2015b. *Mission Basin Groundwater Purification Facility Technical Memorandum No. 1 Preliminary Concentrate Treatment Evaluation*.
- Carollo Engineers, 2016. *Proposal for Pilot Testing Services at the MBGPF*.
- RMC Water and Environment, 2016. *Draft 2015 Urban Water Management Plan*. Prepared for the City of Oceanside.
- San Diego County Water Authority (SDCWA), 2013. *2013 San Diego County IRWM Plan*.
- U.S. Geological Survey (USGS), 2005. *The State of the Colorado River Ecosystem in Grand Canyon*. <http://pubs.usgs.gov/circ/1282/c1282.pdf>.