PROJECT JUSTIFICATION

This attachment provides the project justification for the various Projects contained in this Proposal. This Attachment is organized as follows:

Project Summary Table – A table showing how each project addresses Integrated Regional Water Management (IRWM) Project Elements of the 2015 IRWM Grant Solicitation. This table is consistent with California Department of Water Resources (DWR) Proposal Solicitation Package (PSP) Table 4.

Project Description – For each of the three projects, a brief description of each project contained in the Proposal and an expanded project description. Finally, a discussion of how the project will address a current need of the region is provided.

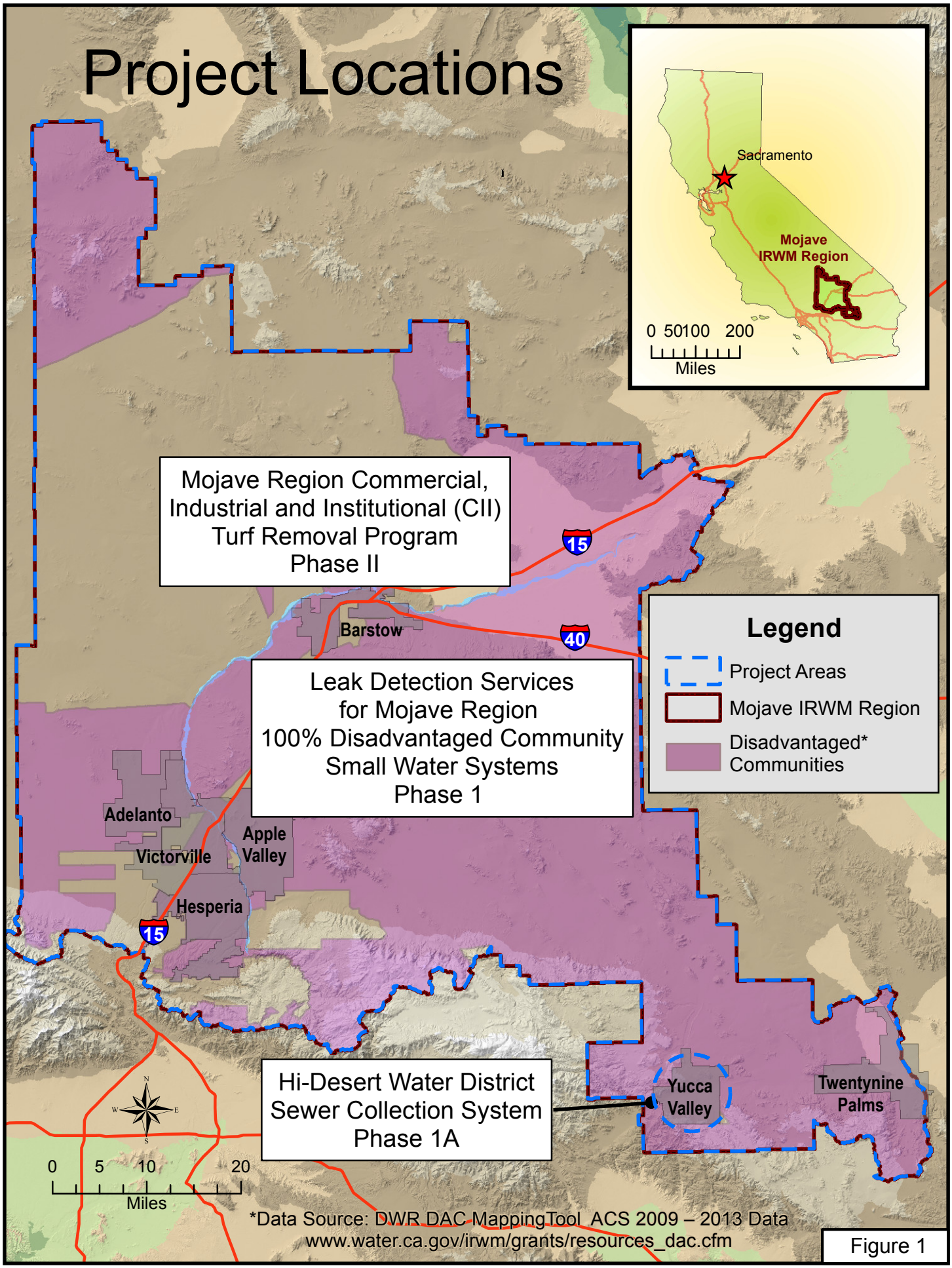
Regional and Project Maps - An illustration of the IRWM regional boundary and the location of each Project is shown on Figure 1 (Page 2-3) as well as a map for each Project (Figures 2, 3, and 4) (Pages 2-5, 2-15, 2-26).

Project Physical Benefits – Information for each project is provided in the following order:

- Project description
- Project-specific map
- Description of project physical benefits and technical analysis of physical benefits claimed
- Discussion on direct water-related benefit to a disadvantaged community (DAC)
- Cost -effectiveness analysis of the project
- Project Performance Monitoring Plan

Project Summary Table

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table				
	IRWM Project Element	**Mojave Region CII Turf Phase II Removal Program**	**Hi-Desert Sewer Collection System Phase 1A**	**Leak Detection Services Mojave Region 100% DAC Small Water Systems Phase 1**
IR.1	Water supply reliability, water conservation, and water use efficiency	✓	✓	✓
IR.2	Stormwater capture, storage, clean-up, treatment, and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands			
IR.4	Non-point source pollution reduction, management, and monitoring	✓	✓	
IR.5	Groundwater recharge and management projects		✓	✓
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users		✓	
IR.7	Water banking, exchange, reclamation, and improvement of water quality	✓	✓	
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management	✓	✓	✓
IR.10	Drinking water treatment and distribution		✓	✓
IR.11	Ecosystem and fisheries restoration and protection		✓	✓


Project Locations
Sacramento
Mojave IRWM Region
0 50100 200
Miles
Mojave Region Commercial, Industrial and Institutional (CII) Turf Removal Program Phase II
Leak Detection Services for Mojave Region 100% Disadvantaged Community Small Water Systems Phase 1
Hi-Desert Water District Sewer Collection System Phase 1A
Legend
Project Areas
Mojave IRWM Region
Disadvantaged* Communities
Barstow
Adelanto
Victorville
Apple Valley
Hesperia
Yucca Valley
Twentynine Palms
15
40
0 5 10 20
Miles
*Data Source: DWR DAC MappingTool ACS 2009 – 2013 Data
www.water.ca.gov/irwm/grants/resources_dac.cfm
Figure 1

Mojave Region Commercial, Industrial and Institutional (CII) Turf Phase II Removal Program

This Project is being implemented by the Mojave Water Agency (MWA).

Project Description

The success of the Prop 84 Drought-funded Mojave Region CII Turf Removal Program has created demand for this Project: Phase II CII Turf Removal Program.

Managing demand is critical to effective water resources management in the Mojave Region, which must balance limited local water supplies with declining State Water Project imports and the recovery from groundwater overdraft through two adjudications. During this current drought, groundwater production has drawn down banked reserves, because supply from the SWP has been insufficient to meet the full replenishment need to offset overdraft, and SWP direct-delivery customers have had to switch part of their operations to groundwater production.

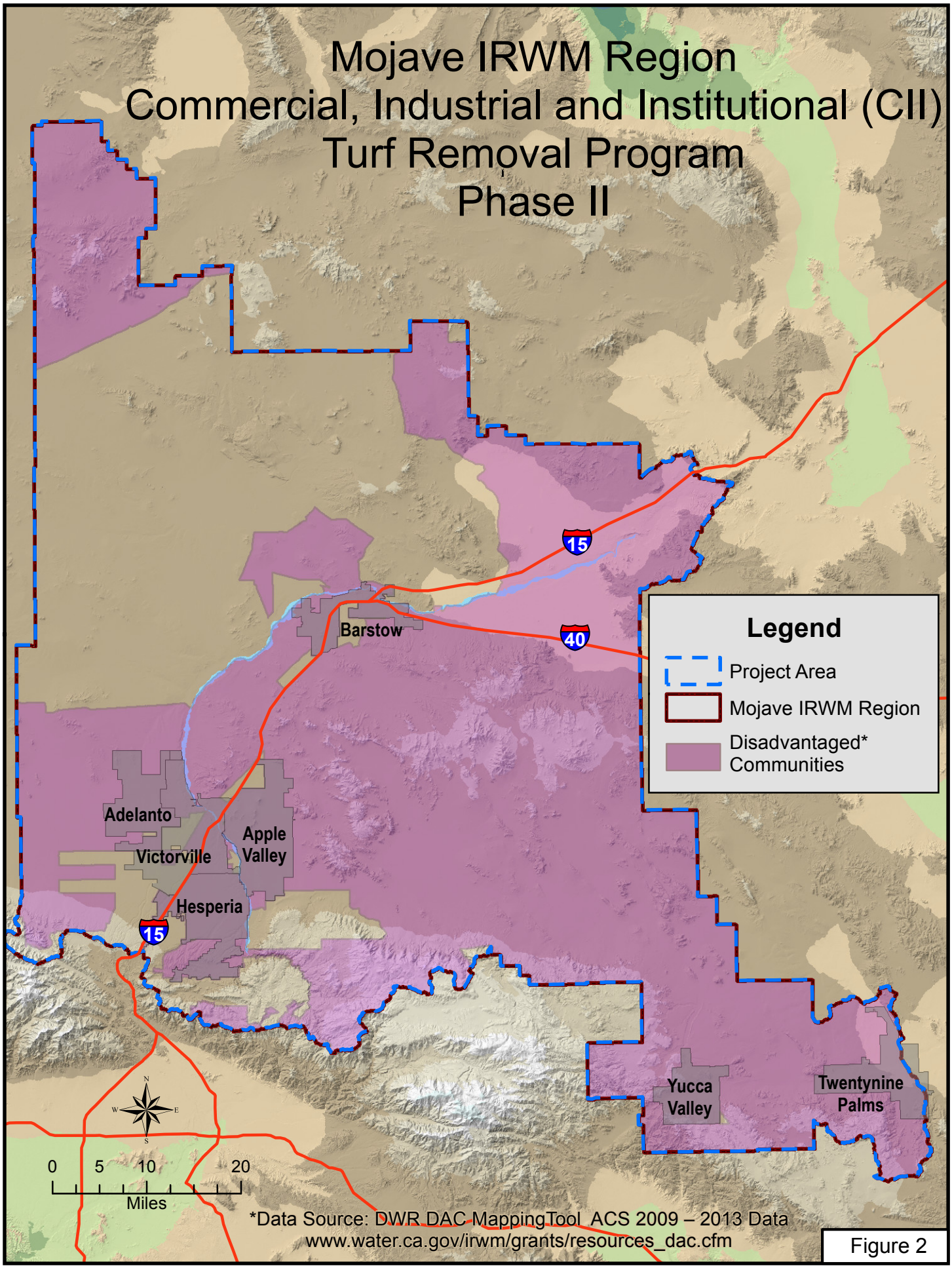
This Project will decrease potable demand by promoting turf (i.e., grass lawn) removal on commercial, industrial, and institutional landscapes (and potentially large residential users). Water savings are estimated at 55.8 gallons per square foot of turf removed and up to approximately 154 acre feet per year (afy) and 1,541 acre-feet (af) over its ten year life. The Project will build on the success of the existing CII Turf Removal Program. With about 60% of regional water use used for landscape irrigation, and the State focusing on this as the "next step" for conservation programs, implementation of this water conservation Project is a vital complement to ongoing water demand reduction efforts in the Region. Reducing water demand will help extend existing supplies, offset the need for supplemental supplies, reduce runoff and nonpoint source pollution from pesticides and fertilizers, and decrease groundwater overdraft. Gains in groundwater saved would be significant in alleviating threats to aquifers while the long-term demand reductions achieved from this Project are essential to buffer impacts from already stressed and limited water supplies. This will also help prepare for potential future droughts.

Current Need Addressed

This water conservation Project provides immediate demand reduction by removing about 900,000 sq ft of turf and as shown in this attachment reducing water used for irrigation by about 154 afy. The water savings would be seen immediately upon Project implementation and achieve a ten year reduction of 1,541 af. This long-term reduction in water use will enhance the ability to meet demands during water shortages and increase the reliability of water supplies available in the Mojave Region.

The Project makes turf conversions possible for customers who would otherwise not be able to afford it. Although they have been identified as one of the most effective methods of reducing irrigation use, turf conversions are costly and not locally cost-effective. The rebates provided through this Project will help make turf removal a cost-effective alternative for Mojave Region CII customers.

With landscape irrigation accounting for 60% of Regional municipal use, minimizing the amount of turf in the Region is needed to assure short- and long-term supplies. This Project is ready for immediate implementation. Water savings will begin immediately upon removal of turf, freeing up supplies to meet the Region's drinking water needs.


Mojave IRWM Region
Commercial, Industrial and Institutional (CII)
Turf Removal Program
Phase II
Legend
Project Area
Mojave IRWM Region
Disadvantaged* Communities
Barstow
Adelanto
Victorville
Apple Valley
Hesperia
Yucca Valley
Twentynine Palms
15
40
15
N
W
E
S
0 5 10 20
Miles
*Data Source: DWR DAC MappingTool ACS 2009 – 2013 Data
www.water.ca.gov/irwm/grants/resources_dac.cfm
Figure 2

Project Physical Benefits

Mojave Region CII Turf Phase II Removal Program

The following primary and secondary physical benefits are expected from this project:

- 154 afy in water conservation
- Reduction in municipal landscape irrigation return flow with concentrations ranging from 765 mg/L to 5,620 mg/L depending on native source water (native sources range 153 to 1,124 mg/L total dissolved solids (TDS), respectively)

Each benefit is discussed in further detail below, with an overview of each benefit expected over the project life and a technical analysis of the physical benefit claimed. Following the Project benefits discussion, a cost effectiveness analysis of the Project compared to its alternatives is provided with the Project Performance Monitoring Plan discussed at the end of this section.

Technical Analysis of Physical Benefits Claimed

Primary Benefit: 154 afy in water conservation

As shown in Table 2-1, the Project provides incentives to commercial, industrial and institutional (CII) water users to reduce their water consumption by replacing irrigated turf grass with drought tolerant and desert adaptive landscaping, thereby saving 154 afy.

Table 2-1 – Annual Project Physical Benefits (PSP Table 5)
Project Name: Mojave Region CII Turf Phase II Removal Program
Type of Benefit Claimed: Water conserved by turf removal (primary benefit)
Units of the Benefit Claimed : Acre-feet per year (afy)
Anticipated Useful Life of Project (years): 10

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	0	0
2016	0	77	77
2017	0	154.1	154.1
2018	0	154.1	154.1
2019	0	154.1	154.1
2020	0	154.1	154.1
2021	0	154.1	154.1
2022	0	154.1	154.1
2023	0	154.1	154.1
2024	0	154.1	154.1
2025	0	154.1	154.1
2026 (Final year of project)	0	77	77

Comments: The Mojave Region CII Turf Phase II Removal Program will remove 900,000 square feet of turf. Assuming water savings of 55.8 gallons per square foot results in a total savings of 154 afy. The Program will begin rebating turf removal in January 2016. Rebates are expected to be fully claimed within 24 months, given the participation rate in the Mojave Region's Phase 1 CII Turf Removal Program. Rebates are also expected to be distributed evenly over this period, with one-half being distributed in 2016 and the remainder in 2017. When the Project is fully implemented, it will provide water savings of approximately 154 afy.

1. Explanation of need for the project including recent and historical conditions

MWA manages and offsets declining groundwater levels within the Mojave Groundwater Basin and the Morongo Basin Area, covering 4,900 square miles. MWA supplies 25 retail water agencies almost entirely by pumping local groundwater sources (MWA, 2014a, p.5). In order to meet increasing demand due to population growth and increased requirements for groundwater recharge, MWA has a contract for up to 85,800 afy from 2015 to 2019; and 89,800 afy from 2020 to 2035 of State Water Project (SWP) supplies, however recent deliveries have been as low as 4,290 (5%, 2014). The local surface water supply that is available to recharge the Region's underground aquifers is estimated to be 54,000 afy; the Region has been banking SWP water for the past ten years to mitigate stress on local supplies (MWA, 2014a, p.6). According to MWA, the Region would risk running out of water without SWP supplies.

Water production within Agency boundaries in 2012 was 156,181 af, which was slightly higher than the recent ten-year average of 148,963 af. CII use for the same time period accounts for roughly 15% of the total (MWA, 2014a, page 19).

The geology along the Mojave River at Camp Cady and the Upper Narrows Riparian Area, home to sensitive riparian habitat, causes groundwater to surface and flow year-round, although most of the Mojave River is dry for most of the year. Groundwater overdraft causes surface flow in these areas to be reduced, directly impacting the riparian habitat (Ellsworth, 2014, page 4-7). As a result of the current drought, local storm flow has been reduced resulting in less natural groundwater recharge, while SWP reductions have resulted in insufficient imported water available for mitigation of groundwater overdraft. These conditions have caused "Base Flow" (non-storm surface flow) at the Upper Narrows Riparian Area to decrease since 2011. Severe drought conditions increase the risk of riparian habitat loss by further depleting groundwater levels. The shrinking riparian areas can only be restored by raising the hydrostatic head in surrounding aquifers to contribute to a healthy riparian base flow (CDFG, 2004, pgs. 8, 15). Prevention of further aquifer declines in drought periods (and increased groundwater levels in wet periods) is critical to the restoration of the Camp Cady and Upper Narrows Riparian areas. Projects that reduce groundwater pumping (such as the Mojave Region CII Phase II Turf Removal Program) will help alleviate impacts to these sensitive riparian areas.

MWA is already funding multiple other water conservation efforts for its 25 retail water agencies along with the Alliance for Water Awareness and Conservation (AWAC), a collaborative group of over twenty agencies whose goal is to promote conservation within the MWA service area and to implement water savings measures, including outreach, education and customer incentives. These programs are helping the region obtain a 20% reduction in baseline per-capita water use in accordance with Senate Bill 7 of Special Extended Session 7 (SBX7-7). Programs offered include residential turf removal rebates, high-efficiency (HE) toilet and HE clothes washer rebates, as well as the development of new landscape standards. All of these efforts have played a significant part in reducing water consumption. Since 2000, per capita use has decreased 37%, from 271 to 172 gallons per capita-day (GPCD) (MWA, 2014b). Further turf removal is desirable not only to return the Region to natural landscaping, but to address the Governor's recent executive order to remove 50 million square feet of turf state-wide.

MWA's turf removal program began in 2008, supported by funds from the California Proposition 50 IRWM Implementation Grant. MWA's second phase of turf removal was supported independently, third phase was funded by the California's Proposition 84 Round 1 IRWM Implementation Grant and fourth phase funded most recently by the Proposition 84 Drought Grant awarded in 2014 (MWA, 2014a).

Turf removal rebate programs are particularly effective in the dry, hot climate of the Mojave Region; however without rebates these efforts are typically cost-prohibitive for residents and businesses. Seventy-nine percent of the Mojave Region is comprised of disadvantaged communities (DACs), and even $0.50 per square foot rebates have been enormously effective in incentivizing households to convert to natural landscaping. Previous turf removal rebates have already contributed to the removal of roughly 6.5 million square feet of turf.

The current residential removal program imposes a limit of 20,000 square feet (or $10,000) for rebates, and therefore does not offer options for larger CII users to participate. With the previous Proposition 84 Drought CII Turf Removal Project awarded to MWA, this need was addressed by raising the rebate amount in an effort to attract CII customers to replace larger turf areas. MWA developed advertising and outreach aimed at informing larger CII customers of the new opportunity. Implementation of the Proposition 84 Drought CII Turf Removal Program for MWA was overwhelming due

to the large response of various participants AWAC received that wanted to utilize this program. To help satisfy the Mojave Region's large need for CII turf removal, funding for this Phase II CII Turf Removal Program is being requested.

2. Estimates of without project conditions with respect to this benefit

Without this project, CII customers will only be able to apply for $0.50 per square foot turf removal rebates under the existing residential turf removal program and be limited to $10,000, or 20,000 square feet. Also, at the time this grant was being written in late July 2015, MWA staff confirmed that "existing residential turf funds is almost all spent for the residential program." By not implementing this program, CII entities will continue to irrigate approximately 900,000 square feet of turf over the next ten years, using approximately 154 acre-feet (af) of valuable groundwater supplies.

3. Descriptions of methods used to estimate physical benefits

The Southern Nevada Water Authority (SNWA) performed an extensive study of water savings achieved by converting turf grass to natural landscaping. This study found that conversion saves approximately 55.8 gallons per year for every square foot of turf removed, with up to 9.62 gallons saved during the month of July (Sovocool, 2005, pg. 4). Audited water bills of previous MWA program participants show similar results. The average evapotranspiration and rainfall in the Mojave Integrated Regional Water Management (IRWM) Region are 70 inches and 3-5 inches of rain per year, respectively, which are similar to the conditions in the SNWA service area at the time of the 2005 study, which was reported to be 90 inches of evapotranspiration (ET) and 4.5 inches of rain.

Mojave Region CII Phase II turf removal rebates of $1 per square foot will be dispersed evenly over the twenty-four month project implementation period, with 1/2 of the total 900,000 square feet of turf to be replaced in 2016 and the remainder in 2017. In the first year, 77 af of water savings is expected (55.8 gallons per square foot * 450,000 square feet of rebates / 325,851 gallons per af = 77 afy of savings). In the second year, 77 additional af of water savings is expected, making a total of 154.1 af of water savings at full implementation. The lifetime of water savings is expected to be 10 years, and total water savings over that time period for the project is expected to be 1,541 af.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits

No new facilities, policies, or actions are required to obtain this physical benefit. CII entities must apply for rebates using a process similar to the one being utilized in the residential program. MWA will administer the program and process the rebates (including photos and documentation), with very little involvement from retail agencies. MWA already has the administrative capacity to implement this project, and will target CII accounts.

5. Description of any potential adverse physical effects

There are no anticipated adverse physical effects due to this project. In general, water conservation will reduce revenues for MWA and its retail agencies; however this is a consideration for any water use efficiency program.

6. Description of whether the proposed project effectively addresses long-term drought preparedness

This Project addresses long-term drought preparedness as identified in the Statewide Priorities for the IRWM Grant Program by meeting several criteria. First, the Project will "promote water conservation" by providing an incentive to CII customers to replace 900,000 square feet of turf. Second, the Project will achieve a "long-term reduction in water use". While the claimed project life of the turf removal project is ten years, with proper care of the landscaping turf removal can provide a water use reduction lasting multiple decades. In addition, this Project provides "efficient groundwater basin management". As mentioned previously, groundwater levels in the Mojave Groundwater Basin and the Morongo Basin Area have been recovering from historical declines. By conserving 154 afy of water, MWA will be able to more effectively manage groundwater levels.

Summary of benefit

This Project will provide 154 afy in water savings through removing 900,000 square feet of turf. Water conserved through this Project will help reduce stress on groundwater supplies, as well as important fish and wildlife habitats that are at risk due to low flow.

Secondary Benefit: Reduction in municipal irrigation return flow with 2,500 mg/L TDS concentration

The Project will improve water quality from converting turf into drought-tolerant landscaping. As shown in Table 2-2, for properties where turf is removed, this will eliminate infiltration into the vadose (unsaturated) zone of irrigation water with an average TDS concentration of 2,500 mg/L total on an annual basis region-wide after the salts have been evapo-concentrated, .

Table 2-2 – Annual Project Physical Benefits (PSP Table 5)

Project Name: Mojave Region CII Turf Phase II Removal Program
Type of Benefit Claimed: Reduction in municipal irrigation return flow by 2,500 mg/L TDS concentration (secondary benefit)
Units of the Benefit Claimed : milligrams per liter (mg/L)
Anticipated Useful Life of Project (years): 10

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	0	0
2016	2,500	0	-2,500
2017	2,500	0	-2,500
2018	2,500	0	-2,500
2019	2,500	0	-2,500
2020	2,500	0	-2,500
2021	2,500	0	-2,500
2022	2,500	0	-2,500
2023	2,500	0	-2,500
2024	2,500	0	-2,500
2025	2,500	0	-2,500
2026 (Final year of project)	2,500	0	-2,500

Comments: Based on the 2015 Mojave Salt and Nutrient Management Plan (Draft) (Kennedy/Jenks Consultants and Todd Groundwater), water applied for turf irrigation evaporates, leaving behind salts. Regional municipal landscape irrigation return flow to the vadose (unsaturated) zone is assumed to have an evapo-concentration factor of 5 under the following relationship with regard to TDS: *Source Water TDS Concentration * Evapo-Concentration Factor (5) = Return Flow TDS, e.g.*, 250 mg/L TDS Source * Concentration Factor (5) = 1,250 mg/L TDS Return Flow to basin, meaning that groundwater applied to turf with an average TDS concentration of 500 mg/L would evaporate, concentrating the TDS which remains behind so that municipal irrigation return flow that infiltrates to the vadose zone would have a concentration of 2,500 mg/L (5 x 500 mg/L assumed concentration for groundwater applied to turf). With the Project, there is no municipal landscape irrigation return flow (and therefore a 0 mg/L concentration) because turf is removed and irrigation water is no longer applied (other than highly efficient drip irrigation with 0 return flow for replacement desert adaptive landscaping).

1. Explanation of need for the project including recent and historical conditions

The Mojave Region includes portions of both the South Lahontan and Colorado River DWR-defined Hydrologic Regions and is therefore governed by the two hydrologic regions of the Regional Water Quality Control Board (RWQCB, Regional Board); the Lahontan Region and the Colorado River Basin Region. To ensure attainment of water quality objectives and protection of beneficial uses are met, both of these RWQCBs have Regional Water Quality Control Plans (Basin Plans) that designated groundwater for municipal or domestic supply (MUN) shall not contain concentrations of chemical constituents exceeding their respective MCL or secondary maximum contaminant level (SMCL) based upon drinking water standards specified in Title 22 of the California Code of Regulations (CCR). The recommended SMCL for TDS is 500 mg/L with an upper limit of 1,000 mg/L and a short-term limit of 1,500 mg/L.

Salts (TDS) in applied irrigation water are returned to the groundwater basin via return flow. Regional municipal return flow (from irrigated turf grass) is very concentrated in salts due to much of the applied irrigation water being lost to the atmosphere, while the mass of salt doesn't change. Municipal return flow has been shown to be a source of ongoing salt loading within the groundwater basin(s) throughout the Mojave Region. Removal of municipal turf grass virtually eliminates municipal return flow and thus removes a chronic source of salt to the groundwater basin(s) in the Region as demonstrated in the 2015 Mojave Salt and Nutrient Management Plan (Draft).

2. Estimates of without project conditions with respect to this benefit

TDS concentrations in groundwater are estimated to range from 153 mg/L to 1,224 mg/L across the Mojave Region. TDS concentrations are generally below 500 mg/L in many subregions of the Mojave Region; elevated TDS concentrations in some subregions are believed to be a result of naturally-occurring mineralization (Kennedy/Jenks Consultants and Todd Groundwater, 2015).

Without the Project, water will continue to be applied to the turf that would otherwise not be used (or conserved) because of the Project. TDS in the groundwater applied for urban irrigation will continue to be evapo-concentrated, and infiltrate into the groundwater as return flow. Return flow will continue to infiltrate into the groundwater basin and contribute to chronic salt loading of said basin(s). Evapo-concentrated return flow is approximately 5 times that of the source irrigation water (e.g. Turf irrigation of source water at 250 mg/L TDS concentrates by a factor of 5 after applied and condensed resulting in a return flow into the basin at 1,250 mg/L TDS)

3. Descriptions of methods used to estimate physical benefits

The 2015 Mojave Salt and Nutrient Management Plan estimates that a percentage (up to 5 percent) of applied municipal irrigation water may return to groundwater. For municipal landscape irrigation return flow TDS concentrations, a fixed evapo-concentration factor of five (5) is applied to source water concentrations for TDS (Kennedy/Jenks Consultants and Todd Groundwater, 2015). This means that groundwater applied to turf with an average TDS concentration of 250 mg/L would evaporate, concentrating the TDS which remains behind so that municipal irrigation return flow that infiltrates through the vadose zone to the water table would have a concentration of 1,250 mg/L (5 x 250 mg/L assumed concentration for groundwater applied to turf). Variation in the TDS concentration of groundwater across the Mojave Region means that the TDS concentration of the infiltrated municipal irrigation return flow will also vary. With the Project, there is no municipal landscape irrigation return flow for the properties where turf is removed (and therefore a 0 mg/L concentration) because irrigation water is no longer applied (other than highly efficient drip irrigation with 0 return flow for replacement desert adaptive landscaping).

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits

No new facilities, policies, or actions are required to obtain this physical benefit. MWA will administer the program and process the rebates (including photos and documentation), with very little involvement required from retail agencies.

5. Description of any potential adverse physical effects

There are no anticipated adverse physical effects due to this project. Lowering TDS concentrations in municipal irrigation return flow is consistent with the goals established under the Draft Mojave SNMP.

6. Description of whether the proposed project effectively addresses long-term drought preparedness

See primary benefit discussion for long-term drought preparedness.

Summary of benefit

This Project will prevent return flow with TDS concentrations of 2,500 mg/L from infiltrating the vadose zone and reaching groundwater. This will help the Mojave Region maintain acceptable regulated water quality in terms of TDS while maintaining progress reversing historical groundwater level declines.

Direct Water-Related Benefit to a DAC

The proposed Project serves the entire Mojave Region and includes 79% DACs, by population, and therefore qualifies for DAC scoring consideration.

This Project addresses a water-related need of these DACs, which is to conserve water thereby helping to manage groundwater levels that have historically been in an overdraft condition. With landscape irrigation accounting for 60% of municipal use, minimizing the amount of turf in the Region is needed to assure short- and long-term water supplies. With declining SWP imports, the Region can no longer rely upon imported water to meet the full groundwater replenishment need to offset overdraft. Part of the process of reducing demand locally is to promote a Region/community goal to encourage residents to use water in a responsible manner that better reflects that they live in a desert environment. This turf removal Project and the public outreach associated with it address this water-related need of these DACs.

Cost Effectiveness Analysis

This section presents a cost-effectiveness analysis comparing relevant project alternatives to the proposed project. The project alternative considered is creating a rebate program for weather-based irrigation controller (WBIC) installation.

Table 2-3 – Cost Effectiveness Analysis

Project name: Mojave Region CII Turf Phase II Replacement Program

Question 1	*Types of benefits provided as shown in Table 2-2 (PSP 5):* 154 afy in water savings Reduction in municipal irrigation return flow with 2,500 mg/L TDS concentration.
Question 2	*Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?* Yes
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs: The proposed Project is a Phase II turf removal program for CII customers. It has a total cost of $1,000,000 and a present value cost of $925,600. A CII turf removal program was determined to be the only feasible project option that can achieve similar water savings. A weather based irrigation controller rebate program was considered, but given that 79% of the Mojave Region is designated disadvantaged community, and that the cost per WBIC rebate to customer would be $150 to $200, a WBIC rebate was determined to be not feasible. Furthermore, turf removal really reflects the priority of promoting desert climate appropriate landscapes which should precede other irrigation efficiency improvements. The goal of the community is to acknowledge that they live in desert environment, and that moving the landscaping back to its natural state is the responsible approach.
Question 3	*If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.* Not applicable.

This Project has a total cost of $1,000,000, or $925,596 in present value 2015 dollars. These costs cover the turf removal costs, program administration, and public outreach costs including placing print and broadcast media ads and attending community functions to distribute multi-lingual application materials.

One potential alternative Project to the Mojave Region CII Turf Phase II Removal Program is a weather-based irrigation controller (WBIC) rebate program. However, 79 percent of the Mojave Region consists of DACs. Smart controller rebates would only cover about 50% of the total cost, leaving a large cost for customers that participate, given the average $300-$400 price tag that accompanies a single irrigation controller. This cost burden would likely result in a much lower level of participation, and therefore lower level of water savings, if customers were required to pay $150-$200 of their own money for each controller.

Additionally, irrigation controllers would have to be installed in such a way that covers a higher amount of irrigated land in order to achieve the same level of water conservation as outright turf removal. Large landscape WBICs achieve water savings of anywhere between 17% to 48% depending on how well they are calibrated, maintained, and monitored (CUWCC, 2014, pg. 5), whereas turf removal has resulted in water savings up to 75% in southern Nevada, which has a climate and landscape very similar to the Project area (Sovocool, 2005, pg. 60). Turf rebates have provided better incentive to encourage water savings. WBICs are an effective option for irrigating climate appropriate landscapes and could be installed in the future to further improve efficiency.

While WBICs are a feasible alternative to turf removal, it is a priority of the Mojave Region to reclaim the desert from unused turf surfaces and to return the Region to its natural state. WBIC installation will not help California reach the Governor's mandate that at least 50 million square feet of turf and ornamental lawns be replaced with drought tolerant landscapes.

Project Performance Monitoring Plan

Table 2-4– Project Performance Monitoring Plan (PSP Table 6)

Project: Mojave Region CII Turf Phase II Removal Program

Physical Benefits	Targets	Measurement tools and methods
Water Conservation	Reducing water used for irrigation by 154 afy over 10 years.	Compare average 2011-2014 residential water demand for the retail purveyor against average residential water demand after Project implementation. Use submittal application summary to determine estimated reduction per retail purveyor.
Reduction in municipal irrigation return flow	Avoided increase in TDS concentration of 765 mg/L to 5,620 mg/L depending on native source water (native sources range 153 to 1,124 mg/L TDS, respectively).	After Project, quantified via modeling relationships detailed in the 2015 Mojave Salt and Nutrient Management Plan (Draft) and vetted against empirical data by reviewing trends in TDS levels via the established regional water quality network.

Primary Physical Benefit

The water conservation benefit has a target of 154 afy in reduced residential outdoor water demand. This target is appropriately set, based on calculated water savings for the number and types of rebates provided under the existing/current Mojave Region CII Turf Removal Program – funded via the Proposition 84 Drought application grant award. The water conservation benefit performance will be measured by comparing average historical residential water demands against post-implementation residential water demands for the various retail purveyors in the Mojave Region. These water demand comparisons will be based on annual customer use data collected by the individual retail agencies. Post-implementation water use data will be adjusted for factors that could skew the results, including population growth. The demand comparison method is most effective to evaluate project performance in relation to water conservation targets.

Secondary Benefit

An extensive review of water quality data and water quality modeling described in the 2015 Mojave Salt and Nutrient Management Plan (Draft) demonstrated the effects of salt loading associated with concentrated TDS within municipal return flow (from turf irrigation). Modeling efforts associated with the 2015 Salt and Nutrient Management Plan (Draft) clearly demonstrate that the reduction of this source of TDS (the elimination of turf irrigation and replacement with efficient drip irrigation and desert adaptive flora) has a positive correlation with regards to reducing the long-term loading of TDS within the groundwater basin(s). This relationship (reducing municipal irrigation return flow sources) can be seen throughout the service area and reducing this return flow source is shown to be a positive benefit across the region. Secondary water quality benefits associated with the Program can be quantified via modeling relationships detailed in the 2015 Mojave Salt and Nutrient Management Plan (Draft) and vetted against empirical data by reviewing trends in TDS levels via the established regional water quality network.

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Hi-Desert Sewer Collection System Phase IA

This Project is being implemented by the Hi-Desert Water District (HDWD).

Project Description

HDWD's water is contaminated by nitrate, the result of discharge from septic systems in the groundwater. This Project collects wastewater and keeps septic discharge out.

Currently, septic systems are the predominate method by which wastewater is disposed of within the HDWD's entire service area. However, a small number of package treatment plants have been installed to treat commercial wastewater flow under individualized discharge permits issued by the California Regional Water Quality Control Board, Colorado River Basin Region (Regional Board).

The HDWD's primary water source is groundwater from the Warren sub-basin of the Morongo Groundwater Basin. In a 2003 study, the United States Geological Survey (USGS) reported that an imbalance between natural groundwater recharge and pumping caused groundwater levels in the Warren sub-basin to decline by as much as 300 feet from the late 1940s through 1994. The HDWD implemented an artificial recharge program in February 1995 to alleviate the declining groundwater levels using SWP imported water. The artificial recharge program resulted in water-level recoveries; however, nitrate concentrations in some wells also increased from a background concentration of 10 milligrams per liter (mg/L) to more than the US Environmental Protection Agency (USEPA) maximum contaminant level (MCL) of 45 mg/L (10 mg/L as nitrogen). The 2003 study also reported that the primary cause of the nitrate pollution was septic tank effluent from households, commercial, and industrial facilities within and surrounding the Town of Yucca Valley.

In 2007, the Regional Board adopted a resolution identifying the Town of Yucca Valley as a top priority for eliminating the use of septic systems. The resolution led to an amendment to the Regional Board's Water Quality Control Plan (Basin Plan) which was adopted on May 19, 2011. The amendment imposed a septic tank prohibition on new and existing septic systems within the Town of Yucca Valley which takes effect on specific dates following a phased approach identified as Phase 1, 2, and 3. The Phase 1 prohibition is currently scheduled to take effect on May 19, 2016 with Phase 2 and 3 prohibitions taking effect on May 19, 2019 and May 19, 2022, respectively. Following the prohibition dates, property owners will be required to cease discharging waste through their septic systems. Should property owners continue to discharge, the Regional Board will begin enforcement actions that include issuing Cease and Desist Orders and/or fines for non-compliance. As the local sewerage agency, the HDWD has responded to the threat septic tank discharges have had on the Basin and the prohibition by fast-tracking the design and construction of its Project.

The Project consists of:

- Wastewater collection system that will collect wastewater currently being discharged via septic systems (Phase 1A only, which includes 25 or about 1/3, out of the total 78 miles of sewer pipeline required for the Phase 1 system and the Paxton and Barron Pump Stations, is included in this grant application. The remaining portion of Phase 1 is NOT included in this grant application);
- Wastewater treatment plant referred to as the Wastewater Reclamation Facility (WRF) will initially be capable of treating Phase 1 flow of up to 1.0 million gallons per day (MGD) using membrane bioreactors, expandable to meet future Phase 2 and 3 flow (and NOT included in this grant application);
- Water reclamation recharge pond(s) that will receive the treated effluent on-site, returning Title 22 water to the local aquifer for future extraction (NOT included in this grant application).

Though the HDWD has made extensive progress toward the completion of the Project, critical path objectives such as the collection system design have been achieved through available grant funding. The HDWD's current financial position is not able to support continued progress without additional funding which is needed to complete the design and begin construction of the treatment facility and the collection system. The HDWD has applied for a State Revolving Fund (SRF) loan that has been secured through the formation of an Assessment District (AD). HDWD announced May 13, 2015 that 72 percent of weighted votes supported the formation of an AD that has secured a one percent loan from the State and will fund construction of the Sewer Collection System in Phase 1. The AD's formation attaches a special lien on properties within the Phase 1, 2, and 3 boundaries. Property owners will pay off the lien through installments included on their property taxes over a 30-year period at a low interest rate.

Current Need Addressed

The Regional Board collected evidence which indicated that the continual use of septic systems within the Town of Yucca Valley has caused: (a) violations of water quality objectives; (b) impairment of groundwater beneficial uses; (c) conditions of pollution, nuisance, and/or contamination; and (d) unreasonable degradation of the quality of state waters, the primary source of drinking water for properties located within the HDWD. This Project – the first of four construction bid packages (Phase 1A) to construct a sewer collection system will eliminate septic systems discharges causing the above list of contamination issues and address these current needs.

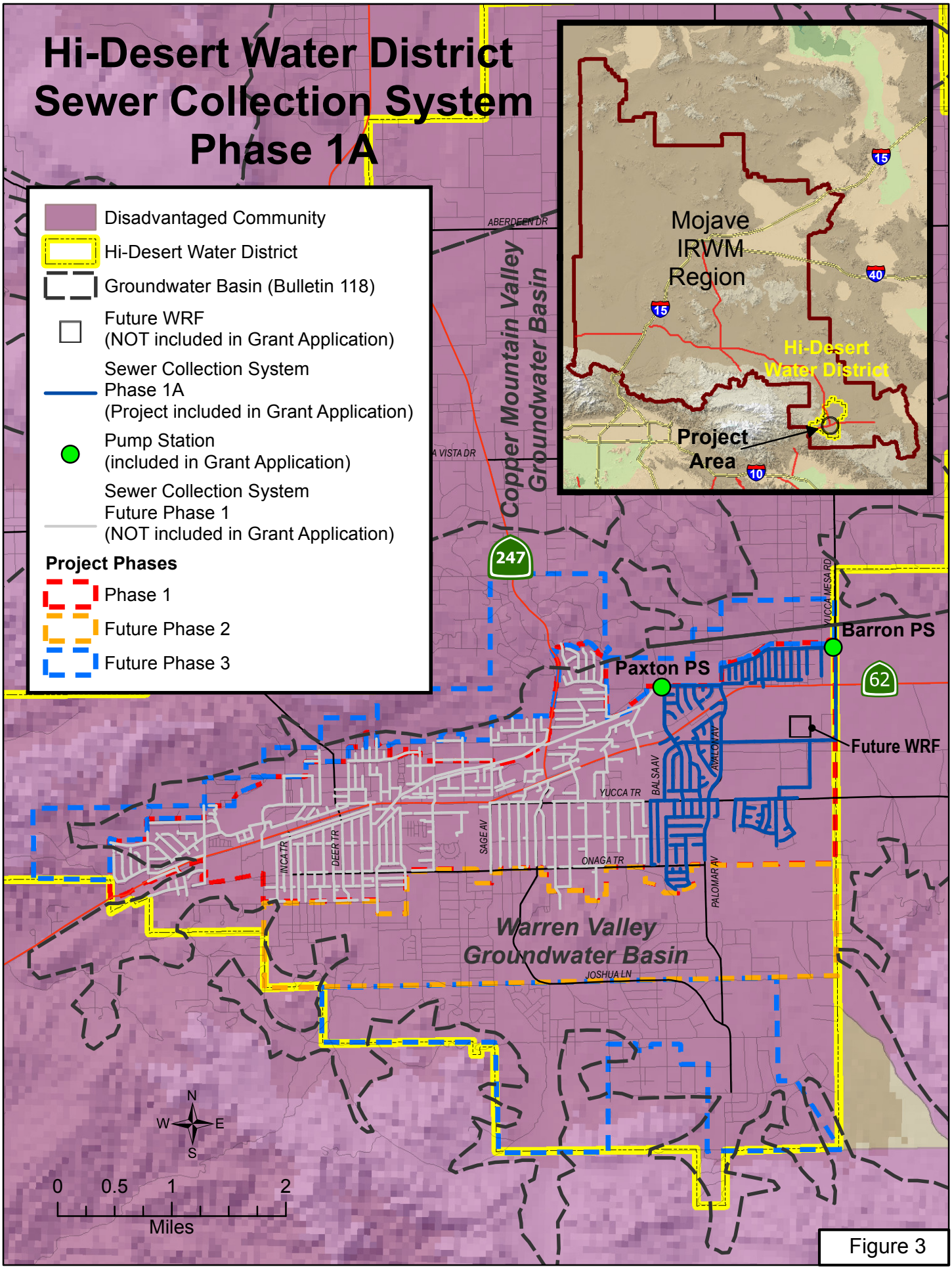
Hi-Desert Water District
Sewer Collection System
Phase 1A
Disadvantaged Community
Hi-Desert Water District
Groundwater Basin (Bulletin 118)
Future WRF
(NOT included in Grant Application)
Sewer Collection System
Phase 1A
(Project included in Grant Application)
Pump Station
(included in Grant Application)
Sewer Collection System
Future Phase 1
(NOT included in Grant Application)
Project Phases
Phase 1
Future Phase 2
Future Phase 3
Mojave
IRWM
Region
Hi-Desert
Water District
Project
Area
Copper Mountain Valley
Groundwater Basin
Warren Valley
Groundwater Basin
ABERDEEN DR
A VISTA DR
247
62
15
40
10
Barron PS
Paxton PS
Future WRF
YUCCA MESA RD
YUCCA TR
BALSA AV
AVALON AV
SAGE AV
INCA TR
DEER TR
ONAGA TR
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Figure 3

Project Physical Benefits

Hi-Desert Sewer Collection System Program Phase 1A

The following primary and secondary physical benefits are expected from the Hi-Desert Sewer Collection System Phase 1A:

- Primary Benefit: Reduction in groundwater nitrate (NO_3) concentrations
- Secondary Benefit: Production of recycled water available for groundwater recharge

The physical benefits for the Project are discussed individually below, with an overview of each benefit expected over the project life and a technical analysis of each physical benefit claimed. Following the project benefits discussion, a cost effectiveness analysis of the Project and project alternatives is provided with the Project Performance Monitoring Plan discussed at the end of this section.

Technical Analysis of Physical Benefits Claimed

Primary Benefit: Reduction in groundwater nitrate (NO_3) concentration

As shown in Table 2-5, this project will reduce the nitrate (NO_3) concentration in groundwater by up to 9 mg/l by 2067.

Table 2-5 – Annual Project Physical Benefits (PSP Table 5)
Project Name: Hi-Desert Sewer Collection System Phase 1A
Type of Benefit Claimed: Reduction in groundwater nitrate (NO_3) concentration (primary benefit)
Units of the Benefit Claimed : milligrams per liter (mg/L) of nitrate (NO_3)
Anticipated Useful Life of Project (years): 50

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2018/2019	5.69/5.88	4.71/4.74	0.73/1.14
2020/2021	6.06/6.25	4.76/4.79	1.30/1.46
2022/2023	6.44/6.63	4.81/4.84	1.63/1.79
2024/2025	6.82/7.00	4.87/4.89	1.95/2.11
2026/2027	7.19/7.38	4.92/4.94	2.28/2.44
2028/2029	7.57/7.76	4.97/4.99	2.60/2.76
2030/2031	7.95/8.13	5.02/5.05	2.93/3.09
2032/2033	8.32/8.51	5.07/5.10	3.25/3.45
2034/2035	8.70/8.89	5.12/5.15	3.58/3.74
2036/2037	9.08/9.26	5.17/5.20	3.90/4.06
2038/2039	9.45/9.64	5.23/5.25	4.23/4.39
2040/2041	9.83/10.02	5.28/5.30	4.55/4.71
2042/2043	10.21/10.39	5.33/5.35	4.88/5.04
2044/2045	10.58/10.77	5.38/5.41	5.20/5.36
2045/2046	10.77/10.96	5.41/5.43	5.36/5.53
2047/2048	11.15/11.33	5.46/5.48	5.69/5.85
2049/2050	11.52/11.71	5.51/5.53	6.01/6.18
2051/2052	11.90/12.09	5.56/5.59	6.34/6.50
2053/2054	12.28/12.46	5.61/5.64	6.66/6.83
2055/2056	12.65/12.84	5.66/5.69	6.99/7.15
2057/2058	13.03/13.22	5.72/5.74	7.31/7.48
2059/2060	13.41/13.59	5.77/5.79	7.64/7.80
2061/2062	13.78/13.97	5.82/5.84	7.96/8.13
2063/2064	14.16/14.35	5.87/5.90	8.29/8.45
2065/2066	14.54/14.72	5.92/5.95	8.61/8.78

Table 2-5 – Annual Project Physical Benefits (PSP Table 5)			
Project Name: Hi-Desert Sewer Collection System Phase 1A			
Type of Benefit Claimed: Reduction in groundwater nitrate (NO_3) concentration (primary benefit)			
Units of the Benefit Claimed : milligrams per liter (mg/L) of nitrate (NO_3)			
Anticipated Useful Life of Project (years): 50			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2067/2068	14.91/15.10	5.97/6.00	8.94/2.28
Comments: Average daily flow (ADF) for this Project (Sewer Collection System Phase 1A) is approximately 30% of HDWD's Phase 1 flow of 1.0 MGD (0.29/1.0) = 29%); thus this Project provides approximately 30% of the benefits. Project life is 50 years; benefits start to accrue in January 2018 (100% of benefit in 2018) and stop in 2068. Source: Kennedy/Jenks Consultants and Todd Groundwater, 2015.			

1. Explanation of need for the project including recent and historical conditions

The HDWD provides water services to residents and businesses in the Town of Yucca Valley via groundwater wells that draw water from the Warren Valley Groundwater Basin. An imbalance between natural groundwater recharge and pumping caused groundwater levels in the Warren Valley to decline by about 300 feet from the late 1940s through 1994 (Nishikawa et al., 2003; page 2). In response, the HDWD initiated an artificial recharge program in February 1995 where imported water from the State Water Program (SWP) was used to recharge groundwater through surface spreading (Nishikawa et al., 2003; page 4). The recharge efforts recovered as much as 250 feet of groundwater by December 2001. However, nitrate-$_3$ concentrations also increased from background concentration of 10 milligrams per liter (mg/L) to more than 110 mg/L in some areas (Nishikawa et al., 2003; page 26), exceeding USEPA's and the California Department of Public Health's drinking water MCL of 45 mg/L (10 mg/L as Nitrogen; State Water Resources Control Board (SWRCB), 2010). Septic tanks are the primary method of wastewater disposal in the Town of Yucca Valley, and the USGS 2003 study found that the rapid rise in water levels from the artificial recharge program allowed the septic effluent in the unsaturated zone, increasing groundwater NO_3 concentrations (Nishikawa et al., 2003; page 66). Although recent groundwater management actions successfully reduced nitrate (NO_3) concentrations below their historical peak in the early 2000s, projections suggest that nitrate (NO_3) concentrations could reach the MCL by 2049 under current growth forecasts (Kennedy/Jenks Consultants and Todd Groundwater, 2015).

In 2011, the Regional Board adopted Resolution R7-2011-0004 amending the Regional Board's Basin Plan to prohibit septic tank discharges in the Town of Yucca Valley. The Resolution enacted a phased approach to the prohibition of future discharges of wastewater from septic systems. To meet the State requirements and protect the community's groundwater supplies, HDWD is implementing a Sewer Collection System and a WRF to collect and treat residential and commercial wastewater discharges. The wastewater will be treated to recycled water quality and could be reused for groundwater recharge.

The Sewer Collection System and WRF consists of (1) a wastewater collection system to collect wastewater currently discharged via septic systems; (2) a WRF to treat wastewater flow using membrane bioreactors; and (3) water reclamation recharge ponds to receive treated effluent and return water to the local aquifer for future extraction. This Project focuses on implementation of the wastewater collection system for Phase 1A. Operation of the WRF will begin in April 2018, when benefits start to accrue.

2. Estimates of without project conditions with respect to this benefit

Without the Sewer Collection System Phase 1A (the Project), groundwater quality would not be improved. Existing septic system treatment facilities would continue to treat wastewater in the Phase 1A area until the Regional Board mandated Prohibition dates set to start in May 2016. After this date, the Regional Board will issue 'cease and desist' orders to property owners; failure to comply will result in fines.

Without a viable waste treatment alternative, septic systems may continue to treat waste. Under this scenario and assuming projected rates of population growth and associated increased water demand, return flow, and imported SWP, the HDWD would exceed the USEPA's and the California Department of Public Health's drinking water MCL for nitrate (NO_3) by 2059, as shown below in Figure 2-1 (Kennedy/Jenks Consultants and Todd Groundwater, 2015). High nitrate (NO_3) concentrations

in groundwater would continue to pose health risks to infants due to methemoglobinemia or "blue baby syndrome;" long-term health effects on adults are not well-known (SWRCB, 2010).

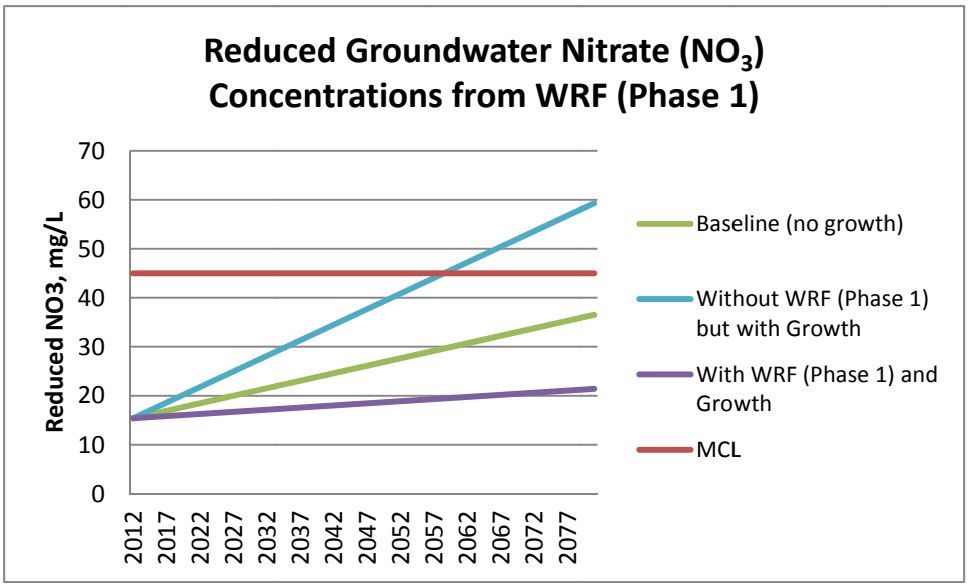

Figure 2-1: Reduced Groundwater Nitrate (NO_3) Concentrations-Proposed WRF (Phase 1 Conditions)
Source: Adapted from Kennedy/Jenks Consultants/Todd Groundwater, 2015

3. Descriptions of methods used to estimate physical benefits

During the development of the 2015 Mojave Salt and Nutrient Management Plan (Draft), a regional groundwater quality mixing model was developed to (1) simulate regional groundwater quality, focusing on TDS and nitrate, under future loading conditions (or scenarios) and (2) quantify the effect of planned future recycled water projects on regional water quality. The model simulates three future scenarios:

- Scenario 1: Simulates future groundwater quality under existing conditions, including 2012 rates of groundwater production, return flow, and imported SWP water but with no growth.
- Scenario 2 (Without Phase 1 and WRF Project): Simulates future groundwater quality under projected rates of population growth and associated increased water demand, return flow, and imported SWP. This scenario does not take into account future wastewater treatment or reclamation plants (including the HDWD's Sewer Collection System constructed as Phase 1 or WRF (1.0 MGD capacity)); increased sewer flow is treated by existing facilities (septic systems). This scenario is the without-project scenario for purposes of this analysis.
- Scenario 3 (With Phase 1 and WRF Project): Similar to Scenario 2, this scenario simulates future groundwater quality under projected rates of population growth and associated increased water demand, return flow, and imported SWP. This scenario takes into account planned future wastewater treatment and assumes that the increased sewer flow is treated by the future WRF. For the Warren Valley, this scenario assumes construction and operation of HDWD's Sewer Collection Project and WRF. This is the with-project scenario for purposes of this analysis.

For the Warren Valley, the 2015 Mojave Salt and Nutrient Management Plan (Draft) projects significant increases in groundwater nitrate (NO_3) concentrations in Scenario 2 (the without-project scenario), where increased return flow is treated using existing septic system treatment facilities (see Figure 2-1). In this scenario, groundwater nitrate (NO_3) exceeds the drinking water MCL of 45 mg/L by 2059. The implementation of the Sewer Collection Project and the WRF, as detailed in Scenario 3, significantly reduces groundwater nitrate (NO_3) concentrations and do not exceed the drinking water MCL.

The benefits for this Project are scaled down to 30% compared to the WRF, as simulated by the 2015 Mojave Salt and Nutrient Management Plan (Draft). HDWD projects average daily flow from Phase 1 to equal 1.0 MGD; of this, the Sewer

Collection System Phase 1A will treat 0.29 MGD or 30%. As such, the benefits associated with this Project are 30% of the benefits from the WRF. Benefits start to accrue when the WRF begins operation in April 2018.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits

The Sewer Collection System Phase 1A (the Project) is a portion of the Phase 1. Phase 1 boundary runs along the valley bottom to remove septic tanks that are closest to HDWD wells; this area was chosen due to its higher density and potentially greater impact on potable water supply wells. The bid packages are designated into east, central and west areas. Phase 1A is the first and the east construction package of Phase 1, which is located closest to the WRF. Design of the Phase 1 Sewer Collection System is 98% complete by Atkins (Design Engineer), including the Sewer Collection System Phase 1A Project (the first of four bid packages to construct the entire Phase 1 system). The Sewer Collection System Phase 1A includes two pumping stations: the Paxton and the Barron Pump Stations; approximately 25 miles of sewer pipelines primarily on the east side of the Town of Yucca Valley as shown on Figure 2 in Attachment 2. To obtain physical benefits, septic system treatment facilities must be eliminated from Phase 1A and wastewater previously discharged via septic systems must be treated by a WRF. HDWD projects the WRF will begin operation in April 2018 and HDWD will begin diverting wastewater flow from Phase 1A residential, commercial, and industrial septic systems to the WRF for treatment.

The sewer collection system is designed to utilize public right-of-way where possible; however, where necessary, HDWD is working with regional and local entities to acquire right-of-way easements for Phase 1A. Easements are required across vacant properties; residential properties; commercial, industrial, or other retail/service properties; and schools (Atkins, 2013; page 6-4).

5. Description of any potential adverse physical effects

Most of the sewer collection system will be placed in previously disturbed paved or graded roadway alignments road rights-of-way (Tom Dodson & Associates, 2009; page 43). Several sewer pipelines and pump stations cross relatively undisturbed areas, including ephemeral stream channels (Tom Dodson & Associates, 2009; page 81). In these instances, mitigation measures will be implemented to prevent or reduce the impact on sensitive plant and animal species, including relocation and maintenance of Joshua tree and cacti plants from disturbed areas to undisturbed areas (Tom Dodson & Associates, 2009; page 81).

The WRF and the Sewer Collection System will consume energy and produce associated emissions during construction and operations. Construction-generated emissions associated with pipeline construction are considered less than significant. Construction will generate fugitive dust, which is a local nuisance; fugitive dust mitigation efforts, such as watering the construction area, will reduce dust emission (Tom Dodson & Associates, 2009; page 64). Once constructed, the Sewer Collection System and WRF will consume an estimated 8,000 kilowatt hours (kWh) per day or 2.9 million kWh of electricity per year. Existing energy sources can serve the WRF; as such, energy impacts should be minimal. Emissions associated with energy generation will conform to federal requirements and no mitigation is required (Tom Dodson & Associates, 2009).

6. Description of whether the proposed project effectively addresses long-term drought preparedness

This Project addresses long-term drought preparedness through "efficient groundwater basin management," described in this section, and "promoting water reuse," as described in the *Secondary Benefits* section.

The Project will reduce groundwater nitrate (NO_3) concentrations in the Warren Valley Groundwater Basin. With the reduction of nitrate (NO_3) concentrations from the basin, HDWD improves the health of the basin, and is able to use the local groundwater resource in a more sustainable manner.

Summary of Benefit

This Project will reduce groundwater nitrate (NO_3) concentrations by approximately 9 mg/L over the 50 year lifetime of the Project.

Secondary Benefit: Production of recycled water available for groundwater recharge

As shown in Table 2-6, this Project will produce up to 621 afy of recycled water that will be available for groundwater recharge.

Table 2-6 – Annual Project Physical Benefits (PSP Table 5)			
Project Name: Hi-Desert Sewer Collection System Phase 1A **Type of Benefit Claimed:** Production of recycled water for groundwater recharge (secondary benefit) **Units of the Benefit Claimed :** afy **Anticipated Useful Life of Project (years):** 50			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2018	0	25.89	25.89
2019	0	207.14	207.14
2020	0	310.71	310.71
2021	0	414.29	414.29
2022	0	517.86	517.86
2023 - 2067	0	621.43	621.43
Comments: Average daily flow for this Project (East collection system construction project- 1 of 4 to complete entire Phase 1 sewer collection system construction) generates approximately 30% of the Phase 1 flow (0.29 ADF/1 MGD = 0.29 or 30%); thus this Project provides approximately 30% of the benefits of the larger project which includes the WRF. Project life is 50 years; WRF online in April 2018 and benefits accrue six months later in October 2018. **Source:** Kennedy/Jenks Consultants and Todd Groundwater, 2015.			

1. Explanation of need for the project including recent and historical conditions

As described above, imported water from the SWP recharges groundwater in the Warren Valley Basin through surface 2015 Mojave Salt and Nutrient Management Plan 2015 Mojave Salt and Nutrient Management Plan 2015 Mojave Salt and Nutrient Management Plan 2015 Mojave Salt and Nutrient Management Plan 2015 Mojave Salt and Nutrient Management Plan 2015 Mojave Salt and Nutrient Management Plan spreading (Nishikawa et al., 2003; page 4). In an effort to reduce reliance on the imported water supplies, this Project will produce up to approximately 621 afy of recycled water (Kennedy/Jenks Consultants and Todd Groundwater, 2015), which will be used for groundwater recharge. This Project was ranked third out of 73 projects in the Mojave Integrated Regional Water Management (IRWM) Plan. The Project ranking was high for several reasons including being in a 100% DAC area, preserving water quality of the groundwater basin, and increasing the use of recycled water in the Region (Kennedy/Jenks Consultants, 2014).

2. Estimates of without project conditions with respect to this benefit

Without the Sewer Collection System Phase 1A (the Project), the WRF will not generate recycled water for groundwater recharge because there would be no wastewater to treat and turn into recycled water. Without the Project, wastewater generated by homes to be included in the proposed Project will continue to infiltrate from septic leachate fields until the Regional Board's prohibitions went into effect and then people using septic systems would start to be fined. Septic systems in the area utilize very high evaporation rates to function properly. The remaining amount of wastewater from septic systems takes decades to travel towards the vadose zone, after which a portion reaches the groundwater table. According to a USGS study of nitrate contamination of groundwater in the Yucca Valley area, septic leachate from one house on a 0.1 acre parcel does not reach the water table during the 100-year stimulation (Izbicki et al., 2015).

3. Descriptions of methods used to estimate physical benefits

The WRF will effectively treat the collected wastewater to recycled water quality. According to the Draft Mojave SNMP, recycled water discharges will increase from zero to approximately 2,100 afy in six years (Kennedy/Jenks Consultants and Todd Groundwater, 2015; page 5-10). Treated wastewater will be recharged at designated percolation facilities. HDWD has 20 years of experience replenishing the local aquifer; HDWD will use this experience to actively manage recharge of the

recycled water. HDWD estimates that approximately 1% of the recycled water is lost evaporation from the spreading basin[1], a rate likely to be significantly lower than the evaporation losses from the septic tank leachate fields.

The benefits of recycled water for this Project are scaled down from the WRF to the 30% portion of benefits that are applicable for the Sewer Collection System Phase 1A as described previously. Recycled water must be in the ground for six months before it is pumped out (Olds, personal communication, 2015); therefore, benefits for the recycled water will start to accrue six months after the WRF begins operation in April 2018.

4. Identification of all new facilities, policies, and actions required to obtain the physical benefits

As described above, the Sewer Collection System Phase 1A (the Project) is a portion of the Phase 1 Sewer Collection System and WRF. The entire Phase 1 Sewer Collection System boundary runs along the valley bottom to remove septic tanks that are closest to HDWD wells; this area was chosen due to its higher density and potentially greater impact on potable water supply wells. The bid packages are designated into east, central and west areas. Phase 1A is the east construction package of Phase 1, which is located closest to the WRF. Atkins is designing Phase 1 of the sewer collection system (Atkins, 2013); currently, 98% of the Phase 1 Sewer Collection System design is complete. The Phase 1A Project includes two pumping stations: Paxton and Barron Pump Station including approximately 25 miles of sewer pipelines and manholes and necessary appurtenances .To obtain physical benefits, septic system treatment facilities must be stopped and wastewater previously discharged via septic systems treated at the proposed WRF. HDWD projects the WRF will begin operation in April 2018, so that is the estimated date for when HDWD can begin diverting Phase 1A wastewater flow (previously sent for treatment to septic systems) to the proposed WRF for treatment.

The sewer collection system is designed to utilize public right-of-way where possible; however, where necessary, HDWD is working with regional and local entities to acquire right-of-way easements for Phase 1A. Easements are required across vacant properties; residential properties; commercial, industrial, or other retail/service properties; and schools (Atkins, 2013; page 6-4).

5. Description of any potential adverse physical effects

As described above, most of the sewer collection system will be placed in previously disturbed, paved or graded roadway alignments road rights-of-way (Tom Dodson & Associates, 2009; page 43). Several sewer pipelines and pump stations cross relatively undisturbed areas, including ephemeral stream channels. In these instances, mitigation measures will be implemented to prevent or reduce the impact on sensitive plant and animal species, including potential relocation and maintenance of Joshua tree and cacti plants from disturbed areas to undisturbed areas (Tom Dodson & Associates, 2009; page 81).

The WRF, of which the Sewer Collection System Phase 1A is one component, will consume energy and produce associated emissions during construction and operations. Construction-generated emissions associated with pipeline construction are considered less than significant. Construction will generate fugitive dust, which is a local nuisance; fugitive dust mitigation efforts, such as watering the construction area, will reduce dust emission. Once constructed, the WRF will consume an estimated 8,000 kilowatt hours (kWh) per day or 2.9 million kWh of electricity per year. Existing energy sources can serve the WRF; as such, energy impacts should be minimal. Emissions associated with energy generation will conform to federal requirements and no mitigation is required (Tom Dodson & Associates, 2009).

6. Description of whether the proposed project effectively addresses long-term drought preparedness

This Project addresses long-term drought preparedness through "efficient groundwater basin management," described in the *Primary Benefits* section, and "promoting water reuse," as described in this section. This Project produces up to approximately 620 afy of recycled water that will be available for reuse. The water produced from the Project can be recharged into the Warren Valley Basin, which will improve water supply reliability in the Yucca Valley, as this area currently relies on imported SWP for groundwater recharge.

[1] A similar nearby pond along the Oro Grande Wash near Victorville had a documented evaporation rate of about 0.13% (750 cubic meters evaporated/ 59,750 cubic meters infiltrated and evaporated) during the time period October 2002 to September 2003 (Izbicki et al., 2008. p.480). The 1% percent evaporation rate is a conservative assumption in comparison.

Direct Water-Related Benefit to a DAC

As discussed in Attachment 7, the proposed Project serves 100% DAC, by population, and therefore qualifies for DAC scoring consideration. This Project serves the HDWD service area or the Town of Yucca Valley.

This Project addresses the water-related need of this DAC, which is to comply with the Regional Board adopted Resolution R7-2011-0004 amending the Regional Board's Basin Plan to prohibit septic tank discharges in the Town of Yucca Valley. If the community does not respond to this order, it could face fines that would significantly affect the local economy. To meet the State requirements and protect the community's groundwater supplies, HDWD is implementing the Phase 1 Sewer Collection System and the WRF to collect and treat residential and commercial wastewater discharges. The wastewater will be treated to recycled water quality and will be reused for groundwater recharge. The proposed Project (Phase 1A) is the first construction bid package (one of four) for the Phase 1 of a multi-phased project to meet the objective of the resolution.

Cost Effectiveness Analysis

This section presents a cost-effectiveness analysis comparing the relevant project alternative to the proposed project. The project alternative considered is discussed below:

Table 2-7 – Cost Effective Analysis (PSP Table 7) **Project Name: Hi-Desert Sewer Collection System Phase 1A**	
Question 1	**Types of benefits provided as shown in Tables 2-5 and 2-6 (PSP Table 5)** 1) Reduction in groundwater nitrate (NO_3) concentrations 2) Production of recycled water available for water reuse
Question 2	**Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?** Yes. The other alternative identified that would comply with the Regional Board's Resolution R7-2011-0004 to prohibit septic tank discharges in the Town of Yucca Valley would be to pump wastewater out of the basin and treat it elsewhere. This alternative is scaled to Phase 1A to allow for comparison with the project.
	If no, why? Not applicable
	If yes, list the methods (including the proposed project) and estimated costs. The proposed Project is the Hi-Desert Sewer Collection System Phase 1A. Total costs are approximately $24.8M in present value 2015 dollars. The alternative project is to pump and treat wastewater from septic tanks that would otherwise be removed under Phase 1A of the proposed project. This alternative would cost $307.1M in present value 2015 dollars.
Question 3	**If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.** Not applicable. The proposed Project is the least cost alternative.

The present value of capital costs for the Hi-Desert Sewer Collection System Phase 1A, as proposed in this grant application, is approximately $26.9M in undiscounted 2015 dollars, or a present value of $24.8M in 2015 dollars using a 6% discount rate. The Operations and Maintenance (O&M) costs for this Project total $190,000 per year in undiscounted 2015 dollars. The present value O&M costs over the project life total $2.5M in 2015 dollars totals using a 6% discount rate. Thus, the present value of capital and O&M costs for the Project totals $27.3M in 2015 dollars.

If the Sewer Collection System Phase 1A is not constructed, HDWD must consider an alternative that meets the Regional Board's Resolution R7-2011-0004 to prohibit future septic tank discharges in the Town of Yucca Valley. HDWD considered

a pumping and treating residential and commercial wastewater discharges in Phase 1A as the alternative to the current Project.

Alternative 1 - Pump and treat Phase 1A septic tanks

In this alternative, HDWD would pump the septic effluent from all septic tanks that would otherwise be removed under Phase 1A of the proposed Project. The pumped raw sewage would be treated at an offsite location, which would eliminate septic tank discharges from Phase 1A in the Town of Yucca Valley and reduce groundwater nitrate (NO_3) concentrations in the Warren Valley Groundwater Basin. To maintain groundwater basin levels and avoid overdraft of groundwater resources, HDWD will need to acquire additional water supplies from the SWP.

Phase 1A wastewater flow of 0.29 MGD or 106 million gallons per year would be pumped on a regular basis at a rate of $169 per thousand gallons.[2] The present value in 2015 dollars of pumping this wastewater out of the basin over the 50-year life of the proposed project would be $301.6M. The cost estimate for this alternative does not include the cost of treating the Phase 1A septic raw sewage at an offsite location.

Water exported from the basin for treatment would be replaced through additional importation of SWP water using the MWA contract at a cost of approximately $477 per acre foot in 2015 dollars.[3] This is assuming that there is SWP available for MWA to use as a replacement, which could be highly unlikely depending on the weather and time of year. It is also assumed that MWA would only replace the portion of Phase 1A wastewater flow that would have infiltrated from septic tank leach fields, after assuming that 37.5% of the wastewater applied in the leach fields evaporates (37.5% is the mid-point of the evaporation rate range of 30 to 45%). The present value of the replacement totals $5.48M over the assumed 50-year project lifetime.

The present value of the total cost for this project alternative is estimated to be $307.1M over the expected 50-year life of the project. Alternative costs do not include treating the septic effluent at an offsite location; therefore, these project costs are expected to be a lower bound estimate for this alternative.

Project Performance Monitoring Plan

Table 2-8– Project Performance Monitoring Plan (PSP Table 6)

Project: Hi-Desert Sewer Collection System Phase 1A

Physical Benefits	Targets	Measurement tools and methods
Water Quality Improvements	Reduce the nitrate (NO_3) concentration of the drinking water from HDWD's wells in the Warren Valley groundwater basin by up to 9 mg/l by 2067	Since Nitrate (NO_3) is a drinking water MCL, is should be part of HDWD's annual Consumer Confidence Reports (CCRs), this source of monitoring can be used to compare annual results for decreases in nitrate.
Recycled Water Supply	621 afy of recycled water	Collect and analyze metered delivery readings of recycled water from the proposed WRF.

Primary Physical Benefit

The water quality target for nitrate is set by the USEPA for drinking water standards and is monitored and tested frequently by HDWD as required by various regulatory agencies. Sampling from various HDWD drinking water wells once the recycled water is being recharged into the groundwater basin will indicate the nitrate (NO_3) levels and comparisons can be made from previous monitoring samples to see if targets are being met. Data on recycled water nitrate concentrations will also be compared against the secondary drinking water standards for nitrate in order to ensure regulatory compliance.

[2] Quote of $162.50 per thousand gallons from Ferris Septic of southern California in 2012 dollars. Price updated to $169 in 2015 dollars. Additional fees for septic system location, excavation and lid removal were not included in quote.

[3] These costs have been rising at around 8% per year in nominal terms, and are likely to continue to rise to pay for Bay-Delta and other SWP improvements. It is conservatively assumed that these charges to IDM costs will continue to rise at 3% per year (thus will be constant in real dollars).

Secondary Benefit

The recycled water supply benefit has a target of 621 afy, which is the amount of recycled water that will be made available via the proposed HDWD WRF. In order to evaluate achievement of the new water supply target, recycled water flow will be measured at the discharge side of the WRF. Meter readings will occur regularly and will be totaled to determine the cumulative recycled water supply per year of operation. Cumulative flow meter readings are the most effective and therefore appropriate means, to evaluate whether actual deliveries meet new water supply targets.

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Leak Detection Services for Mojave Region 100% Disadvantaged Community (DAC) Small Water Systems Phase 1 Program

This Project is being implemented by the Mojave Water Agency (MWA).

Project Description

This Project will provide initial leak detection analysis for twenty-six (26) 100% DAC small water systems in the Region.

This Leak Detection Program will be Phase 1 of a two-phase Capital Improvement Plan (CIP), where this Phase 1 Program identifies leaks throughout the twenty-six (26) small water systems in the Mojave Integrated Regional Water Management (IRWM) Region that are 100% DAC. Phase 2 will take place when the leaks found in Phase 1 are corrected via the CIP program. The plan is to apply for Proposition 1 grant monies to fund Phase 2 of this Program. Many of the small water systems in the Mojave Region were constructed in the 1960s and 70s, with the originally installed pipes still being used today, well beyond their typical expected life span of 30-40 years.

The Program's scope of work includes reaching out to various qualified DAC small water systems (26 in total) and discussing what the unaccounted water loss is estimated to be for each system. The method for determining the leaks is discussed in the Work Plan in more detail. With each interested system, we will discuss the benefits a leak detection analysis can provide in terms of reducing system water losses. An additional non-quantifiable benefit of this Program is that MWA will further develop relationships with the staff of these small water systems (which are typically understaffed, or one person is doing all the necessary jobs) and will also gather data from these systems to help the Region gain a clearer picture of its overall water status.

The California Department of Water Resources (DWR) defines a DAC as a municipality, including, but not limited to a city, town or county, or a reasonably isolated and divisible segment of a larger municipality, that has an average median household income (MHI) that is less than 80 percent of the statewide annual MHI. In California, a MHI of less than $48,875 meets this threshold based on 2009 US Census Bureau (USCB) data. A community with an MHI less than 60 percent the statewide annual MHI is deemed a severely disadvantaged community. As shown on Figure 4, by area, 26 small water systems in the Mojave IRWM Region are 100% DAC (out of a total of 40, or 65%) and are included in this Leak Detection Project, with over one-half of these 26 DAC systems considered severely disadvantaged (or having a MHI of less than $36,656).

From MWA's preliminary design work for evaluating the need and feasibility of the Leak Detection Services Program (for a pilot study type case), early indications show that most of the small water systems are in the 8%-20% water loss category (with the assumption that anything greater than 10% should be reduced per industry standard (American Water Works Association (AWWA) Manual M36 Water Distribution System Audit)). With this grant application Project (Phase 1 Program), we will complete Phase 1 (Leak Detection for the DAC small water systems) and for Phase 2 (the CIP program), we will apply for Proposition 1 grant funding to correct the leaks found in Phase 1.

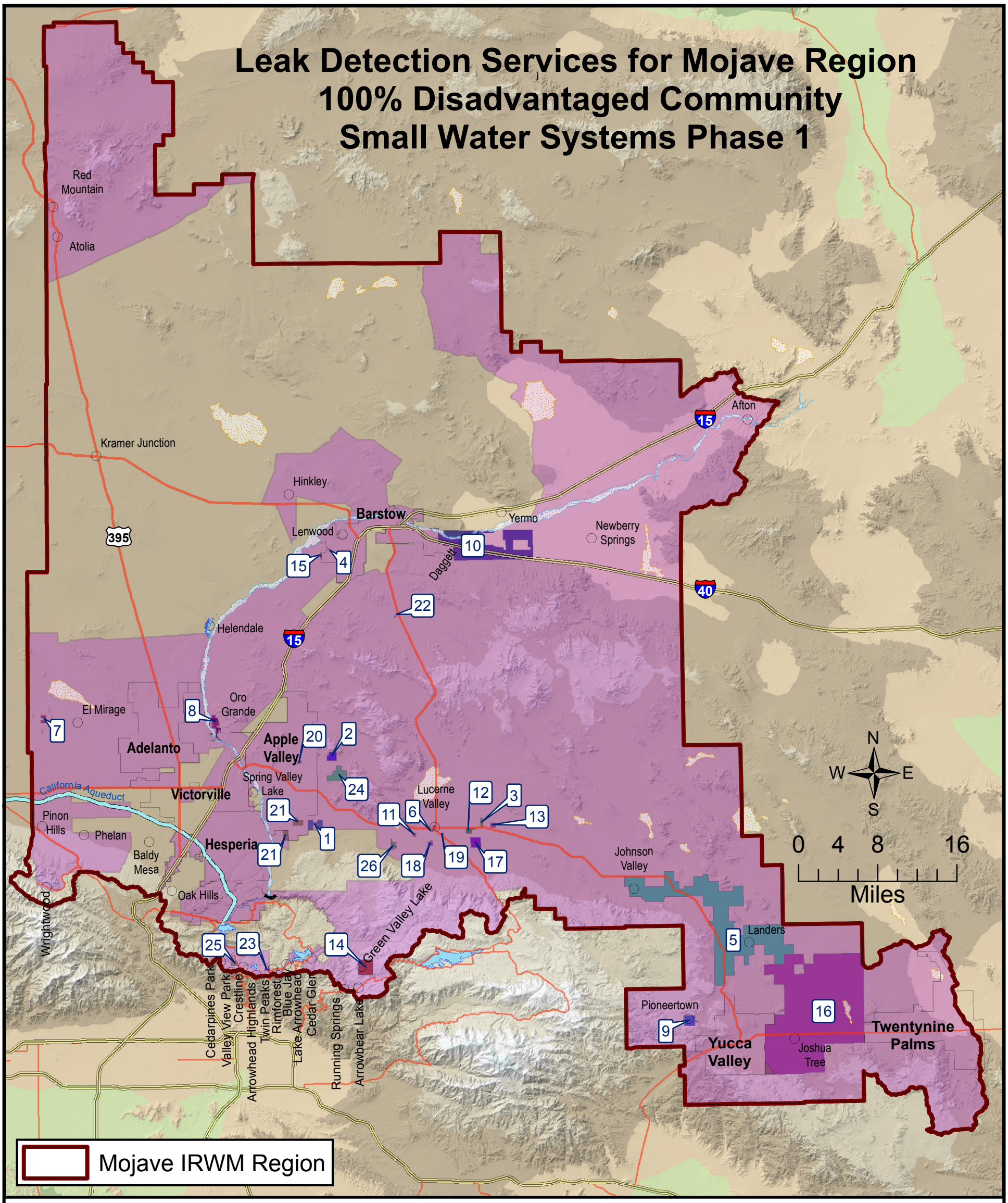
When both phases are complete, the Program will assist the small water system DACs in meeting their critical water supply needs through infrastructure renovations to public water supply systems that are necessary to assure continued reliability of the minimum quality and quantity of water. The Program will also result in reduced water losses in the Region assisting in achieving water conservation goals and increasing the water supply.

Phase 1 of the Program is to be implemented as an umbrella grant program, which puts the decision- making in the hands of MWA (local experts) to do the best for the community. Many of these DAC small water systems are run by 1-3 people and they don't have the time and in certain cases the knowledge on how to apply for a grant. Putting that decision-making power in the hands of an "umbrella agency" (MWA) that has the resources and communication with the small water systems to understand their needs, helps the entire community and the small water systems. In this case, leak detection is relevant to every water system in the Mojave Region.

Current Need Addressed

The Program will assist the 26 small water systems that are 100% DACs in meeting their critical water supply needs through infrastructure renovations to a public water supply system that are necessary to assure continued reliability of the minimum quality and quantity of water. The Program will also result in reduced water losses in the Region assisting in achieving water conservation goals and aiding in the drought relief surplus of water fund.

Leak Detection Services for Mojave Region
100% Disadvantaged Community
Small Water Systems Phase 1



Legend

1. Apple Valley Foothill County Water District
2. Apple Valley View Mutual Water Company
3. Bar H Mutual Water Company
4. BarLen Mutual Water Company
5. Bighorn-Desert View Water Agency
6. Center Water Company
7. Chamisal Mutual Water Company
8. County Service Area 42
9. County Service Area 70 W4
10. Daggett Community Services District
11. Desert Dawn Mutual Water Company
12. Desert Springs Mutual Water Company
13. Gordon Acres Water Company
14. Green Valley Mutual Water Company
15. Hi Desert Mutual Water Company
16. Joshua Basin Water District
17. Jubilee Mutual Water Company
18. Lucerne Valley Mutual Water Company
19. Lucerne Vista Mutual Water Company
20. Navajo Mutual Water Company
21. Rancheritos Mutual Water Company
22. Stoddard Valley Mutual Water Company
23. Strawberry Lodge Mutual Water Company
24. Thunderbird County Water District
25. Valley of Enchantment Mutual Water Company
26. West End Mutual Water Company

Disadvantaged Communities

US Census American Community Survey 5-Year Data: 2009 - 2013

DAC Data Source: http://www.water.ca.gov/irwm/grants/resources_dac.cfm

Figure 4

Project Physical Benefits

Leak Detection Services for Mojave Region 100% DAC Small Water Systems Phase 1 Program

This Leak Detection Program will be Phase 1 of a two-phase Capital Improvement Plan (CIP); this Phase 1 Program identifies leaks throughout the twenty-six (26) small water systems in the Mojave Integrated Regional Water Management (IRWM) Region that are 100% disadvantaged communities (DAC). Phase 2 will occur when the leaks found in Phase 1 are corrected via the CIP program. The plan is to apply for Proposition 1 grant monies to fund Phase 2 of this Program. This two-phase Program provides direct water-related benefits to DACs in the Mojave IRWM Region and includes the 26 small water systems for which 100% of the service area fits the definition of a DAC.

The Phase 1 Program is in the planning and design phase, and does not intend to complete construction with this solicitation. Therefore, this section presents the modified project justification as allowed in the California Department of Water Resources (DWR) Proposal Solicitation Package (PSP) for this grant application. This justification provides a qualitative description of the proposed work and the anticipated benefits of the Program upon completion. We also provide an explanation of the water-related need of the DACs, including recent and historical conditions. We explain how the proposed Program will benefit the water-related needs of the DACs, and provide justification that at least 25% of the project service area will benefit a water-related need of a DAC.

1. Qualitative description of the proposed work?

This leak detection project is the first phase of the MWA's two-phase CIP to locate and repair leaks in 26 small water systems that serve DACs in the IRWM Region. Phase 1 of the CIP will identify the locations of leaks in these systems—the first step in the process of repairing leaking infrastructure, reducing water losses, and reducing costs to small water systems and residents in DACs. The Association of California Water Agencies (ACWA) supports leak detection and remediation programs, and has promoted leak detection as an effective approach to achieving state-wide water savings and to responding to severe drought (ACWA, 2015).

The MWA's Phase 1 Leak Detection Program involves seven steps in each small water system:

1) Meet with water system operators in each small system, to identify system needs and areas of concern.
2) Obtain maps of each system, to locate lines, valves, and other potential leak sources.
3) Locate distribution pipes in the field and record GPS coordinates of pipe locations.
4) Install data loggers on system valves in areas of concern, to download leak sounds and use GPS and GIS to identify general areas where leaks may exist.
5) Conduct leak survey acoustic correlation analysis, using two acoustic sensors and a correlation algorithm that provide more specific information about leak locations.
6) Using acoustic leak detection results, physically pinpoint leaks in the field and record exact leak locations with GPS coordinates.
7) Prepare a summary report of the locations and sizes of identified leaks in each small water system.

2. Qualitative description of the anticipated benefits of the project upon completion of construction?

Based on needs assessments of small water systems and past experience with leak detection, MWA estimates they will find water losses in the range of 8% to 20% in the systems selected for this Phase 1 Program (although MWA has worked in the past with systems where losses exceeded 50%) and repairing these leaks has the potential to provide significant water savings in DACs in the Mojave IRWM Region. MWA provides two options for the leak detection activities – to locate leaks in the entire system, or to focus only on critical areas in the system. MWA (using their Project partner's (California Rural Water Association – CRWA) previous leak detection experience) estimates that leak detection efforts across entire systems can reduce current losses by over 90%, while focusing only on critical areas in a system can reduce losses by 70-80%.

In addition to water-savings benefits, past research has indicated that leak detection and remediation projects can produce significant energy savings. The California Public Utilities Commission (CPUC) approved water-energy pilot projects to investigate the relationship between water conservation measures and water providers' associated energy savings. Pilot projects included water recycling projects, customer audit programs, high efficiency toilet replacement programs, irrigation innovations, and leak detection programs. The CPUC found that, compared to these other strategies, leak detection and remediation programs provided the greatest energy savings by reducing water losses and reducing the total amount of energy used for water delivery (CPUC 2011).

Reducing water losses and energy use can lead to cost savings for water providers and for customers. Water systems treat and produce less water overall when leaks are repaired, and this reduces costs for the system. On average, the savings in water no longer lost to leakage outweigh the cost of leak detection and repair (Lahlou, 2001). Leak detection and repair can also reduce the need to build additional treatment system capacity if customer demand is growing over the long term. Leak detection and repair can therefore reduce or eliminate water rate increases and help keep costs low for customers, which is an especially important consideration for DACs.

The process of identifying leaks can also reduce the risk for potential cross-connections, and better protect public health. Also, leak detection often results in the identification and elimination of illegal taps into the water system. This can save the system money for the system by reducing amount of water produced for which there is no revenue.

California is experiencing a historic drought, and water-saving measures are a top priority state-wide. This combined two-phase Program will help meet water conservation goals of the Region, and will make the Region less vulnerable to future drought.

3. Explanation of the need for the project including recent and historical conditions?

Most of the small water systems in the Mojave IRWM Region were founded in the 1960s or 1970s, and much of the existing infrastructure has exceeded the typical lifetime of 30-40 years. Based on needs assessments of small water systems and past experience with leak detection, MWA estimates they will encounter water losses of 8% to 20% in these systems, although MWA has worked with systems where losses have exceed 50%. Some systems currently estimate their water losses by comparing the amount of water that they pump with the amount of water that customers receive through the meter, but they often do not have information about the locations of leaks. Water providers in the Region are particularly concerned about aging infrastructure and line breaks that lead to low system pressure, outages, and bacterial problems. Locating and repairing leaks before line breakages occur and before water quality problems arise saves time and money in small water systems and ensures uninterrupted water delivery to customers. These repairs and improvements are necessary to assure that these small systems can meet minimum water quality and quantity requirements into the future.

4. Direct Water-Related Benefit to a DAC

a. Explanation of how the proposed project will address the described need of the DAC?

Many of the small water systems to be served by the Program have limited budgets and small staffs of one to three people, who often lack the technical expertise to implement system-wide leak detection projects, especially using the acoustic leak detection methods that are standard in the field. These limitations prevent regular monitoring of water losses and timely repairs of leaks. As a result, water losses accumulate over time in these aging systems, increasing water treatment and pumping costs and, in some cases, increasing rates for economically disadvantaged residents.

In Phase 1 of this Program, MWA, as the local experts, will act as an "umbrella" agency, and will manage the funding, human resources, technical work, and communications with small water systems in the Mojave Region. MWA has the expertise and the capacity to assess the needs of individual systems, and to manage a large-scale Program across the Mojave IRWM Region. This Program will identify the unaccounted water loss for each system. The Phase 1 Program (combined with the Phase 2 Program) will assist the small water system DACs in meeting their critical water supply needs through infrastructure renovations to public water supply systems that are necessary to assure continued reliability of the minimum quality and quantity of water. The Program will also result in reduced water losses in the Region, thereby assisting in achieving water conservation goals.

b. Justification that at least 25% of the project service area will benefit a water-related need of a DAC?

The Phase 1 Program for the Mojave Region includes 26 DAC small water systems. As is demonstrated in Attachment 7, each small water system meets the definition of a 100% DAC. Instead of only 25% of the Project service area benefiting a DAC, in this Project, 100% of the Project service area benefits DACs. The Project will serve the following 100% DACs in the Mojave IRWM Region:

	DAC
1	Apple Valley Foothill County Water District
2	Apple Valley View Mutual Water Company
3	Bar H Mutual Water Company
4	BarLen Mutual Water Company
5	Bighorn-Desert View Water Agency
6	Center Water Company
7	Chamisal Mutual Water Company
8	County Service Area 42
9	County Service Area 70 W4
10	Daggett Community Services District
11	Desert Dawn Mutual Water Company
12	Desert Springs Mutual Water Company
13	Gordon Acres Water Company
14	Green Valley Mutual Water Company
15	Hi Desert Mutual Water Company
16	Joshua Basin County Water District
17	Jubilee Mutual Water Company
18	Lucerne Valley Mutual Water Company
19	Lucerne Vista Mutual Water Company
20	Navajo Mutual Water Company
21	Rancheritos Mutual Water Company
22	Stoddard Valley Mutual Water Company
23	Strawberry Lodge Mutual Water Company
24	Thunderbird County Water District
25	Valley of Enchantment Mutual Water Company
26	West End Mutual Water Company

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