5 ATTACHMENT 2 – Project Justification

This attachment includes a summary of the proposed project(s), the estimated physical benefits of the project(s); justifies how the project is technically feasible; describes how the project can achieve the claimed level of benefits; and explain whether the benefits will be attained through the least cost alternative. The information contained in this attachment will be used by DWR reviewers to score questions #1 and #6-14.

The Kaweah River Basin IRWM selected two projects through its IRWM selection committee protocols to be pursued under this Implementation Grant opportunity. This process aims to fully vet each project through a selection committee made up of IRWM group members. The selection committee reviews and internally scores each project in an effort to be transparent and to allow projects supported by the group to move forward in the application. Projects are reviewed and scored by criteria developed by the group, which is based on items that are most beneficial to the IRWM group's regional water planning efforts. Detailed information for each project is included in the following sections.

5.1 Projects Summary Table

Table 4 is provided to summarize the IRWM project elements addressed by this Proposal. Each project meets at least one element.

Table 5-1: Project Summary Table (Table 4)

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table			
IRWM Project Element		Conjunctive Exchange Program	Well Abandonment Project
IR.1	Water supply reliability, water conservation, and water use efficiency	X	X
IR.2	Stormwater capture, storage, clean-up, treatment, and management	X	
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	X	
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	X	X
IR.8	Planning and implementation of multipurpose flood management programs	X	
IR.9	Watershed protection and management		
IR.10	Drinking water treatment and distribution		
IR.11	Ecosystem and fisheries restoration and protection		

5.2 Regional Map

The Kaweah River Basin IRWM boundary and location of the proposed projects included with this application are shown on **Figure 5-1**. Parcels serve as the location markers for wells scheduled for abandonment as part of the Well Abandonment Project.

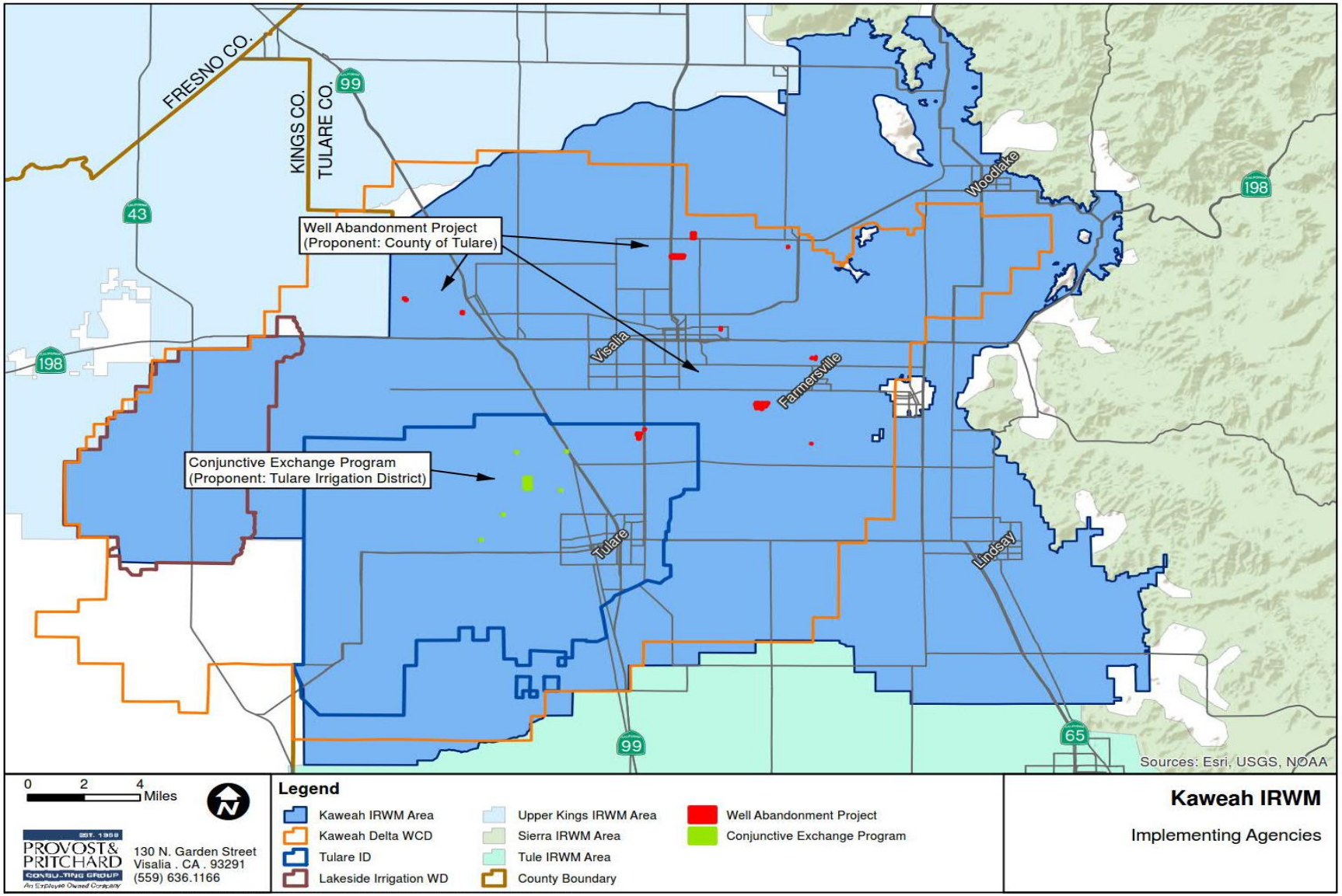

Figure 5-1: Kaweah IRWM Regional Project Map

5.3 Conjunctive Exchange Program – Tulare ID

5.3.1 Project Description

Brief: The TID Program includes: increasing an existing recharge facility, implementing a surface water exchange, and developing a groundwater study and plan to enhance recharge efforts.

Expanded: The Conjunctive Exchange Program (Program) plans to address the loss of the District's surface water supplies due to varying climate and environmental regulations, such as the San Joaquin River Restoration Program (SJRRP), by implementing an effective groundwater recharge program, expanding wet-year exchanges with other Central Valley Project (CVP) Friant Contractors and enhancing ongoing conjunctive use of groundwater within the District. Components of this Program include:

- Develop a formal Exchange Policy with terms and conditions to facilitate the exchange of water with other CVP-Friant contractors.
- Plan, design, and construct a 58-acre recharge basin (Cordeniz) as the initial phase of improvement to an existing recharge basin in order to offset the loss of surface water and reduce groundwater overdraft. Approximate storage capacity of the improved basin is 300 AF.
- Perform a Groundwater Recharge Capacity Study (Study) which includes developing a water balance of the District and estimating overdraft within its boundaries.
- Implement a Groundwater Recharge Basin Strategic Plan (Strategic Plan) to guide future planning of recharge projects that will address the loss of surface water supplies and the ability to sustain/expand conjunctive use operations.

Tulare ID is a CVP Friant Contractor (Class 1 and Class 2) and holds pre-1914 surface water rights on the Kaweah River. Collectively, these sources generate an average annual surface water supply of approximately 163,000 AF to meet demand and, in years of excess, recharge deliveries. Given the inherit variability of surface water supplies TID developed a conjunctive use system by which groundwater from landowner wells is used to make up the shortfall in surface water supplies. Over the last several decades, TID has observed groundwater elevations declining, on average, approximately 8.3 inches per year because farmers were forced to supplement the shortfall in surface water with groundwater in order to satisfy crop needs. Groundwater levels vary with the wet and dry hydrologic cycles but the long-term average trend is downward. This trend is anticipated to continue and possibly increase due to existing demands on groundwater in the area as a result of drought conditions, other regulations, and compliance with the SJRRP. TID estimates, on average, 20% of its CVP supply will be redirected to the SJRRP.

As TID faces the loss of surface water supplies it's anticipated there will be increased demand upon groundwater to meet irrigation demands, which has the potential to significantly impact groundwater and exacerbate declining water levels. Limited dry year surface water supplies will be diminished further to meet crop demands and wet year recharge water will be lessened due to increased reliance by all CVP Contractors on this source of water. Thus, a goal of the Program is to leverage dry year surface water supplies into a beneficial exchange agreement with other CVP Contractors allow TID to increase its wet year recharge supplies and bolster groundwater availability. The Cordeniz Basin and Strategic Plan aim to increase the recharge capacity of TID with the intent of providing a stable supply of groundwater in dry years that all can access and stabilize conjunctive use within TID.

5.3.1 Project Map

See **Figure 5-2** for a map of the Cordeniz and Enterprise Basins.

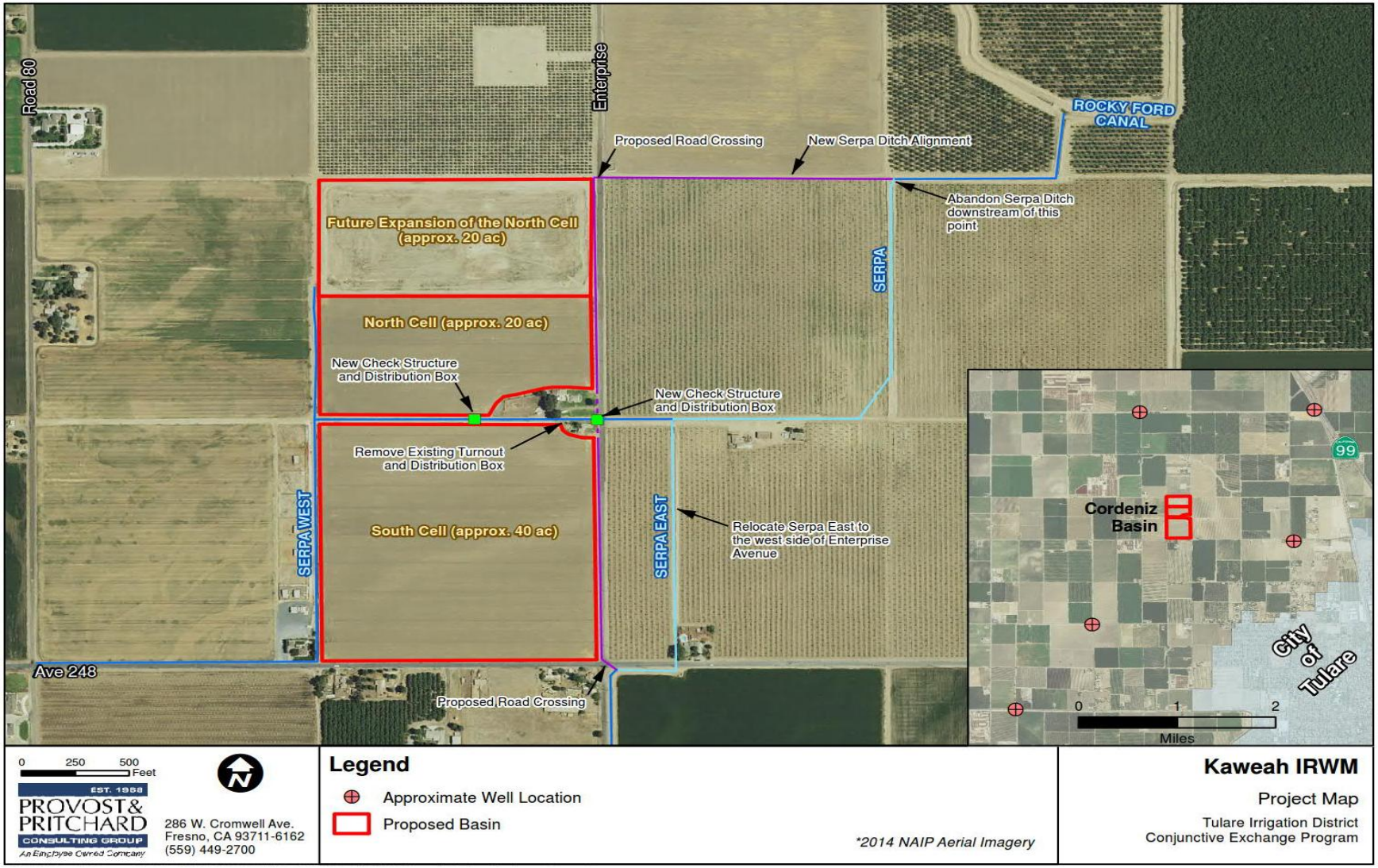

Figure 5-2: Conjunctive Exchange Program Location Map

5.3.2 Project Physical Benefits

The next two tables show the physical benefits to be gained by the Program. The primary physical benefit is an increase to the surface water supply through an Exchange Policy with the U.S. Bureau of Reclamation (USBR). The secondary physical benefit from the Program will be increased groundwater recharge capacity gained through construction of the Cordeniz Basin and better basin management developed through the Groundwater Recharge Basin Strategic Plan.

Table 5-2: Conjunctive Exchange Program Primary Physical Benefits (Table 5a)

Table 5a – Annual Project Physical Benefits **Project Name: Tulare Irrigation District Conjunctive Exchange Program** **Type of Benefit Claimed: Increased Water Supply** **Units of the Benefit Claimed : Acre-Feet per Year (AFY)** **Anticipated Useful Life of Project (years): 30**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
30	0	5,700 AFY	5,700 AFY (170,000 AF for Project Life)
Comments: Primary benefit is increased water supply in AFY from the Exchange Policy to leverage additional wet year water supplies for recharge.			

Table 5-3: Conjunctive Exchange Program Secondary Physical Benefits (Table 5b)

Table 5b – Annual Project Physical Benefits Project Name: Tulare Irrigation District Conjunctive Exchange Program Type of Benefit Claimed: Increased Groundwater Recharge Capacity Units of the Benefit Claimed : Acre-Feet per Year (AFY) Anticipated Useful Life of Project (years): 30			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015	0	0	0
2016	0	975	975
2017	0	1,950	1,950
2018	0	2,925	2,925
2019	0	3,900	3,900
2020	0	4,875	4,875
2021	0	5,850	5,850
2022	0	6,825	6,825
2023	0	7,800	7,800
2024	0	8,775	8,775
2025	0	9,750	9,750
2026	0	9,750	9,750
2027	0	9,750	9,750
2028	0	9,750	9,750
2029	0	9,750	9,750
2030	0	9,750	9,750
2031	0	9,750	9,750
2032	0	9,750	9,750
2033	0	9,750	9,750
2034	0	9,750	9,750
2035	0	9,750	9,750
2036	0	9,750	9,750
2037	0	9,750	9,750
2038	0	9,750	9,750
2039	0	9,750	9,750
2040	0	9,750	9,750
2041	0	9,750	9,750
2042	0	9,750	9,750
2043	0	9,750	9,750
2044	0	9,750	9,750
2045	0	9,750	9,750
Comments: TID has approximately 1,300 acres of basins (including the Cordeniz Basin). The goal is to increase recharge 0.25' per acre per day. Implementing management over the next 10 years (improving approximately one tenth of the acreage each year to 2025), TID will significantly improve annual recharge capacity. Estimates based on District historical average of 30 days per year for recharge.			

5.3.3 Technical Analysis of Physical Benefits Claimed

5.3.3.1 Explanation of need for the project, including recent and historical conditions that provide background for benefits claimed

The District currently faces an overdraft situation that is the result of groundwater extractions in the region exceeding average annual recharge of surface water. In wet years, landowners can rely upon surface water to meet crop demands and the District also can conduct groundwater recharge operations. However, in dry years the District lacks sufficient surface water supplies to meet crop demand or any groundwater recharge; therefore, landowners must almost solely rely upon groundwater from deep wells to meet crop demands, which has been the case for the past three years. In the near term, farmers are able to rely upon deep wells to meet any water demands not met by the District. However, as landowners continue to rely upon groundwater and as depths to groundwater increase, the cost and ability to meet crop demands may become financially and logistically unrealistic.

Over the long-term horizon, the District anticipates a 20% loss in CVP Friant supplies on average due to the San Joaquin River Restoration Program (SJRRP), which equates to approximately 15,000 AF of water annually. Much of this loss comes from the reduction in Class 2 supplies (about two-thirds of the total) and this poses a significant adverse impact on the District's ability to carry out its conjunctive use practices and sustain groundwater supplies.

TID estimates that to replace the surface water supply lost to the SSJRP it would cost the District $750,000 in wet years and $4.5 million[1] in dry years, assuming the water was available to purchase. The other compounding problem is that as the CVP Friant system as a whole loses water to the Restoration Program, therefore there is less water for the District to access in both dry years and wet years. In such years Friant contractors will have increased competition amongst themselves to acquire surface water supplies therefore driving up the cost as collective attempts are made to acquire supplies to meet demands.

Since the District's formative years in the early 1900s, conjunctive use of surface and groundwater has emerged as the key strategy to manage its highly variable water supply and TID has been one of the forerunners in this practice. Recharge basins were added over time to capture the high flows of the Kaweah River system, and the District later secured a contract for a large share of Class 2 water from the Friant Unit to further maximize its conjunctive use and recharge capabilities. Excess supplies available within the Friant system, along with the regular occurrence of flood releases to the San Joaquin River below Friant Dam continue to represent the near exclusive means to restore the lost water supply dedicated to the Restoration Program. Taken together, the three core elements of this Program, i.e., the Cordeniz Basin for recharge, the Exchange Policy to provide Class 1 water in Millerton Lake in dry years and thereby incentivize leveraged exchanges, and a study and plan to advance groundwater recharge within TID and the larger Kaweah Region, represent a meaningful step to expand the conjunctive use operations of the District and thereby mitigate for

[1] Based on current market prices being $50/AF in wet years and $300/AF in dry years. During drought conditions the District has seen surface water values in excess of $1,500 per acre foot.

impacts from drought, climate change and/or the SSJRP. Many of the data and tools also gathered through the Program have been designed to assist TID in addressing SGMA.

From a recharge capacity standpoint, TID currently utilizes an array of basins (1,250 acres in total) to replenish the aquifer. Collectively, these basins are able to recharge at a rate of approximately 250 cubic feet per second (CFS), or 500 AF per day. In years when excess surface water is available TID is often recharging at the maximum capacity available, i.e., 250 CFS. With a distribution system capable of conveying approximately 1,000 CFS, TID has the potential to increase its recharge efforts with additional basins. The Program intends to address this situation by initially adding recharge capacity through development of the Cordeniz Basin. In the long run, the Capacity Study and Strategic Plan together will provide information necessary to identify and develop future groundwater exchange/recharge programs, and improve and maintain a maximum rate of recharge capacity within the District.

5.3.3.2 Estimates of without-project conditions

Without the Program TID will not receive additional wet year water supplies to deliver and/or recharge to groundwater. The recharge capacity within the District would remain stagnant or have minimal improvement as there would be no guiding policy for enhancement. Operations would continue as they have been and the ability to obtain more water for recharge and recharge capacity will be diminished. The District would continue to lose surface water to the SJRRP and other impacts, which would exacerbate overdraft conditions and the downward trend in groundwater levels.

5.3.3.3 Description of methods used to estimate physical benefits

Increased Water Supply:

A model was developed for the Friant Water Authority, known as the Steiner Model was developed to quantify impacts of the SJRRP on CVP contract holders. This model evaluated 80 years of CVP records and applied conditions associated with the SJRRP. The SJRRP takes water originally scheduled to CVP contractors and routes it the San Joaquin River to restore natural flows. The model was applied to each CVP contractor; TID's forecast is included in **Attachment 2 – Appendix A**. According to this model TID can lose approximately 20% of its CVP supplies, or approximately 15,000 AF per year. This reduction in supply is significant since it primarily impacts Class 2 water, a major source for TID. This reduction is significant because it reduces TID's Class 2 supplies which occur during wet years when they are trying to recharge as much water as possible. This led to the need to determine methods to bring wet year water back to the District, and the start of the proposed Exchange Policy.

TID is primarily a wet year water provider, meaning that in very dry years no water is delivered into the District even if there are contract supplies available. In years such as these, TID aims to develop an exchange with CVP contractors that need water in dry years and can give up excess water in wet years. Based on the Steiner Model, TID anticipates that it can make approximately 2,800 AF of Class 1 supplies available each year. In return, TID would like to leverage a 3:1 exchange which would make 8,500 AF available to TID. This nets the District 5,700 AF per year, which is shown in **Table 5-2**.

Increased Recharge Capacity:

TID is situated in the lower part of the Kaweah River alluvial fan where highly permeable sands are located. On the northeastern portion of the District the soils tend to be sandy and to the southwest, towards the historical Tulare Lake Bed area the soils become heavier. Typical infiltration rates within the District range from 0.25 to 0.75 feet per day. Aside from localized cones of depression, groundwater flows in a southwesterly direction across the District. The Capacity Study and Strategic Plan will attempt to use this knowledge and gain more in an effort to determine methods for increasing the recharge capacity within TID through the addition of recharge basins and best management practices that will improve recharge rates of existing basins. With the Cordeniz Basin, TID will have approximately 1,300 acres of recharge basins. The goal is to increase the recharge rate 0.25 feet per day, which would equate to an additional 325 AF per day of recharge. Historically, TID has approximately 30 days of excess water for recharge per year. With this increased recharge rate, TID could recharge an additional 9,750 AF per year. Benefits presented in **Table 5-3** show gradually implementing (first ten years) a maintenance program that improves recharge rates. After the ten year implementation, the maintenance is continued to preserve the higher recharge rates.

5.3.3.4 Identification of new facilities, policies, and actions required to obtain the physical benefits

Several actions are required to obtain the physical benefits of the Program including construction of a recharge basin, performing a study of TID's groundwater balance, and implementing strategic plans and policies that aim to bring more wet year water supplies into the District for recharge. For immediate increases in recharge capacity, TID will construct the Cordeniz Basin. This project consists of developing approximately 60 acres into a new recharge site that would receive wet year recharge water. Also, as part of this project the existing Serpa Ditch – the main lateral for this area – will be realigned and improved so that it conveys water more effectively to this basin.

The Cordeniz Basin is only one small step in the longer-term effort by TID to restore and expand upon its conjunctive use operations. TID is proposing to conduct a Capacity Study that includes development of a detailed water balance along with identifying ways to improve conjunctive use within the District. This study will be conducted by an engineering firm specializing in water resources and has a good understanding of the District and its facilities. The scope of work for this investigation is expected to include, at a minimum, the following:

- Surface water diversions into the District (primarily from a System Optimization Review Study recently completed for TID), storm water from the City of Tulare, groundwater pumped by the District, and spills by the District.
- District cropping, irrigation methods and application efficiency.
- Records on the flows in Packwood, Cameron and Dry Creeks.
- Precipitation for the period of record and estimate the amount of precipitation used by crops.

- Groundwater contours for the area (TID and KDWCD from 2000 to present) and long-term hydrographs to develop an estimate of the groundwater flowing into and out of the District. Also, determine average rates of groundwater decline in areas of the District.
- Use irrigated demand of crops, reduced by effective precipitation and District water deliveries to estimate the approximate amount of groundwater pumping to support agriculture in the District.
- Groundwater pumping by all local communities with public water systems utilizing groundwater.
- Develop a simple water balance to quantify the groundwater overdraft conditions within the District.
- Review surface water delivery information developed in the SOR Study and estimated average annual impacts from San Joaquin River Restoration flows.
- Identify the surplus water supply periods seen from 2000 to present and develop estimated quantities of surplus water available.
- Given the evaluations of available supply, potential supply limitations, and current rate of overdraft; develop estimates for necessary recharge facilities to address needs based on varying recharge rates.

Once the amount of acreage has been determine to reduce and/or eliminate groundwater overdraft, TID and its consultant will move into the next phase of the Program which is to develop the Groundwater Recharge Basin Strategic Plan (Strategic Plan) to determine the best locations for future recharge basins. The Strategic Plan may include, but is not limited to the following:

- Evaluation of cost to acquire lands across the District (row vs. permanent, developable vs. rural).
- Investigation of Natural Resources Conservation Service (NRCS) soil mapping across TID.
- Review of publicly available aerial photography to identify old stream or creek channels.
- Work with TID Staff and Board of Directors on strategically developing recharge facilities.
- Determine where the facilities should be located given depths to water and restrictive clay layers that may be present.
- Determine where the most economical locations to develop basins are.
- Determine what areas would have the highest recharge rates.
- Given proposed locations, determine if other infrastructure improvements be needed to take full advantage of the new facilities when surplus water is available.
- Determine the price of water thresholds that TID is willing to pay for recharge/exchange water.
- Translate this vision into a set of achievable goals and develop timeframes to meet these goals.
- Presentation to District landowners on the District's desire to develop additional basins and their desire to buy from willing sellers of suitable ground.
- Recommendations on potential funding opportunities and deadlines for project develop preparation.

- Identify any regional partnership (i.e. Kaweah Delta WCD, City of Visalia, City of Tulare, local ditch companies, J.G Boswell, Corcoran ID, and Tulare Lake Basin WSD) that could be leveraged to further the recharge basin development effort.
- Provide a District map with prioritized groundwater recharge capacity zones.

TID will develop an Exchange Policy that will outline the utilization of water for future recharge programs, terms and conditions for acquiring water, and payback terms. The Exchange shall leverage the District receives wet year water (typically Class 2 or other wet-year Friant water) in exchange for making water (typically Class 1) available at Millerton Lake for dry year paybacks. Potential exchange rates are summarized in **Table 5-4**. A ledger for each exchange shall be kept by the District and made available to the Bureau of Reclamation and CVP exchange partner(s) for their review.

Table 5-4: Proposed Exchange Ratio Table

Class 1 Percentage (%) Greater than or equal to	Return (AF) (Dry Year)	Ratio (Wet Year)
0	0	1
50	4,000	4.5
60	4,500	4
70	5,000	3.75
80	5,500	3.5
90	6,000	3
100	6,500	2.75

5.3.3.5 Description of any potential adverse effects (if none, explain)

The Program requires several components to make it successful; however, none of the components are expected to have any potential adverse effects within TID or the Kaweah Region as a whole.

Exchange Policy: The Exchange Policy will be subject to a NEPA analysis and an Environmental Assessment. The Exchange Agreement itself is not anticipated to have any environmental impacts, as it is a program intended to increase surface water supplies to the District through a structured exchange that benefits the District. The District has processed numerous limited-term exchange agreements through the Bureau and the NEPA process without environmental issues.

Capacity Study and Strategic Plan: The Capacity Study and Strategic Plan are reports, which of themselves would not cause adverse effects. However, actions that come as a result of the recommendations in these reports may have potential adverse effects, which will be addressed during the development of the project. .

Cordeniz Basin: The Cordeniz Basin portion of the Program will involve a significant amount of earthwork, new SCADA equipment, construction of inlet/outlet facilities and meter structures, and the realignment and improvement of the TID's Serpa Ditch, which will deliver surface water to the proposed basin. The new basin will be constructed on property that was recently farmed in row crops. As a part of the environmental review process under the USBR grant, this portion of the project has completed both NEPA and CEQA analyses and no adverse effects were identified.

Endangered/Threatened Species: There are no anticipated endangered or threatened species near the Cordeniz Basin. An initial Biological Assessment was performed as part of the environmental review for the USBR grant and nothing significant was discovered. Construction of this basin will also be conditioned with mitigation measures in the event an endangered species is encountered. TID has constructed projects in the vicinity (within 5 miles) and has noted in previous CEQA documents the potential for the San Joaquin Kit Fox and the Swanson's Hawk. Neither species were discovered during biological site visits, nor during construction; however, TID will ensure that, prior to and during construction, mitigation measures will be implemented to reduce and/or eliminate any potential impacts.

Wetlands Within the Project Area: There are no known wetlands areas within the basin area. The property is actively farmed and does not contain any standing water. The property is regularly planted, irrigated and disked, therefore eliminating the potential for wetlands to exist.

Age of Delivery System: TID was formed on September 21, 1889, with many of the District-served lands being annexed in 1948. From a historical perspective, some features within TID can be over a century old. However, TID performs routine maintenance on its facilities including turnouts, check structures, pump facilities, canals, basins, etc. From previous analyses for other NEPA and CEQA documents, TID has found that many of its structures and facilities are old, but are not of any historical significance.

Modification to Features: Development of the Cordeniz Basin includes realignment of the Serpa Ditch that will feed the basin. The age of the ditch and features are unknown, but it can be assumed to be over 50 years in age. Although these structures and facilities are old, they do not represent any historical significance and have been significantly modified over time due to maintenance and operation practices.

Historical Buildings, Structures or Features and Archeological Sites: There are no known historical buildings, structures or features, or Archeological sites as a part of the Program or in the vicinity of the affected property (Cordeniz Basin).

5.3.3.6 Description of whether proposed project effectively addresses long-term drought preparedness

Yes, the proposed Program will effectively address long-term drought preparedness in a number of ways. Benefits from the Program include:

- Promoting water conservation, conjunctive use, and reuse;
- Improving groundwater basin management; and
- In the long-term as the Strategic Plan is being implemented and more basins are constructed, the reduction of water use.

The District believes that will be conserved through the Exchange Policy and development of more recharge basins. Excess water in wet years that would typically be lost, can be delivered to TID and put into new or improved basins. This wet year water can now be beneficially reused during dry periods in a conjunctive use fashion. Conserving wet year water and operating as a successful conjunctive use District, TID will be able to better manage the groundwater basin and reduce and/or eliminate any groundwater overdraft conditions.

This better management won't only be seen by TID, but will positively impact the entire Kaweah Groundwater Sub-basin with more surface water being brought into the region for recharge. Additionally, as new basins are incorporated into the system, they will generally replace active farming. Replacing active fields will reduce long-term water use by providing locations with direct groundwater recharge and no demand. Consumption could be reduced in the range of 3 to 8 acre-feet per acre with new basin locations.

5.3.4 Direct Water-Related Benefit to a DAC

The proposed Program does provide water-related benefits to DACs not only within TID's boundary, but to the Kaweah region as a whole. Groundwater is the primary source of drinking water within the Kaweah region. Declining groundwater levels have led to issues with meeting water supply for residential homes. With implementation of the Program, TID will increase the amount of wet year water brought into the region and their District boundary and used to recharge the groundwater. The increased recharge efforts aim to reduce groundwater overdraft and stabilize groundwater levels.

There are several DACs within the Kaweah region, which are discussed in Attachment 7 of this proposal. Some of these DACs are located within TID, such as the city of Tulare and the community of Okieville. The location of the Cordeniz Basin is in between the city of Tulare and Okieville. This location is known by TID to have high depths to groundwater, which cause groundwater to flow away from areas with shallower depths to groundwater and potentially away from supply wells. By constructing a new recharge basin in this area, groundwater levels are expected to rise and flatten the gradient. Flattening the gradient will stabilize groundwater levels and make for a more reliable source. The Cordeniz Basin can provide this effect of increasing groundwater levels, which benefit the water supplies for both the city of Tulare and Okieville. Finding more locations like this through the Capacity Study and Strategic Plan will lead to new recharge basins and further stabilization of groundwater levels thereby improving the reliability and improve a more reliable drinking water supply. Additionally, the increased surface water brought to the area will reduce the stress on groundwater because a greater portion local agricultural demand will be satisfied by additional surface water.

5.3.5 Project Performance Monitoring Plan

Table 5-5: Conjunctive Exchange Program Performance Monitoring (Table 6)

Table 6 – Project Performance Monitoring Plan Project: Conjunctive Exchange Program		
Proposed Physical Benefits	**Targets**	**Measurement tools and methods**
Increased Water Supply	- 3:1 leveraged exchange that nets 5,700 AFY in more surface water supplies to TID	- Exchange Policy in place by end of 2016, in effort to have at least one exchange in place by end of 2017 - Exchanges average 3:1 in TID favor. This will be tracked by the amount of water brought in via the exchange and compared to what supply would have been without exchange.
Increased Recharge Capacity	- Increase quantity of water recharged per acre per day - Increase TID total recharge capacity	- Develop annual basin maintenance program to increase basin recharge capacity. Increase will be measured by water quantities delivered to basins and compared to TID records - Increase acreage of recharge through new basins. This will be measured through number of acres of basins added.

5.3.6 Cost Effective Analysis

The cost-effective analysis for the Program has been performed and provided in Table 7.

Table 5-6: Conjunctive Exchange Program Cost Effectiveness Analysis (Table 7)

Table 7 – Cost Effectiveness Analysis **Project name: Conjunctive Exchange Program**	
Question 1	Types of benefits provided as shown in Table 5 -The primary benefits of the Program shown in Table 5a are increased water supply in acre-feet per year (AFY). The increased supply will enable TID to increase its groundwater recharge efforts and reduce groundwater overdraft in the area. -Secondary benefits associated with the Program, shown in Table 5b, are increased recharge capacity in AFY. The increased capacity will enable TID to make fuller use of its distribution system to deliver water for recharge efforts in wet or flooding periods.
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? If no, why? If yes, list the methods (including the proposed project) and estimated costs. - This Program, with its included Capacity Study and Strategic Plan, can be viewed as the method for considering basin alternatives that would achieve the same types and amounts of physical benefits as the Cordeniz Basin proposed in this application. Additionally, there really is no alternative method for achieving more wet year water supplies for TID than through an exchange. Currently, there are no new water supply sources and the existing water supplies are seeing declines due to drought and increased regulation. TID continually looks to improve its wet year water supplies and recharge capacity, and this Program is set up so that TID has strategic guidance for considering alternatives in the future. Given that there are no new surface water supplies, the only method to address groundwater concerns is to better manage the existing supplies that the District has access to.
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. -This Program is considered the least cost alternative. The Cordeniz Basin location is adjacent to an existing basin that has high recharge rates due to sandy soils in the area. With higher recharge rates, the basin construction will cost less per acre-foot recharged than a basin built in tighter soils. Additionally, the Capacity Study and Strategic Plan will guide TID in future basin projects. Performing the Study and Plan are much cheaper than going after basin locations with no real plan and potentially purchasing and building in a location that does not recharge well.
Comments: N/A	

5.4 Well Abandonment Project – County of Tulare

5.4.1 Project Description

Brief: Tulare County's project consists of properly abandoning 100 wells near DACs to reduce the groundwater contamination risk, thereby protecting water quality in the region.

Expanded: Groundwater contamination is a pervasive problem particularly impacting critical water supplies for DACs in the Region. Almost exclusively dependent on groundwater for drinking water supplies, many community water systems and private household wells struggle to provide safe potable water to their consumers. To address this problem initially, the County proposed the Groundwater Quality Protection and Investigation Project in the 2011 Implementation Funding opportunity. This initial project undertook a three-phase approach: (1) eliminating pathways for contamination in vulnerable areas; (2) developing solutions for those areas; and (3) planning for improvement in water quality delivery. This project integrated a number of different water management strategies (source water protection, education, data collection, and development of engineered solutions) to address groundwater supply and quality challenges and was developed through collaboration with multiple stakeholders and organizations focused on disadvantaged communities. During this original process the County found that there were numerous abandoned and unused wells needing proper abandonment in addition to the wells already proposed to be abandoned in the project. This led to the need for another phase, and is the purpose of the currently proposed Well Abandonment Project (Project).

This Project aims to properly destroy 100 wells in and around DACs and will engage with DAC residents and nearby landowners to spread awareness of the Region's water quality challenges. By doing so, this project addresses critical water supplies for disadvantaged communities, environmental justice, and water quality challenges in the region, all of which are priorities for the Kaweah River Basin IRWM Plan. Removal of potential conduits (abandoned wells) through which groundwater contamination could occur is one benefit of the Project. Another benefit is improving water supply reliability to DACs. The water quality issues, and now supply issues due to the on-going drought have made many wells unusable leaving many without a reliable water supply. Tulare County Ordinances require these wells be properly abandoned prior to be connecting to a more reliable supply or drilling of a new well. Since DAC residents lack the financial means to have a well properly abandoned funding this Project will help alleviate some of these issues and provide them with a reliable supply. Thus, this Project integrates a number of different water management strategies (source protection, education, and data collection) to address groundwater quality and supply challenges for DACs in the Region.

5.4.2 Project Map

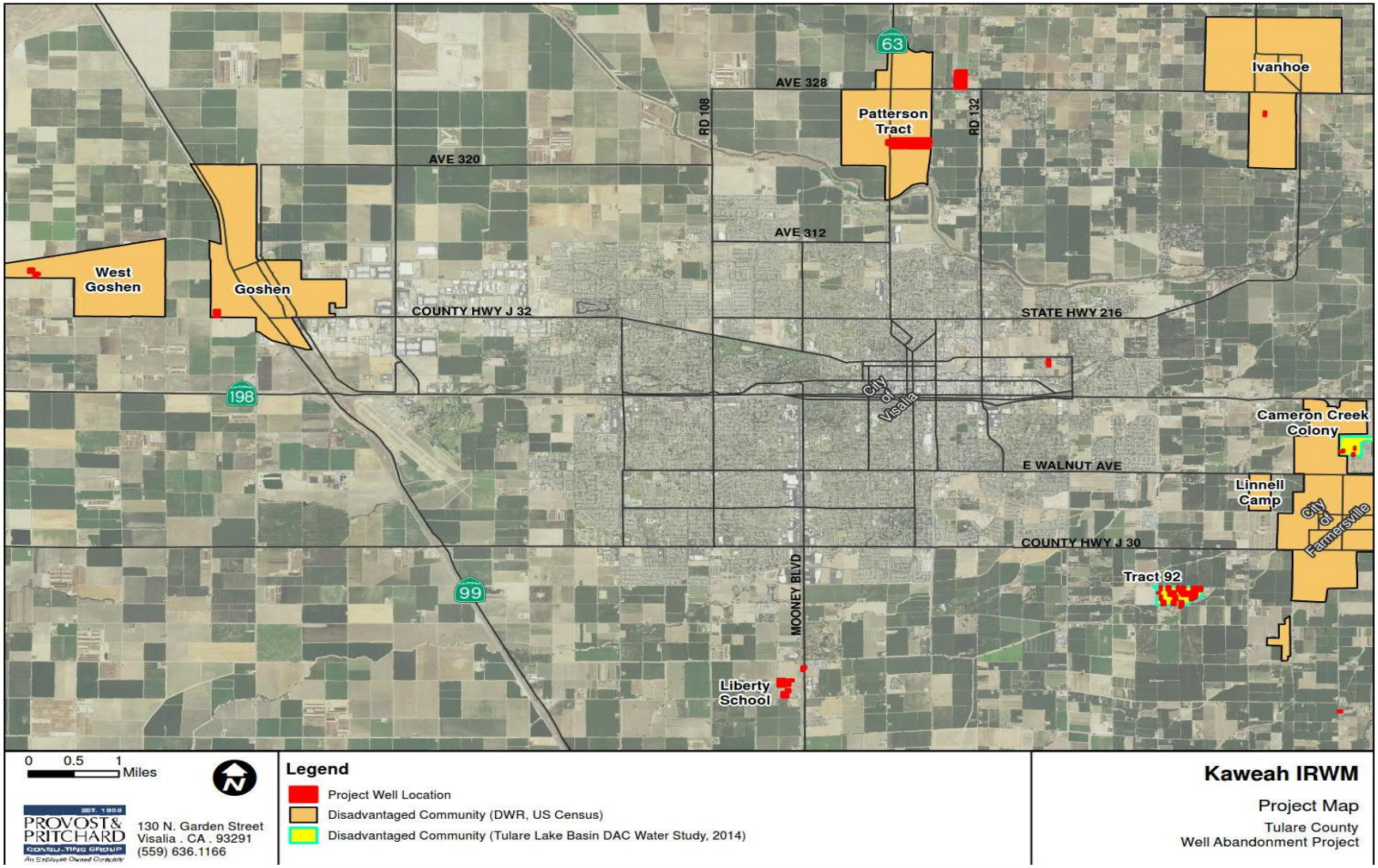

Figure 5-3: Well Abandonment Project Map

5.4.3 Project Physical Benefits

The next two tables show the physical benefits to be gained by the Project. The primary physical benefit is an increase in water supply reliability for DACs in the Kaweah region. The secondary physical benefit from the Project will be to improve groundwater quality through reducing the potential for contaminant concentration by a percentage each year.

Table 5-7: Well Abandonment Project Primary Physical Benefits (Table 5a)

Table 5a – Annual Project Physical Benefits Project Name: County of Tulare Well Abandonment Project Type of Benefit Claimed: Increase local water supply reliability and the delivery of safe drinking water Units of the Benefit Claimed : Acre-Feet per Year (AFY) Anticipated Useful Life of Project (years): 30			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
30	0	50 AFY	50 AFY (1,500 AF for Project Life)
Comments: Assumed that water supply demand for each well was 0.5 acre-feet per year (AFY). Proper abandonment of 100 DAC wells so the communities to can connect to a reliable source would lead to 50 AFY for the next 30 years.			

Table 5-8: Well Abandonment Project Secondary Physical Benefits (Table 5b)

Table 5b – Annual Project Physical Benefits Project Name: County of Tulare Well Abandonment Project Type of Benefit Claimed: Groundwater Quality Improvement (Reduction of groundwater contaminant concentration) Units of the Benefit Claimed : mg/L per year Anticipated Useful Life of Project (years): 30			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
30	0	0.5%/year	0.5% mg/L per year.
Comments: Aiming to reduce contaminant concentration by 0.5% from the previous year for 30 years.			

5.4.4 Technical Analysis of Physical Benefits Claimed

5.4.4.1 Explanation of need for the project, including recent and historical conditions that provide background for benefits claimed

In 2009 the County of Tulare tested 357 public water systems in the County and found that 45 of those wells (12.6%) violated at least one State or Federal minimum contaminant levels (MCLs) for drinking water supplies. The County also considers water systems with water quality constituents that are within half of the State or Federal MCLs to be at risk candidates for potential exceedance of State or Federal MCLs. Of the

357 public water systems in the County tested, an additional 54 wells (15.1%) were within half of the State or Federal MCLs and therefore considered at risk. In an associated effort, the County tested 546 private wells in the County and found that 136 wells (24.9%) violated at least one of the State or Federal MCLs for drinking water supplies. Also, an additional 127 wells (23.2%) were within half of the State or Federal MCLs and therefore considered at risk. This information shows that there are significant water quality concerns in Tulare County for both private and public water systems, and that efforts to contain groundwater contamination and reduce available contaminant migration pathways have significant potential for regional water quality benefits.

In addition to quality problems in existing wells, the on-going drought has led to an increased reliance on groundwater by all within the Kaweah Region. This increased reliance has caused groundwater levels to decline leading to numerous wells to going dry (over 1,400 in Tulare County). Dry wells have forced residents to abandon or leave a well unused as they search for other ways to get water. However, per Tulare County Ordinance, to connect to another system or drill a new well, the unused well must be properly abandoned. Proper abandonment is expensive and beyond the financial capacity of those living within a DAC.

5.4.4.2 Estimates of without-project conditions

Without the Project, the wells would remain abandoned and un-used. The potential for contamination would remain and the residents in the DACs would not be able to hook-up to clean, reliable sources of supply.

5.4.4.3 Description of methods used to estimate physical benefits

The benefits from this Project are very difficult to quantify based on a unit of measure because the most significant benefits accrued through the project are the removal of potential conduits (abandoned wells) through which groundwater contaminant could occur. The risk of potential contamination associated with each abandoned well is very significant given the potential damage to groundwater resources that can occur at any single location from illegal dumping. Abandoned wells are in rare cases used as dumping sites for materials that were never intended to enter a groundwater aquifer, and more commonly can also allow the migration of contaminated groundwater if the abandoned well is perforated across multiple aquifers and the flow is from higher elevation to lower elevations. Although it is understood that proper well abandonment will not lead to avoided water quality issues there is a definite benefit from removing risks associated with properly destroying 100 wells.

One physical benefit that will be realized through the Project is that DACs and residents will be able to legally connect to a reliable water source with their unused wells properly abandoned. Estimates for increased water supply reliability were based upon an assumed demand per well of 0.5 acre-feet per year (AFY). Once all 100 wells have been abandoned, this would lead to an increased water supply reliability of 50 AFY for projected project life of 30 years, as shown in **Table 5-7**.

The other physical benefit is groundwater quality improvement through the reduction of potential contaminant sources and thus a reduction in contaminant concentration. As mentioned earlier, it is rare that abandoned wells are used as regular disposal locations, but there are confirmed instances where this has

happened. For the purposes of this benefit discussion it will be assumed that this situation generally occurs in one out of 200 abandoned domestic wells (0.5%) in Tulare County. This general ratio is not rooted in any empirical data, but is a reasonable approximation that has been ground-truthed with several knowledgeable regulators and professionals in the area. In this hypothetical instance a contaminant (DBCP, EBD, nitrate, salt, etc) is dumped into the abandoned well at periodic intervals so that a concentration of this contaminant develops near the well. As groundwater is pumped through the year this concentration of contaminant moves out away from the source well and creates a plume of contaminated groundwater in the area. The contaminant source well is located near other active domestic wells, so over time water in the adjacent active wells will be impacted to such a degree that the groundwater supply becomes unusable as a drinking supply. The logic is that as wells are abandoned potential contaminant sources are blocked preventing further contamination. As sources are eliminated the contaminant concentration would gradually drop as uncontaminated recharge takes its place. While it is difficult to quantify the specific concentration removed each year, the goal is to reduce the concentration by the same 0.5% from the previous year. See **Table 5-8** for a summary of benefits.

5.4.4.4 Identification of new facilities, policies, and actions required to obtain the physical benefits

The primary action associated with the Project would be physical deconstruction and abandonment of the selected wells. This will be performed by an approved contractor selected through a public bid process with the County of Tulare. To obtain the full water supply benefits additional infrastructure (i.e. wells, pumps, pipe, etc.) may be needed for DAC residents to connect to a reliable supply, if they are not already in place. No new policies are required as the action associated with the Project a requirement of an existing policy (Tulare County Well Ordinance) whereby unused/abandoned wells must be properly abandoned prior to connecting to a new source.

5.4.4.5 Description of any potential adverse effects (if none, explain)

There are no adverse effects expected from the Project as the wells already in place and there would be no new construction. Proper abandonment would prevent the potential adverse effect of contaminants reaching groundwater, the primary drinking supply for most in the Region.

5.4.4.6 Description of whether proposed project effectively addresses long-term drought preparedness

The Project will aim to effectively address long-term drought preparedness through effective groundwater basin management. The Kaweah Region as a whole benefits from groundwater protection efforts. Groundwater is the primary source of drinking water in the Region and when dry years and drought reduce the surface water supply, even more importance is put on this resource. When sole reliance is placed on groundwater to supply drinking water it needs to have good quality since many in the region do not have the financial resources to afford well-head treatment or install a new well. Managing the quality of the groundwater basin allows the Region to be prepared for drought conditions as it will be a clean and reliable source to draw from.

5.4.5 Direct Water-Related Benefit to a DAC

The Project is being implemented on behalf of DACs; therefore, DACs receive direct water-related benefits from the Project. As shown in Attachment 7 of this proposal, there are several DACs within the Kaweah Region. The Project is set to properly abandon wells for DACs such as Goshen, Patterson Tract, and Tract 92. By abandoning wells that are dry or have quality issues, DACs such as these can tie into an adjacent water system that provides clean and reliable drinking water. For those that opt to have a new private well, the Project will benefit them by protecting the groundwater source in which they are drawing from further contamination.

5.4.6 Project Performance Monitoring Plan

Table 5-9: Well Abandonment Project Performance Monitoring Plan (Table 6)

Table 6 – Project Performance Monitoring Plan **Project: Well Abandonment Program**		
Proposed Physical Benefits	**Targets**	**Measurement tools and methods**
Increase Water Supply Reliability	- New source for all that previously used the wells to be abandoned through the Project.	- Verify water source for those that used the well. This will be done by contacting the owner that signed the permission forms. Goal to have 100% of the users connected to the new source within 6 months of abandonment
Groundwater Quality Improvement	- Reduce groundwater contaminant concentration by 0.5% (mg/L) of previous year's concentration	- Review readily available groundwater quality data and analyze contaminant concentrations. Track annual concentration and evaluate rate of concentration reduction from year to year.

5.4.7 Cost Effective Analysis

The cost-effective analysis for the Well Abandonment Project is summarized below in Table 7.

Table 5-10: Well Abandonment Project Cost Effective Analysis (Table 7)

Table 7 – Cost Effective Analysis **Project name: Well 15 Water Quality Protection Project**	
Question 1	Types of benefits provided as shown in Table 5 -The primary benefit shown in Table 5 is increased water supply reliability for delivery of safe drinking water. With this Project, DACs will be able to access more reliable sources of safe drinking water -Secondary benefits associated with the Project, shown in Table 5b, is improving groundwater quality by reducing contaminant concentration. By eliminating conduits for contaminates to reach groundwater, the Project hopes to gradually reduce contaminant concentrations each year.
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? If no, why? If yes, list the methods and estimated costs. No, other alternatives have not been considered at this time for this phase of the Project. Proper well abandonment is a requirement under Tulare County Ordinance Section 4-13-1245. While connection to water systems or drilling new wells may be a direct result of the Project, this effort is focused on the proper abandonment that can facilitate those actions occurring at a sooner date.
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. The proposed alternative is viewed as the least cost alternative as it is a required action. It is also action that facilities various options that provide a reliable source of water supply to the DACs impacted by the project.
Comments: N/A	

ATTACHMENT 2 – PROJECT JUSTIFICATION

APPENDIX A

Steiner Model – TID Estimates

Table A-3. Estimated Average Annual Reductions Average in Friant Water Supplies

Contractors	Avg. Friant Supply w/o Settlement (af)		Avg. Reduction w/ Settlement (af)		Reduction as % of Avg. Supply		
	Class I	Class II	Class I	Class II	Class I	Class II	Total
Friant-Kern Canal							
Arvin-Edison WSD	37,700	87,295	1,915	23,655	5%	27%	20%
Delano-Earlimart ID	102,545	20,866	5,209	5,654	5%	27%	9%
Exeter ID	10,839	5,322	551	1,442	5%	27%	12%
Fresno ID		21,006		5,692		27%	27%
Garfield WD	3,299		168		5%		5%
International WD	1,131		57		5%		5%
Ivanhoe ID	7,257	2,213	369	600	5%	27%	10%
Lewis Creek WD	1,367		69		5%		5%
Lindmore ID	31,103	6,162	1,580	1,670	5%	27%	9%
Lindsay-Strathmore ID	25,919		1,317		5%		5%
Lower Tule River ID	57,681	66,660	2,930	18,063	5%	27%	17%
Orange Cove ID	36,946		1,877		5%		5%
Porterville ID	15,080	8,403	766	2,277	5%	27%	13%
Saucelito ID	19,981	9,187	1,015	2,489	5%	27%	12%
Shafter-Wasco ID	47,125	11,091	2,394	3,005	5%	27%	9%
Southern San Joaquin MUD	91,423	14,004	4,644	3,795	5%	27%	8%
Stone Corral ID	9,425		479		5%		5%
Tea Pot Dome WD	7,069		359		5%		5%
Terra Bella ID	27,333		1,388		5%		5%
Tulare ID	28,275	39,492	1,436	10,701	5%	27%	18%
Madera Canal							
Chowchilla WD	51,838	44,813	2,633	12,143	5%	27%	15%
Madera ID	80,113	52,096	4,070	14,117	5%	27%	14%
San Joaquin River							
Gravelly Ford WD		3,921		1,063		27%	27%
Friant Division M&I							
City of Fresno	56,550		2,873		5%		5%
City of Orange Cove	1,320		67		5%		5%
City of Lindsay	2,356		120		5%		5%
Fresno County WWD 18	141		7		5%		5%
Madera County	189		10		5%		5%
SUBTOTALS - CLASS I & II	***754,005***	***392,531***	***38,301***	***106,366***	*5%*	*27%*	*13%*
SUBTOTAL - §215		***134,303***		***63,390***			*47%*
TOTAL - Class I , II & §215	***754,005***	***526,834***	***38,301***	***169,756***			*16%*

Source: Steiner 2005, 1922-2003 data.