CABY Integrated Regional Water Management Group
2014 IRWM Drought Grant Solicitation

Attachment 3. Project Justification

Attached please find the Technical Analysis of Physical Benefits Claimed.

Attachment 3: Technical Analysis of Project Physical Benefits Claimed

Project 1. City of Placerville Waterline Replacement - Chamberlain/Sacramento Street Area

The City of Placerville is a historic mining town with infrastructure systems dating back to the 1800's. Over the years various materials have been used to update the City's water systems, including clay and iron pipes, to varying degrees of success. Many of the aging pipes have deteriorated and cracked resulting in frequent failure and system loses that have reached 20% in the past. The poor condition of the pipes in the Main service area which services homes has also created continuously wet areas on private properties leading to continued complaints from residents to the City.

Technical Basis of the Project

Many of the older pipes in the City of Placerville are also undersized. Undersized pipes provide inadequate flows to service areas and are unable to meet fire flow standards for emergency response. Many areas throughout the City remain unprotected and in some cases do not have local access to fire hydrants.

Other solutions to address the City's water infrastructure in the Project area have been considered and include; leaving systems as they are (do nothing) or replacing existing pipelines where they are currently located. The do nothing option would avoid construction costs but would result in increasing costs for continued service and repair to the failing systems. This option would also mean continued access, construction, and mitigation on private property leading to continued homeowner complaints and substantial costs. The option to replace pipelines where they are currently located would also require access to private property which has the potential to increase construction costs dramatically.

In 2005, the City completed a Water Master Plan (WMP) that identifies and prioritizes the water infrastructure that needs to be replaced/upgraded or looped (interconnected) for improved system efficiency and reliability including segments along Sacramento and Chamberlain Streets. After review and consideration of the WMP, the City strategically targeted segments of the water system for replacement including the 1,180 feet of pipeline proposed for this project which was previously included in the City of Placerville's Capital Improvement Program along with the prior phase of the project along Big Cut Road (CIP 2008, pages 10-11). Achieving the physical benefits described below would require the replacement of the deteriorated waterlines, replacement of service laterals and installation of new fire hydrants in the existing easements, as well as the design and acquisition of Right of Way for a new line that would complete the looped system and ensure adequate system reliability.

City staff has further refined and prioritized pipeline reaches identified in the WMP and has developed this project to address its highest priority reliability, water loss and fire flow issues.

Table 2.1 Technical and Scientific Documentation Table

Technical and Scientific Document Name	Document Description	Relevant Page #
Kennedy/Jenks Consultants. 2005. City of Placerville's Water Master Plan. December 2005	This document identifies and prioritizes the water infrastructure that needs to be replaced/upgraded or looped (interconnected) for improved system efficiency and reliability.	All
City of Placerville. 2008. Proposed Capital Improvement Program Budget 2008/2009	Describes and prioritizes infrastructure and equipment needs within budgetary constraints.	10-11
PSOMAS. 2012. City of Placerville Pardi Wy/ Big Cut Rd/ Sacramento St Waterline Replacement Project: Overall Site Plan Proposed Waterline Improvements, 4.	Engineering design and construction documents.	All
EPA. 2012. Pollution Prevention Program's Greenhouse Gas Calculator, Water Conservation.	GHG calculator helps quantify the GHG emission reductions by converting standard metrics for electricity, green energy, fuel use, chemical use, water use, and materials management into metric tons of carbon dioxide equivalent, $MTCO_2e$.	All

Recent and Historical Conditions that Provide Background for Benefits Claimed

As described in the physical benefits tables, the City of Placerville anticipates the proposed project would result in reduced waterline failure, increased stability of the pipeline infrastructure, and adequate pipe size. The city expects the proposed project will result in decrease pumping and reduce GHG Emissions.

Benefit 1 - Water Conserved: This project would replace failing waterlines in the Main service area and conserve approximately 15 acre feet per year of water.

Benefit 2 - Improvements to Public Safety: Chamberlain Street does not meet fire flow standards, which have been set by the El Dorado County Fire District at 1,000 gpm for 2 hours in residential areas (WMP 2005, ES-1), due to lack of available fire hydrants and inadequate pipe size (Overall Site Plan).

Benefit 3- Improvements to Service Reliability/Aging Infrastructure: Many of the older pipes are also undersized. Undersized pipes provide inadequate flows to service areas and are unable to meet fire flow standards for emergency response. Many areas throughout the City remain unprotected and in some cases do not have local access to fire hydrants. One of the primary benefits of the new looped system is that the city will be able to bypass the cross country portion of line and improve reliability of service and fire flows to several hundred homes on the west side of our water service area.

Benefit 4 -Tons of Emissions Avoided: The amount of energy needed to treat and pump water to the Main service area results in annual added GHG emissions.

Benefit 5 - Integrated Flood Management: The pipeline will create more sustainable flood and water management systems (page 12 of the PSP guidelines) and the overall flood protection system in the City of Placerville will be improved. The poor condition of the pipes in the Main

Pipeline Service Area often results in customer complaints from the 15 homes which experience continuously wet areas on these private properties leading to continued complaints from residents to the City.

Un-quantified Benefit 5 - Increased Instream Flows/Environmental Water Use: The project would reduce the demand on local resources and provide more water for instream habitat and drought preparedness. Environmental water use is defined by the DWR as the amount of water purposefully allowed to flow through natural river channels and wetlands that is not diverted or used for urban or agricultural purposes. The project would result in improvements to environmental water use by contributing potential Bay-Delta outflows required by the State Water Resources Control Board.

Estimates of without the Project Conditions

Without this project, it is estimated that the City would continue to lose 15 acre feet and more per year over time due to the failing water lines in the Main service area. At this time, no other projects are planned or being considered that would address the failing water lines. In addition, Chamberlain Street would continue not to meet fire flow standards, which have been set by the El Dorado County Fire District at 1,000 gpm for 2 hours in residential areas (WMP 2005, Executive Summary page 1), due to lack of available fire hydrants and inadequate pipe size (Overall Site Plan).

Other solutions to address the City's water infrastructure in the Project area have been considered and include; leaving systems as they are (do nothing) or replacing existing pipelines where they are currently located. The do nothing option would avoid construction costs but would result in increasing costs for continued service and repair to the failing systems. This option would also mean continued access, construction, and mitigation on private property leading to continued homeowner complaints and substantial costs. The option to replace pipelines where they are currently located would also require access to private property which has the potential to increase construction costs dramatically.

The following bullet statements summarize the expected conditions **without the project**:

- 15 acre-feet per year of water supply would continue to be lost per year due to failing water lines.
- 1,180 feet of aging and failing pipe segment would remain in place.
- Ongoing customer complaints would continue concerning wet areas on private property along Sacramento and Chamberlain Streets.
- Undersized pipes would remain, providing inadequate flows to service areas and are unable to meet fire flow standards for emergency response.
- Increasing costs for continued service and repair to the failing systems.
- Lost opportunity to reduce the amount of energy needed to treat and pump water to the Main service area and result in an annual GHG reduction of 7.3 MTCO2e, which equates to 365 MTCO2e over the 50-year life of the project.

Methods for Estimation

The potential amount of water that is conserved by the Project (15 acre feet per year) is based on estimates from City engineers that were calculated using water purchase summaries. The length of pipe

being replaced and the number of fire hydrants to be installed were estimated using design plans created by PSOMAS engineering. GHG savings were calculated using the EPA GHG Conversion Calculator.

Acknowledgement of New facilities, policies, and actions required

Achieving these physical benefits would require the replacement of the deteriorated waterlines, replacement of service laterals and installation of new fire hydrants in the existing easements, as well as the design and acquisition of Right of Way for a new line that would complete the looped system and ensure adequate system reliability.

Adverse physical effects

Air quality and noise impacts due to construction activities would be temporary and any habitat disruption is expected to be minimal as construction would take place in previously disturbed areas along road right-of-ways. Longer term effects are expected to be beneficial for overall water quality by reducing pipe erosion and potentially harmful sedimentation in the pipelines.

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Attachment 3: Technical Analysis of Physical Benefits Claimed - References

The references that relate to the Technical Analysis of Physical Benefits Claimed for **City of Placerville - Waterline Replacement – Chamberlain/Sacramento Street Area can be found in the PDF document entitled Att_DG_ProJust_3of5.** The references cited in the Technical Analysis are the same as those identified in Table 5 – Physical Benefits.

Attachment 3: Technical Analysis of Project Physical Benefits Claimed

Project 2. El Dorado County, Regional Water Conservation Planning - Model Implementation and Education Programs

With this project, El Dorado County Water Agency would develop a comprehensive WUE_WCO program and implementation plan. Specific elements of the program/plan would draw from the implementing agencies 2010 Urban Water Management Plan Drought Management Measures and Best Management Practices (BMPs) and other successful components of WUE_WCO programs. The WUE_WCO program/plan would consist of BMPs/DMM that would include but are not limited to: rebates for toilet replacements, cash for grass programs, water conservation educational materials, school education presentations and curriculum add-ins for teachers, water audits/surveys, showerhead giveaways, etc. Through public education and other outreach activities, this program would help educate customers on the value of water, how to use it efficiently and the need to conserve water immediately. Over time, this would result in long-term water savings benefits and water use efficiency.

Implementation components include: 1) The widely acclaimed Great Water Mystery Program and 2) the El Dorado County Government Building Retrofit as described below.

Great Water Mystery Program. The Great Water Mystery Water Conservation Program and School Audit Program is designed to promote life-long water conservation behaviors amongst K-8 school children. The South Yuba River Citizens League (SYRCL), an original CABY RWMG member, has run this program all over Northern California for the past 12 years and shown it to more than 250,000 with demonstrable results. SYRCL will adapt the program to create a CABY region-wide version of the Great Water Mystery and produce the program in schools region-wide. SYRCL pre-and post-program surveys (resulting from a SYRCL/DWR funded Water Use Efficiency Program in 2004) demonstrate clearly that The Great Water Mystery program promotes life-long water conservation behaviors that would be realized immediately and year-over-year. The School Water Audit would be used as part of the classroom teaching curriculum to have students conduct a school-wide water audit that would show existing school facilities water demands and demonstrate water conservation savings. Consistent with the 20x2020 statewide per capita water reduction, this program would be developed to promote water use efficiency to achieve countywide 20% per capita water demand reduction**.**

El Dorado County Government Building Retrofits. The County of EI Dorado's government functions operate from both County-owned and leased facilities dispersed on the western and eastern slopes, covering from EI Dorado Hills to South Lake Tahoe. The County has over 746,000 square feet of owned facilities under its direct operational control. The facilities are comprised of numerous administrative offices, senior centers, community centers, libraries, animal shelters, jails and juvenile halls, psychiatric and health facilities, as well as workshops and storage facilities. The County owns over 70 buildings and structures that range from a relatively new South Lake Tahoe Animal

Shelter, built in 2008, to the Chamber of Commerce building in Placerville, built in 1923. The average age of all owned buildings is approaching 40 years old.

Buildings and facilities within the EDC government center complex were constructed over numerous years, most of which were built before 1992 and therefore, not compliant with 1992 or later federal plumbing code requirements. As a result, pre-1992 constructed facilities (EDC Government Center buildings, Jail and Library) are fitted with high-volume, inefficient toilets, urinals, sinks, showers and showerheads.

This project promotes water conservation and achieves long-term reduction of water use by increasing water use efficiency through replacement of high-volume, inefficient toilets, urinals, sinks, showers and shower-heads throughout the EDC Government Center buildings, Jail and Library and with modern, low or ultra low fixtures and high-efficiency models to reduce water demand within the EDC Government Center. It also improves reliability of downstream supplies by reducing the quantity of diversions needed for meeting future water demands within the EDC Government Center.

Technical Basis of the Project

El Dorado County Water Agency would develop a comprehensive WUE_WCO program and implementation plan. Specific elements of the program/plan would draw from the implementing agencies 2010 Urban Water Management Plan Drought Management Measures and Best Management Practices (BMPs) and other successful components of WUE_WCO programs. Implementation components include: 1) The widely acclaimed Great Water Mystery Program and 2) the El Dorado County Government Building Retrofit as described below.

Great Water Mystery Program. According to the USGS, Californians used an average of over 38,400 million gallons of fresh water *every day* in 2000[1]. Over 60 percent of this water was surface water, which came out of our rivers, lakes and streams,[2] putting pressure on aquatic habitats and endangered fisheries resources. Domestic water use, which includes self-supplied domestic and public supply, makes up a large portion of this off-stream water demand. Across the United States, domestic water use made up 11 percent of the total off-stream demand for water in 2000[3], and trends show that this demand is increasing. Per capita withdrawals for domestic water use in the United States jumped 53 percent from 1950 to 2000[4]. The increasing demands of domestic water use have put undue pressure on our environment and water supply.

The Great Water Mystery Water Conservation Program is run by the South Yuba River Citizens League (SYRCL) - one of the original CABY stakeholders. This is a successful school water conservation program currently being used in parts of the CABY region funded by the Nevada Irrigation District and Placer County Water Agency. The program has been shown to more than 250,000 school children throughout Northern California over the past twelve years. The program consists of two parts:

[1] USGS "Estimated Use of Water in the United States in 2000" Circular 1268, 15 figures, 14 tables (released March 2004, revised April 2004, May 2004)
[2] ibid
[3] ibid
[4] ibid

1. The Great Water Mystery School Assembly and
2. The School Water Audit Program

The Assembly element is designed to promote life-long water conservation behaviors. SYRCL pre-and post-program surveys (resulting from a similar SYRCL/DWR funded Water Use Efficiency Program in 2004) demonstrate clearly that The Great Water Mystery Assembly promotes life-long water conservation behaviors that would be realized immediately and year-over-year. The Great Water Mystery also teaches CA and National Science Standards, making it extremely desirable to teachers since it fits well with school curriculum across counties. The presentation is adapted for each grade level, so that the mystery story teaches age-appropriate science concepts for kindergarten through eighth grade while delivering a powerful message about water conservation. The Assembly program has been funded by multiple agencies including the DWR, Bureau of Reclamation, Stockton Area Water Suppliers and the Sacramento Stormwater Quality Partnership.

The School Water Audit element would be used as part of the classroom teaching curriculum to have students conduct a school-wide water audit that would show existing school facilities water demands and demonstrate how water conservation savings can be achieved. As part of this project, SYRCL would update existing materials for the School Water Audit to reflect current state and national educational standards and adjust all materials for the specific attributes of the relevant watersheds throughout the CABY region and then take the program to schools in the CABY Region where the program has not yet been shown.

Government Building Retrofits. In 2013, El Dorado County hired Vanir Construction Management, Inc. to compile a Conditions Assessment Report (all pages), which comprehensively evaluated the EDC Government Center and made recommendations for upgrades and improvements at each building. This Assessment report serves as the basis for a model retrofit implementation project and as an example for other agencies throughout the CABY region and beyond. This is a model shovel-ready project which scores as a high priority program in the CABY IRWM Plan with immediate water savings to benefit drought impacts. The project would retrofit the County Buildings A, B, and C as well as the library and the main jail with modern, low or ultra low flow, high efficiency fixtures to reduce daily water demand. As a direct function of these plumbing retrofits, demand for water would be reduced resulting in lower wastewater loads from the EDC Government Center. This project would also reduce energy consumption with complete replacement of an evaporative cooling tower unit with a modern, no water, high energy efficient cooling system to reduce water demand within the EDC Government Center. Based on the Assessment Report, over the next three-year period the following savings would occur:

- Up to 553,520 gallons in 2015;
- Up to 1,952,280 gallons in 2016;
- Up to 3,433,320 gallons in 2017 – after 2017, annual water use is expected to remain at approximately 11,354,640 gallons, which is an estimated savings of 735,284 annually.

Table 3-2 Technical and Scientific Documentation Table

Technical and Scientific Document Name	Document Description	Relevant page #

Technical and Scientific Document Name	Document Description	Relevant page #
DWR. 2010. 20x2020 Water Conservation Plan	Statewide conservation plan.	Page 42 All pages.
Vanir Construction Management, Inc. 2013. El Dorado County compiled a Conditions Assessment Report	Provides detailed descriptions of the County facilities.	All pages
EDC Government Center Facilities CIP	Capital Improvement Plan for County facilities.	All pages
Graphs Total 2 - Excel Spreadsheets that summarize pre and post surveys from 2004 implementation.	Summarize results of The Great Water Mystery Program implemented in 2004.	All tabs.

Recent and Historical Conditions that Provide Background for Benefits Claimed

As described in the physical benefits tables, the project would result in water savings through retrofits and public education programs. Following describes the specific benefits achieved.

Benefit 1 - Water Conserved

Great Water Mystery Program. This water education program is designed to conserve water supplies and water use efficiency to achieve 20% demand reduction throughout El Dorado County. Through public education and other outreach activities, this program would help educate school children on the value of water, how to use it efficiently and the need to conserve water immediately. This program would conduct 90 assemblies with an estimated 100 children in each assembly (total 9,000). The program would conduct 30 audits with 60 students in each audit (1,800). The grand total number of students reached is therefore estimated at 10,800. Through the life of this project, about 24,000 children will benefit from this project, resulting in an average water savings of 19,635,000 gallons per year. This is based in part on The Great Water Mystery pre and post surveys of students conducted in 2004 as charted in Graph Analyses 2 and 3 (all pages).

Government Building Retrofits. It is estimated the project would result in 20% demand reduction throughout El Dorado County buildings. The project would result in reduced energy consumption through elimination of an antiquated cooling tower and lower wastewater loads. In terms of gallons conserved (water supplies improved) over the next three year period:

- Up to 553,520 gallons in 2015;
- Up to 1,952,280 gallons in 2016;

- Up to 3,433,320 gallons in 2017 – after 2017 annual water use is expected to remain at approximately 11,354,640 gallons, which is a estimated savings of 735,284 annually.

Benefit 2 - Improvements to Aging Infrastructure: Project physical benefits are consistent with CABY IRWMP performance measures to reduce energy consumption within the EDC Government Center. This project responds to climate change by reducing energy consumption of water systems and uses through replacement of antiquated fixtures and hardware with modern, low or ultra low fixtures and high-efficiency models along with complete replacement of the cooling tower unit with a modern, no water, high energy efficient cooling system to reduce water demand within the EDC Government Center.

Benefit 3 - Implement DWR 20x2020 Drought Conservation Plan: As noted above, The Great Water Mystery Program would serve an estimated 10,800 students (assuming 90 assemblies with 100 children each, and 30 audits with 60 children each). The DWR 20x2020 Water Conservation Plan (page 42) strongly recommends that the state accelerate public outreach programs. Page 42 states: "A statewide water conservation campaign can communicate the need for water conservation, explain its importance within the context of the state's overall water supply and demand situation, and help to build a conservation ethic among customers." The proposed project is designed in compliance with this recommendation.

This Project integrates with other CABY IRWMP projects in the following ways:

- Improves source water supply reliability
- Implementing the goals and objectives of the CABY IRWM Plan
- Improves landscape and agricultural irrigation efficiencies
- Achieves long term reduction of water use
- Assists water supplier and the region to implement conservation programs and measures that are not locally cost-effective

Estimates of without the Project Conditions

Great Water Mystery Program. Many parts of El Dorado County and the CABY region do not currently have a Great Water Mystery Water Conservation Assembly and School Audit Program. As a result, potable water is not used efficiently and through lack of understanding of the value of water is not used beneficially for the good of the region. The Great Water Mystery Water Conservation Assembly and School Audit Program in El Dorado County would help the County meet its raw water savings and 20x2020 water use efficiency goals.

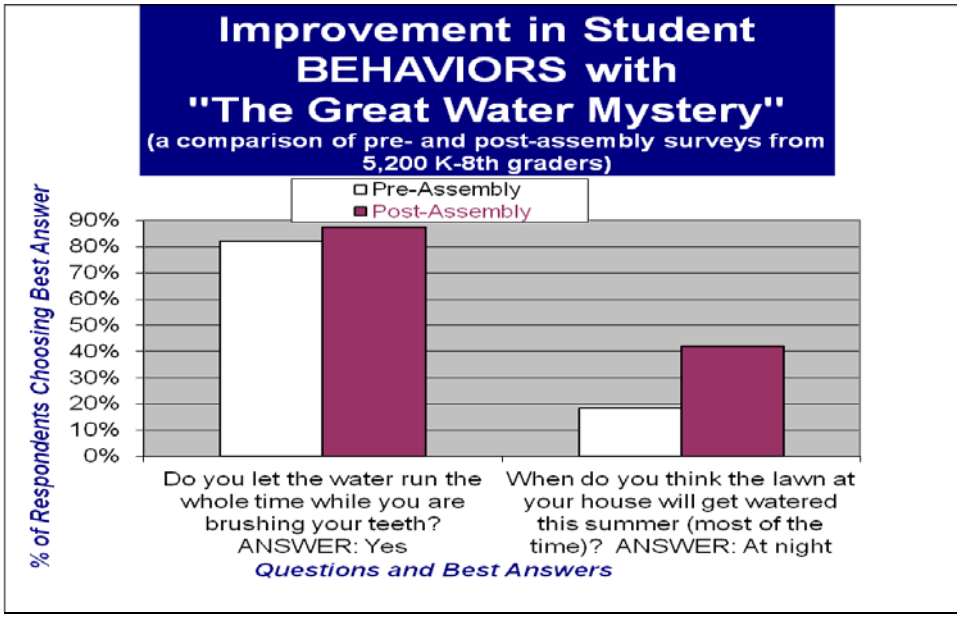
Government Building Retrofits. The average age of all owned buildings is approaching 40 years old. Buildings and facilities within the EDC government center complex were constructed over numerous years, most of which were built before 1992 and therefore, not compliant with 1992 or later federal plumbing code requirements. As a result, pre-1992 constructed facilities (EDC Government Center buildings, Jail and Library) are fitted with high-volume, inefficient toilets, urinals, sinks, showers and showerheads that contribute to gross water consumption and wasteful use of regional supplies. Without funding this EDC Government Center Water Conservation Retrofits project El Dorado County would not meet its 20x2020 water use efficiency goals, consume large quantities of energy and generate excessive wastewater that requires treatment and disposal.

The following bullet statements summarize the expected conditions **without the project**:

- High-volume, inefficient toilets, urinals, sinks, showers and showerheads that contribute to gross water consumption in El Dorado County and wasteful use of regional supplies would remain in place.
- Aging and inefficient facilities would remain in place indefinitely.
- An opportunity to implement an important goal and recommendations from the 20x2020 Water Conservation Plan for a County that includes rural DACs would be lost.

Methods for Estimation

Great Water Mystery Program. In 2004, DWR funded a Water Use Efficiency program with school assemblies and a water audit program and this program is modeled after this previous project. In 2004, pre- and post surveys were conducted of individual students and the results of the surveys were then plotted and graphed (see references folder - Graphs Totals2 "Behaviors" tab). As displayed in the example graph below, the students demonstrated a marked improvement in their understanding of water conservation needs and behaviors.



Source: "Graphs Total 2" Excel spreadsheet found in the "References" Folder.

Government Building Retrofits. Existing water use at the government center was determined by calculating water using fixtures (factor daily use/daily demand and employees) i.e. replace this many fixtures and using the same water demand from existing (without project) gallons per minute per use and came up with demand for project.

EDC staff and its consultant team developed an EDC Government Center Facilities CIP (all pages) that would be implemented over the next 3 to 4 years. As part of development of the CIP staff investigated

potential energy savings achieved through equipment upgrades and replacements. The resulting investigations arrived at the potential energy savings of at least 20% annually after 2017.

Acknowledgement of New Facilities, Policies, and Actions Required

This project does not require new facilities or policies.

Adverse Physical Effects

The project may produce temporary impacts to EDC staff, employees and visitors while construction activities occur and restrooms are being modified. After construction facilities and access would be return to pre-construction or better conditions.

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Attachment 3: Technical Analysis of Physical Benefits Claimed - References

The references that relate to the Technical Analysis of Physical Benefits Claimed for **El Dorado County Regional Water Conservation Planning - Model Implementation and Education Programs can be found in the PDF document entitled Att_DG_ProJust_3of5.** The references cited in the Technical Analysis are the same as those identified in Table 5 – Physical Benefits.

Attachment 3: Technical Analysis of Project Physical Benefits Claimed

Project 3. Georgetown Divide Public Utilities District, Water Conservation, Supply Reliability and Environmental Protection Project

The Georgetown Divide Public Utility District (GDPUD) owns and operates raw water storage and delivery systems and treated water storage, pumping and distribution facilities which serve the El Dorado County communities of Georgetown, Cool, Pilot Hill, Auburn Lake Trails, Greenwood, Garden Valley, Kelsey and surrounding rural areas. Water is supplied from GDPUD's Stumpy Meadows Reservoir. Raw water is delivered to irrigation services and to water treatment plants through a system of open ditches and closed conduits. GDPUD water treatment plants, supplied by the GDPUD ditch system, include the Walton Lakes Water Treatment Plant and the Auburn Lake Trails Water Treatment Plant.

Technical Basis of the Project

The GSPUD operations, inspections, and recent studies have identified areas of major leakage. The District's annual average water losses for the past 19 years are almost 40%, which is for all sources within the entire water system operations. The GDPUD estimates over 3,000 acre-feet of water a year is lost due to leaks and percolation throughout its entire ditch system (USDA NRCS Soil Maps of El Dorado Area, KASL Section VII pages 2-8). The leakage rate was determined by KASL Engineers (2002) in the Water System Reliability Study (pages 2-8). Using data from the measuring flume at the Buckeye Conduit, typical ditch flows, and usage metering, KASL estimated that the losses in the ditch systems specifically are approximately 25% of total design flows.

The proposed project is estimated to conserve 1,504 acre-feet of water lost due to leaks in the ditch system, which is over half the estimated water lost annually through the entire system (USDA NRCS Soil Maps of El Dorado County, KASL 2002 pg VI-19). In other words, the approximately 2.3 mile segment of canal proposed for lining as part of this proposed project represents only a small portion of 69.9 mile system managed by GDPUD, but the extensive water leakage along this relatively small segment proposed for lining makes up over half the total water lost throughout the entire system due to leakage. Moreover, the estimated 1,504 acre-feet of water conserved annually equates to approximately 150,400 acre-feet over the 100-year life of the project.

Ditch lining is identified as a top priority project in the GDPUD's Urban Water Management Plan (pg 26) to help reach its 20x2020 water conservation goals. Ditch lining is also supported in several management plans including the GDPUD's Drought Plan (Pgs 2, 2-12, 2-13, 2-14) and the EDCWA Water Resources Development and Management Plan (pg 5-28). This project also conforms to the El Dorado County 2004 General Plan, which supports projects that can reduce future water demand (Policy 5.2.1.10 page 90 of the General Plan).

In November 2002, the GDPUD engineering, management and field operations staff worked cooperatively with KASL Consulting Engineering, Inc. to compile a comprehensive "*Water System Reliability Study*" of the GDPUD water infrastructure. One of the key problems identified in the study

was the large extent of the water system that relied on open and unlined ditches to deliver water to water treatment plants and raw water customers (KASL 2002, pg VI-19). The initial engineering solutions identified by the 2002 study included three alternatives: 1) gunite lining of earthen reaches where seepage is prevalent, 2) installation of vertical concrete crib-wall sections to cut off seepage or raise ditch banks (freeboard) where overflow is an issue, 3) replacement of the leaking ditch reach with a new pipelines (Section VIII pgs 1-12). Alternative 1 is considered the most cost-effective and least environmentally obtrusive option to address the seepage issue and is thus proposed under this grant application as the best solution to the problems with open and unlined canals.

Through a series of in-field inspections and monitoring and based on the 2002 *Water Systems Reliability Study*, the GDPUD identified approximately 12,380 lineal feet of high priority ditch reaches proposed for upgrades as part of this grant proposal to DWR. The priority reaches are broken into two main sections; the Main/Pilot Hill Ditch and Kelsey Ditch. These two main sections are further divided into nine distinct reaches which have demonstrated high water loss and have relatively easy access from existing roadways.

The table below lists the proposed sections of ditch lining and anticipated conservation benefits.

Table 3-1 Anticipated Annual Transit Loss Reductions

				Infiltration Rate (in/hr)		Annual Leakage per	
				0.06			
Ditch System	**Description/Segment**	**Unlined Length (in feet)**	**Leakage Area (in Sq.Ft.)**	**Leakage/Day (acft)**	**Leakage/Year (acft)**	**mile per section**	**mile for overall project**
Upcountry	Balderson WG to Sandtrap Siphon	800	11,840	0	119	1.7	
Pilot Hill	Wagner Reservoir to Wagner Res. WG	320	2,976	0	30	0.4	
Main #2	Blue Herron Falls to Kaiser Siphon	750	11,625	0	117	1.7	
Main #2	Willow Creek WG to Baldridge WG	5,700	81,510	3	821	11.7	
Kelsey #2	Black Oak Siphon to Dukes WG	1,440	15,840	1	159	2.3	
Kelsey #2	Dukes WG to State Hiway 193	800	7,360	0	74	1.1	
Kelsey #2	Mellows WG to	960	8,544	0	86	1.2	

				Infiltration Rate (in/hr)		Annual Leakage per	
				0.06			
Ditch System	**Description/Segment**	**Unlined Length (in feet)**	**Leakage Area (in Sq.Ft.)**	**Leakage/Day (acft)**	**Leakage/Year (acft)**	**mile per section**	**mile for overall project**
	Kelsey Flume						
Kelsey #2	Kelsey Flume to Stork WG	650	4,355	0	44	0.6	
Kelsey #2	Stork WG to Kelsey Res.	960	5,376	0	54	0.8	
	Totals	**12,380**	**149,426**	**4**	**1,504**		**21.5**

GDPUD engineering, management and field operations staff worked cooperatively with EN2 Resources, Inc. to produce the table above.

Table 3-2 Technical and Scientific Documentation Table

Technical and Scientific Document Name	Document Description	Relevant page #
KASL Consulting Engineering, Inc. 2002. Water System Reliability Study. Submitted to the Georgetown Divide Public Utility District. November 2002.	The purpose of this Study was to identify and prioritize repairs, upgrades and measures to ensure that GDPUD raw water and treated water distribution and storage networks reliably meet customer demands. This Reliability Study serves as the basis for the implementation of cost effective raw water and treated water improvements. It is intended that this Study assist GDPUD in developing a Capital Improvements Program so that reliability measures can be budgeted and scheduled.	pg VI-19 pgs VII-1-39 VIII 1-12

Technical and Scientific Document Name	Document Description	Relevant page #
Georgetown Divide Public Utility District. 2011. 2010 Urban Water Management Plan. Final July 22, 2011.	These plans function as long-term planning documents and the conclusions and recommendations from the UWMPs will determine key aspects of long-term capital investment by each agency, and guidance for Plan project development. UWMPs describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, both of which inform the IRWMP.	Page 26.
Brown and Caldwell. 2007. Drought Plan for Georgetown Divide Public Utility District. December 2007.	The Drought	Pages 2, 2-12, 2-13, 2-14
El Dorado County Water Agency. 2007. Water Resources Development and Management Plan. December 2007.		Page 5-28
El Dorado County. 2004. El Dorado County General Plan A Plan for Managed Growth and Open Roads; a Plan for Quality Neighborhoods and Traffic Relief. Adopted July 19	The general plan expresses the community's development goals and embodies public policy relative to the distribution of future public and private land use. Planning and land use play a vital role in water use and distribution, and as such will influence infrastructure needs, water demand and supply, and impacts on natural systems addressed in the Plan.	Land Use Element Page 90
USDA Natural Resources Conservation Service. Soils maps of El Dorado County.		

Recent and Historical Conditions that Provide Background for Benefits Claimed

As described in the physical benefits tables, the GDPUD anticipates the proposed project would result in reduced seepage, increased stability of the canal infrastructure, and decreased customer outages resulting from problems with the infrastructure. The GDPUD expects the proposed project will decrease the potential for environmental damage due to erosion and overtopping as well.

Benefit 1 - Water Conserved: Evaluations by the GDPUD operations staff, in-field inspections by ditch technicians, and studies conducted as part of the 2002 Water System Reliability Study identified the top priority problem areas with excessive leakage from the main water supply ditch. The lining of unlined porous canal sections was identified as the highest priority improvement to ensure water supply reliability and to prevent needless water losses. Ditch loss evaluations include field inspections by operations personnel who regularly detect running water through leakage areas. Extensive canal toe moisture was further confirmed by observations of year-round, unnaturally green vegetation growing adjacent to the ditches.

The proposed project would conserve approximately 1,504 acre-feet per year of water along a 2.3 mile segment of canal that leaks so extensively that water leakage along this relatively small segment proposed for lining makes up over half the total water lost throughout the entire system due to leakage (KASL 2002 - Section VII). Moreover, the estimated 1,504 acre-feet of water conserved annually equates to approximately 150,400 acre-feet over the 100-year life of the project.

Benefit 2 - Increased Instream Flows/Environmental Water Use: The proposed project would immediately reduce GDPUD diversions by approximately 1,504 acre-feet per year, thereby increasing instream flows in the nearby Pilot Creek which feeds the Middle Fork of the American River which in turn flows into Folsom Reservoir/Lower American River and the Sacramento River and eventually the Bay-Delta. The potential environmental gains of instream flows over the 100-year life of the project are estimated at 150,400 acre-feet.

Environmental water use is defined by the DWR as the amount of water purposefully allowed to flow through natural river channels and wetlands that is not diverted or used for urban or agricultural purposes. In other words, environmental waters are waters set aside or managed for environmental purposes that cannot be used for other purposes in the locations where the water has been reserved or otherwise managed.[1]

The California Water Plan Update Bulletin 160-98 defines environmental water use as the sum of:

1. dedicated flows in State and Federal Wild and Scenic Rivers;
2. in-stream flow requirements established by water right permits, DFG agreements, court actions, or other administrative documents;
3. Bay-Delta outflows required by State Water Resources Control Board (SWRCB); and
4. applied water demands of managed freshwater wildlife areas.

The project would result in improvements to environmental water use by contributing potential Bay-Delta outflows required by the State Water Resources Control Board.

Benefit 3 - Improvements to Aging Infrastructure: Like many of the older water systems in the Sierra Nevada, these ditches were originally developed as part of the gold mining industry and later were converted for agricultural and domestic uses. These older ditch systems are extremely inefficient with extensive water losses during conveyance and they are highly susceptible to structural failure as well.

Benefit 4 - Reduced Erosion/Improved Stream Crossing Protection: The ditch sections considered a priority for gunite lining are described further in the table above. Along these sections, ditch technicians and contract engineers have observed saturated soils, slumping, and other indicators of leakage and percolation into soils. The potential exists for erosion to occur along stream crossing intersections.

Benefit 5 - Reduced Erosion/Terrestrial Habitat Protection: Ditch failures and overtopping has been observed during in-field inspections and can result in erosion and potential damage to

[1] DWR Water Plan Update 1998 - Bulletin 160-98

wildlife habitat.

Estimates of without the Project Conditions

The GDPUD is currently experiencing an average of about 25% water loss through leakage from unlined, earth bottom ditch sections. The proposed project would eliminate approximately 149,426 square feet of leakage area through lining and/or piping, decreasing the overall ditch water losses from the current 25% to about 19% (KASL 2002 pages 1-39). In the absence of the project, these benefits would not occur.

The GDPUD's annual average water losses over the last 19 years are estimated at almost 40%. This is for all sources of loss within the entire water system operations. The ditch leakage rate was determined by KASL (2002) engineers in the *Water System Reliability Study* (Section II pages 1-39). Using data from the measuring flume at the Buckeye Conduit, typical ditch flows, and usage metering, KASL estimated that the average losses in the ditch systems specifically are approximately 25% of total design flows. Below the measuring flume, water supply flows are split into two ditches. The exact quantity of water flowing into each ditch is not certain, and therefore the quantity of leakage from the two ditches is estimated based on accumulated distribution (i.e., customer water delivery) data. An unquantified, but minor, water loss is evaporation. Assuming that losses due to evaporation are around 40 in/year, the resulting evaporation quantity is less than 10% of the total estimated water lost to seepage.

The following bullet statements summarize the expected conditions **without the project**:

- 1,504 acre-feet per year of water supply lost through ground seepages and overtopping of the canal.
- Aging and inefficient canal system infrastructure with earthen bottom remain in place indefinitely.
- Ongoing customer outages due to infrastructure problems along the Main/Pilot Hill Ditch and Kelsey Ditch continue indefinitely.
- Ongoing erosion and impacts to wildlife habitat adjacent to the canal and reduced watershed health continue indefinitely.
- Lost opportunity for 1,504 acre-feet per year of instream flows increases n Pilot Creek, Middle and North Forks American River and Folsom Reservoir and beyond.

Methods for Estimation

The seepage rates were hydrologically estimated by assuming a steady infiltration rate through the soils of the identified leakage areas. USDA NRCS soils maps generally describe the area as having well-drained soils with moderately low infiltration rates. Of the soil types present, the most common are described as well-drained with moderately low infiltration rates. Since the head pressure in the ditch will increase the infiltration rate, and since the areas identified are known to leak at a higher than usual rate, a ksat[2] value of 0.06 inches per hour was used. Since the leakage areas experience seepage rates well in excess of the surrounding soils, the infiltration rate of 0.06 inches per hour is a conservative estimate. After deducting losses for unpermitted diversions, for watering-up, and for evaporation, the remaining lost water is very similar to the amount determined by analyzing soil infiltration rates. Therefore, there is a reasonably high level of confidence in the ditch water loss estimates.

[2] Ksat refers to the ease with which pores in a saturated soil transmit water.

The proposed project would result in an estimated 1,504 ac-ft/yr of water savings. Estimated savings were calculated by converting the leakage area of the unlined portions of the ditch outlined in this project to ac-ft/yr based on infiltration rates for the USDA NRCS defined soil types in the corresponding areas. These estimates and identified ditch sections for lining are supported by previous engineering evaluations and GDPUD ditch inspector observations. (Leakage Area (sqft)) X (Infiltration Rate (in/hr)) X (24hr) X (.000023) X (304days) = Leakage (ac-ft/yr)

Acknowledgement of New Facilities, Policies, and Actions Required

Project components primarily consist of new concrete lining for the ditch sections experiencing significant water loss. Gunite surfaces are strong, water tight, and smooth, which are ideal for efficient water transport. Gunite requires fewer joints than other types of concrete and is the least susceptible to cracking. The losses due to leakage in the gunite lined areas will be undetectable compared to other losses from evaporation and leakage from unlined sections of ditch system. Future losses after lining are expected to be less than 10 percent.

Adverse Physical Effects

The proposed project has the potential to result in short-term impacts to the environment immediately adjacent to the unlined ditch sections, primarily during project construction, with temporary impacts to ditch-related riparian habitat, aquatic habitat, water quality and air quality (dust). Longer term effects are expected to be beneficial for surface water quality and quantity and risk of environmental damage from overflows.

CABY Integrated Regional Water Management Group
2014 IRWM Drought Grant Solicitation

Attachment 3: Technical Analysis of Physical Benefits Claimed - References

The references that relate to the Technical Analysis of Physical Benefits Claimed for **Georgetown Divide PUD Water Conservation, Supply Reliability and Environmental Protection Project can be found in the PDF document entitled Att_DG_ProJust_4of5.** The references cited in the Technical Analysis are the same as those identified in Table 5 – Physical Benefits.

Attachment 3: Technical Analysis of Project Physical Benefits Claimed

Project 4. Grizzly Flats Community Services District, Drought Measures Infrastructure Project

The Grizzly Flats Community Services District (GFCSD) provides domestic water service to 611 residential customers in a geographically remote foothill community in El Dorado County. The system is classified as a "Small Community Water System" by the Department of Health Services. The community is officially a disadvantaged community with extremely limited financial resources. The community is served by a small two-source water system, which was originally constructed in the mid 1960's through the mid 1970's. Water for the community is derived from two local creeks, North Canyon and Big Canyon, which are tributaries to the Cosumnes River. These creeks are diverted and the water is transported roughly two miles via pipeline to a storage reservoir prior to treatment.

Technical Basis of the Project

This project will substantially improve GFCSD water supply delivery system to a rural Disadvantaged Community with a water supply system that is over 40 years old. The various components of the project are described further below.

Air Release Valve. Eagle Ditch Pipeline, which is about 3 miles long, is the GFCSD's only water transmission line from their diversions to their raw water reservoir (which feeds the GFCSD's treatment plants). It used to be an open ditch but was piped using volunteer labor force in the late 1980s. In the last few years, GFCSD staff observed reduced flows coming from the pipe into the reservoir. They also noticed that the pipe is not taking all the water it should at the diversions. Using a camera, staff inspected approximately 3,000 feet of this pipe and found that roughly a third of it has air pockets trapped inside. Air pockets are known to reduce water flows to less than a quarter of the pipeline capacity. Water loss occurs when the air has to be removed and the system stopped. Staff estimated that 20-25 ARVs need to be installed to remove these air pockets.

Backwash Tank. The GFCSD currently uses two backwash tanks that are over forty years old. The metal walls of these tanks were measured and results showed substantial thinning, as documented in the CSI Inspection Report. As these tanks could fail due to thinning, GFCSD staff determined that it would be best to replace the two tanks with one tank of equal or larger capacity. A newer, more efficient tank would allow the GFCSD to reclaim water used for backwash and recycle it back into the reservoir for treatment more effectively. The new tank would also allow solids in the water to settle and be drained from the bottom of the tank, which is not possible with the old tanks. The clarified water could be returned to the reservoir. The project would include construction and installation of a new tank, piping for the recovery system and a pump.

Cathodic Protection. The GDPUD's four treated water storage tanks hold their total supply of treated water and keep water lines pressurized and operating correctly. They are a major component of the GDPUD's system reliability. The four tanks hold 600,000 gallons of water and they represent the GFCSDs only storage for treated water. A recent "Tank Coating Evaluation," which is documented in the CSI Inspection Report, uncovered significant corrosion issues in the treated water storage tanks, which threaten the reliability of the system and could lead to leakage and water loss. The CSI Inspection

Report offered various alternatives to solve this corrosion issue, but they are all quite expensive. Replacing the tanks with new ones could cost anywhere from $150,000 - $300,000, depending on the size of the tank and on unavoidable issues that could occur during construction. Relining or recoating the tanks was estimated by CSI to be around $60,000 per tank. Cathodic Protection systems, however, are much more cost effective and are about $12,000 per tank. It would also extend the life of the storage tank by 10-15 years. It is imperative that Cathodic Protection systems be installed. GFCSD cannot afford to replace the tanks or recoat them without increasing water rates to their customers, which is especially burdensome considering Grizzly Flats qualifies as a Disadvantaged Community (DAC).

Leak Detection and Repair. The GFCSD water system is over 40 years old and consists of 25,248 feet, or approximately five miles, of one-inch to eight-inch pipeline that delivers water to over 600 residential accounts. The main lines are primarily asbestos cement and the service lines are thin-walled PVC with inadequate pressure ratings (less than Schedule 40). The pipelines were constructed with native backfill, without the benefit of engineered pipe zone material. As a result, point loads are a common cause of the ever increasing trend of waterline leaks and breaks, with three to five service or main line breaks per year. Timely detection and repair of water leaks will reduce treated-water losses, increase water use efficiency and optimizing the use of GFCSD's local water resources. The critical issue facing the GFCSD is meeting domestic water demand and fire suppression needs, especially in the late summer and fall months when stream flows are at their lowest stages. This leak detection and repair program will provide efficiencies within GFCSD's existing water infrastructure and ensure that treated water is reliable and consistently available to meet existing customer demands and fire suppression needs. While leak detection and repair program is not expected to eliminate all leaks, it is expected to fix a substantial amount of leaks within the GFCSD's system. A successful program will directly reduce water losses Conditions suggest that this project will realize a possible 20 percent in savings from the implementation of the leak detection and repair program, given that this project will identify and repair 36 leaks, which upon completion help achieve countywide 20 percent per capita water demand reduction and provide additional system reliability.

Meter Replacement. The 20x20 Water Conservation Plan states: "Metering is the foundation for measuring consumption as well as detecting waste. The state must continue to push for near universal metering in its urban water systems which account for the majority of potable water use, and also begin to improve the incidence of metering in smaller systems and rural areas." (DWR 20x20 Water Conservation Plan, page 38).

GFCSD staff reviewed a global list of all 600 meters in the GFCSD service territory and determined that about half of their meters are over 20 years old. This is problematic because meters on average have a 10-15 year life span. Many of these old meters provide inaccurate readings and they lack leak indicators. Implementation of this project would replace roughly 300 meters to newer meters that not only provide accurate readings, but can detect leaks on properties. By replacing old meters, the GFCSD can ensure the accuracy of each customer's water demand, which is beneficial to both the customer and the GFCSD. These new meters would also help to better and more quickly identify leaks on the customer side, thus conserving water and preventing unnecessary water loss.

Residential Water Conservation. Rural watersheds throughout California are experiencing replacement of open space, grazing lands and irrigated agricultural land with suburban, ex-urban, and resort developments, resulting in increased water demand and alteration of traditional irrigation practices. Changes in water withdrawal, conveyance and use have altered surface water interactions, and exacerbating conflicts among users. There is an immediate need to achieve watershed-scale objectives

through water use efficiency strategies, promote effectiveness of such strategies, and train water professionals to optimize local water systems. Water use efficiency projects are those that result in measurable water savings. Projects may be considered valuable if they address these three elements:

- an **incentive** designed to change water-related habits or hardware
- **education** about water use efficiencies and the benefit of it, and
- **regulatory requirements**, where appropriate.

Water conservation programs help educate customers on the value of water and how to use water efficiently. As behaviors change over time, water conservation savings will result in long-term water savings benefits to achieve water use efficiency. To the extent feasible, rebates on replacement of pre-1992 hardware, fixtures (showerheads, faucets), and toilets, will contribute to water savings on a per capita basis. As behavioral changes are realized within households i.e. shorter showers, running water during brushing teeth, washing hands and shaving, it is anticipated that annual water use reductions will achieve long-term water savings. Further, retrofits could also provide water saving irrigation controls, drip systems and installation of drought-tolerant landscape plantings would also reduce water demands and long-term water use efficiencies. Residential Water Conservation Program will include Best Management Practices (BMPs), as recommended by the California Urban Water Conservation Council (CUWCC) and codified in the Demand Management Measures (DMMs) for the Department of Water Resources. This Residential Water Conservation Program will provide performance measures to assist GFCSD in achieving the CABY region goal of Best Management Practices (BMPs) compliance. The Residential Water Conservation Program will focus on water use awareness, education and conservation savings. It will be designed to change lifestyle behaviors and the understanding of water as natural resource. While outreach and education programs do not have direct quantifiable water savings; however, consistent with the 20x2020 statewide per capita water reduction, it promotes water use efficiency to help achieve countywide 20% per capita water demand reduction. This Residential Water Conservation Plan will also include a reporting metric that documents the annual water conservation savings.

SCADA. In 2014, GFCSD staff worked cooperatively with Carlton Engineering to compile the GFCSD Water System Improvement Project (WSIP) PER, (pg 13) to comprehensively assess the GFCSD's water system needs. This assessment determined that system monitoring at the treatment plant and in the distribution system is needed to detect large-scale water losses resulting from line breaks. Currently, the GFCSD physically monitors the potable water storage tank levels as often as possible. In the event of a major failure in the system, the GFCSD is notified by either customers calling the emergency line or by the auto dialer at the treatment plant. A Supervisory Control and Data Acquisition System (SCADA) is needed to gather readings and alarm conditions from the various components of the water system. This system will allow operators and maintenance personnel to respond more quickly and appropriately to problems in the system. Ultimately, quick warning and easy access to system status will help reduce water waste, soil erosion, unauthorized discharge of chlorinated water into the environment, and public safety issues from water damage to roadways.

The project would install a Supervisory Control and Data Acquisition (SCADA) control system to monitor and control the water treatment process and distribution system and to improve operational performance of the treatment plant. The SCADA system will include a Human-Machine Interface (HMI) apparatus, a supervisory computer system to gather and acquire data, Remote Terminal Units (RTUs), Programmable Logic Controller (PLCs), and a communication infrastructure to connect the system to the RTUs.

Table 4-1 Technical and Scientific Documentation Table

Technical and Scientific Document Name	Document Description	Relevant page #
Tank Coating Evaluation. CSI Inspection Report.	Evaluation of water tanks at GFCSD treatment plant	3,4
Global List of all meters in the GSCSD Service Territory	Customer Data Sheets	All pages
Carlton Engineering. Water System Improvement Project	Evaluation of GFCSD Water System	13
URS. Water Supply and Demand Update. May 2012	Update of Water Supply and Demand within GFCSD's service area	24
DWR. 2010. 20x2020 Water Conservation Plan	Statewide water conservation plan.	38

Recent and Historical Conditions that Provide Background for Benefits Claimed

As described in the physical benefits tables, the GFCSD anticipates the proposed project would result in reduced seepage, increased water reliability, improved local supplies, statewide 20x2020 water conservation goals and improve emergency response time. The projects are designed to reduce seepage from water tanks, promote water use efficiency and conservation, reduce and repair leaks, improve emergency response to system failures, and result in more efficient water transport. Following are more detailed descriptions and background about the benefits of the proposed project.

Benefit 1 - Water Conserved: Evaluations by the GDPUD operations staff, in-field inspections by technicians, and inspection reports from CSI identified the top priority problem areas with potential for excessive leakage throughout the GFCSD water supply infrastructure systems. Immediate drought response through water use efficiency through water conservation education and public outreach. Excessive corrosion of the four water tanks, substantial thinning of the backwash tank, and meter replacement were identified as the highest priority improvements needed to ensure water supply reliability and to prevent needless water losses. The potential for water loss is extremely difficult to quantify and is therefore based largely on CSI Inspection Reports which are further supported by GFCSD field inspections conducted by operations personnel.

In the absence of hard data, it seems reasonable to assume the GFCSD has the potential to experience as much as 20% water loss over time through leakage if the four water tanks and backwash tanks are left in their current condition. The proposed project would provide much-needed upgrades to these water tanks resulting in untold water savings estimated at as much as 60,000 gallons per filling, which occurs daily during normal water operations. In the absence of the project, these benefits would not occur.

Benefit 2 – Improve Water Supply Reliability: Like many older water systems, the GFCSD pipelines require improvements to alleviate trapped air and improve delivery efficiency. This

results in improved water supply reliability. The water conservation measures described above also increase water supply reliability.

Benefit 3 - Improvements to Aging Infrastructure: All of the infrastructure improvements included in this project are designed to improve aging infrastructure. The GFCSD currently uses two backwash tanks that are over forty years old, the water meters and pipeline are over 20 years old, and the water tanks were originally installed in the 1960s. The SCADA system is essential for the safe and reliable maintenance and management of the system.

Benefit 4 – Implement DWR 20x2020 Water Conservation Plan: The DWR 20x2020 Water Conservation Plan (page 38) strongly recommends that the state accelerate meter installation and facilitate more widespread metering of small water systems, especially in rural and disadvantaged areas. The 20x2020 Plan acknowledges that meters tend to become less accurate over time as they are used and parts begin to wear. The proposed project would replace 300 water meters with more accurate and upgraded meters.

Estimates without the Project Conditions

Without funding, the GFCSD cannot afford to solve the corrosion of the treated water storage tanks (replace the tanks, reline/recoat, or install CP systems), design and implement a water use efficiency program, respond promptly to leaks or replace the aging and thinning backwash tanks, or replace all 300 over-aged meters.

The GFCSD will experience up to 10% water loss through on-going leakage within the service main, has the potential to experience additional losses (estimated to be 1.3 million gallons per year) each if the four water tanks and backwash tanks are left in their current condition. The proposed project would provide much-needed upgrades to these aged water tanks resulting in future water savings estimated at as much as 4.3 million gallons per year or 16.2 acre-feet per year. In the absence of the project, these benefits would not occur. Similarly, in the absence of the project over time the backwash tanks could fail due to leaks.

Without the project, air pockets would continue to disrupt water flow through the Eagle Ditch pipeline. By keeping water flowing as it should through the Eagle Ditch pipeline, water can continue to reliably flow in the pipeline so it can be treated and delivered to GFCSD customers. Carlton Engineering investigated the replacement cost of the ditch and bed it properly to eliminate high spots that cause the air pockets and they estimated this alternative would cost the GFCSD several million dollars.

The 300 over-aged water meters would remain in place. The GDPUD's annual average water losses due to outdated meters are difficult to estimate. However, according to the DWR 20x2020 Water Conservation Plan (page 38), water metering of water deliveries is considered essential to obtain valid data about consumption and water waste, and positively promotes water conservation programs. Most often, worn meters under-register the volume of water delivered. Because of the DAC status of GFCSD, in the absence of funding, the meter replacement program would likely not occur and the opportunity to implement a strong recommendation from the 20x2020 DWR Water Conservation Plan would be lost.

The following bullet statements summarize the expected conditions **without the project**:

- The Eagle Ditch Pipeline would continue to trap air pockets and become less efficient and more

problematic with time. Water flows would continue to be reduced to less than optimum conditions and system reliability could be impaired. Some water loss would also continue to occur as GFCSD staff uses other methods to remove the air pockets from the pipeline.

- Potential for as much as 30% water loss over time in the event the water tanks lining break and leak and water supply is lost through ground seepages. If Cathodic Protection systems are not installed on the treated water storage tanks, then they will continue to corrode and thin, causing leakages, water loss, and threatening system reliability.
- Without a new backwash tank, the current backwash tanks would continue to thin and could possibly fail. They are also not as efficient as a new one, slowing down the water treatment system and also making it less reliable. Ultimately a less reliable and inefficient water treatment system could affect water delivery to the customers of GFCSD.
- 300 aging and inefficient meters would become completely unreliable over time. Without funding, the GFCSD cannot afford to s in a timely fashion due to cost. Delays in replacing the meters would result in continued inaccurate water readings and missed opportunities to fix leaks as they occur at customer properties. Inaccurate water readings could be hurting the GFCSD financially as they could be undercharging customers for their water use. On the other end of the spectrum, customers could be overpaying for their water use due to an inaccurate reading. This leads to unreliable water delivery reliability and pricing. Continued use of the old water meters would make it more difficult to identify leaks in the system, contributing to water loss.
- This GFCSD would not achieve long-term reduction of water uses. The main service pipeline would continue to leak, customers would call to report leaks and leak repair response times would be slow. Plumbing retrofits would not be distributed and applicable rebates to replace water wasting toilets would not occur. The model Water Conservation component would not expand GFCSD's existing water conservation program to include additional Best Management Practices (BMPs), as recommended by the California Urban Water Conservation Council (CUWCC). There would be a complete absence of direct water savings through residential water audits. As a result, this project would not reduce demand within the GFCSD service area and in the upstream river system to improve reliability therefore the downstream systems including the Sacramento-San Joaquin Delta would continue to suffer from upstream diverters.
- An opportunity to comply with recommendations from the 20x2020 Water Conservation Plan for a rural DAC would be lost.
- The GFCSD would not be able to afford to have the SCADA system installed. As a result, the GFCSD would have to continue doing what they are currently doing; physically monitoring the tank levels as often as possible and relying on customers and workers at the treatment plant to notify them of any serious failures in the system. Not being able to stay on top of potentially major failures, leaves the GFCSD vulnerable to significant water losses, soil erosion, unauthorized discharge of chlorinated water into the environment, and public safety issues from water damage to roadways.

Methods for Estimation

Air Release Valves. The physical effects of the project arise from installing the ARVs into the Eagle Ditch Pipeline and managing the air pockets that the aging pipeline creates. While no studies have been completed to exactly quantify this benefit, it is reasonable that water supply conserved because ARVs do not contribute to water loss as other methods of removing air pockets in pipes can. It is also reasonable to assume that system reliability will be increased as a result of more water being able to flow through the pipeline at all times. The air pockets reduce water flow to less than a quarter of the pipe at times,

which can potentially interrupt water service and disrupt the system. Initial installations of two ARVs have proven that the air can be effectively removed without interruptions in service and without losses in water.

Backwash Tanks. The GFCSD staff determined that it would be best to replace the two tanks with one tank of equal or larger capacity. A newer, more efficient tank would allow the GFCSD to reclaim water used for backwash and recycle it back into the reservoir for treatment more effectively. The physical effects of the project arise from replacing the old backwash tanks with a new and more efficient tank. While no studies have been completed to exactly quantify these benefits, it is reasonable to assume that there is an increase in treatment system reliability as the likelihood of the tanks failing due to thinning and old age would be minimized with the installation of the new better performing tank. And finally, if funded, project costs would not be directly transferred to the customer in higher water rates, although the exact amount of savings cannot be quantified at this time.

Cathodic Protection Measures. The physical effects of the project arise from installing the CP systems in the water storage tanks and by preventing further corrosion of the tanks. While no studies have been completed to exactly quantify these benefits, it is reasonable to assume that the water supply will be conserved as result of fewer leakages and water loss from the corroded tanks. It is also reasonable to assume that there is an increase in system reliability as the likelihood of the tanks failing due to corrosion would be minimized with the installation of the CP systems. And finally, if funded, project costs would not be directly transferred to the customer in higher water rates, although the exact amount of savings cannot be quantified at this time.

Leak Detection and Repair. The project will detect and repair leaks throughout the GFCSD system. The District expects to repair a total of 36 leaks (1 leak per month for 36 months). A variety of studies have attempted to predict the average savings of leak detection and repair programs and the actual loss from leaks within a system. For example, using a detailed water audit of 47 California water utilities, the California Department of Water Resources (DWR) estimates that leaks account for 10 to 30 percent of the total water loss within a system. The July 1997 Journal of the American Water Works Association reported that 45 percent of water within a system is lost to leaks. While this project is not expected to eliminate all leaks, it is expected to fix a substantial amount of leaks within the GFCSD's system.

Meters. The physical effects of the project arise from replacing the 300 old water meters with new ones. While no studies have been completed to exactly quantify this benefit, it is reasonable that water supply is conserved because the new meters have leak indicators, making it easier to identify and fix leaks on people's properties. It is also reasonable to assume that water delivery reliability will be increased as a result of more accurate water readings. An increase in accuracy ensures that the GFCSD is reliably serving their customers, by charging everyone more accurately for the amount of water they use.

Residential Water Conservation.

According to the CUWCC, conducting public information programs do not have quantifiable water saving or assumptions or measures; however, consistent with the 20x2020 statewide per capita water reduction, this Residential Water Conservation Program will be developed to promote water use efficiency to achieve water use reductions within GFCSD's service area. Existing conditions suggest that this project will realize a possible 20 percent in savings from the implementation of the leak detection and repair program, given that this project will identify and repair 36 leaks, which upon completion help to achieve countywide 20% per capita water demand reduction and provide additional system reliability.

SCADA. The physical effects of the project arise from installing a SCADA system at their potable water storage tanks. While no studies have been completed to exactly quantify these benefits, it is reasonable to assume that the water supply will be conserved as result of being able to quickly respond to any potential leaks in the tanks or in the system. It is also reasonable to assume that there is an increase in system reliability as the GFCSD would no longer have to rely on people to notify them of any failures in the system. By being able to access the information remotely and being notified immediately of any significant drop in tank levels, the GFCSD can react faster to any issue, ensuring that the system continues to work properly and that customers continue to get their water without interruptions.

Acknowledgement of New Facilities, Policies, and Actions Required

Air Release Valves. This project does not require new facilities or policies. Actions required to install the ARVs involve needing a team of qualified GFCSD staff to execute the work. Staff will notify affected customers of shut-down dates and using pre-installed clean-outs, they will use a camera to scout out the ARV installation sites (based on air pocket locations). They will then dig up the ditch area where the ARV is to be installed and expose it. Staff will then cut into the Eagle Ditch Pipeline and install the ARVs. Afterwards, GFCSD staff will install a box over the ARV and then bury the box to conceal it. After installation of the ARVs, GFCSD staff will check for leakages by turning the water back on and looking for leaks as water flows through the pipe and also by using an internal camera to make sure air is no longer trapped in the pipe.

Backwash. This project does not require new facilities or policies. Actions required to install the new backwash tank involve needing a team of experienced and qualified people to execute the work. The contractor, which will be chosen based on competitive pricing and superb qualifications, will design and prepare all final plans and specifications for the Backwash Tank. They will also be responsible for disposal of the old tanks, providing any necessary grading and site prep that may be needed. The new tank will then be constructed onsite and installation will include all connections to the existing system. Once the new tank is installed, the contractor will execute all required commissioning and sign offs to ensure proper performance.

Cathodic Protection. This project does not require new facilities or policies. Actions required to install the Cathodic Protection systems involve needing a team of experienced and qualified people to execute the work. Four water storage tanks will be equipped with CP systems. A licensed State of California General Contractor with over 20 years of experience will install the cathodic protection per the design created by a NACE International, Certified Cathodic Protection Specialist with significant experience in corrosion engineering and CP systems. Upon completion of the installation of the CP systems, the contractor will perform system energizations, system adjustments and calibrations and tank-to-water potential surveys per industry and NACE International standards. The contractor will also provide a post installation, comprehensive written report discussing any findings as well as provide an operations and maintenance (O&M) manual for the new CP systems. The contractor will also provide technical training for Grizzly Flats maintenance personnel on the proper operation and maintenance of the subject tanks' CP systems.

Leak Detection and Repair. This project does not require new facilities or policies. Actions require notifying the customer of the potential loss of water during the leak repair, when possible notification will be given to effected customers prior to leak repair. GFCSD staff will then repair the leak. Once the leak is repaired, they will restore service and flush the water line to the residence. GFCSD staff will

check the leak repair to verify the repair was completed adequately. This will be done by turning the water back on and visually inspect that repair area is the not leaking.

Meters. This project does not require new facilities or policies. Actions require notifying the customer of the loss of water during the meter replacement 24 hours prior to commencing. GFCSD staff will then close the curb stop and clear the meter box of debris. They will then remove and replace the old meter with a new one. Once the new meter is installed, they will restore service and flush the water line to the residence. Once the old meter has been replaced with the new meter, GFCSD staff will check the meter to verify proper performance. This will be done by turning the water back on and testing that the new meters are accurately displaying information and not leaking.

Residential Water Conservation. This project does not require new facilities or policies. Actions required to implement the Residential Water Conservation plan involve needing a water use efficiency practitioner contractor experienced and qualified to execute the work. Alongside the water use efficiency contractor, GFCSD staff will coordinate local workshops and insert water conservation notices in monthly billings.

SCADA. This project does not require new facilities or policies. Actions required to install the SCADA system involve needing a team of experienced and qualified people to execute the work. Alongside the contractor, GFCSD staff will discuss design and specifications for installation of the SCADA system. The contractor will, as necessary, perform any needed mobilization for installation of the SCADA system. They will then handle all installation needs including installation of sensors, wiring of sensors, installation of equipment, software set up, and programming of system. Once installed, the contractor will execute all required commissioning and sign offs needed to ensure proper system performance and compliance. Alarms will be programmed and the system will be tested by contractor. Contractor will provide an O&M Manual and a one day training session for GFCSD staff on SCADA system use.

Adverse Physical Effects

Air Release Valves. The project may produce temporary interruptions in water service, but will be returned to normal operation when complete. No large physical changes will be made during project implementation.

Backwash. The project may produce temporary interruptions in water service, but will be returned to normal operation when complete. While the old tanks will be removed and a new tank constructed and installed, the area is so small and there will be little to no disturbance that no large physical changes will be made during project implementation.

Cathodic Protection Measures. The project may produce temporary interruptions in water service, but will be returned to normal operation when complete. As work will be done on existing tanks, no large physical changes will be made during project implementation.

Leak Detection and Repair. The project may produce temporary interruptions in water service, but will be returned to normal operation when complete. As work will be done on existing pipelines, no large physical changes will be made during project implementation.

Meters. The project may produce temporary interruptions in water service, but will be returned to normal operation when complete. Additionally, no large physical changes will be made during project implementation.

Residential Water Conservation. No large physical changes will be made during project implementation.

SCADA. The project may produce temporary interruptions in water service, but will be returned to normal operation when complete. No large physical changes will be made during project implementation.

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Attachment 3: Technical Analysis of Physical Benefits Claimed - References

The references that relate to the Technical Analysis of Physical Benefits Claimed for **Grizzly Flats Community Services District, Drought Measures Infrastructure Project can be found in the PDF document entitled Att_DG_ProJust_5of5.** The references cited in the Technical Analysis are the same as those identified in Table 5 – Physical Benefits.

Attachment 3: Technical Analysis of Project Physical Benefits Claimed

Project 5. Nevada Irrigation District, Rock Creek Contingency Intertie Project

Nevada Irrigation District (NID) provides irrigation water for agriculture and other non-potable uses and treated water for domestic, municipal, and industrial use, including areas in the Disadvantaged Community of North Auburn and Western Placer County. Within its service area, NID serves a section of North Auburn's residential population and commercial properties, including Auburn Faith Hospital (treated water). Currently, the primary source of water for the North Auburn Treatment Plant is the Rock Creek Reservoir (Reservoir) and the Bear River Canal System. The Combie Reservoir and the Combie (and Combie Ophir) Canal systems provide irrigation water for most of the North Auburn Area; and separately, the Rock Creek Reservoir and Bear River Canal system provides irrigation water to the southwestern portion of NID's service area. The intertie would be approximately 3,750 feet in length and 36 inches in diameter.

Technical Basis of the Project

NID's existing raw water system operates effectively under normal conditions to serve customers in the North Auburn Area; however, the existing facilities lack adequate redundancy. In other words there is not sufficient capacity for back-up or failsafe in the existing system to adequately respond to emergencies and drought conditions. The emergency water supply for upstream canal failures (Bear River Canal System) is through the Nevada Irrigation District's Combie Canal. The existing Combie Canal System is very limited for an emergency supply and requires large reductions in existing customer water deliveries in order to provide a limited supply of water to the Rock Creek Reservoir, and consequently, the two water treatment plants – this was evident during the Bear River Canal failure of 2011, described below (the canal also failed in 1996 affecting 75,000 people). This project will add an intertie pipeline that will directly connect the Combie Canal to the Rock Creek Reservoir, which can be used during outages of PG&E's Wise Canal, or Bear River Canal, or both.

The proposed intertie and turnout pipelines would not increase the existing system capacity under normal conditions, but the project would improve NID's ability to provide additional water supply during times of high demand. The project would substantially improve the system reliability, redundancy and NID's responsiveness to drought, upstream canal failures and fire protection. As demonstrated by the April 19, 2011 canal failure, in the absence of the intertie pipeline, the only immediate alternative to upstream canal failure is trucking water and there is no back-up system for severe drought conditions (NID Engineering Staff Memo, 7-17-14, pages all).

The proposed intertie connection would provide much-needed back-up water supply deliveries for Pacific Gas & Electric (PG&E), which owns and operates Rock Creek Reservoir, and Placer County Water Agency, which delivers water to thousands of customers in western Placer County. Both PG&E and PCWA customers would also benefit from the increased system-wide redundancy proposed by this project.

Documentation Table

Technical and Scientific Document Name	Document Description	Relevant Page #
NID Board Meeting Notes, May 11 2011.	Board meeting notes in the immediate aftermath of the canal failure.	All
PCWA Newsletter, Vol 25, No 3, June-July 2011	Description of canal failure and impact to customers	Pages 1-3
Rock Creek Intertie Project, Initial Study/Mitigated Negative Declaration, March 2014	Environmental Compliance documentation.	Pages 1-40
Alternative Pipe Route Analysis Rock Creek Pipe – WO# 6898 7-17-12	Memo and Engineering Drawing	All

Recent and Historical Conditions that Provide Background for Benefits Claimed

The project is designed to improve water supply reliability and public safety by developing an emergency water supply for backup due to a canal failure; and, an additional water supply during times of high demand (drought).

Background for Benefit 1 - Water Supply Reliability/Improved System-wide Redundancy: The project will greatly increase the water supply availability to two water treatment plants and irrigation services through the additional source of water to the Rock Creek Reservoir, effectively minimizing the potential disruption to 150,000 people. The Rock Creek Reservoir (Reservoir) provides an intermediate water supply source to two water treatment plants (WTP), the North Auburn WTP and the Foothill WTP; combined, they provide drinking water for approximately 62,180 people located in North Auburn and western Placer County. Water supply to the Rock Creek Reservoir is accomplished primarily by way of PG&E Bear River and Wise Canals, which are fed from the Rollins Reservoir. The Bear River Canal is PG&E's main conveyance into the Auburn and lower Placer County area and normally runs about 420 cubic feet per second (cfs).
The structural vulnerability of the Bear River Canal was highlighted on April 19, 2011 when a PG&E canal patrolman discovered a breach of about 40 feet just downstream from Rollins Reservoir. Based on the failure, the operators shut down the Canal while engineers, geologists, drillers and a construction company arrived on site. The primary issue that caused the failure was over-steepened and unstable banks that gave way during a storm event. During this event, the Bear River Canal was out of service and critical water supplies that feed the Rock Creek Reservoir and the North Auburn and Foothill WTPs were disrupted for six weeks. The failure of the Bear River Canal directly affected approximately 150,000 people (64,600 water customers) in western Placer County (PCWA June-July 2011 Newsletter, page 2).

In response to this event, the Nevada Irrigation District and PCWA worked together cooperatively and were able to partially serve affected water customers through temporary measures until water delivery resumed in mid-June (488 cfs capacity). This event highlighted the need for increased redundancy in NID's (and PG&E's) existing water delivery system. The existing raw water system operates effectively under normal conditions and serves NID customers in the area; however, a backup or failsafe is needed to increase reliability of the existing system.

Background for Benefit 2 – Drought Preparedness/Additional Reliability: During a drought, water availability is crucial. The project will eliminate disruption of water availability should the existing primary source of water to Rock Creek Reservoir be impacted. As a result of damages to the Bear River Canal in April 2011, the canal was out of use for about six weeks, creating a severe water shortage emergency for thousands of customers. During the time when the canal was out of service, the 62,180 people who rely on water supplied via the two canals were asked to severely limit their water usage. In the immediate aftermath, water was trucked from Rollins Reservoir (NID Facility) to Lake Arthur (PCWA Facility) so relief could be provided to some of PCWA's hardest hit customers. Approximately 14 trucks a day were running 12 hours a day to move water. A tank was installed at the Gold Country Fairgrounds and water was hauled to this tank. Some commercial agriculture customers were hardest hit during this event.

Background for Benefit 3 - Upgrades to Infrastructure: While the Bear River Canal was under permanent repair in 2011, the back-up emergency water supply was delivered by way of the Nevada Irrigation District's Combie Canal. However, the Combie Canal emergency supply option is insufficient and additional infrastructure is needed in order to avoid severe reductions in existing customer raw water deliveries and to provide a more reliable supply of water to the Rock Creek Reservoir, and consequently, the two water treatment plants.

Estimates without the Project Conditions

In the absence of the proposed intertie project and in the event of an upstream canal outage, treated raw water supply to the NID North Auburn Water Treatment Plant (WTP) would be seriously reduced; potentially jeopardizing the potable water supply. Irrigation customers would also be impacted with reduced deliveries. Both of these conditions put NID and its customers at risk.

The following bullet statements summarize the expected conditions **without the project**:

- Approximately 2,800 water customers in the North Auburn Area (a disadvantaged community) would remain at risk of direct and severe water shortages in the event of upstream canal failure.
- An additional 59,380 customers in western Placer County remain at risk of indirect impacts and severe water shortages in the event of upstream canal failure.
- The existing canal system infrastructure would remain in place and would lack redundancy.
- Lost opportunity for 35 cfs back-up supply offered by a project with no significant environmental impacts as documented in the 2014 Initial Study/Mitigated Negative Declaration.

Methods for Estimation

The methods used to estimate the physical benefits of water supply reliability, improved system redundancy, drought preparedness and upgrades to aging infrastructure is based on NID Engineering analyses as described in a memo dated July 17, 2012 (all pages). The Rock Creek intertie is designed to supply water to the Rock Creek Reservoir from the Combie Ophir II canal during scheduled PG&E shutdowns and to provide a backup water supply for emergencies (PG&E's Bear River Canal). It was determined the intertie pipe would carry a maximum 35 cfs peak, and 12 cfs off-season flow per Placer County Water Agency's stated needs. The assumed pipe size calculated is 36-inches in diameter, based on available hydraulics and distance factors.

Acknowledgement of New Facilities, Policies, and Actions Required

The proposed Project entails the installation of a diversion structure located at the Combie Ophir II Canal, just prior to entering an existing NID pipeline. The diversion structure would include a concrete headwall, bar rack with two-inch spacing to prevent debris and persons from entering the pipeline. The bar rack would be manually cleaned by NID operations staff. A slide gate would be used to divert a portion of water flow into the pipeline. There would also be the installation of approximately ¾ mile (~ 3,750 feet) of anticipated 36- inch pipe from the existing Combie Ophir II Canal to the Rock Creek Reservoir. The pipe would be constructed using ductile iron, PVC, or HDPE. The pipeline trench during construction would be approximately four feet wide with an anticipated maximum depth of five to six feet. Upon completion, approximately 30 inches of fill would cover the pipe and the pipeline corridor would be restored, to the extent feasible to pre-existing conditions (pavement or grassland). Valves and other appurtenances would be buried or located in vaults adjacent to the pipeline.

The Project also involves the installation of an outlet structure including a headwall, energy dissipation structure to reduce velocity, erosion, and prevent wildlife or persons from entering the pipeline. The outlet structure would be constructed at Rock Creek Reservoir just east of the dam. It would be located above the ordinary high water mark (OHWM) of the reservoir; however, an approximately 15ft by 10ft erosion control riprap area would line the reservoir bank below the outlet. It is estimated that the Project would be completed within 150 days and would require three potential staging areas.

Adverse Physical Effects

The proposed project has the potential to result in short-term impacts to the environment in the immediately vicinity of work areas, primarily during project construction. There are no potential adverse physical effects. Any physical effects to the environment have been detailed and noted in the completed environmental document and are minimized through mitigation measures.

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Attachment 3: Technical Analysis of Physical Benefits Claimed - References

The references that relate to the Technical Analysis of Physical Benefits Claimed for **Nevada Irrigation District, Rock Creek Water Contingency Intertie can be found in the PDF document entitled Att_DG_ProJust_5of5.** The references cited in the Technical Analysis are the same as those identified in Table 5 – Physical Benefits.

Attachment 3: Technical Analysis of Project Physical Benefits Claimed

Project 6. Placer County Water Agency, Greeley Canal Drought Measures Optimization Project

The Greeley Canal System consists of the Upper Greeley Canal, Lower Greeley Canal, Gaylord Pipe, Jamison Pipe, Monte Rio Pipe, and the Niegel Siphon and serves 330 irrigation customers in summer months and 236 irrigation customers in winter months. The system has two points where it receives water and two points where unused water is spilled. This project would modify existing Greeley Canal System facilities through the removal of manual operated equipment and replacement with automated equipment. The automated equipment would require power and communications capabilities. Operations would change requiring less visits to the sites for adjustments since this operation would be handled by the automation or can be adjusted remotely from a SCADA station at the Operations facility. Maintenance of the electrical and electronic aspects of the project would require technical expertise not currently required at the existing sites.

Technical Basis of the Project

Under the existing manually operated system, the operators set the flow rates into the canals usually based on peak demand to ensure all customers receive their allotted deliveries. Flow recorders located at the two spill locations are used to adjust flows. It takes approximately four hours for the water diverted at the upper Greely Canal to reach the lower Greely Canal. A valve between the upper and lower canals is partially closed to pressurize a portion of the canal upstream.

The amount of water diverted and sent through the Greely Canals corresponds to the pattern of spill volume. In other words, when more water is sent through the canal than is used by the customers that water is sent through the spill channel. The operators aim to achieve a spill volume that approaches zero but does not drop all the way to zero since at zero there is no way for them to determine if all customers received their delivery. As customer usage decreases during certain times of the day the spill flow increases, resulting in wasted water.

PCWA engineering and operations staff conducted a review of the flow data which suggests a daily cycle of use and customer irrigation demands along the canal. Customer demands vary based on their needs which include irrigation for farms and ponds etc. The proposed upgrades and equipment proposed as part of this project would install automated equipment to monitor these spill variations and make flow adjustments at the heads of the canals to minimize the peak spill flow rates. PCWA engineering staff anticipates the project would re-direct an estimated 360 acre-feet per year of water currently lost to the system and significantly reduce the amount of water that is unnecessarily spilled.

This project would install an electrically operated gate and meter combination to maintain a discharge flowrate to the Upper Greeley Canal regardless of upstream conditions. It would be connected to the PCWA SCADA system where it would receive the target flow rate to discharge. It would automatically make adjustment to itself to achieve the desired flow. SCADA would monitor the spill flows and based on the usage patterns and travel time from beginning of canal to end, make adjustments to minimize

the amount of water reaching the spills. Estimated peak spill reductions of around 2/3 are anticipated which equal approximately 360 acre-feet per year.

Flow variations in the Upper Greeley Canal cause corresponding variations in the pressure in the piped downstream section of the canal. If these variations are too extreme, customers on portions of the pipe lose service. Also since deliveries to customers is based on pressure, variations in pressure result in inaccurate deliveries. The automation of the valve between the Upper and Lower Greeley canals along with a pressure and flow meter at the site would enable the pressure in the pipe to be stabilized regardless of flow, preventing spilling at the spill associated with the pipe and stabilizing deliveries to the customers based on actual demand.

Table 6-1 Technical and Scientific Documentation Table

Technical and Scientific Document Name	Document Description	Relevant page #
Flow data at two spill locations.	Flow recorders located at the two spill locations have been recording flow for 10 years.	NA
Water Purchase Summaries	Customer Records reviewed by Operations Managers.	NA
System Losses and Expert Opinion by PCWA Engineers and Operations Managers	Expert opinion and direct experience.	NA

Recent and Historical Conditions that Provide Background for Benefits Claimed

As described in the physical benefits tables, PCWA anticipates the proposed project would result in increased system reliability and efficiency and upgrades to aging infrastructure. PCWA anticipates the proposed project would increase water efficiency of the Greeley Canal System through automation of control gates that would minimize spilling at the canal ends.

Benefit 1 - Water Conserved: Based on evaluations by the PCWA operations staff, review of flow data collected over a ten year period, and in-field inspections by canal technicians, PCWA estimates the project would result in approximately 360 acre-feet per year of water savings. The proposed control and monitoring devices would allow detailed analyses and much more accurate estimates of customer water demands. The additional data generated would also enable refinements to the adjustment algorithm being implemented. Stabilization of the pressures in the piped section of the project would help stabilize deliveries in the system that would help in smoothing the spill flow curve which would in turn make it easier to estimate necessary adjustments. Within approximately one to two years, the algorithm could be calibrated to achieve a 2/3 reduction in unneeded spill volume to meet demands or an estimated 360 acre-feet of water savings per year.

Benefit 3 - Water Supply Reliability: The reductions in spill volume in the Greeley system would allow those flows to remain within PCWA's Boardman Canal where they can then be captured and stored in the PCWA Mammoth Reservoir. The larger volume in the reservoir would allow deliveries from other sources to the reservoir to be reduced by a corresponding amount.

Reducing deliveries to Mammoth would keep water higher in the PCWA system making it available for use throughout the system and reducing demands. Furthermore, reducing the amount of water that is spilled at the ends of the canals would significantly reduce the amount of water diverted from the delivery systems that provide the surface water to PCWA's regional water treatment plants.

Benefit 2 - Upgrades to Aging (and outdated) Infrastructure: Currently the canal flow rates are operated manually to ensure PCWA customers receive water deliveries. This is efficient only if the spill volume approaches zero but does not go all the way to zero. Once the spill volume reaches zero, there is no way to gage if all customers received their delivery. Throughout the day, customer usage varies and decreases during certain times of the day. During times of decreased demand, the spill flow increases correspondingly resulting in wasted water through the spillway. This project would install automated equipment to make flow adjustments at the heads of the canals to minimize the peak spill flow rates. This project would install an electrically operated gate and meter combination to maintain a discharge flow rate through installation of the following:

- Electrically operated Headgate
- Flow measuring and recording
- Remote monitoring and control of flow
- Pressure monitoring and control to regulate deliveries

Benefit 4 - Increased Instream Flows/Environmental Water Use: The proposed project would reduce the amount of water PCWA needs to purchase from PG&E for water delivery. This is because the amount of water that is not sent through the spill would be made available to the PCWA system for the treatment plants and other customer demands. This would result in reduced upstream diversions for PG&E's system and potential instream benefits throughout the system. The potential annual environmental gains of instream flows of the project are estimated at 360 acre-feet per year.

Estimates of without the Project Conditions

Combined spill rates have a maximum to minimum variation ranging from 1 to 2 CFS. This equates to a volume of approximately 530 acre-feet per year that reaches the spills and is lost to the system.

The following bullet statements summarize the expected conditions **without the project**:

- 360 acre-feet per year of potential water supply unnecessarily diverted and spilled.
- Aging and inefficient manual control methods of canal system operations would remain in place indefinitely.
- An inefficient irrigation delivery system would remain in place that over-estimates the water use demands per acre of land irrigated.
- Customers on portions of the pipe would continue to lose service due to extreme flow variations.
- Ongoing inaccurate water deliveries to customers.
- SCADA would not be updated and would not control the spill flows based on the usage patterns and travel time from beginning of canal to end. This would result in a lost opportunity to make

adjustments to minimize the amount of water reaching the spills.

Methods for Estimation

The estimated amount of water saved is based on engineering evaluations and review of the flow data recorded over a ten year period and customer demand reports and data. The potential benefits described for upgrades to outdated infrastructure is based on decades of in-field ditch tender inspection reports, customer interactions with PCWA operations and management experience and industry standards for canal systems. The Greely Canal System serves 330 customers and estimates concerning improved customer service are based on management and operations team estimates and first-hand experience.

Acknowledgement of New Facilities, Policies, and Actions Required

This project would modify existing facilities through the removal of manual operated equipment and replacement with automated equipment. The automated equipment would require power and communications capabilities. Operations would change requiring less visits to the sites for adjustments since this operation would be handled by the automation or can be adjusted remotely from a SCADA station at the Operations facility. Maintenance of the electrical and electronic aspects of the project would require technical expertise not currently required at the existing sites.

Adverse Physical Effects

Additional above ground facilities would create visual impacts which would be mitigated in compliance with California regulations. Flows in natural waterways receiving the spill flows would be reduced but not eliminated potentially requiring similar mitigation.

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Attachment 3: Technical Analysis of Physical Benefits Claimed - References

The references that relate to the Technical Analysis of Physical Benefits Claimed for **Placer County Water Agency – Greeley Canal Drought Measures Optimization can be found in the PDF document entitled Att_DG_ProJust_3of5.** The references cited in the Technical Analysis are the same as those identified in Table 5 – Physical Benefits.