Attachment #7-Technical Justification of Projects

Tahoe Sierra

Project #1: Markleeville Creek Restoration Project

The purpose of the Markleeville Creek Restoration Project is to reestablish the natural form and function of Markleeville Creek and its floodplain through the site of the former United States Forest Service (USFS) Guard Station in downtown Markleeville, California. This site, which is approximately four acres in size, has been subject to significant and repeated flooding over the years.

This proposal is to fund the initial phase of implementation, Phase 3A, which will include sewer system modifications and pre-project baseline monitoring. Sewer system modification is the critical path element to begin project implementation and ensure compliance with water quality standards. The primary elements of this phase of the restoration project include the following: replacement and relocation of underground sewer lines, replacement and relocation of above ground sewer infrastructure (manholes and pump station infrastructure), realignment and access road improvements to waste water treatment plant through restoration area, and pre-project baseline monitoring.

Project Physical Benefits

Summary of the types of physical benefits being claimed

The Markleeville Creek Restoration Project will accomplish the following benefits:

1. Reduce threat to water quality
2. Improve community sewer system
3. Increase public awareness and stewardship of natural resources

Narrative to support the physical benefits of the Markleeville Creek Restoration Project:

1. Reduce threat to water quality

Replacement of aging sewer pipe crossing under the creeks and manholes and lift station within the 25-year floodplain reduces the potential for leaks or spills that could contaminate the natural surface and ground waters (either from a damaging flood event or from pipe deterioration).

The existing condition of the project reach is that of a narrow, constructed stream channel which is just downstream from the bridge for Highway 89. The creek has been highly altered since the 1930s when rock floodwalls were erected and the floodplain was filled for the construction of the Guard Station facility. This stream confinement has resulted in accelerated water flows causing erosion, stream incision and bank failures downstream.

By relocating the gravity sewer mains and manholes out of the floodplain restoration area, it will reduce the risk of inundation due to flooding and reduce the risk of pipe failure due to shallow depth/cover exposure.

By removing the existing sewer pump station from its current location, the flood plain restoration project can incorporate an improved design at the confluence of Millberry Creek and Markleeville Creek to simulate natural conditions and reduce erosion/scour.

2. Improve community sewer system

The project will provide for three major improvements in the sewer system: 1) increase the life span and reliability of the sewer system, 2) reduce the probability of a sewer pipe or manhole failure/leaks, and 3) enhance safety and security for MPUD infrastructure and accessibility.

Project will prevent inundation of ~700 feet of sewer pipelines, four sewer manholes, and the primary sewer pump station for all flood events 100-year or greater magnitude. One of the existing sewer manholes within the project limits is not accessible by construction or service vehicles for inspection, maintenance, or bypass pumping under any conditions. Several of the existing sewer manholes within the project limits are not accessible during inclement weather or flood conditions.

By relocating sewer manholes outside the floodplain area to locations adjacent to (existing and proposed) roadways, the sewer infrastructure will be accessible during all weather conditions. The proposed new sewer manholes and pump station facilities will be constructed outside the floodway restoration area at finish surface elevations above the maximum anticipated flood height. This improvement will reduce the risk of inundation and subsequent sewer overflows.

The existing access road to the MPUD sewer pump station and wastewater treatment plant has limited access to large vehicles (such as vacuum trucks) especially during inclement weather. The existing sewer pump station site does not have sufficient space for bypass pumping, temporary power, and maintenance/construction activities while maintaining access to the treatment plant. The sewer pump station is not accessible during flood events. These current system characteristics represent deficiencies in the system and jeopardize water quality.

By relocating the sewer pump station to a more suitable location along the proposed (improved) access road, sufficient space will be available for maintenance and/or emergency activities to prevent sewer overflows – during all weather conditions. Construction of a new sewer pump station at a more accessible location (off HWY 88) will provide improved access to the facilities during all weather (and flooding) conditions, replace a critical piece of infrastructure nearing the end of its service life, and allow provisions to increase or mitigate the response time prior to sanitary sewer overflows.

The proposed collection system and pump station improvements will include provisions for extending the Time-To-Overflow for sewage in the event of a pump station failure or malfunction, via storage. This improvement will provide additional safeguards and reliability for sewer function and extend the time necessary to procure emergency equipment and contractors in the event of a major failure or blockage.

Underground sewer collection system piping will be constructed in new locations (alignments) outside the proposed floodway restoration areas, with sufficient cover and protection to prevent damage due to flooding, erosion, or exposure. New pipe constructed to today's standards (materials and methods), which will extend the service life for the foreseeable future.

3. Increase public awareness and stewardship of natural resources

The project will provide educational presentations for citizens and visitors about the important of natural resource protection, low-impact recreation and watershed stewardship. Project partners will inform the community and visitors about watershed processes and the need for restoration.

Community members will be engaged as volunteers in monitoring of site conditions and assistance in long-term site maintenance. The Alpine Watershed Group will continue to identify opportunities where volunteers can be trained to reliably support the official monitoring program.

This project will also initiate the next phase of floodplain restoration and ensure the preservation of four acres of land for open space, wildlife habitat and public recreation.

Adverse physical effects to the implementation of this project:

We do not foresee any adverse effects arising from the project. We will implement construction safeguards to ensure that any construction related water quality impacts are avoided – working when drainages are dry, installing Best Management Practices (BMPs), maintaining BMPs, and following the Stormwater Pollution Prevention Plan as required by State Water Board permits.

Supporting Documentation

The methods used to estimate physical benefits are based on watershed assessments and technical input from professionals on the Technical Advisory Committee. This floodplain restoration project has been identified as a priority restoration project for the Upper Carson River Watershed in three watershed-level planning and assessment documents:

- Upper Carson River Watershed Stream Corridor Condition Assessment, MACTECH Engineering (2004), pgs. 182-183 (attached)
- Carson River Watershed Adaptive Stewardship Plan, Carson Water Subconservancy District (2007), pg. 125 (attached)
- Carson River Watershed Floodplain Management Plan, Carson Water Subconservancy District (2008), pg. 30 (attached).
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The site assessment conducted during the first phase of the project between 2005-2007 confirmed the need for the floodplain restoration and identified the importance of moving the sewer manholes out of the floodplain. This is substantiated in the Markleeville Creek Restoration Project Design Report, May 2007 (pg. 1-5 of this document attached).

Additional steps have been taken over the past year to determine the condition and needs of the sewer system for the next phase of the project. Conceptual sewer line designs have been drafted by the current consulting firm, Cardno Entrix, involved in Phase 2. Four alternatives were presented. MPUD and TAC feedback identified a modified version of Alternative #3 (attached) to be the preferred alternative.

Sewer line replacement and manhole relocation out of the floodplain has been identified as an MPUD priority in the MPUD Memo #002-07-01 entitled, "Condition Assessment of Sewer Facilities within Markleeville Creek Restoration Project Limits" (April 2012). A complete copy of this report is attached. This report identifies four deficiencies regarding the existing pump station condition and three additional deficiencies regarding the pump station location.

MPUD District Engineer has also reviewed and commented on these drawings. Input from MPUD board and staff regarding the sewer alternative best suited for this project have been summarized in a Technical Memo #002-07-03 entitled, "Markleeville Creek Restoration Project – Priority Ranking for Proposed Sewer Facilities Concepts" (June 2012). A complete copy of this report is attached. This report identifies the priority ranking of the four sewer system concepts. This funding proposal allows for the implementation of a sewer system solution which will provide "a much higher long-range sustainability goal for the project site, due to the construction of a new pump station with improved spill/flooding safeguards and a greatly extended life-cycle" (pg 4).

Table 9 – Annual Project Physical Benefits

Project Name: Markleeville Creek Restoration Project

Type of Benefit Claimed: Reduce threat to water quality and improve community sewer system

Measure of Benefit Claimed (Name of Units): linear feet (LF) of aging sewer lines within the floodplain

Additional Information About this Measure: Annual measurement, averaged over 20 years of Total Maximum Daily Load lifespan

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
Yrs of Project Life	700 LF	0 LF	There will be no aging sewer lines remaining in the floodplain
Comments: This project will replace 700 feet of aging sewer lines in the floodplain			

Type of Benefit Claimed: Reduce threat to water quality and improve community sewer system

Measure of Benefit Claimed (Name of Units): # manholes within the floodplain

Additional Information About this Measure:

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
Yrs of Project Life	4	0	There will be no sewer manholes in the floodplain
Comments: This project will remove 4 sewer manholes which lie within the floodplain			

Type of Benefit Claimed: Reduce threat to water quality and improve community sewer system **Measure of Benefit Claimed (Name of Units): # sewer lift stations within the floodplain** **Additional Information About this Measure:**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	1	0	There will be no sewer lift stations remaining in the floodplain
Comments: This project will remove 1 sewer lift station which lies within the floodplain			

Type of Benefit Claimed: Increase public awareness and stewardship of natural resources **Measure of Benefit Claimed (Name of Units): # volunteer recruited for project support** **Additional Information About this Measure:**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	3	10	At least 7 new volunteers will be involved in site monitoring and stewardship

Project #2: Negro Canyon Restoration Project

The Negro Canyon Restoration project restores the eastern portion of the Gregory Creek sub-watershed in the Truckee River watershed. The watershed has experienced significant impacts through past land use including intense logging, fire, and construction of Interstate 80. These impacts have led to the development of a poorly constructed road network that has disrupted natural drainage patterns and is causing significant erosion.

Restoration of the eastern side of the watershed was identified as the highest priority through a watershed assessment. Restoration work will primarily consist of restoring abandoned road alignments, revegetating areas with native plants, restoring eroded stream channels, and re-establishing natural drainage patterns. Significant water quality improvement and habitat gains will be achieved.

Project Physical Benefits

Summary of the types of physical benefits being claimed

The Negro Canyon Restoration Project will accomplish the following benefits:

1. Improve water quality through reduction of fine sediment – 177 tons/year for 20 years;
2. Restore 1,200 linear feet of stream channel;
3. Restore and enhance 0.62 acres of riparian and upland native scrub habitat; and
4. Improve/re-route 2,000 linear feet of trail

Narrative to support the physical benefits of the Negro Canyon Restoration Project:

Degradation in Negro Canyon is primarily caused through historic degradation described in detail in the NCWA. To summarize, some of the significant effects of past periods of logging leading to current impacts include:

Construction of road network for timber harvest: By 1952, the main system of logging roads had been constructed, causing many direct channel impacts. Where the main roads crossed larger perennial channels, crossings were constructed with fill and culverts. Culverts were often undersized, resulting either in erosion or aggradation and abandonment of the culvert. Where roads crossed ephemeral channels, typically culverts were not included. In most cases, the fill is actively eroding and the resulting sediment is moving downstream, impacting habitat and causing channel instability. Due to the steep nature of the watershed, instability is able to propagate through the length of the stream channels. In the eastern half of the watershed, roads have captured and diverted ephemeral channels causing even more significant erosion.

Changes to hydrologic function: Nearly the entire watershed was deforested between 1940 and 1980. Timber harvest on this scale has inevitable hydrologic consequences, primarily resulting in flashier and

more concentrated runoff periods. These changes to the natural runoff patterns are a result of the removal of the forest canopy, compaction of soils, and decreased infiltration due to harvesting. The road network amplifies the impacts to hydrologic function by capturing drainages at sites where culverts have failed.

The effects of past land use are particularly significant in the eastern half of the Negro Canyon watershed, our project location. This is due to the relatively steep slopes, the somewhat drier conditions, and poorer soils as compared to the western half of the watershed. We propose to implement the restoration plan as conceptually established in the NCWA in the eastern half of the watershed. The projects on the eastern half of the watershed will address 50% of the total land area in Negro Canyon, approximately 500 acres. However, because of the nature of the watershed, we are addressing more than half the sediment production in the watershed.
These impacts have led to impaired water quality, degraded stream channels, and impacted riparian and upland habitat. The technical basis for measuring the benefits is described in detail below.

1. **Improve water quality**

The project addresses six actively eroding areas within Negro Canyon. We have begun quantitative monitoring of load reduction; however only some of the project data are available. We are directly estimating load reductions from the project in two ways. First, we will take pre-and post-project cross sections of each restored area. The pre-project data will give an estimate of the amount of fill that will eventually erode from each site. During restoration, we will remove the fill and restore natural hydrologic patterns at each site. By doing so, we remove the potential for future erosion. Post-construction cross sections will give us an immediate measure of erosion reduction. We will have an estimate of fine particle size from construction screening, therefore we should be able to make relatively accurate estimates the proportion of fill removed that consists of fine sediments (the pollutant of concern).

Second, we will directly measure runoff rates using a rainfall simulator at one of the restoration sites. A rainfall simulator measures the quantity and quality of surface water runoff from a known area by delivering water, mimicking rainfall at a specified rate, to the soil surface. The portable rainfall simulator consists of a flat Plexiglass reservoir for water, with 500 hypodermic needles on the underside. Water drops are produced on the needles by providing a constant gravity head. The rainfall simulator wets a defined area, and a steel frame focuses the runoff from 2000 cm2 of the wetted area. Rainfall rates are determined from historical precipitation data for the area. Rainfall is allowed to continue until steady runoff is obtained or 60 minutes have elapsed. Runoff quantity measurements include timing of ponding, runoff formation, and flowpath formation. The suspended sediment concentration of the collected runoff is measured. Rainfall simulation gives an immediate measurement of how effective restoration work has been in increasing the infiltration capacity of the soil and reducing soil erosion through runoff. This technique has been used extensively in the Tahoe Basin to establish erosion rates, and additional information is included in the attached Monitoring Report.

We have completed the pre-project runoff simulation, and sediment yields from the project site are extremely high. Rills formed within the first minute of the simulation, and eroded rapidly. Average sediment concentration from runoff samples taken was 108 g/L – extremely high. As a point of comparison, suspended sediment concentrations of area streams during storm events are measured in mg/L. See the attached Monitoring Report for additional information.

These methods will give us an accurate and quantitative water quality improvement. We have made rough preliminary estimates of the water quality benefits based on the NCWA and project design plans for Sites G & H. The estimates are based on the amount of fill to be removed at each site and an estimate of the proportion of the fill that is composed of fine sediment. At present, stream channels are actively eroding into the fill, and over the course of the next several years, this fill can be assumed to move into the stream channel, mobilizing as a potential sediment source. The amount of fill to be removed across the six restoration sites is approximately 3,750 cubic yards or 5,062 tons. Of this, we estimate 70% is fine sediment – the project area is composed of highly erodible volcanic soils. This gives an estimate of 3,543 tons of fine sediment to be removed from the project area. This averages out to 177 tons of fine sediment per year over the next 20 years, the life of the Truckee River sediment Total Maximum Daily Load (TMDL). Sediment production is likely higher, as in-channel erosion below the project site is further exacerbated by the erosion of fill from upstream.

2. Restore 1,200 linear feet of stream channel

Altered flow paths have led to instream erosion throughout the project area. We have identified 1,200 linear feet of channel that will be restored during project implementation. Linear feet of channel restored will be measured directly in the field. Length of degraded channel will be recorded during project design, and construction as-built documents will record the completed length.

3. Restore and enhance 0.62 acres of riparian and upland native scrub habitat

Past land use has impacted riparian and upland habitat through increased erosion. Amount of habitat restored will be recorded both quantitatively and qualitatively. We will map vegetation extent and type (upland or riparian) during project design. We will repeat these measurements after project completion. Vegetation will take a few years to become established, so we will only be able to obtain initial revegetation estimates during the grant period. We will also qualitatively assess vegetation coverage and vigor through photo-monitoring.

4. Improve/re-route 2,000 linear feet of trail

At present, a portion of the Donner Lake Rim Trail uses an old road bed which exceeds grades of 25% in sections. This section of the road is actively eroding and the restoration plan includes decommissioning this road segment and restoring the degraded areas. The restoration plan includes re-routing the trail segment to a more sustainable alignment that will provide recreational and water quality benefits. We will measure the length of trail re-located directly in the field, when we complete the final as-built mapping.

Adverse physical effects to the implementation of this project:

We do not foresee any adverse effects arising from the project. We will implement construction safeguards to ensure that any construction related water quality impacts are avoided – working when drainages are dry, installing Best Management Practices (BMPs), maintaining BMPs, and following the Stormwater Pollution Prevention Plan as required by State Water Board permits.

Supporting Documentation

The Negro Canyon Restoration project is based upon previous technical studies:

- Negro Canyon Watershed Assessment (NCWA)
  Integrated Environmental Restoration Services (IERS) & River Run, 2010. Prepared for TRWC. Included as an attachment.
- Negro Canyon Restoration Plan – Projects G& H
  IERS, 2010. Prepared for TRWC. Included as an attachment.
- Negro Canyon Pre-Treatment Monitoring Report
  IERS, 2012. Included as an attachment.
- Truckee River Sediment TMDL – Staff Report
  Lahontan Regional Water Quality control Board (LRWQCB), 2008a. Chapter 10 included as an attachment.
- Coordinated Watershed Management Strategy (CWMS)
  Truckee River Watershed Council, 2004. Chapter 5 included as an attachment.

TRWC completed the Negro Canyon Watershed Assessment (NCWA) in 2010 (IERS, 2010a). The purpose of the assessment was to understand geomorphic and hydrologic processes in the watershed and how human actions have interrupted these functions. From that scientific and technical basis, areas of erosion and impacted function within the watershed were identified. Preliminary restoration actions and project concepts were derived from the assessment, including relative cost, impacts to the drainage network, sediment production, and project sequencing. Chapter 3 of the watershed assessment documents human disturbance in the watershed, and Chapter 5 describes restoration projects. This current proposal covers project D, E, and I, although the complete project also includes sites F, G, and H.

We completed design work for two of the projects identified in the NCWA – G&H (IERS 2010b), and have begun pre-project monitoring (IERS, 2012). The Project Design and Monitoring Report are included in full with this application.

Restoration in Negro Canyon Restoration in the entire Donner Lake sub-basin (including Negro Canyon) was identified as a general priority through the CWMS (Page 120) and the TMDL studies (Page 10-12). Chapter 5 of the CWMS describes projects identified as a priority in the Truckee River Watershed and is included with this application. Chapter 10 of the Truckee River Sediment TMDL Staff Report describes implementation actions to achieve the desired sediment load in the Truckee River.

Table 9 – Annual Project Physical Benefits

Project Name: Negro Canyon Watershed Restoration

Type of Benefit Claimed: Water Quality Improvement

Measure of Benefit Claimed (Name of Units): Tons (of sediment eroded from project site)

Additional Information About this Measure: Annual measurement, averaged over 20 years of Total Maximum Daily Load lifespan

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012	177	177	Current conditions, no change
2013	177	177	Planning phase, no change
2014	177	0	177 fewer tons of sediment generated from site annually
2015-2034	177	0	177 fewer tons of sediment generated from site annually

Type of Benefit Claimed: Stream channel restored

Measure of Benefit Claimed (Name of Units): Linear feet

Additional Information About this Measure:

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012	0	0	Current conditions - length of degraded channel, no change
2013	0	0	Planning phase, no change
2014	0	1,200	Project will result in 1,200 feet of restored stream channel
Last Year of Project Life	0	1,200	

Comments: The project restores 1,200 feet of stream channel during construction in 2014.

Type of Benefit Claimed: Native riparian and upland habitat restore **Measure of Benefit Claimed (Name of Units): Acres** **Additional Information About this Measure: Full revegetation success will take up to three years to achieve.**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2012	0	0	Current conditions -area of degraded habitat, no change
2013	0	0	Planning phase, no change
2014	0	0.30	Initial revegetation estimate is 0.3 acres restored
2015	0	0.50	0.5 acres restored as revegetation progresses
2016	0	0.62	0.62 acres of habitat restored, expect to achieve success in 2016
Last Year of Project Life	0	0.62	0.62 acres
Comments: The project restores and enhances 0.62 acres of native riparian and upland habitat.			

Type of Benefit Claimed: Trail re-routed and improved

Measure of Benefit Claimed (Name of Units): Linear feet

Additional Information About this Measure: Project includes re-route of eroding trail section to more sustainable alignment.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2012	2,000	0	Current conditions - length of eroding trail, no change
2013	2,000	0	Planning phase, no change
2014	0	2,000	Project will result in re-route of 2,000 linear feet of trail
Last Year of Project Life	0	2,000	

Comments: The trail re-route will be completed in 2014

Project #3: Water Quality Monitoring Program

The Truckee River Water Quality Monitoring Plan (TRWQMP) has been created in response to an order issued by the Lahontan Regional Water Quality Control Board (the Board). The California Water Code Section 13267 Board order, issued to both Placer County (the County) and the Town of Truckee (the Town) on March 9, 2007 and July 3, 2007, respectively, required the creation of a comprehensive monitoring plan for the middle Truckee River. Though regulated under separate board orders, the County and Town chose to coordinate efforts in the development of a monitoring program to ensure the cost-effective collection, integration and analysis of water quality data within the watershed. The TRWQMP has been completed and approved.

The TRWQMP is a tool to monitor the effectiveness of stormwater programs and improvement projects in the Truckee River Watershed. Both the County and the Town have developed and are implementing Stormwater Management Programs (SWMPs). The respective SWMPs detail the specific actions each jurisdiction (County and Town) will implement in order to protect surface water. Each jurisdiction is responsible for the water quality monitoring on waters within their boundaries.

In 2009, the Town voluntarily started implementing Phase I of the TRWQMP, but requires additional funds for the completion of Phase I and the implementation and operation of Phase II and III of the plan.

The project area covered under the TRWQMP includes the main stem of the middle Truckee River and all areas contributing surface water runoff between its outlet from Lake Tahoe and its confluence with Juniper Creek. This area includes 15 sub-watersheds, which drain to the main stem of the Truckee River either through tributaries, direct runoff, or stormwater infrastructure. Preliminary screening for potential source areas was conducted using an integration of GIS data on land use, land condition and other human disturbances. The analysis resulted in the classification of each sub-watershed as low, medium or high disturbance. Of the seven identified high disturbance sub-watersheds, three are in Truckee including Truckee Town Corridor, Donner/Cold Creeks and Trout Creek. The TRWQMP was subsequently designed to focus monitoring resources and efforts on those high disturbance sub-watersheds where water quality is expected to be the most impaired and where the majority of actions under the Town's SWMPs are expected to be implemented.

As monitoring has progressed and been conducted now for three years, partners and stakeholders continue to coordinate efforts as conditions change and opportunities arise. The Truckee River Watershed Council (TRWC) received grant funding related to TMDL monitoring and has recently started implementation. The Town also received approximately 37% of the grant funds requested from the first round of Proposition 84. The second round of Proposition 84 grant funding would assist in filling in gaps to the program as well as continue the program longer. When the Town was planning the next few years of monitoring, monitoring conducted by TRWC was considered and the Town's future monitoring components complement the work being done by the TRWC.

Project Physical Benefits

1. Water quality monitoring; and
2. A comprehensive and integrated data collection analysis and reporting framework.

Narrative to support the physical benefits of the Water Quality Monitoring Program

1. Water Quality Monitoring

The Town of Truckee will implement and operate a water quality monitoring program on the three identified high priority sub-watersheds within Truckee. Areas to be monitored focus on areas with the greatest risk of pollutants of concern. The proposed work will include the implementation and operation of Phase 1 and Phase II of the Truckee River Water Quality Management Plan (TRWQMP). In addition, as part of the annual reporting, the monitoring performed previously is evaluated and minor modifications to the program may be made to improve efficiency, evaluate opportunities, data, and existing and changing conditions at the monitoring sites. In the TRWQMP, this is considered Phase III, or adaptive management of the program.

All phases include implementation, equipment, operation, maintenance, permits, analysis, and reporting, including:

Phase 1-

- Rapid Assessment Monitoring (RAM) along the main stem of the Truckee River and from the confluence of the Truckee River upstream 1 mile at Donner Creek and Trout Creek.
- Discrete Community Monitoring Stations.

Phase 2-

- Discrete Community Monitoring Stations in additional locations.
- Discrete Tributary Monitoring Stations in tributaries.
- Near Continuous Turbidity Probes and grab samples at the upstream and downstream ends of the Truckee River.

Phase 3-

- Adaptive Management

The project work includes the implementation of different performance assessment types. The results of each assessment type provide a different evaluation of the surface water resource condition with the project area. When integrated, the results from the various assessment types address a number of key questions regarding water quality in the project area, the pollutant load contribution of a number of key community developments, and the effectiveness of the SWMPs. Collectively, these assessment types are designed to meet the goals and objectives of the water quality monitoring program.

2. **Data Collection Analysis**

The TRWQMP was developed using SWAMP protocols, existing USGS National Field Manual for the collection of Water-Quality Data protocols, as well as other methods for data collection, reporting and QA/QC that are scientifically defensible and repeatable.

The TRWQMP provides a framework for reporting data and comprehensive analysis. An annual report will be produced every year and results of the monitoring data coordinated with the annual reporting and effectiveness evaluation for the Stormwater Management Programs. Data will be used to make Land Use decisions and recommendations for stormwater capital improvement projects. Annual reports will be posted on the Town's website. Data will be reported to the Truckee River Information Gateway (TRIG) and will be available to other agencies and the public.

Adverse physical effects to the implement of this project
N/A

Supporting Documentation

The base of this project is the Truckee River Water Quality Monitoring Plan (TRWQMP) which references many existing documents such as the USGS National Field Manual for the Collection of Water-Quality Data, SWAMP Program, Middle Truckee River TMDL and Truckee's SWMP.

- Truckee River Water Quality Monitoring Plan, 2nd Nature, September 2008 for Placer County and the Town of Truckee.
- Truckee River TMDL, Lahontan Regional Water Quality Control Board.
- Storm Water Management Program, Town of Truckee, December 6, 2007.
- Annual Reports for TRWQMP, CDM Smith for the Town of Truckee, January 2011, January 2012, and January 2013.
- Many existing studies, data and resources were used in the creation of the TRWQMP and are cited within the plan.

The TRWQMP documents spatial scale of observations, assessment types, data collection and management protocols by assessment type and data management and reporting.

Table 9 – Annual Project Physical Benefits

Project Name: Water Quality Monitoring Program

Type of Benefit Claimed: Water quality monitoring

Measure of Benefit Claimed (Name of Units): water quality monitoring stations

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2013	0	5	5
2014	0	5	5
2015	0	5	5
Last Year of Project Life (2016)	0	5	5

Comments: Implementation of this project includes three types of water quality monitoring: 1) Rapid Assessment Monitoring, 2) Discrete Community Monitoring, and 3) In Stream Monitoring. Monitoring will be conducted each year at between 3 and 10 stations.

Project Name: Water Quality Monitoring Program

Type of Benefit Claimed: Data Collection Analysis

Measure of Benefit Claimed (Name of Units): Datasets/Reports

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2013	0	1	1
2014	0	1	1
2015	0	1	1
Last Year of Project Life (2016)	0	1	1

Comments: All data collected and analyzed will be reported yearly in an annual report.

Project #4: Woodfords Community Improvement and Pipe Replacement

The Woodfords Community Improvement and Pipe Replacement Project is a comprehensive water conservation program/ water efficiency program that will be implemented by the Washoe Tribe of Nevada and California. The Project involves the implementation of four concurrent tasks: 1) Coordinate/Integrate Water Efficiency Plan with Partners, 2) Water Use Efficiency Program-Indoor and Outdoor water use activities, 3) Water Meter Program/Leak Detection and Repairs, and 4) Pipe Replacement/Weed Control/Revegetation/ Fire Hydrants.

This project focuses on water use efficiency best management practices implementation to decrease water usage, educate residents of the Tribe's Woodfords Community on the importance of water conservation and how to detect leaks in homes, repair laterals and mains as prioritized by water meter data collection.

In conjunction with our partner agencies, incentives will be offered through rebates for water efficient appliances, household leak repair, Turf Buy Back and Smart Controller Irrigation to reduce water consumption. By focusing on indoor retrofits, outdoor landscaping improvements and repairs to priority leaking pipes, a significant water savings can be realized.

The Woodfords Community Improvement and Pipe Replacement Project is addressing critical needs of a 100% Disadvantaged Community. All of the Woodfords Community residents will be benefit by the water supply savings, the reduced water demand, and the improved operational efficiency and supply reliability and other physical benefits as summarized below. The Woodfords Community/Reservation is located in Markleeville, California on 80 Acres of Trust Land in Alpine County. Through this project, the Washoe Tribe of NV and CA (Tribe) will partner and collaborate with other water suppliers and stakeholders within the Tahoe Sierra IRWM region. Together addressing inter-related natural resource issues on a watershed basis is an opportunity to share and optimize resources through this regional approach and partnering. The Tribe for this Project will work directly with other urban water suppliers to continue to create a regional approach within the Tahoe Sierra IRWM. Throughout the Project, the Tribe will continue efforts to coordinate with the partners and to exchange water conservation information and materials.

Project Physical Benefits

Summary of the types of physical benefits being claimed

The Woodfords Community Improvement and Pipe Replacement Project will accomplish the following benefits:

1. Reduce water demand;
2. Reduce energy consumption; and

3. Reduce Greenhouse Gas (GHG) Emissions.

Narrative to support the physical benefits of the:

1. **Reduce water demand**

There will be a total water savings of 1,605,591 gallon saved annually.

The Woodfords Community Improvement and Pipe Replacement Project will provide a water savings as it will reduce water demand on the system and correspondingly will extend the life of the waste treatment plant. This is in conjunction with comprehensive water conservation activities that will be implemented concurrently. These conservation activities include: Coordinate/Integrate Water Efficiency Plan with Partners; Water Use Efficiency Program-Indoor and Outdoor Activities; Water Meter Program/Leak Detection and Repairs; and Pipe Replacement/Weed Control/Revegetation/ Fire Hydrant

The Regional Water Use Efficiency Project proposes the implementation of several Best Management Practices (BMPs) as defined by the California Urban Water Conservation Council: turf removal and irrigation efficiency upgrades; high efficiency toilets; water efficient clothes washers and education outreach to promote water use efficiency. By implementing these methods, there would be an annual water savings of 1,605,590 gallons. Below please find descriptions for the calculations used in Attachment 8: Benefit Cost Analysis for the amount of water this project proposes to save annually and reduce the demand.

Turf Removal and Irrigation Efficiency Upgrades: The Southern Nevada Water Authority estimates an average yearly saving of 55 gallons of water for every square foot of grass replaced with water smart trees, shrubs, and flowers. Since Southern Nevada is able to irrigate 365 days a year and Tahoe's climate only allows irrigation for approximately 150 days per year, the calculation below converts the water savings to .15 gallons per day and applies this to Tahoe's usage which is a shortened irrigation season of approximately 150 days per year. Please see below for computation for this adjustment:

<u>Turf Buy Back Water Savings</u>:

55 gallons/square foot/year / 365 days/year = .15 gallons/square foot/year

Thus: .15 gallons/square foot / year x 150 days /year = 22 gallons/square foot/year

Source: Smart Savings Water Conservation Measures that Make Cents, Western Resources Advocates, 2008 (page 24, Southern Nevada Water Authority, Water Smart Landscapes Rebates, Las Vegas, NV)

As the Woodfords Community Improvement and Pipe Replacement Project is being applied to a rural water system and much smaller DAC community, the Turf Buy Back savings will be much less or the Tribe's will be a smaller contribution. Only a relatively small number of homes have turf in the Woodfords Community. Thus, the following is estimated for just Woodfords:

1260 square feet of turf x 22 gallons of water per foot = **<u>27,720 gallons of water saved annually</u>**

Water efficient clothes washers:

An estimated average annual water saving for the water efficient clothes washer rebate is based on data from the California Urban Water Conservation Council (CUWCC) BMP Costs and Savings Study. According to this study, which included five larger washing machines saving from a variety of example sites, the mean savings was 5085.6 per machine, per year. The calculations for water savings are as follows:

5085.6 gallons x 10 clothes washer rebates = **50,850 gallons of water saved annually**

Source: BMP Costs and Savings Study: A guide to data and methods for cost-effectiveness analysis of Urban Water Conservation Best Management Practices, March 2005. Prepared for the California Urban Conservation Council by A&N Technical Services, Inc.

High Efficiency Toilets:

Rebates are also are being issued for retrofitting pre-1992 toilets with new High Efficiency Toilets (HET's). A high-efficiency toilet uses 1.28 gallons per flush. Pre-1992 toilets used an average of 3.5 to 4 gallons per flush. Replacing an older toilet with a new high-efficiency toilet will save on average 2.22 to 2.72 gallons per flush. Over time this will add up to significant water savings. Calculations below are from the US Environmental Protection Agency's Benchmarks for Estimating Residential End Uses of Water. To calculate the amount of gallons of water saved using the information in the tables provided in the Benchmarks, we calculated on the very low end of the scale (most toilet calculations are much higher):

2.22 gallons per flush saved x 10.5 flushes per day (between 4-6 per capita in the household x household size of 2.55) = 23.31 gallons per day saved

23.4 gallons per day x 365 days per year x 50 toilet replacements = **427,020 gallons of water saved annually**

Source: USEPA Water Conservation Plan Guidelines, Appendix B: Benchmarks Used in Conservation Planning, pages 163 and 164.

Leak Repairs and Pipe Replacements:

The Regional Water Use Efficiency Project proposes a minimum of 100 leak audits. Estimated water savings from leak repairs are difficult to quantify for the purposes of this project as it is impossible to guess how many leaks may be identified in the audits. Repairing interior and exterior residential water leaks range in water savings, but an average household can save 11,000 gallons a year by repairing small water leaks in showerheads, faucets etc. according to the US Environmental Protection Agency. Leak detection and pipe replacements are estimated to be an even greater saving but no quantification data is available. Therefore this estimate is very conservative for the Woodfords Community Improvement and Pipe Replacement Project. The estimate of leaks repaired is as follows in the calculation:

11,000 gallons annually x 50 or more leak repairs/pipe replacements = **1,100,000 gallons of water saved annually**

Source: USEPA WaterSense, Fix a Leak Week Factsheet, March 16-20, 2009

Total Water Savings, all BMP Implementation:	Gallons saved annually
Turf Removal, Irrigation efficient upgrades	27,720
Water efficient clothes washers	50,850
High efficiency toilets	427,020
Leak detection and repair	1,100,000
Total Water Saved:	**1,605,590 gallons annually**

Other reference material used to design the BMP program implementation as described above include: *Handbook of Water Use and Conservation, Amy Vickers, Waterplow Press, Fourth printing June 2012; Evaluating the Effectiveness of Cash for Grass Programs, Mojave Water Agency, June 2011*

Long term water conservation programs can reduce water consumption by 10 to 20 percent over even a 10 to 20 year period (Maddaus, 1989).

The most recent background study concerning the technical justification for this Project is a draft study dated December, 2012. This study was prepared by Blackrock Geoscience, a Boseman, Montana consultant, for the Washoe Tribe of Nevada & California. It is an infrastructure feasibility study on all four Tribal communities developed from careful analysis comparing video pipe inspection footage to maps and as-built drawing. Woodfords Community was determined to contain many leaks, many with major root intrusion. This study and it's delineation of degraded and leaking pipes will be utilized.

Technical justification for water conservation activities is also indicated in the three year pre-project water meter database. In addition, water meters and radioread transceivers will be repaired and calibrated. Due to lack of funding, software problems, and water meter/MXU equipment problems, only about 60 percent of the Woodfords Community homes have readable meters. A three year plus data base of monthly meter reads are available for pre-project data. As needed, water use could be monitored more frequently especially in leak detection activities. All homes do physically have meters and Sensus RadioRead 520R transceivers (MXU) installed in 2007. It is planned to repair, calibrate and increase the number of meters read to at least 95% with this funding.

The above studies are recent studies that provide technical justification for the planned and measurable physical benefits of this Project. Listed below is a chronological summary of previous technical studies:

- 1980's Homes and infrastructure being built at Woodfords Colony
- 1994 Comprehensive Land Use Plan
- 1997 WHPP and Land Use

- 2001 Preliminary Engineering
- 2005 WHPP 2,5,10
- 2007 Final
- 2011 Video inspection of pipes – Summit Plumbing
- 2012 Feasibility

2. **Reduce energy consumption**

There will be a total energy savings of 19,069 kilowatts per hour (kWh) saved per year of 381,380 kWh over the expected life of the project (up to 20 years). The Tribe will be participating with the Regional Partners in the Regional Water Use Efficiency Program which will have a significant impact on the reduction of energy consumption within the Tahoe Sierra IRWM region. As stated in the California Energy Commission's 2005 Integrated Energy Policy Report, annual electricity use in a typical urban water system in Northern California is estimated to be 3,950 kWh/MG of water. Typically, the Tribe's water system has been similar to an urban water system with a high percentage of energy consumption rates due to the need to pump, treat, convey and distribute water supply. In addition, the majority of this water will then ultimately need to be re-conveyed and treated as wastewater. This estimate includes the following: supply and conveyance, water treatment, distribution, and wastewater treatment. Based on this figure, it is anticipated that the proposed project will reduce energy consumption by water suppliers by an approximate 19,069 kWh of electricity per year. Calculation is as follows:

Total Electricity Savings: 1,604,590 MG x 3950 kWh per MG = 19,069 kWh of electricity saved per year or 381,380 Kwh over the expected life of the project (up to 20 years).
Source: California Energy Commission, 2005 Integrated Energy Policy Report.

3. **Reduce Greenhouse Gas (GHG) Emissions**

The reduction of energy consumption (as described in b above) has a direct correlation to the reduction of Greenhouse Gas (GHG) Emissions. Utilizing the Greenhouse Gas Equivalencies Calculator as designed by the US Environmental Protection Agency and entering the estimated 19,069 kWh of annual electricity saved by the water use efficiency program, the calculator estimates 13.5 Metric Tons of Carbon Dioxide Equivalent would be saved from entering the environment through the successful implementation of the regional water use efficiency program. The calculations explanation is included with this attachment. This would be 270 Metric Tons of GHG reduction for the life of the project.
Source: U.S. EPA Greenhouse Gas Emissions calculator, available on-line but attached for reference

Adverse physical effects to the implementation of this project:

N/A. There are no adverse effects arising from this Project. Oversight during implementation will be provided by the Washoe Tribe of Nevada & California Environmental Department staff.

Table 9 – Annual Project Physical Benefits **Project Name:** Woodfords Community Improvement and Pipe Replacement **Type of Benefit Claimed: Reduce Water Demand** **Measure of Benefit Claimed (Name of Units): Gallons of water**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Each year of project life	0	1,605,590	1,605,590
Comments: Gallons of water saved annually are based on estimates of water saved for each Water Conservation BMP/Activity implemented.			

Table 9 – Annual Project Physical Benefits **Project Name:** Woodfords Community Improvement and Pipe Replacement **Type of Benefit Claimed: Reduce Energy Consumption** **Measure of Benefit Claimed (Name of Units): Kilowatts per hour (kWh)**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Each year of project life	0	19,069	19,069
Comments: It is estimated by the California Energy Commission that a typical urban water system in Northern California utilizes 3950 kWh/MG of water x total regional 4,827,812 MG saved by project is 19069 kWh saved per year as benefits are interdependent within the region for this estimated benefit.			

Table 9 – Annual Project Physical Benefits

Project Name: _04_ Woodfords Community Improvement and Pipe Replacement

Type of Benefit Claimed: Reduce Greenhouse Gas Emissions

Measure of Benefit Claimed (Name of Units): Metric Tons

Additional Information About this Measure: Carbon Dioxide or CO-2 Equivalent related to reduction in electricity

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
Each year of project life	0	13.5	13.5

Comments: Attached to this Section is the greenhouse gas reduction calculator as provided by the US Environmental Protection Agency. The metric tons reduced are based on the electrical savings shown in Attachment 8: Benefit Cost Analysis that result from the reductions in water production that will occur after full implementation of the Regional Water Use Efficiency Project.

Project #5: Aquatic Invasive Species Regional Outreach Framework

Aquatic Invasive Species (AIS) are one of the largest threats to the ecosystems and economies of the United States. Approximately 49% of the species on the threatened or endangered species lists are at risk primarily because of predation or competition with AIS. In fact, impacts of invasive species are second only to habitat destruction as a cause of global biodiversity loss. AIS such sea lamprey, hydrilla, and the New Zealand mudsnail may prey upon, displace, alter habitat, or otherwise harm native species. Other AIS, such as Quagga and Zebra mussel may reduce production of fisheries, decrease water availability to residential and commercial users, block transport routes, choke irrigation canals, foul industrial and public water supply pipelines, degrade water quality, accelerate filling of lakes and reservoirs, and decrease property values. The damages to human enterprises caused by AIS results in enormous economic costs. The United States invests more than $120 billion per year in damage and control costs to combat invasive species. As the world trade network continues to grow, the number and frequency of introduced species are expected to increase. Additionally, climate change may also allow increased introductions.

The purpose of the Aquatic Invasive Species Regional Outreach Framework project is to help protect multiple inland waters from the introduction of AIS by developing a regional prevention and outreach framework designed to unify consistent messaging, provide useful tools for collaboration, and identify shared resource possibilities. The development and approval of the framework will be accomplished through a coordinated Regional Outreach Committee.

Project Physical Benefits

Summary of the types of physical benefits being claimed

The Aquatic Invasive Species Regional Outreach Framework project will accomplish the following benefits:

1. Protect multiple inland waters from the introduction of aquatic invasive species
2. Increase awareness of Clean, Drain, Dry practices
3. Expand the regional boundary of aquatic invasive species prevention collaboration

Narrative to support the physical benefits of the Aquatic Invasive Species Regional Outreach Framework:

Physical benefits will be measured by attendance and acceptance of a regional outreach committee; development of a cooperative Memorandum of Understanding with regional partners; regional distribution of framework package; and surveying implementing entities and water-related recreational users.

1. Protect multiple inland waters from the introduction of aquatic invasive species

Over the past 200 years, more than 50,000 non-native plant and animal species have become established in the United States. Approximately one in seven has become invasive, with damage and control costs estimated at more than $120 billion per year - a cost higher than the total of all other natural disasters combined[1]. Zebra and quagga mussels (*Dreissena polymorpha, D. rostriformis bugensis*) alone cause one billion dollars per year in damages. [2] Another 100 million is spent annually in the United States to control non-native aquatic weeds.[3] In two California lagoons, more than $7 million was spent in the first 3 years of an on-going eradication program for the seaweed *Caulerpa taxifolia*.[4] As a final example, the Great Lakes States invested over $26.7 million toward prevention and control of aquatic invasive species in just 2 years, of which almost $900,000 was committed to Asian carp control efforts. [5] These numbers are likely underestimated as they do not consider ecosystem health or the aesthetic value of nature, which can influence tourism and recreational revenue. Estimating the economic impact associated with AIS is further confounded as monetary values are difficult to estimate for the extinction of species or loss of native biodiversity and ecosystem services.

The Aquatic Invasive Species Regional Outreach Framework project will increase the number of inland waters protected from eight to 12 in the first year of the project and will protect and additional 15% of inland waters in subsequent years. The Aquatic Invasive Species Regional Outreach Framework project will help protect multiple inland waters from the introduction of AIS by developing a regional prevention and outreach framework designed to unify consistent messaging, provide useful tools for collaboration, and identify shared resource possibilities. The development and approval of the framework will be accomplished through a coordinated Regional Outreach Committee. Currently, the regional focus of this proposed project includes the entire Tahoe Sierra IRWM with the inclusion of the west slope of El Dorado County. The Tahoe Resource Conservation District (Tahoe RCD) and current project partners wish to expand the current regional boundary to include participation from a wide regional area, and will include but is not limited to additional counties, groups, water managers, etc. to participate in the development of a regional outreach framework. While there is awareness of particular AIS programs such as the one in the Tahoe Region, the project hinges on enhancing regional public awareness concerning AIS, most notably quagga and zebra mussels, and will bring together stakeholders to address regional outreach needs and provide guidance for developing a unified approach in the prevention of the increasing threat of AIS.

2. Increase participation in the Clean, Drain, Dry practice by 20% in the first year.

The Clean, Drain, Dry practice is a national message that has been utilized at the local level, especially with the Tahoe Sierra IRWM through the Tahoe Watercraft Inspection Program and the Truckee Regional AIS Prevention Program. Additionally, this message has been applied as a shared resource through collaboration with a subcommittee of the Western Aquatic Nuisance Species Task Force. The Aquatic Invasive Species Regional Outreach Framework project will increase the awareness and participation of Clean, Drain, Dry and there will be a 20% increase in boaters arriving in inland waters

Clean, Drained and Dry in the first year of the program with an additional 10% in subsequent years. Extensive outreach, using the Clean, Drain, Dry messaging, will be a direct product of the project and exist through a diverse set of media outlets such as print ads, billboards and rack cards.

The proposed project will help protect multiple inland waters from the introduction of AIS by developing a regional prevention and outreach framework designed to unify consistent messaging, provide useful tools for collaboration, and identify shared resource possibilities. The development and approval of the framework will be accomplished through a coordinated Regional Outreach Committee. Currently, the regional focus of this proposed project includes the entire Tahoe Sierra IRWM with the inclusion of the west slope of El Dorado County. The Tahoe Resource Conservation District (Tahoe RCD) and current project partners wish to expand the current regional boundary to include participation from a wide regional area, and will include but is not limited to additional counties, groups, water managers, etc. to participate in the development of a regional outreach framework. While there is awareness of particular AIS programs such as the one in the Tahoe Region ,the project hinges on enhancing regional public awareness concerning AIS, most notably quagga and zebra mussels, and will bring together stakeholders to address regional outreach needs and provide guidance for developing a unified approach in the prevention of the increasing threat of AIS.

3. **Increase the number of participating entities in the aquatic invasive species prevention collaboration by 10% the first year and 5% in subsequent years.**

The Aquatic Invasive Species Regional Outreach Framework project will expand the regional boundary of the aquatic invasive species prevention collaboration by actively coordinating with adjacent or otherwise interested resource managers or working groups. Specifically, the project will produce a framework that provides a coordinated effort in prevention outreach across the region. This framework will be used to increase awareness and understanding of the aquatic invasive species threat to ecosystems, native biodiversity and local economies. The process will include supporting agencies, entities and other partners with limited resources to implement prevention outreach by developing a Regional Outreach Committee; developing and coordinating regional prevention protocols; developing and coordinating regional outreach tools; identifying reciprocity opportunities; and investigating the potential for a regional cooperative MOU.

In response to this increasing threat, the Aquatic Nuisance Species Task Force was formed as an intergovernmental organization dedicated to preventing and controlling AIS and implementing the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990. The various NANPCA mandates were expanded later with the passage of the National Invasive Species Act (NISA) in 1996. The Task Force consists of 13 Federal agency representatives and 12 Ex-officio members, and is co-chaired by the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration. The Task force coordinates governmental efforts dealing with AIS in the U.S. with those of the private sector and other North American interests via regional panels and issue specific committees and work group.

Locally and within the Tahoe Sierra IRWM, the Tahoe Regional Planning Agency has adopted a mandatory ordinance prohibiting the launch of motorized watercraft without a watercraft inspection. In addition, the Town of Truckee and the Counties of Nevada and Sierra have adopted ordinances that mandate inspection of watercraft prior to launching in water within each jurisdictional boundary.

Adverse physical effects to the implementation of this project:

The uncertainty of achieving the benefits described relies on the response and receptivity that will be achieved through public participation. Participation by jurisdictions and resource managers is also critical. The project is designed to address the uncertainty of participation by incorporating cost effective, efficient and user convenience strategies and tools. The goal is to create behavioral changes in how watercraft users and other water-related recreationists, including anglers and paddlers, view their role in protecting rivers, lakes and reservoirs from the introduction of aquatic invasive species.

Potential adverse physical effects may arise from certain users declining participation in the Clean, Drain, Dry practices. Certain users may subsequently avoid certain water bodies and/or decline to answer survey questions. This may, in turn, have an impact on the recreational economy of local jurisdictions.

Supporting Documentation

United States Department of Agriculture APHIS Fact Sheet. Invasive Species. October. 2006.

[2] Army, 2002. Economic Impacts of Zebra Mussel Infestation. http://www.wes.army. mil / el /zebra/zmis/zmis/zmishelp/economic_

impacts_of_zebra_mussel_infestation.htm (Accessed April 1, 2012).

[3] Zhang, C., Boyle, K.J., The effect of an aquatic invasive species (Eurasian watermilfoil) on lakefront property values, Ecol. Econ. (2010), doi:10.1016/j.ecolecon.2010.09.011

[4] Daiz, S., Smith, J., Zaleski, S., Murray, S.N., 2012 Effectiveness of the California State Ban on the Sale of Caulerpa Species in Aquarium Retail Stores in Southern California, Frontiers in Ecology and the Environment 4: 75–79.

5 2012 Asian Carp Control Strategy Framework. Asian Carp Regional Coordinating Committee. February 2012. http://asiancarp.us/documents/2012Framework.pdf. Accessed May 3, 2012.

Table 9 – Annual Project Physical Benefits

Project Name: Aquatic Invasive Species Regional Outreach Framework

Type of Benefit Claimed: 1. Protect multiple inland waters from the introduction of aquatic invasive species

Measure of Benefit Claimed (Name of Units): # of inland waters protected

Additional Information About this Measure: there will be a 50% increase in first yr; 15% in subsequent years

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015	8	12	4
2016	12	14	2
2017	14	16	2
2018	16	18	2
Last Year of Project Life	18	20	2

Comments: The project is for 15 months so each successive year is based on the momentum of the project sustaining itself.

Project Name: Aquatic Invasive Species Regional Outreach Framework

Type of Benefit Claimed:Increased awareness of Clean, Drain, Dry Practices

Measure of Benefit Claimed (Name of Units): %

Additional Information About this Measure: % of boaters arriving to inland waters Clean, Drained and Dry.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015	10%	30%	20%
2016	30%	40%	10%
2017	40%	50%	10%
2018	50%	60%	10%
Last Year of Project Life	60%	70%	

Comments: The project is for 15 months so each successive year is based on the momentum of the project sustaining itself.

Project Name: Aquatic Invasive Species Regional Outreach Framework **Type of Benefit Claimed: 3. Expand the regional boundary of aquatic invasive species prevention collaboration** **Measure of Benefit Claimed (Name of Units): Number of partners**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2015	10	12	2
2016	12	13	1
2017	13	14	1
2018	14	15	1
Last Year of Project Life	15	16	1
Comments: The project is for 15 months so each successive year is based on the momentum of the project sustaining itself.			

Project #6: Regional Water Use Efficiency Project

The purpose of the Regional Water Use Efficiency Project is to decrease water usage within the Tahoe basin and to educate local residents on the importance of water conservation. By increasing public knowledge of water saving techniques, behaviors, and devices, we also give residents the opportunity to play a role in improving the quality of their local water bodies by managing water more efficiently. The goals of the program will be accomplished by providing incentives through rebates for water efficient appliances, leak repair, Turf Buy Back and Irrigation Efficiency Improvements to reduce water consumption. By focusing on indoor retrofits and outdoor landscaping improvements significant water savings can be realized. Utilizing the program at a regional level will allow partners to share resources and send a unified message to consumers in the region regarding the importance of water conservation.

Project Physical Benefits

Summary of the types of physical benefits being claimed

The Regional Water Use Efficiency project has the following physical benefits:

1. Water supply saved
2. Power cost savings (Energy reduced/saved)
3. Greenhouse gas emissions (GHGs) reduced
4. Benefits to endangered species
5. Reductions in water supply shortages due to climate variability
6. Increase water supply for Native Tribes

Narrative to support the physical benefits of the Regional Water Use Efficiency Project:

1. **Water Supply saved:**

The Regional Water Use Efficiency Project proposes the implementation of several Best Management Practices (BMP's) as defined by the California Urban Water Conservation Council: turf removal and irrigation efficiency upgrades; high efficiency toilets; water efficient clothes washers and education outreach to promote water use efficiency.

By implementing these methods, there would be an annual water savings of $4,827,812 MG. Below please find descriptions for the calculations utilized in Attachment 8: Benefit Cost Analysis for the amount of water this project proposes to save annually.

Turf removal: The Southern Nevada Water Authority estimates an average yearly savings of 55 gallons of water for every square foot of grass replaced with water-smart trees, shrubs and flowers. Since Southern Nevada is able to irrigate 365 days a year and Tahoe's climate only allows irrigation for approximately 150 days a year the calculation below converts the water savings to .15 gallons per day

and applies this to Tahoe's usage which is a shortened irrigation season of approximately 150 days per year. See chart below.

Turf Buy Back Water Savings:				
55 gallons/square foot/year	/	365 days/year	=	.15 gallons/square foot/day
.15 gallons/square foot/day	x	150 days/year	=	22 gallons/square foot/year

Source: Smart Savings Water Conservation Measures that Make Cents, Western Resources Advocates, 2008 (pg. 24, Southern Nevada Water Authority, Water Smart Landscapes Rebates, Las Vegas, NV)

As the Regional Water Use Efficiency Project proposes to remove 126,000 square ft. of turf, the following annual water savings will be achieved:
126,000 square feet of turf x 22 gallons of water per foot = **2,772,000 gallons of water saved annually**

Water efficient clothes washers: An estimated annual water savings for the water efficient clothes washer rebate is based on data from the California Urban Water Conservation Council (CUWCC) BMP Costs and Savings Study. According to this study, which included 5 of the largest washing machine savings from a variety of example sites, the mean savings was 5085.6 per machine, per year. The calculations for water savings are as follows:
5085.6 gallons X 20 clothes washer rebates = **101,712 gallons of water saved annually**

Source: BMP Costs and Savings Study: A guide to data and methods for cost-effectiveness analysis of Urban Water Conservation Best Management Practices, March 2005. Prepared for the California Urban Water Conservation Council by A & N Technical Services, Inc.

High Efficiency Toilets: Rebates are also are being issued for retrofitting pre-1992 toilets with new High Efficiency Toilets (HET's). A high-efficiency toilet uses 1.28 gallons per flush. Pre 1992 toilets used an average of 3.5 to 4 gallons per flush. Replacing an older toilet with a new high-efficiency toilet will save on average 2.22 to 2.72 gallons per flush. Over time this will add up to significant water savings. Calculations below are from the US Environmental Protection Agency's Benchmarks for Estimating Residential End Uses of Water. To calculate the amount of gallons of water saved using the information in the tables provided in the Benchmarks, we calculated on the very low end of the scale (most toilet calculations are much higher):
2.22 gallons per flush saved x 10.5 flushes per day (between 4-6 per capita in the household x household size of 2.55) = 23.31 gallons per day saved
23.4 gallons per day x 365 days per year x 100 toilet replacements = **854,100 gallons of water saved annually**

Source: USEPA Water Conservation Plan Guidelines, Appendix B: Benchmarks Used in Conservation Planning, pages 163 and 164

Leak Repairs: The Regional Water Use Efficiency Project proposes a minimum of 100 leak audits. Estimated water savings from leak repairs are difficult to quantify for the purposes of this project as it is impossible to guess how many leaks may be identified in the audits. Repairing interior and exterior residential water leaks range in water savings, but an average household can save 11,000 gallons a year by repairing small water leaks in showerheads, faucets etc. according to the US Environmental Protection Agency. This estimate is used for the following calculation:
11,000 gallons annually x 100 leak repair audits = **1,100,000 gallons of water saved annually**

Source: USEPA WaterSense, Fix a Leak Week Factsheet, March 16-20, 2009

Total Water Savings, all BMP Implementation:

	Gallons saved annually
Turf Removal, Irrigation efficient upgrades	2,772,000
Water efficient clothes washers	101,712
High efficiency toilets	854,100
Leak detection and repair	1,100,000
Total Water Saved:	**4,827,812**

Other reference material used to design the BMP program implementation as described above include: *Handbook of Water Use and Conservation, Amy Vickers, Waterplow Press, Fourth printing June 2012; Evaluating the Effectiveness of Cash for Grass Programs, Mojave Water Agency, June 2011*

2. Power Cost Savings (Energy reduced/saved):

The Regional Water Use Efficiency Program will have a significant impact on the reduction of energy consumption within the Tahoe Sierra IRWM region. Typically, urban water suppliers have large energy consumption rates due to the need to pump, treat, convey and distribute water supply. In addition, the majority of this water will then ultimately need to be re-conveyed and treated as wastewater. As stated in the California Energy Commission's 2005 Integrated Energy Policy Report, annual electricity use in a typical urban water system in Northern California is estimated to be 3,950 kWh/MG of water. This estimate includes supply & conveyance, water treatment, distribution, and wastewater treatment. Based on this figure, it is anticipated that the proposed project will reduce energy consumption by water suppliers by an approximate 19,069 kWh of electricity per year. Calculation is as follows:

Total Water Savings: Approximately 4,827,812 MG per year (implementation of all water conservation best management practices)

Total Electricity Savings: 4,827,812 MG x 3,950 kWh per MG = 19,069 kWh of electricity saved per year, or 381,380 kWh over the expected life of the project (up to 20 years).

Source: California Energy Commission, 2005 Integrated Energy Policy Report

3. Greenhouse gas emissions (GHG) reduced:

The reduction of energy consumption (as described in b above) has a direct correlation to the reduction of Greenhouse Gas (GHG) Emissions. Utilizing the Greenhouse Gas Equivalencies Calculator as designed by the US Environmental Protection Agency and entering the estimated 19,069 kWh of annual electricity saved by the water use efficiency program, the calculator estimates 13.5 Metric Tons of Carbon Dioxide Equivalent would be saved from entering the environment through the successful implementation of the regional water use efficiency program. The calculations explanation is included with this attachment. This would be 270 Metric Tons of GHG reduction for the life of the project.
Source: U.S. EPA Greenhouse Gas Emissions calculator, available on-line but attached for reference

4. Benefits to Endangered Species:

Two species listed under the Endangered Species Act will benefit from the project.

1.Cui-ui (Chastmistes Cujus)

Listing: Endangered

2. Lahontan Cutthroat Trout (Oncorhynchus clarki henshawi)

Listing: Threatened

The Truckee-Carson Irrigation Project, located in the lower Carson River Basin in Churchill County Nevada,(later named the Newlands Project), supplied water from the Truckee River Basin to the Carson River Basin via the Truckee Canal. The 32 mile canal which ran from the lower Truckee River to the Carson River and later to the Lahontan Valley reservoir supplied Lahontan Valley farmers with 1,785 acre feet of water per day for irrigation. This resulted in adverse effects to Pyramid Lake, the Cui-ui and Lahontan Cutthroat Trout. The level of Pyramid Lake had dropped 86 feet shortly after diversions began into the Truckee Canal in 1906. Pyramid Lake, which was 50 miles long and 12 miles wide lost 31 square miles of surface area by 1953. The drop in water level and decline in water quality from 3,500 TDS to 5,500 TDS caused the near-extinction of the Cui-ui and LCT (Springmeyer et al. 2011).

"As the terminus of the Truckee River, Pyramid Lake, and a lengthy stretch of the Lower Truckee…bear the brunt of any upstream impairment of either quantity or quality. Lake level, river habitat, and endangered species suffer the consequences of water removed from the river." (Springmeyer et al. 2011). The only population of Cui-ui exists in Pyramid Lake. It was extirpated from adjacent Lake Winnemucca which dried up in the 1930's. According to the U.S. Fish and Wildlife's Recovery Plan for the Cui-ui, actions needed include "increasing inflow to Pyramid Lake." The Lahontan Cutthroat Trout (LCT) were listed as endangered by the US Fish and Wildlife Service in 1970 and subsequently

reclassified as threatened in 1975, under the Endangered Species Act, to facilitate management and allow regulated angling. The species is native to the Lake Tahoe basin and historically occupied most of the perennial stream systems, including the lower Truckee River and interconnected lakes including Lake Tahoe and Pyramid Lake. Currently LCT occupy approximately 0.4 percent of former lake habitat and 10.7 percent of former steam habitat. Water conserved in the Lake Tahoe Basin ultimately benefits in-stream flow, water quantity and water quality in the Truckee River and Pyramid Lake therefore conserving habitat and viability of both species.

Source: Don Springmeyer, Wolf, Rifkin, Shapiro, Schulman, Rabkin, 2011. "The Pyramid Lake Paiute Tribe, The Truckee River an Pyramid Lake- Decades of Battles for Better Instream Flow, Quantity and Quality." American Bar Association: Section of Environment, Energy and Resources. San Diego, California.

5. Reductions in water supply shortages due to climate variability

Various studies have been conducted in the last decade to measure the effects of climate change in the Lake Tahoe basin. The results of these studies have indicated three major changes are occurring in the basin: (1) the air temperature is increasing, (2) the percent of total annual precipitation falling as snow is decreasing, and (3) the timing of the spring snowmelt peak discharge is shifting towards earlier dates.[1] Climate change scenarios for the Tahoe basin also indicate increased use of groundwater to accommodate population growth.

In the Sierra Nevada mountain range, the winter snowpack holds an average of 15 million acre-feet of water that is released in the spring and early summer, acting as the state's largest storage reservoir and a source for recharging groundwater aquifers. Currently, California's Department of Water Resources (DWR) is projecting a 25% reduction in the Sierra snowpack by mid-century.[2] In the Lake Tahoe basin, the shift from rain to snow and the shift in timing of snowmelt towards earlier dates appear to be the main causes of the declining snowpack. It has also been found that the effects of climate warming on the snowpack is strongly related to elevation, with the highest amount of loss occurring between the elevations of 1300 and 2200m. 53.4% of the Tahoe basin lies within this elevation range. In Robert Coats article on Climate change in the Tahoe basin, he states:

"In a study based on 30 years of snow survey data(1966-1996) from 260 snow courses in the Sierra Nevada, Johnson et al. (1999) found that the Tahoe basin had the highest loss – 54% - in May SWE(snow water equivalent) of any of the 21 river basins studied."

If the snowpack continues to decline and melt earlier in the year, it will affect the recharge of the Tahoe basin groundwater aquifers. STPUD's peak water usage is during the summer months, mostly due to landscape irrigation and a higher seasonal population. The inability of the snowpack to sufficiently

[1] Climate change in the Tahoe Basin: regional trends, impacts and drivers, Robert Coats
[2] Climate Change Impacts on California's Water, State of CA-Dept of Water Resources

recharge the aquifers in spring and early summer could potentially cause a shortage or overuse of groundwater when demand is at its highest level.

If the Tahoe basin were to enter a multi-year drought, as has happened in the past and is believed to happen again based on historical weather patterns, STPUD could face the challenge of maintaining an adequate water supply for its customers. By instituting water conservation measures now, including installing water meters and maintaining an aggressive water conservation program, STPUD can mitigate potential future water shortages. Also, by implementing conservation measures now, more water will be available in the basin, and ultimately for other end (downstream) users outside the Tahoe basin.

Conserved water will benefit the Paiute Tribe and the fisheries they manage at Pyramid Lake. The mission of Pyramid Lake Fisheries is to "operate and maintain fishery facilities at Pyramid Lake and the lower Truckee River for the purpose of enhancing Cui-ui and Lahontan Cutthroat Trout populations, while creating a balance within natural resources management actions, which reflects the social, cultural, economic, and natural resource values of the Pyramid Lake Paiute people," (Pyramid Lake Fisheries 2011).

6. Increase water supply for Native Tribes

The conserved water, originating from the Tahoe Basin flows from Lake Tahoe into the Truckee River where it terminates in Pyramid Lake, which has no outlet. The Paiute Tribe Reservation encompasses a lengthy stretch of the Lower Truckee River and Pyramid Lake in its entirety. The reservation bears the brunt of any upstream impairment of either water quality or water quantity. Lake level, river habitat, and endangered and threatened fish species suffer the consequences of water removed from the river. The Pyramid Tribe has pursued many avenues, including litigation to secure and protect adequate water supply to Pyramid Lake.

The Tribe's primary water rights were decreed under claims 1 and 2 of the *Orr Ditch Decree,* as a result of the priority date of the establishment of the reservation. To protect its resources, beginning in the 1980's the Tribe protested and litigated many applications seeking to change the place or manner of use of other Truckee River surface water rights. The battles on this front spanned decades and resulted in multiple decisions from the Ninth Circuit Court of Appeals relating the law of forfeiture and abandonment as applied to the Newlands Project.

The Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990, Title II, Public Law 101-618, 32 Stat. 3294, 3306 (Settlement Act), and the resulting Operating Agreement for the Truckee River are keystones in the long range health of the river and Pyramid Lake. The Settlement Act resulted in a 20 year negotiation to produce the Operating Agreement which was signed in 2008, by the state of Nevada, California, the Secretary of the Interior, the Pyramid Tribe and others. The Operating Agreement provides for actions by the Tribe and Water Authority to cooperate in the use of their water rights, to

take specific measures to prevent the waste of water, and to take steps to acquire additional Truckee River water rights to meet their needs for Truckee River water.

In 1998, the Nevada State Engineer issued ruling 4683, giving the Tribe the right to appropriate all of the "unappropriated waters" of the Truckee River for, "instream/in situ right to the high flows in excess of decreed or existing water rights on the Truckee River system in order to sustain the threatened and endangered fishery at Pyramid Lake." After years of appeals, in 2009, the Nevada Supreme Court dismissed the last appeal and upheld ruling 4683. The Tribe was officially granted the rights to all remaining unappropriated waters of the Truckee River.

For all the Tribe's various water rights, the authority granting those rights has recognized the importance of Truckee River surface flows to Pyramid Lake to protect their fisheries for their cultural and recreational value. Any decrease of the in-stream flow of the Truckee River and water level in Pyramid Lake is of critical importance to the Tribe, Pyramid Lake Reservation and the threatened and endangered species found there (Springmeyer et al. 2011).

Source: Excerpts taken from: Don Springmeyer, Wolf, Rifkin, Shapiro, Schulman, Rabkin, 2011. "The Pyramid Lake Paiute Tribe, The Truckee River an Pyramid Lake- Decades of Battles for Better Instream Flow, Quantity and Quality." American Bar Association: Section of Environment, Energy and Resources. San Diego, CA.

Pyramid Lake Fisheries. Welcome to Pyramid Lake Fisheries!

Uncertainty of the benefits and factors that lead to uncertainty

There is no uncertainty that the Regional Water Use Efficiency Program will save water. Estimates as listed above are obtained from reliable, historic sources and have been underestimated rather than overestimated to ensure that the monitoring to be performed on the BMP water conservation implementations will reach stated goals and objectives. It is expected that when the actual monitoring occurs, especially when metered water savings can be measured, the program will save more water than has been stated.

Adverse physical effects to the implementation of this project:

The only adverse physical effect that may result from the implementation of the Regional Water Use Efficiency Program could be lack of maintenance by recipients for landscaping and irrigation improvements.

Supporting Documentation

Supporting documentation is listed under each benefit above.

Table 9 – Annual Project Physical Benefits

Project Name: ____Regional Water Use Efficiency Project__

Type of Benefit Claimed: ___Greenhouse Gas Emissions Reduction_____

Measure of Benefit Claimed (Name of Units): __Metric Tons_____

Additional Information About this Measure:_Carbon Dixide or CO-2 Equivalent related to reduction in electricity_

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2015	0	13.5	13.5
2016	0	13.5	13.5
2035	0	13.5	13.5
Last Year of Project Life	0	270	270

Comments: Attached to this Section is the greenhouse gas reduction calculator as provided by the US Environmental Protection Agency. The metric tons reduced is based on the electrical savings shown in Attachment 8: Benefit Cost Analysis that result from the reductions in water production that will occur after full implementation of the Regional Water Use Efficiency Project.

Table 9 – Annual Project Physical Benefits

Project Name: ____Regional Water Use Efficiency Project__

Type of Benefit Claimed: ___Electric Energy Saved_____

Measure of Benefit Claimed (Name of Units): __kWh_____

Additional Information About this Measure:_Electricity saved as a result of water production reductions

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	19069	19069
2016	0	19069	19069
2035	0	19069	19069
Last Year of Project Life	0	381380	381380

Comments: It is estimated by the California Energy Commission that a typical urban water system in Northern California utilizes 3950 kWh/MG of water x 4,827,812MG saved by project is 19069 kWh saved per year

Table 9 – Annual Project Physical Benefits

Project Name: ____Regional Water Use Efficiency Project__

Type of Benefit Claimed: ___Water Production reduced by water saved____

Measure of Benefit Claimed (Name of Units): __Gallons_____

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	4827812	4827812
2016	0	4827812	4827812
2035	0	4827812	4827812
Last Year of Project Life	0	96556240	96556240

Comments: Gallons of water saved annually are based on estimates of water saved for each Water Conservation BMP implemented

Project #7: West Lake Tahoe Regional Water Treatment Plant

The West Lake Tahoe Regional Water Treatment Plant project is the construction of a permanent all-season surface water treatment plant utilizing Lake Tahoe as the water source. The project replaces an existing summer seasonal water treatment plant and supplements or replaces ground water sources, providing a long term solution to water delivery needs along the West Shore of Lake Tahoe. This project offers an integrated, regional approach to improving the supply of high quality drinking water.

Project Physical Benefits

Summary of the types of physical benefits being claimed

The West Lake Tahoe Regional Water Treatment Plant project will accomplish the following benefits:

1. increase the supply of high quality domestic water;
2. provide improvements in water quality for up to eight independent water systems;
3. provide additional water supply to meet redundancy requirements for to up to eight independent water systems;
4. treat up to 1,820 GPM of water for primary surface water contaminants and microorganisms;
5. improve an estimated 1,000 square feet of floodplain;
6. enhance the scenic corridor along Lake Tahoe;
7. reduce land coverage and habitat disturbance;
8. increase protection of forest habitat;
9. increase public access to Lake Tahoe and publically owned lands;
10. provide a drought-resistant source of water, to ensure adaptation to climate change;
11. Reduce greenhouse gas emissions ; and
12. Reduce energy consumption for duplicative facilities.

Narrative to support the physical benefits of the West Lake Tahoe Regional Water Treatment Plant:

1. Increase the supply of high quality domestic water

The West Lake Tahoe Regional Water Treatment Plant will produce up to 1,820 GPM of drinking water that meets all Federal and State regulations.

Currently, there is an interim summer seasonal water treatment plant that produces 300 GPM and serves only one of the eight water systems along the West Shore of Lake Tahoe. The project will be sized to meet the supply needs of up to eight individual water systems.

There are eight other water systems along the west shore of Lake Tahoe that could be served by this plant. Each system has water supply issues for either their primary or back-up sources. Additionally, there is a lack of adequate storage to meet fire suppression standards throughout the area which becomes critically important in suppressing fires in the wildland-urban interface area

The West Lake Tahoe Regional Water Treatment Plant project will produce up to 1,820 GPM, producing enough water to address the water supply needs for all eight of the water systems and provide emergency back-up supply and storage through an integrated water system.

2. Provide improvements in water quality for up to eight independent water systems

Currently there are eight separate water systems along the West Shore of Lake Tahoe that provide water service to 2,820 residents and businesses. None of these systems is in full compliance with current California Department of Public Health standards. Two of the systems are in violation of primary drinking water standards and all have source capacity issues for either their primary or back-up sources. Also, there is a lack of adequate storage to meet fire suppression standards throughout the area.

The new water treatment plant will improve water quality for up to eight independent water systems by addressing the following water quality issues that currently exist in some of the systems including: high levels of iron, manganese, arsenic, radon, bacteriological contaminants, and carbon dioxide.

3. Provide additional water supply to meet redundancy requirements for to up to eight independent water systems

Currently there are eight separate water systems, under different ownerships, along the West Shore of Lake Tahoe that provide water service to 2,820 residents and businesses. All have source capacity issues for either their primary or back-up sources and there is a lack of adequate storage to meet fire suppression standards throughout the area.

Due to the small numbers of connections in each system (most under 500 connections) these systems are significantly undercapitalized to meet today's drinking water standards. The West Lake Tahoe Regional Water Treatment Plant project will provide adequate water source to address these water supply needs on an integrated, regional basis, in a cost efficient manner. The new plant also increases water use efficiency for the region by eliminating existing redundancies in the water system delivery.

4. Treat up to 1,820 GPM of water for primary surface water contaminants and microorganisms

The West Lake Tahoe Regional Water Treatment Plant project will treat up to 1,820 GPM and provide an efficient and effective solution to existing water supply needs on an integrated, regional basis.

Up to 1,820 GPM of water will be treated for primary surface water contaminants and microorganisms such as turbidity, coliform, E. coli, giardia, cryptosporidium, legionella and other viruses and bacteria that may be present.

By building the new water treatment plant, up to eight water systems will have an alternative to groundwater. The use of surface water over groundwater will reduce the amount of primary inorganic substances such as Arsenic, Radiological contaminants such as Radium 228 and Radon, and potential corrosivity issues associated with groundwater high in carbon dioxide which can lead to Lead and Copper issues. Lake Tahoe surface water typically contains less of the secondary type of contaminants commonly found in groundwater such as Iron, Manganese, Sulfates and Total Dissolved Solids.

The selection of Lake Tahoe surface water and the associated treatment process will result in a very safe, high quality and aesthetically pleasing drinking water product being delivered to the end user.

5. Improve an estimated 1,000 square feet of floodplain

The West Lake Tahoe Regional Water Treatment Plant project improves approximately 1,000 square feet of floodplain. This is accomplished by removing the outdoor water treatment plant equipment and structures that are currently located the floodplain of McKinney Creek.

6. Enhance the scenic corridor along Lake Tahoe

The Bi-State Compact which governs Lake Tahoe land use and protection identifies the importance of preserving and enhancing Lake Tahoe's scenic values. All projects must help meet the established scenic thresholds. The West Lake Tahoe Regional Water Treatment Plant project involves removal of an interim, outdoor water treatment plant located within the scenic corridor of Lake Tahoe and replacing it with a permanent, enclosed, surface water treatment plant that is located away from the lakefront and highway, and is screened from visibility by significant pine forest.

A regional plant also eliminates the need for other water systems to construct water source or treatment facilities within the highway or lakefront areas. Minimizing the amount of potential expanded shoreline structures ensures that the stunning natural landscape remains the dominant feature when viewing the shoreline of Lake Tahoe.

7. Reduce land coverage and habitat disturbance

Constructing one regional water treatment plant that can serve up to eight water systems and up to 2,820 domestic water connections reduces the amount of land coverage and habitat disturbance that would be created by multiple water systems having individual source or treatment facilities. If each of the eight water systems were to build their own facilities it could equate to up to 5,500 sq. feet of buildings. With one consolidated facility that is 2,400 sq. feet there is a reduction of 3,100 sq. feet.

8. Increase protection of forest habitat

Currently water service along the West Shore of Lake Tahoe is provided by eight different water systems in an inefficient, ineffective, disjointed, delivery system. All have source capacity issues for either their primary or back-up sources and there is a lack of adequate storage to meet fire suppression standards throughout the area.

Fire has been a natural part of Tahoe's environment for thousands of year, and during periods of drought the Lake Tahoe Basin is even more susceptible to wildland fire. The construction of a regional water treatment plant addresses a critical need by increasing the quantity of water available for emergency fire protection for over 2,000 acres of land and up to 2,820 homes and businesses along the West Shore of Lake Tahoe.

9. Increase public access to Lake Tahoe and other publically owned lands

This project will eliminate the existing interim treatment facility which is located in a heavily-used recreational area that provides access to publicly owned lakeshore.

Additionally, the construction of one regional water treatment facility instead of up to eight individual facilities increases the amount of land available and the public access to recreational opportunities along Lake Tahoe.

10. Provide a drought-resistant source of water to ensure adaptation to climate change

Currently, the eight separate water systems each utilize different groundwater sources for water. This dependency on groundwater sources poses a threat to the reliability of water delivery in the region, and leaves the area vulnerable if a drought were to occur.

The Regional Water Treatment Plant Project prepares the region for climate change by constructing a surface water treatment plant, reducing the region's dependence on groundwater sources. This integrated surface water treatment plant provides enough capacity to establish system interties between the eight small water systems, providing a viable and reliable alternative to groundwater for the region. By supplementing groundwater sources with surface for the region, this secures safe drinking water supplies, safeguarding public and environmental health.

11. Reduce greenhouse gas emissions

By consolidating treatment facilities, there will be a reduction in vehicle trips for maintenance and monitoring. Total annual reduction is estimated to be a total of 7,720 vehicle miles annually. . By reducing the number of vehicle trips there will be a reduction in greenhouse gas emissions.

12. Reduce energy consumption for duplicative facilities

The eight separate water systems along the West Shore of Lake Tahoe were all constructed well over 40 years ago and have older equipment that does not meet today's energy efficient standard. By consolidating facilities it reduces the need for duplicative facilities which provides an energy savings. Additionally, the new regional water treatment plant will be an upgrade to new technology and equipment which is significantly more energy efficient.

Adverse physical effects to the implementation of this project:

We do not foresee any adverse effects arising from the project.

Table 9 – Annual Project Physical Benefits			
Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: § Increase the supply of high quality domestic water** **Measure of Benefit Claimed (Name of Units): Gallons Per Minute (GPM)**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	300 GPM	up to 1,820 GPM	up to 1,520 GPM
Comments: New regional water treatment plant will replace interim plant and produce up to 1820 GPM of water			
Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Provide improvements in water quality for up to eight independent water systems** **Measure of Benefit Claimed (Name of Units): MCL's** **Additional Information About this Measure: Addresses high levels of iron, manganese, arsenic, radon, bacteriological contaminants and carbon dioxide.**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	Certain contaminants above the MCL	All contaminants below the MCL	Water quality meets or exceeds all Primary and Secondary water quality standards.

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Provide additional water supply to meet redundancy requirements for up to 8 water companies** **Measure of Benefit Claimed (Name of Units): Gallons Per Minute (GPM)**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	300 GPM	up to 1,820 GPM	up to 1,520 GPM

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Treat up to 1,820 GPM for primary surface water contaminants & microorganisms** **Measure of Benefit Claimed (Name of Units): Gallons Per Minute (GPM)**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	300 GPM	up to 1,820 GPM	up to 1,520 GPM

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Improve an estimated 1,000 square feet of floodplain** **Measure of Benefit Claimed (Name of Units): square feet (sq. ft.)**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	0	~1000 sq. ft.	~1000 sq. ft.

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Enhance the scenic corridor along Lake Tahoe** **Measure of Benefit Claimed (Name of Units):sq. ft**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	0	1,600 sq ft.	1,600 sq ft.

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: reduce land coverage and habitat disturbance** **Measure of Benefit Claimed (Name of Units): sq. ft.**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	up to 5,500 sq. ft	2,400 sq. ft.	decrease of 3,100 sq. ft.

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Increase protection of forest habitat.** **Measure of Benefit Claimed (Name of Units): Acres**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	.018 acres	2,050 acres	

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Increase public access to Lake Tahoe and publically owned lands** **Measure of Benefit Claimed (Name of Units): sq. ft.**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	0 sq. ft.	1,600 sq. ft	1,600 sq. ft

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Provide drought resistant source of water to ensure adaptation to climate change** **Measure of Benefit Claimed (Name of Units): GPM**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	300 GPM	1,820 GPM	1,520 GPM
Comments: Project is a surface water treatment plant, reducing region's dependence on groundwater sources			

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Reduce Greenhouse Gas Emissions** **Measure of Benefit Claimed (Name of Units): VMT's (vehicle miles traveled)**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	11,520 VMT	3,800 VMT	reduction of 7,720 VMT's annually
Comments: VMT's are based on maintaining one facility compared with 6 facilities			

Project Name: West Lake Tahoe Regional Water Treatment Plant **Type of Benefit Claimed: Energy Savings** **Measure of Benefit Claimed (Name of Units): KWH : (Kilowatts per Hour)**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Yrs of Project Life	5,320 KWH	2,003 KWH	net reduction of 3,317 KWH annually

Project #8: Griff Creek Water Quality Improvement Project

The Griff Creek Water Quality Improvement project is part of the overall Kings Beach Water Quality Improvement Project (WIP) which focuses on water quality improvements throughout the entire Kings Beach urban community. The Kings Beach community is one of the largest urban watersheds bordering Lake Tahoe and has been identified as one of the largest urban sediment pollution sources to Lake Tahoe. To successfully undertake this 40 million dollar project it has been broken into 13 phases consisting of six separate watersheds and two stream environmental zones. The Griff Creek Water Quality Improvement Project phase improves a portion of one of the SEZ's and provides water quality improvements for the Griff Creek Watershed area.

Griff Creek runs through the urbanized area of Kings Beach, California and outlets directly into Lake Tahoe. Due to development and urbanization the creek has lost its natural meandering and flood control characteristics and has become an eroded stream channel and a sediment pollution source to Lake Tahoe. In addition, no water quality treatment facilities exist in the Griff Creek watershed to treat urban runoff before it enters Griff Creek.

This project will reintroduce Stream Environmental Zone (SEZ) area and natural flood control zones helping to take some of the pressure off of the main Griff Creek Channel. In addition multiple water quality features will be constructed to treat the urban runoff before it enters Griff Creek, all helping to reduce the sediment load in Lake Tahoe.

Project Physical Benefits

Summary of the types of physical benefits being claimed

The Griff Creek Restoration Project will accomplish the following benefits:

1. Improve water quality;
2. Improve an estimated 1.5 acres of stream environmental zone(SEZ)/floodplain;
3. Improve water supply reliability; and
4. Provide educational resources on watershed.

Narrative to support the physical benefits of the Griff Creek Water Quality Improvement Project:

1. Improve water quality

The California Water Quality Control Board – Lahontan Region (LRWQCB) and Nevada Division of Environmental Protection (NDEP) have completed a Lake Tahoe TMDL analysis (LRWQCB and NDEP 2010) with the following key findings: 1) fine sediment particles (<16µm; FSP) are the primary pollutant of concern impacting lake clarity; and 2) stormwater runoff originating in urban areas is estimated to contribute 72% of the annual FSP pollutant load to Lake Tahoe.

The Lake Tahoe TMDL Implementation Plan (LRWQCB and NDEP 2010) establishes interim load reduction milestones for FSP, total phosphorus (TP), and total nitrogen (TN), with the most notable milestone being the Clarity Challenge, which requires that all Tahoe Basin jurisdictions reduce FSP loading by 34% by the year 2026. Upcoming revisions to NPDES permits (California) and Memorandums of Agreement (Nevada) will require that each jurisdiction develop and commit to a load reduction plan formulated to meet these load reduction milestones.

The 2NDNATURE Team (2NDNATURE, Northwest Hydraulic Consultants, Environmental Incentives, and Geosyntec Consultants) was contracted by the US Army Corps of Engineers (ACOE) to develop the "Placer County Stormwater TMDL Strategy Final Technical Report" (July 2011). The goal of the Strategy Report was to: 1) assist Placer County to plan water quality improvements, strategies, and operations that will meet the Lake Tahoe TMDL pollutant load reduction milestones; and 2) provide information and insight for other jurisdictions as they develop their TMDL strategies. The Kings Beach Urban area was rated as high and highest for fine sediment particle load by urban planning catchment within Placer County. The Griff Creek watershed within Kings Beach falls in the high fine sediment particle (FSP) load category with an estimated baseline unit FSP load of 117 lb/year/acre. We're estimating a 47% reduction of fines sediment load as a result of implementing this project. This reduction estimate is based on the results of similar water quality projects implemented by Placer County in the Tahoe Basin. The project will reach these goals by implementing wetlands attenuation, infiltration basins, and water quality treatment improvements (sediment cans, Jell fish filtrations systems).

By reducing the sediment load into Lake Tahoe the project benefits the following Tahoe Sierra Integrated Regional Water Management Plans (IRWMP's) water quality (WQ) objectives:

- ✓ WQ2: Reduce nutrient and sediment loads to receiving water bodies. Water quality improvement (clarity, reduced nutrients) will result for Lake Tahoe, which is a listed 303(d) impacted water body from sediment
- ✓ WQ3: Meet nutrient and sediment standards for tributary streams and storm water runoff. The project is implementing water quality features to treat urban storm water runoff before it enters Griff Creek and Lake Tahoe.
- ✓ WQ4: Ensure that drinking water continues to meet the standards of the Safe Drinking Water Act. These improvements will reduce fine particle and sediment pollutants that are discharged into Lake Tahoe which is a drinking source for Basin communities.
- ✓ WQ5: Restore degraded streams and wetlands to re-establishing natural water filtering

2. Improve an estimated 1.5 acres of stream environmental zone(SEZ)/floodplain

The Tahoe Regional Planning Association (TRPA) SEZ goal is restoration of 25% of disturbed SEZ in the Tahoe Basin within the 20-year life of the Regional Plan according to volume III of the 208 Plan, urban areas are targeted for 1,153 acres of restoration.

Approximately 1.5 acres of SEZ will be restored from the project. The SEZ will be restored by removing 1,106 cubic yards of fill material (currently point source material contributing to sediment load) in the floodplain and reconnecting the historical SEZ area to Griff Creek by constructing 1,089 LF secondary stream channel. The new SEZ area will be revegetated with native species.

The proposed SEZ restoration benefits the following Tahoe Sierra Integrated Regional Water Management Plans (IRWMP's) water quality (WQ) and ecosystem restoration (ER) objectives:

- ✓ WQ5: Restore degraded streams and wetlands to re-establishing natural water filtering processes
- ✓ ER1: Enhance and restore degraded stream environment zones (SEZs) to support healthy and viable native fish populations.
- ✓ ER2: Restore wetlands and natural biogeochemical cycles.
- ✓ ER5: Minimize Disturbance caused by urban development. The project is removing fill placed in the SEZ due to urban development.

3. Improve water supply reliability

The Griff Creek Water Quality Improvement project will improve water supply reliability by reducing fine particle and sediment pollutants that are discharged into Lake Tahoe which is a drinking water source for basin communities. This will help ensure that drinking water continues to meet the standards of the Safe Drinking Water Act.

4. Provide educational resources on watershed

Project will provide interpretative signage for visitors and general public, including educational resources regarding watershed stewardship. In addition, Placer County works directly with the Sierra Watershed Education Partnership (SWEP) on our water quality projects. During our recent Beaver Street Water Quality Project the Kings Beach Elementary School classrooms participated in classroom education directly with the Placer County Project Manager as well as field participation including revegetation planting and photo monitoring of the project. Placer County anticipates continuing this partnership.

Adverse physical effects to the implementation of this project:

We do not foresee any adverse effects arising from the project.

Table 9 – Annual Project Physical Benefits **Project Name: Griff Creek Water Quality Improvement Project** **Type of Benefit Claimed: Improve Water Quality** **Measure of Benefit Claimed (Name of Units): lb/year/acre**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Years of Project Life	0	up to 117 lb/year/acre	up to 117 lb./year/acre
Project Name: Griff Creek Water Quality Improvement Project **Type of Benefit Claimed: Improve an Estimated 1.5 Acres of Stream Environmental Zone (SEZ)/Floodplain** **Measure of Benefit Claimed (Name of Units): acres**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Years of Project Life	0	1.5 acres	1.5 acres
Comments: Participates in reaching TRPA SEZ Restoration Goal in Tahoe Basin			

Project Name: Griff Creek Water Quality Improvement Project **Type of Benefit Claimed: Improve water reliability** **Measure of Benefit Claimed (Name of Units): lb/year/acre**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Years of Project Life	0	up to 117 lb/year/acre	up to 117 lb/year/acre

Project Name: Griff Creek Water Quality Improvement Project **Type of Benefit Claimed: Provide educational resources on watershed** **Measure of Benefit Claimed (Name of Units): signs**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
Years of Project Life	0	2	2
Comments: Two interpretative signs will be created and posted for the general public includes educational resources regarding watershed stewardship.			

Project #9: Lake Tahoe Private Parcel Best Management Practices Retrofit Program

The goal of this project is to improve Lake Tahoe water quality by reducing the inputs of fine sediment particles and nutrients from privately-owned developed parcels. Through implementation of Lake Tahoe Private Parcel Best Management Practices Retrofit Program, the TRPA Stormwater Management Program will engage property owners and assist them in designing and installing low impact development practices and water quality best management practices (BMPs) on their properties. This will include the installation of stormwater treatment and infiltration as well as stabilization of eroding areas and restoration of disturbed soils.

Objectives for this project include improved collaboration between watershed scale implementers and private property owners, increased level of expertise in low impact development and stormwater BMP design and installation among local project designers, reviewers, and installers, and increased public awareness regarding the importance of BMP installation and maintenance in preserving lake clarity.

Historical and current development patterns have resulted in this need to preserve Lake Tahoe's water quality. Prior to 1960, development at Lake Tahoe was mostly limited to small summer cabins. Following the 1960 Winter Olympic Games at Squaw Valley, and the associated completion of Interstate Highway 80, the Lake Tahoe region has seen a rise in winter activity, ski resorts, and year-around residential and commercial use (Marvin et al, 2009, p.9). The rise in activity and growth has included expanded urban corridors, increased built-environment, and as a result, larger pollutant loads from stormwater runoff. TMDL Research at Lake Tahoe attributes lake clarity loss to increased input of fine sediment particles (FSP) and to a lesser extent, nutrients. Fine sediment particles (FSP) scatter and absorb light providing the greatest reduction to water clarity in Lake Tahoe (Swift et al, 2006, p.1-2). Additional clarity occurs through light absorption from organic materials such as [algae, phytoplankton] (Taylor et al, 2003, p.3-12) Research conducted by University of California Davis and the Desert Research Institute (DRI) established urban areas as the primary source of sediment particles (Heyvaert et al, 2007).

Estimates of pre-project conditions are based on the premise that without the BMP Retrofit Program, the only BMPs which would be installed on private parcels are those required as a condition of permitted remodels/new construction. Analysis of data obtained from the TRPA BMP Certificate database shows that since 2009 and average of 60% of the BMPs completed on private parcels (all land uses) have been solely through the efforts of the BMP Retrofit Program. This percentage is significantly higher (approximately 80%) and for commercial properties, which have been identified a much more significant source of pollutants of concern by the Lake Tahoe TMDL (Water Board, NDEP, 2011, p.9-2). This percentage increased dramatically in 2011 and is expected to remain the same or potentially increase over the life of the project. This increase is likely the result of the changing economic conditions in Tahoe since 2008. As of 2011, many of the permits issued during better economic times have since expired. Data provided by Paul Nielson, TRPA Current Planning Manager, shows a 52% drop in permit applications since 2006. The reduced numbers of permits issued indicates that a greater investment in retrofit of existing structures will be required to achieve water quality goals.

Project Physical Benefits

Summary of the types of physical benefits being claimed for The Private Parcel BMP Retrofit Project:

1. Reduced sediment and nutrient loads to Lake Tahoe;
2. Reduced volumes of stormwater runoff leaving properties and improved groundwater recharge;
3. Restored soils/soft coverage; and
4. Increased environmental stewardship.

Narrative to support the physical benefits of the

1. Reduced sediment and nutrient loads to Lake Tahoe

Stormwater treatment systems in the Lake Tahoe Basin are designed to remove pollutants using either the processes found within the soil matrix or though filtration by vegetation or media. Examples of typical infiltration BMPs include gravel infiltration systems and infiltration Basins. Treatment systems on private parcels are designed to either treat through infiltration, thereby preventing the majority of runoff generated by storm events from entering local water bodies, or to reduce the pollutants concentration levels to meet stringent land or water discharge standards. The pollutants that will be reduced through implementation of the project include total suspended sediment (TSS), phosphorous (P), and nitrogen (N).

Estimates of pollutant removal were developed using the Geosyntac Load Reduction Calculator. The Geosyntec calculator estimates load reductions based on land use. The calculator assumes an average parcel size for a designated land use, and computes the volume of runoff generated during a 20 year one hour storm and then multiplies this number by an average effluent concentration for that particular land use. This tool can provide a reasonable degree of accuracy for basin-wide planning purposes, however, due to the assumptions about parcel size and the variations effluent concentration between individual sites, this tool should not be solely relied upon to calculate load reductions from an individual parcel. During the permitting process, catchment scale project load reductions are calculated based on the Pollutant Load Reduction Model developed through a partnership between the Lahontan Regional Water Quality Control Board and the Nevada Division of Environmental Protection or other method approved by the permitting agency.

The lack of maintenance of private property BMPs also adds uncertainty to long term load reductions and continued BMP functionality (Placer County Stormwater TMDL Strategy, 2011, p.3.27).

Estimated benefits follow various assumptions such as the proper installation/functionality of BMPs including: adequate sizing of infiltration facilities for a 20 year – 1hour storm event, correct selection and placement of BMPs to be implemented and proper installation procedures to mitigate construction disturbances. Deviations from these assumptions will result in varying water quality benefits.

This benefit supports the following Tahoe Sierra IRWM objectives:

- ✓ WQ2 Meet nutrient and sediment standards for tributary streams and stormwater runoff. This project will improve the quality of runoff entering tributaries to Lake Tahoe which receive runoff from uban areas.

- ✓ WQ3 Reduce nutrient and sediment loads to receiving water bodies. This project is implementing BMPs to treat urban runoff before it reaches Lake Tahoe.

2. Reduced volumes of stormwater runoff leaving properties and improved groundwater recharge.

The capture and treatment, and infiltration of the volume of runoff generated by the impervious surfaces on residential and commercial properties is sufficient to provide effective stormwater treatment for the pollutants of concern in Lake Tahoe (Water Board, NDEP, 2008, p.97). This means that infiltration BMPs are the preferred BMPs for much of the Tahoe Basin (Water Board, NDEP, 2008, p.163). Infiltration BMPs also have the added benefit of providing a reduction in stormwater volume and improved groundwater recharge.

stormwater and sediment from entering the public right of way and ultimately Lake Tahoe.

In order to estimate the volume of stormwater that will be captured and infiltrated an average parcel size and percent pervious cover are assumed from TRPA GIS data for three primary land use types. The volume of runoff to be captured and infiltrated is calculated using the methods outlined in the USDA TR55 "Urban Hydrology for Small Watersheds." Determination of the number of BMPs that will be installed is based on the number of certificates issued in 2011 and 2012. These years are may be considered representative of the number of permits that will be issued during the project duration due to the fact that they occur after the time period in which building permits issued prior to the recession would expire. Average performance for the Tahoe Basin using the current design standard of one inch of precipitation in one hour is estimated at 91% retention and infiltration of annual stormwater runoff volumes (PLRM; NHC, 2010). This method provides a reasonable estimation for basin-wide planning but may not accurately represent stormwater volumes at the parcel level due to the generalized assumptions of parcel size and impervious cover. At the parcel level, BMPs are designed using a BMP Calculation Spreadsheet designed by the Natural Resource Conservation Service that can accurately calculate the volume of a twenty year storm for an individual site or a method approved by a qualified professional.

This benefit supports the following Tahoe Sierra IRWM objective:

- ✓ GWM1 Create reliable groundwater supply. This project will result in the implementation of infiltration BMPs which will aid in the re-charge of groundwater.

3. Restored soils/soft coverage

Restoration of urban soils prevents sediment loss.

Tahoe's short growing season and nutrient-poor soils result in a high risk of erosion for disturbed soils within that region (Water Board, NDEP, 2008, p.174) In order to limit erosion and additional disturbance to the natural ecosystem, strict limits are placed on the amount of disturbance and development allowed on each parcel. As part of the BMP Retrofit process, Stormwater Management Program staff work with property owners to restore disturbed soils, particularly unpaved parking areas, and protect those areas from future vehicle traffic. Particular emphasis is placed on the restoration and protection of soils within Stream Environment Zones.

A review of the TRPA GIS soft coverage (disturbed, un-vegetated, compacted soils) layer developed using LiDAR technology found that 59% of commercials parcel without BMPs and 24% of residential parcels without BMPs have existing soft coverage. This percentage was used to estimate the approximate number of parcels that will be restored as a result of the BMP Retrofit Program.

LiDAR data has a resolution limit of approximately 6" and may be affected by vegetation cover in some circumstances, which would result in a higher than estimated percentage of parcels without BMPs also having soft coverage. Additional uncertainty arises in instances where soft coverage was created prior to the adoption of the TRPA Code in 1972. In these cases, disturbed soils would be retrofitted with BMPs such as paving rather than restored to natural conditions.

This benefit supports the following Tahoe Sierra IRWM objective:

- ✓ ER5 Minimize disturbance caused by urban development. This project will result in the restoration of soils disturbed by urban development.

4. Increased environmental stewardship

The BMP Retrofit Project requires active participation from basin property owners to install and maintain BMPs on private parcels. These BMPs are installed using private funds and in order to continue this investment, the TRPA Stormwater Management team relies on an aggressive education and outreach program. Each BMP Certificate represents at least one property owner that has taken action to protect Lake Tahoe. Since the creation of the BMP Retrofit Program in 2003, telephone surveys conducted by TRPA have shown an increase in recognition of the term BMP among basin residents from 63% in 2005 to 79% in 2011 (Cromer, 2011). The number of property owners educated is calculated using the average number of property owners who request a BMP evaluation or BMP

certificate each year. This number is most likely underestimates the number of people within the Tahoe Basin that receive education as it does not include renters, visitors, or property owners who receive information but do not contact TRPA or a partner agency.

This benefit supports the following Tahoe Sierra IRWM objective:

- ✓ WQ6 Increase public awareness of regional water quality issues and their role in improving the quality of local water bodies.

Adverse physical effects to the implementation of this project:

Potential for adverse effects on water quality though implementation of the BMP Retrofit Project may result from negligence by the contractor to follow construction practices such as installing and maintain temporary BMPs, protecting the construction site from unnecessary disturbances, and preventing water from enter disturbed areas. These potential effects are mitigated through a permitting process that requires the installation of temporary BMPs prior to construction and maintenance of temporary BMPs throughout the construction process. Agency staff perform routine inspections of projects with involve grading of more the seven cubic yards of soil or more than three cubic yards in areas classified as sensitive by TRPA to ensure that temporary BMPs are properly installed and maintained.

Supporting Documentation

References

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Table 9 – Annual Project Physical Benefits			
Project Name: Private Parcel BMP Retrofit			
Type of Benefit: Reduction in Total Suspended Sediment (TSS)			
Measure of Benefits Claimed(Name of Units): Tons/year TSS			
(a)	(b)	(c)	(d)
Project Life	Without Project	With Project	Change Resulting from Project (b)-(c)
20+ years with maintenance	2,463	13,808	11,345
Comments: Total Suspended Solids load established by event mean concentration (EMC) from Water Board, NDEP, and GeoSyntec Consultants.			
Project Name: Private Parcel BMP Retrofit			
Type of Benefit: Reduction in Phosphorous (P)			
Measure of Benefits Claimed(Name of Units): Tons/year P			
(a)	(b)	(c)	(d)
Project Life	Without Project	With Project	Change Resulting from Project (b)-(c)
20+ years with maintenance	10	48	38
Comments: Total Suspended Solids load established by event mean concentration (EMC) from Water Board, NDEP, and GeoSyntec Consultants. Phosphorus load established by event mean concentration (EMC) from Water Board, NDEP, and GeoSyntec Consultants.			

Project Name: Private Parcel BMP Retrofit			
Type of Benefit: Reduction in Nitrogen (N)			
Measure of Benefits Claimed(Name of Units): Tons/year N			
(a)	(b)	(c)	(d)
Project Life	Without Project	With Project	Change Resulting from Project (b)-(c)
20+ years with maintenance	36	172	136
Comments: Total Suspended Solids load established by event mean concentration (EMC) from Water Board, NDEP, and GeoSyntec Consultants. Phosphorus load established by event mean concentration (EMC) from Water Board, NDEP, and GeoSyntec Consultants.			

Project Name: Private Parcel BMP Retrofit			
Type of Benefit: Reduction in Stormwater Volume and Improved Groundwater Recharge			
Measure of Benefits Claimed(Name of Units): Cubic Feet/Year of Runoff			
(a)	(b)	(c)	(d)
Physical Benefits			
Project Life	Without Project	With Project	Change Resulting from Project (b)-(c)
20+ years with maintenance	91,882	362,757	270,875
Comments: Flow rates based on 20-year 1-hr storm and USDA TR-55 impervious surface data.			

Project Name: Private Parcel BMP Retrofit			
Type of Benefit: Restoration of Disturbed Soils			
Measure of Benefits Claimed(Name of Units): Number of parcels on which restoration is preformed			
(a)	(b)	(c)	(d)
Project Life	Without Project	With Project	Change Resulting from Project (b)-(c)
20+ years with maintenance	38	158	120
Comments: Parcel counts include commercial and residential parcels in California.			

Project Name: Private Parcel BMP Retrofit			
Type of Benefit: Increased Environmental Stewardship			
Measure of Benefits Claimed(Name of Units): Number of Parcel Owners Educated			
(a)	(b)	(c)	(d)
Project Life	Without Project	With Project	Change Resulting from Project (b)-(c)
2014	0	700	700
2015	0	700	700
2016	0	700	700
Comments: Numbers based on the average number BMP evaluations and certificates issued in previous years.			