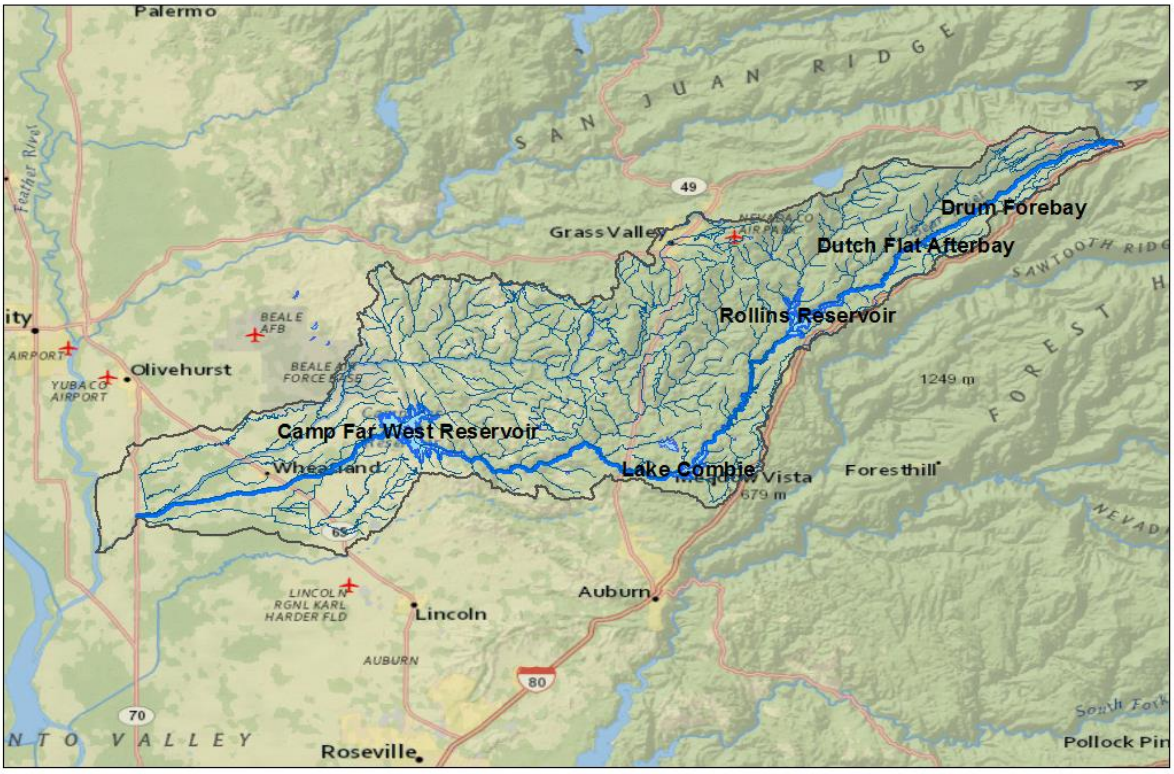
# Bear River Watershed

# Restoration Plan 2018

# Sierra Streams Institute



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*With technical support from:*

The Bear River Watershed Stakeholder Group (members listed on following pages)

*Date:*

May 31, 2018

# The Bear River Watershed Stakeholder Group

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|---|---|
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| US Fish & Wildlife Service | Beth Campbell |
| Beale Air Force Base Conservation Corps | Chuck Carroll |
| Bureau of Land Management | Peggy Cranston |
| US Geological Survey | Kim Taylor |
| US Bureau of Reclamation | Tom Hawes, Shelly Hatleberg, Laurie Sharp |
| National Marine Fisheries Service | Larry Thompson, Tom Holley |
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| CalFire | Karen Villalobos |
| State Water Resources Control Board | Diane Barclay, Jan Stepek, Aaron Button |
| Sierra Nevada Conservancy | Lynn Campbell, Chris Dallas, Andy Fristensky |
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| Nevada County | Tyler Barrington, Randall Yun |
| Placer County | Jennifer Byous,Kally Cecil, Brittany Weygandt |
| Sutter County | Danelle Stylos, Guadalupe Rivera |
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| Nevada City Rancheria | Shelly Covert |
| Auburn United Indian Community | Tristan Evans |
| **Water Agencies** | |
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| Reclamation District 1001 | Joe Henderson |
| Camp Far West Irrigation | Jack Gilbert |
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| Wolf Creek Community Alliance | Jane Pelton, Debra Worth, Joy Waite, Bruce Herring, Jonathan Keehn, Josie Crawford |
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| Friends of Spenceville | Richard Thomas |
| American Rivers | Max Odland, Bonnie Ricord |
| The Sierra Club | Allan Eberhart, Joy Waite |
| Foothills Water Network | Traci Sheehan, Allan Eberhart |
| The Sierra Fund | Karen Atkins, Alex Arditti, Kelsey Westfall |
| Point Blue Conservation Science | Kelly Weintraub |
| Valley Foothill Watersheds Collaborative | Gregg Bates |
| No. Cal. Council Fed. Fly Fishers | Frank Rinella |
| Gold Country Fly Fishers | Wilton Fryer |
| South Yuba River Citizens League (SYRCL) | Peter Burnes |
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| North Fork American River Alliance | Ron Gould |
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| Meadow Vista | Stewart Feldman |
| Dutch Flat | Jim Ricker |
| You Bet | Sandy Jansen, Damon DeCrow, Eric Bowman |
| Additional Residents | John &Jessica Meylor, Peter Van Zant, Gwen Eymann, Stephanie Curin, Karyn Furry, Glen Armintrout, Chris Knox, Rachel Savaloja, Jim Wofford, Gabrielle Lawson, Jeff Jenkins, Richard Miller, Richard Marks, Doug Soule |
| **Consultants** | |
| Stantec Consulting | Morgan Kennedy, Poyom Riles |
| Michael Baker International | Joyce Hunting |

*Dedicated to the future generations…*

**Revision Tracker**

| Revision Number | Date | Revisor | Summary of Revision |
|---|---|---|---|
| 1 | 8/7/2017 | Karin Emanuelson | - Reformatted Restoration Project Descriptions & Added bookmarks<br>- Added Appendix D.<br>- Added Appendix E.<br>- Edited font & added headings to Restoration Project Descriptions |
| 2 | 11/8/17 | Jessica Keszey | -Edited font and size<br>-Inserted page breaks<br>- Added projects and evaluations<br>-Updated pg. # for Figures<br>- Added Appendix F. |
| 3 | 12/8/17 | Emily Feng | -Added project evaluations from 11/15/17 stakeholders meeting. Added note under status update of spenceville riparian restoration project that evaluation sheet is in-process. |
| 4 | 5/22/18 | Emily Feng | -Edited project status appendix<br>-Updated restoration plan titles and dates to 2018<br>-Changed contact person from Kristen to Denise |

# Bear River Watershed Restoration Plan 2017

## Table of Contents

## Figures

# 1. Introduction

## The Bear River Watershed

The Bear River Watershed, on the western slopes of California's northern Sierra Nevada, is home to a diversity of plant, wildlife, and human communities, and has a complex history of development and anthropogenic impact. The watershed is nestled between the Yuba River Watershed to the north and the American River watershed to the south. The Bear River flows into the Feather River shortly before the Feather's confluence with the Sacramento River, which flows through the Delta to the San Francisco Bay. Figures 1 and 2 illustrate the Bear River Watershed's regional location.

The total watershed area is almost 303,500 acres. The main stem of the Bear River is approximately 75 miles long, and the total stream mileage of the watershed is approximately 960 miles, including perennial and intermittent tributary streams. An additional 284 miles of artificial canals, 40 miles of artificial pipes and connectors, and 280 miles of ephemeral streams are present in the watershed, and 3,138 acres of lakes, ponds and reservoirs, the largest of which are Rollins Reservoir, Lake Combie and Camp Far West.

There are five Hydrologic Unit Code (HUC)-10 subwatersheds within the Bear River watershed, which are mapped in Figure 3: Wolf Creek, Dry Creek, and the upper, middle and lower sections of the Bear River. Key tributaries include Greenhorn Creek and Steephollow Creek in the Upper Bear subwatershed;Rattlesnake Creek, Peabody Creek and French Ravine in the Wolf Creek subwatershed; Magnolia Creek (through Lake of the Pines), Wooley Creek (through Meadow Vista), Little Wolf Creek (above Garden Bar) and Rock Creek (above Camp Far West) in the Middle Bear subwatershed; and Best Slough and Yankee Slough in the Lower Bear subwatershed.

A detailed description of the Bear River Watershed is available in Campbell *et al*. 2016, produced as the watershed assessment upon which to base this restoration plan. Multiple sites in the watershed have also been monitored for water quality, with 2016 results available in Lincoln *et al*. 2016 and past results summarized in Campbell *et al*. 2016. Past and present monitoring sites are shown in Figure 4 of this restoration plan.

## The Stakeholder Group and Restoration Planning Process

The mission of the Bear River Watershed Group is to provide a structure within which all stakeholders are able to reach consensus on the issues facing the watershed in order to create and implement a collaborative, science-based restoration plan. Funded by the US Bureau of Reclamation and coordinated by Sierra Streams Institute with meeting facilitation by independent contractor Julie Leimbach, 43 organizations and multiple watershed residents have participated in the planning process leading to this report.

*Figure 1.* Location of the Bear River Watershed within California.

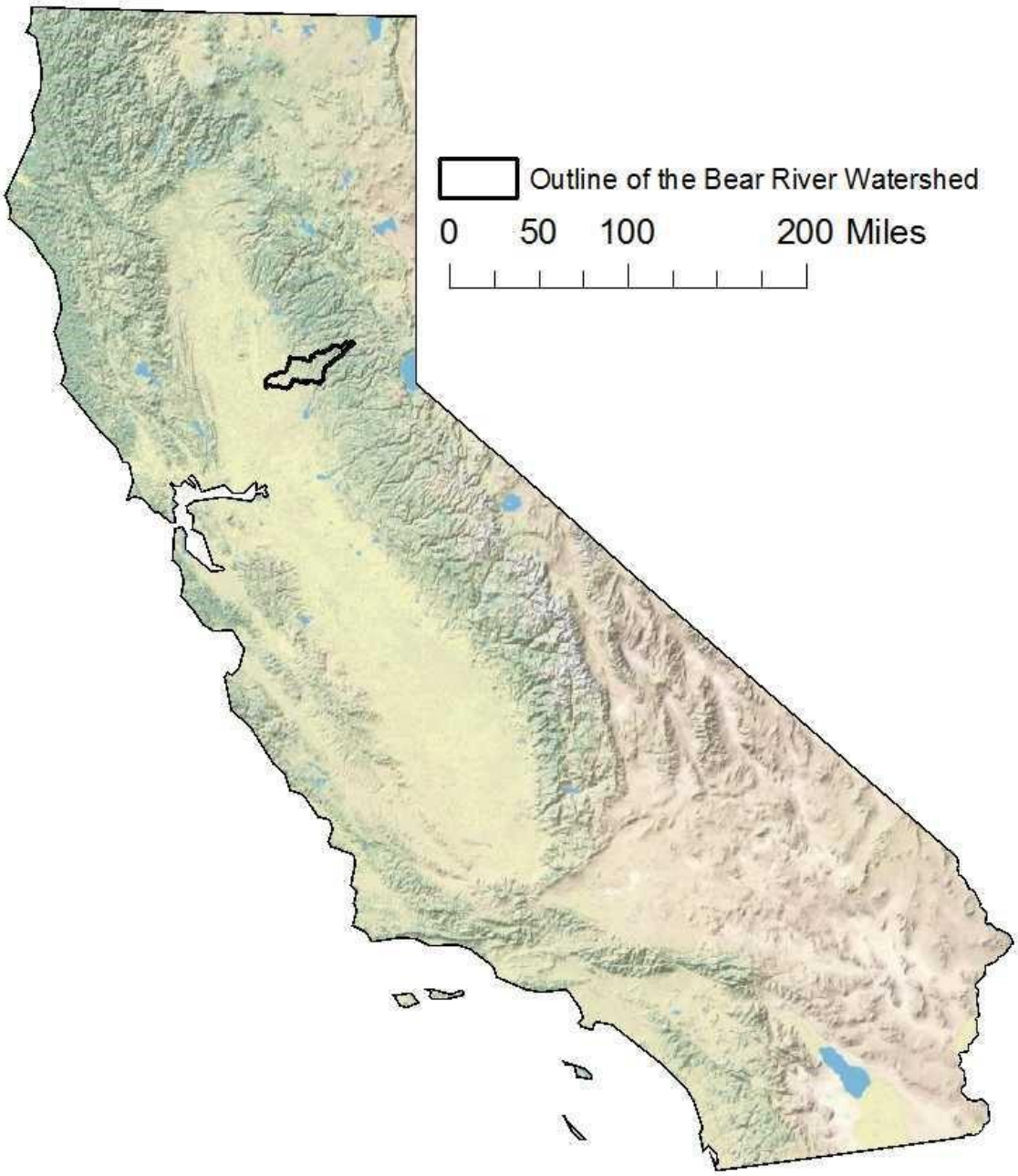


*Figure 2.* Location of the Bear River Watershed within the Northern Sierra Nevada Region.

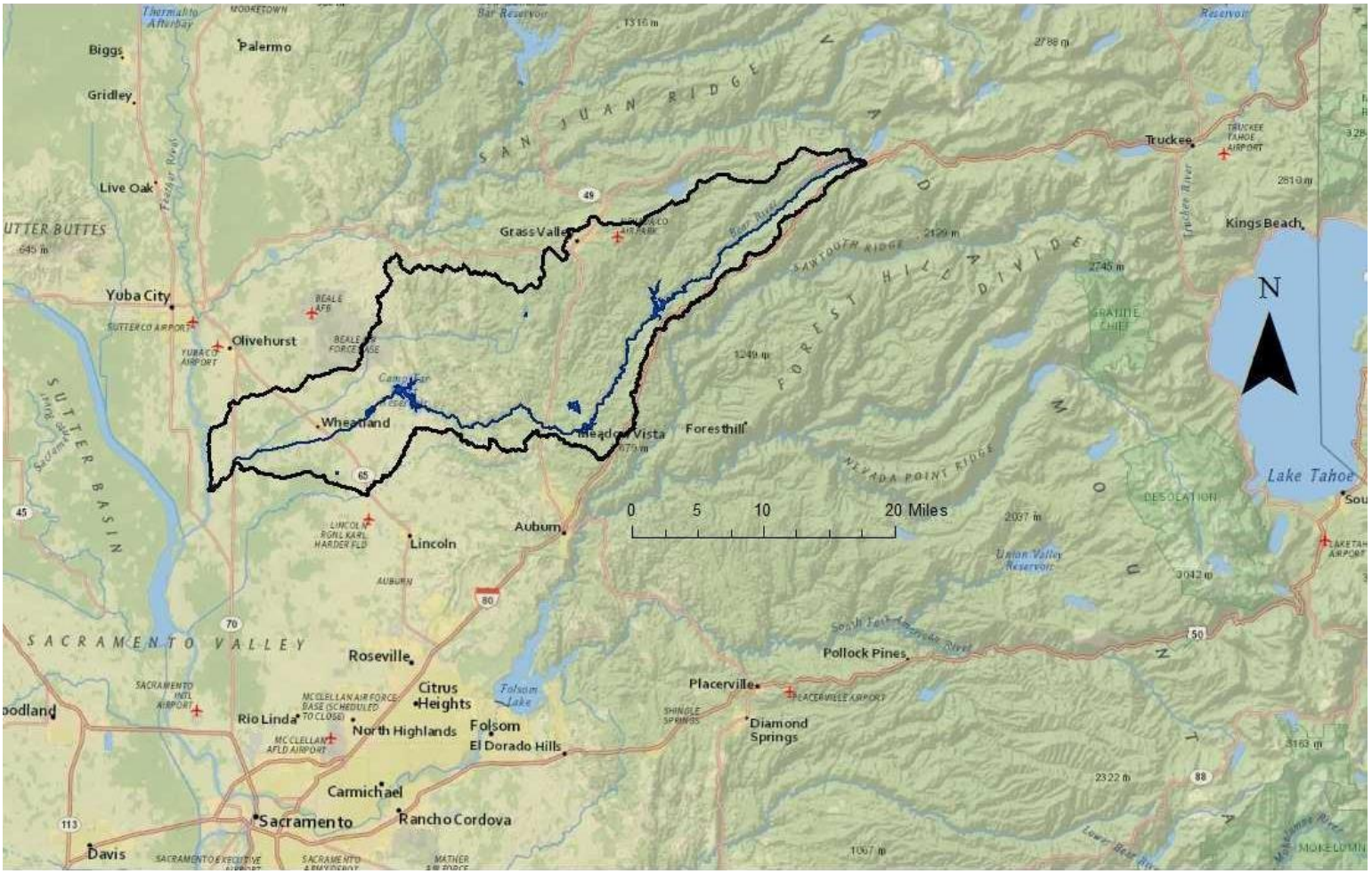


*Figure 3.* Bear River Watershed Subwatersheds, Reservoirs, Towns and Major Highways.

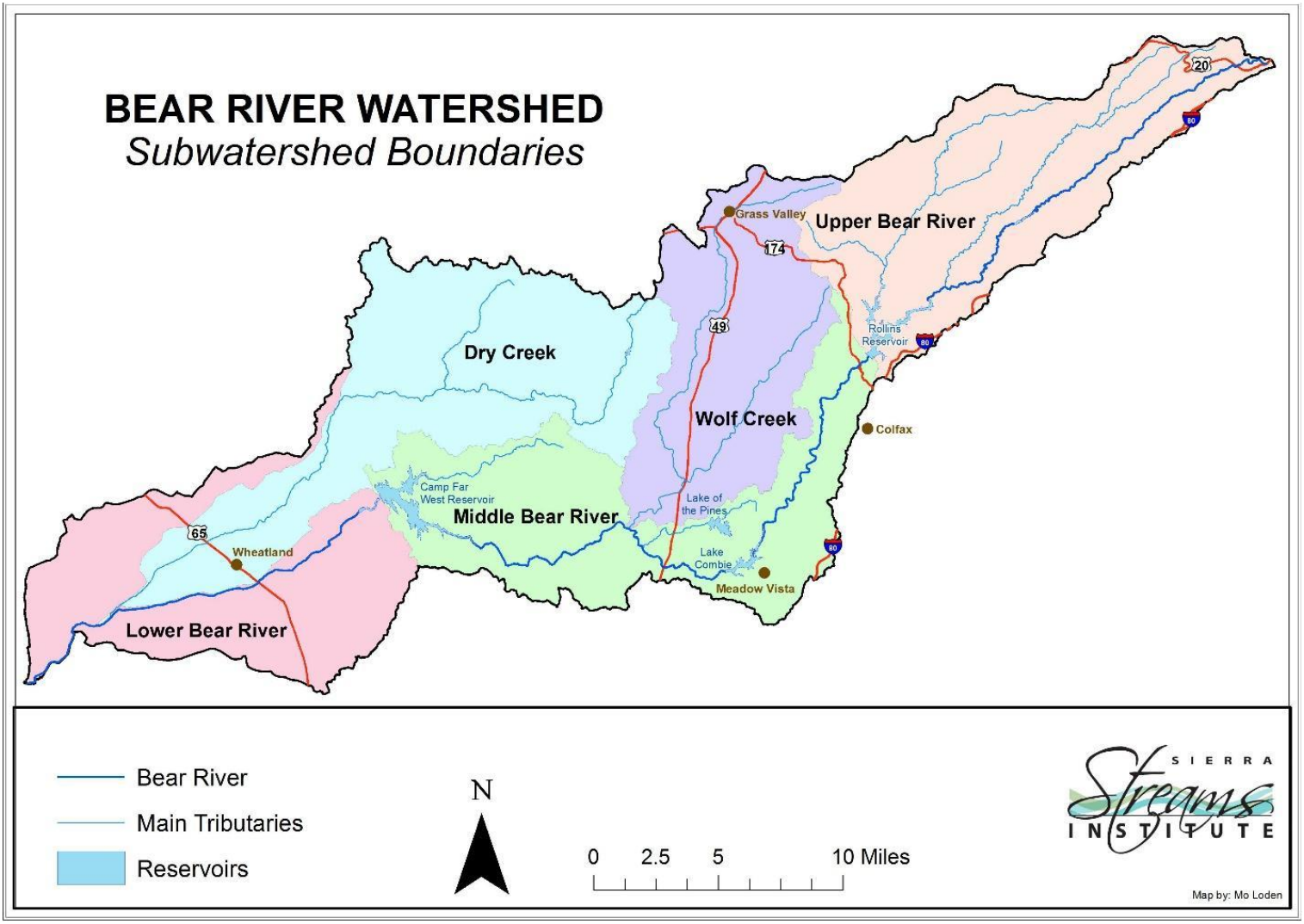
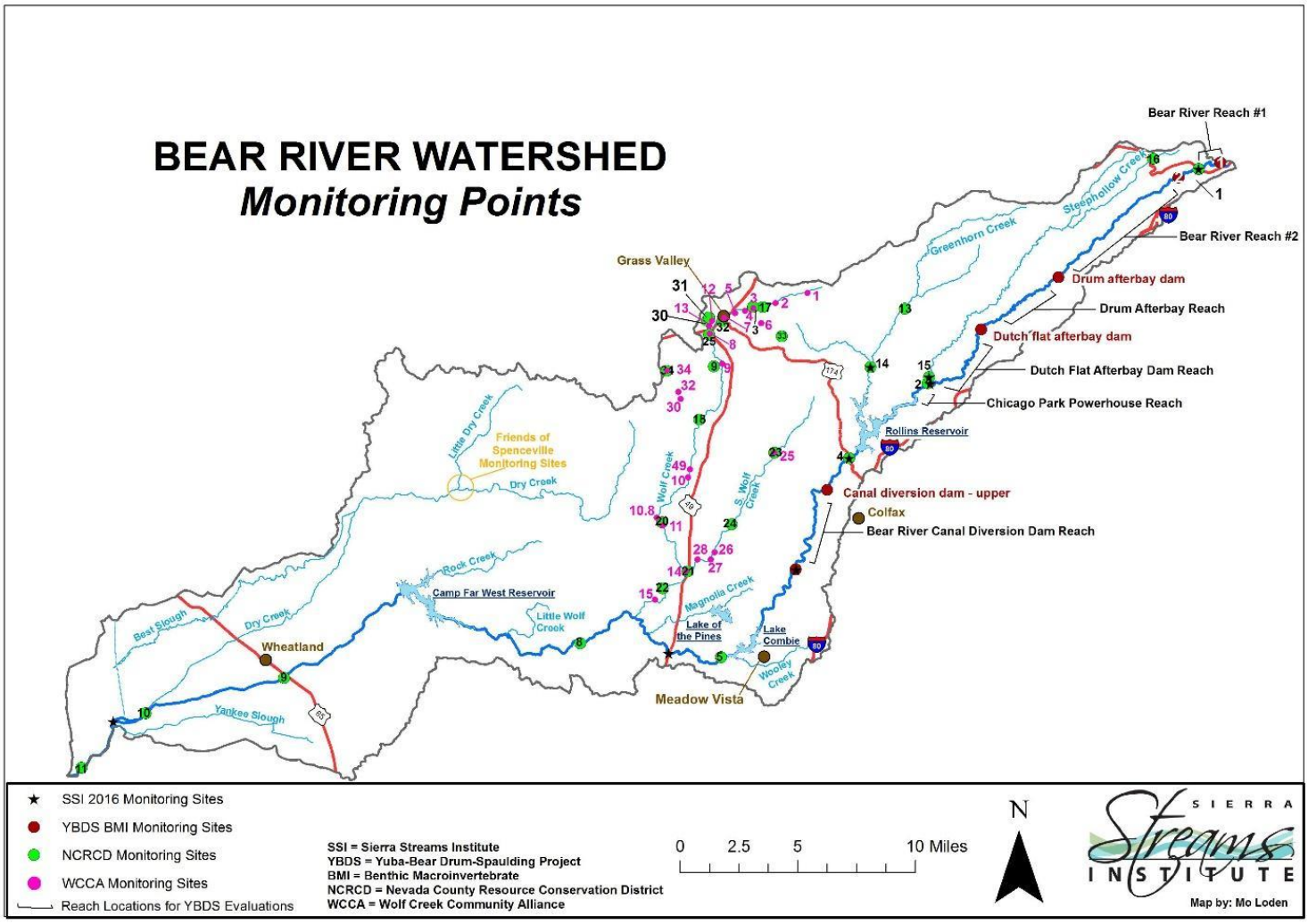


*Figure 4.* Bear River Watershed Tributaries and Monitoring Sites.



## 2. Issues of Concern

This Issues of Concern section serves as an executive summary of the Bear River Watershed Disturbance Inventory (Campbell *et al*. 2016), edited specifically as context for the goals, objectives, and projects described in this Restoration Plan. For additional relevant information to aid further restoration project development, please refer to Campbell *et al*. (2016), which includes 42 detailed maps of resources and impacts throughout the watershed, 32 informative tables interpreting existing watershed data, and detailed text describing the watershed's existing conditions as a foundation from which to plan the watershed's future restoration. All figures, tables and subject headings in the Disturbance Inventory are hyperlinked from its Table of Contents to facilitate quick and efficient referencing by stakeholders.

### Mine-related Toxins

The northern Sierra Nevada was the focal point of the California Gold Rush beginning with the discovery of gold at Sutter's Mill in 1849. The relatively cheap and easy practice of panning for gold in streams and rivers soon gave way to the more capital-intensive, dangerous and environmentally destructive practices of hard rock and hydraulic mining. These practices continued with varying intensity across the state into the 20$^{th}$ century, leaving a legacy of eroding hillsides, mercury and other toxic metal contamination, and excess sediment across the Sierras, including the Bear River and many of its tributary streams. According to the California Department of Conservation Principle Areas of Mine Pollution (PAMP) and US Geological Survey (USGS) Mineral Resources Data System (MRDS), there are 74 PAMP sites, with 48 active and 426 historic MRDS sites (as of 2011) in the Bear River watershed. These sites are mapped in the Bear Watershed Disturbance Inventory (Campbell *et al*. 2016).

Methylmercury is the most concerning form of mercury in the environment because it can be absorbed by organisms and make its way up the food chain in a process known as bioaccumulation. With each trophic level, the mercury is concentrated, or biomagnified, until it can reach dangerously high levels in the large predatory fish that are popular for human consumption (NID 2009, Shilling and Girvetz 2003). Ingesting methyl mercury is considered one of the most harmful forms of mercury exposure, potentially causing permanent damage to the brain and kidneys. Methylation takes place in anoxic, or low oxygen, conditions in the water column and shallow sediments. Additional factors influencing the rate of methylation include pH, temperature, salinity, and the rate of sediment deposition (Jones and Slotton 1996).

Recent studies suggest that more than 139 million cubic yards of hydraulic mining sediment remains stored in the watershed and is subject to remobilization during high flow events (Hunerlach *et al*. 1999). Not only is this sediment a source of mercury pollution but excessive sedimentation can also have disastrous impacts on channel morphology and riparian

vegetation. Additionally, The Office of Mine Reclamation's Abandoned Mine Lands Program listed the Bear as one of the watersheds with the highest potential in California for impacts from acid rock drainage, arsenic and mercury. They estimated that as of 2000, there were 32 mines in the watershed at risk from acid drainage, three with a high potential of impact from arsenic, and 22 at risk from mercury due to placer or hydraulic mining (Dept. of Conservation 2000).

## Pesticides

In 2013, 455,295 pounds of pesticides were applied in the Bear River Watershed, including 2,773 pounds of the organophosphate neurotoxin chlorpyrifos (branded as Dursban, Lorsban, and other trade names). The mainstem Bear River below Camp Far West reservoir is 303(d) listed for chlorpyrifos and diazinon. Yankee Slough, a tributary to the Bear River near its Feather River confluence, is also 303(d) listed for chlorpyrifos. Although the use of diazinon and chlorpyrifos has significantly declined in recent years, following a nationwide ban on household use and increased regulatory restrictions on agricultural use, concerns remain regarding the impacts of these and other pesticides on human health, pollinator populations, fish and wildlife. The California Pesticide Information Portal (CalPIP 2013) has documented over 131 different chemicals used as pesticides in the Bear River Watershed.

Recommended strategies for pollution prevention include integrated pest management techniques and less toxic pest control methods. Examples of integrated pest management techniques include biological control, habitat manipulation, modification of cultural practices, use of pesticides only after monitoring indicates the necessity and with the goal of removing only the target pest, and selection of pesticides to minimize risks to human health, non-target organisms, and the environment (US EPA, 2015).

In the 2013 Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Diazinon and Chlorpyrifos Discharges, the Central Valley Water Board suggests that in addition to pest management practices, changes to water management practices, pesticide application practices, and vegetation management practices can reduce diazinon and chlorpyrifos agricultural discharge (CVRWQCB, 2013). Improvements to water management may involve increased monitoring of soil moisture, increased use of tailwater return systems and vegetated drainage ditches. Changes in application practices including eliminating outward facing sprayer nozzles at the end of crop rows, improved sprayer technology and frequent calibration of sprayer equipment, using aerial drift retardants, and improved mixing/loading procedures may also help control runoff (CVRWQCB, 2013). Improved vegetation management techniques to minimize runoff and reduce pesticide loadings include use of cover crops, riparian buffers, filter strips, hedge rows, and vegetated swales (Central Valley Regional Water Quality Control Board, 2010; Central Valley Regional Water Quality Control Board, 2013). Results from Yolo County RCD and the U.S. Department of Agriculture have shown that vegetated agricultural drainage ditches are twice as effective at

removing 50% of pesticide concentrations (including diazinon and chlorpyrifos) compared to unvegetated ditches (Central Valley Regional Water Quality Control Board, 2010; Moore et al., 2010). Other research by Colusa County RCD, Community Alliance with Family Farmers and the Audubon Society is focusing on diazinon loads before and after storm events to test effectiveness of BMPs (cover crops, hedgerows, vegetated swales), and the Sacramento Water Quality Coalition is examining how orchard floor vegetation and vegetated filter strips may reduce diazinon and chlorpyrifos loads (CVRWQCB, 2010).

Since stormwater runoff is the primary mechanism of diazinon and chlorpyrifos transport during the dormant season, the Central Valley Regional Water Quality Control Board (2013) recommends using pesticide application practices, pest control practices (use less or alternative pesticides), and passive runoff control (i.e. buffer strips) in the dormant season. During the growing season, when chlorpyrifos transport occurs primarily through irrigation runoff, the use of pesticide application practices, pest management practices (use less or alternative pesticides), and irrigation water management practices are recommended (CVRWQCB, 2013). The costs associated with different management practices are estimated by the Regional Water Quality Control Board as follows: alternative pest management ($17 to $219/acre-yr), pesticide application practices ($0/acre-yr), irrigation water management ($50-88/acre-yr), pressurized irrigation system ($160/acre-yr), tailwater recovery system ($89/acre-yr) (CVRWQCB, 2013).

## Bacteria

Counts of total fecal coliform and *E. coli* specifically have consistently been elevated in 2016 SSI Bear Watershed monitoring on the mainstem Bear River below Camp Far West. Total fecal coliform (but not *E. coli*) have also occasionally been elevated above human health standards at Greenhorn Creek, Steephollow Creek, the mainstem Bear River at Dog Bar, and the mainstem at Hwy 49 in 2016. Fifteen of the 33 Bear Watershed sites monitored by NCRCD and YBDS in 2001-2 and 2005-7 had elevated fecal coliform bacteria counts at least once (*E. coli* was not tested), including several Wolf Creek watershed sites, the mainstem Bear River below Camp Far West, and the mainstem at Hwy 174. Wolf Creek is 303(d) listed for pathogenic bacteria counts that exceed human health thresholds, and WCCA documented unhealthy bacteria counts at 18 of 26 Wolf Creek sites monitored between 2004-2012. Four wastewater treatment plants in the Bear Watershed are tracked by the EPA's NPDES as point sources of watershed pollution. More info in Disturbance Inventory and through WCCA. It is unclear what percentage of the watershed's bacterial contamination is caused by septic leaks, sewage system leaks, livestock waste, dog waste, and raw human waste at camp sites. PCR analysis could help identify the source. Several proposed projects discussed in this plan could reduce bacterial contamination from specific potential sources. Two of these proposed projects have an additional objective of reducing the risk of wildfire ignitions, as they address recreational and homeless use of the river, which pose both bacteria and ignition risks.

## Point Sources of Industrial Toxins and Wastewater Treatment Chemicals

Twelve point sources in the Bear Watershed are listed as toxic release sites by the EPA's FFDocket, NPDES & TRI programs. Sites include four manufacturing facilities (Grass Valley Group, JDK Controls, and Lanmark Circuits in Nevada County and Replacon in Placer County); five wastewater treatment plants [Grass Valley, Lake of the Pines, & Cascade Shores (Nevada County), Hamilton Gold Village (Yuba County), and Sheridan (Placer County)];and three mines (Poore, Idaho-Maryland, & Empire, all in Nevada County). Although these sites are regulated and permitted to minimize and mitigate pollution, they still release legal amounts of hazardous waste into the watershed.

## Nonpoint Sources of Watershed Toxins

Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources (USEPA, 2016b).

Urbanization increases the variety and amount of pollutants carried into our nation's waters. In urban and suburban areas, much of the land surface is covered by buildings, pavement and compacted landscapes. These surfaces do not allow rain and snowmelt to soak into the ground which greatly increases the volume and velocity of stormwater runoff. In addition to these habitat-destroying impacts, pollutants from urban runoff include: sediment, oil, grease and toxic chemicals from motor vehicles, pesticides and nutrients from lawns and gardens, viruses, bacteria and nutrients from pet waste and failing septic systems, road salts, heavy metals from roof shingles, motor vehicles and other sources, and thermal pollution from impervious surfaces such as streets and rooftops. A total of 18,279 people, or 23% of the total watershed population, resided within the watershed's three cities. The highest population densities are found along highway corridors and residential areas, including Grass Valley, Alta Sierra, Lake of the Pines, Beale Air Force Base, Wheatland, and Plumas Lake.

Transportation infrastructure also has the additional impacts of local pollution and air quality problems from nitrogen oxide emissions and smog. Near aquatic environments, transportation-associated pollution and erosion can severely impair water quality; thus, it is important to understand how the roads and stream networks in the watershed overlap (Water Education Foundation, 2011). Pesticides and fertilizers used along roadway rights-of-way and adjoining land can pollute surface waters and groundwater when they filter into the soil or are blown by wind from the area where they are applied. There are almost 2,200 miles of roads in the watershed across all four counties, in addition to the highways. These roads range from less than 1 mile up to 15 miles in length, with the majority less than 3 miles long. The majority of the roads in the watershed (64%, over 1240 miles), are within 100 meters of a stream. Fewer roads (13%) are at an intermediate distance, 100-200 meters from streams. Almost a quarter of all roads (24%, almost 560 miles), are greater than 200 meters from a stream. Most of the farther

roads are located in densely populated areas, like Grass Valley and Meadow Vista, and in the lower watershed, along Highway 70.

In order to reduce the effect of nonpoint source pollution on surface water and groundwater, from the sources described above, SSI recommends implementing Best Management Practices (BMP) for Low Impact Development (LID) and understanding the patterns and density of roads to prioritize areas for restoration projects. The City of Grass Valley has developed a Stormwater Management Program (SWMP) Planning Document to address stormwater quality within the City's jurisdiction. The SWMP will address a wide variety of activities conducted in urbanized areas of the City that are sources of pollutants in stormwater. This planning is comprised of six program elements, Public Education and Outreach, Public Involvement and Participation, Illicit Discharges, Construction Activities, New Development and Redevelopment, and Municipal Operations. Several City government departments will implement various tasks outlined in this planning document. Implementation will be monitored and program effectiveness assessed annually over the permit period. The SWMP will be revised annually as necessary to address areas identified as deficient during the effectiveness evaluation process (Department of Public Works, 2003).

Additionally, a Stormwater Quality Design Manual (Manual) has been developed cooperatively between Placer County, the City of Roseville, the City of Lincoln, the City of Auburn, and the Town of Loomis to provide a consistent approach to address storm water management within the West Placer region. The intent of this Manual is to promote LID goals including: minimizing adverse impacts of stormwater runoff, minimizing the percentage of impervious surfaces and implementing mitigation measures, minimizing pollutant loadings, and guiding proper selection, design and maintenance of stormwater BMPs. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions (USEPA, 2016b). It is expected that as these programs are implemented water will be managed in a way that reduces the impact of these built areas and promotes watershed health. SSI recommends that the City of Grass Valley's SWMP and West Placer's Stormwater Quality Design Manual be used as examples and similar projects implemented in other urban areas throughout the watershed (Placer County, 2016).

Water pollution resulting from atmospheric deposition also falls into the category of NPS pollution. Like other pathways of NPS pollution, atmospheric deposition does not come from an isolated source, making it difficult to identify and control. It can come from the burning of fossil fuels, metal smelting operations, waste incinerators, or manufacturing facilities (as outlined above in the point source discussion). The deposition of these air pollutants in the watershed also happens in several ways. Wet deposition occurs when air pollutants fall with rain, snow, or fog. Dry deposition is the deposition of pollutants as dry particles or gases. Pollutants then reach waterbodies by either direct deposition, falling directly into the water, or through indirect deposition, in which pollutants fall onto land and wash into a waterbody as

runoff (NEIWPCC). After a more thorough investigation of the TRI Facility Reports, it was discovered that Grass Valley Group, JDK Controls released TRI chemical to the environment through non-point air emissions. Information found in the TRI Facility Reports will be used to address air quality issues in the watershed.

Acid mine drainage is the formation and movement of highly acidic water rich in heavy metals. This acidic water forms through the chemical reaction of surface water (rainwater, snowmelt, pond water) and shallow subsurface water with rocks that contain sulfur-bearing minerals, resulting in sulfuric acid. Heavy metals can be leached from rocks that come in contact with the acid, a process that may be substantially enhanced by bacterial action (USEPA, 2016b).Further discussion on issues associated with historic mines and recommendations for restoration can be found in Mine-Related Toxins.

The National Water Quality Assessment shows that agricultural nonpoint source (NPS) pollution is the leading source of water quality impacts on surveyed rivers and streams, the third largest source for lakes, the second largest source of impairments to wetlands, and a major contributor to contamination of surveyed estuaries and ground water (USEPA, 2016b). According to county zoning data, almost 128,000 acres, over 40% of the watershed area, is zoned for general or exclusive agriculture. This includes almost all of Sutter, much of Yuba, and a large portion of central Nevada County, within the limits of the watershed. In addition, another almost 69,000 acres, over 20% of the watershed, are zoned as combined-agriculture (i.e. joint agricultural and industrial or residential). Further discussion on issues associated with historic mines and recommendations for restoration can be found in Agriculture.

## Sediment and Nutrient Pollution

Excess nutrients such as nitrogen and phosphorus can cause the overstimulation of growth of aquatic plants and algae. Excessive growth of these organisms can use up dissolved oxygen as they decompose and block light to deeper waters. Lake and reservoir eutrophication can also occur, which produces unsightly algae scums on the water surface and can cause fish kills due to oxygen depletion. Elevated nutrient levels have been observed at least once at 16 of 28 sites monitored by NCRCD and YBDS in 2001-2 and 2005-7. These occurrences where observed at several Wolf Creek watershed sites, the mainstem Bear River above Rollins Reservoir, the mainstem Bear River above Camp Far West, the mainstem Bear River below Lake Combie and Greenhorn Creek. WCCA also measured for nutrients. Excess concentrations were not found for any nutrients except for phosphates. Phosphate sampling locations were targeted and, as such, phosphates were detected at every site tested.

Suspended particles diffuse sunlight and absorb heat, which can increase water temperature and reduce light availability for submerged aquatic vegetation and benthic (bottom-dwelling) macroinvertebrates. One way to monitor sediment pollution is through turbidity. If the turbidity is caused by sediment, it can be an indicator of erosion, either natural or man-made. High sediment loads can clog the gills of fish. Once the sediment settles, it can foul gravel beds

and smother fish eggs and benthic macroinvertebrates. The sediment can also carry pathogens, pollutants and nutrients. High turbidity often occurs during storms. A clear objective for turbidity levels is difficult to determine, as the CRWQCB objectives rely on the natural turbidity of a waterway, which is currently undefined for the Bear River (CRWQCB 2010). However, from previous experience in the region, a threshold of 10 NTU (Nephelometric Turbidity Unit) is likely appropriate. Seventeen of 26 Bear Watershed sites monitored by NCRCD and YBDS in 2001-2 and 2005-7 had elevated turbidity levels at least once including several Wolf Creek watershed sites, various sites along the mainstem Bear River, Greenhorn Creek at Red Dog Road, and Peabody Creek sites. Turbidity was additionally measured across the sites of the WCCA 1,078 times. All sites had a mean turbidity below the approximate 10 NTU thresholds, but most sites experienced spikes in turbidity greater than the threshold, up to 100 NTU. According to WCCA, 67% of the spikes in turbidity occurred between December and March. Several proposed projects discussed in this plan could reduce nutrient loads, decrease erosion and reduce the risk of high-intensity wildfires which can cause increased erosion rates.

## Water Quantity, Management and Use

The network of flow gauges within the Bear watershed is crucial for fully understanding and quantifying the complex hydrology of the watershed, which is one of the most regulated and managed in the Sierra Nevada. Flow patterns in the Bear are typical of the foothill watersheds with high winter and spring flows and low summer and fall flows; however, this natural pattern has been highly altered by a series of diversions and reservoirs along the length of the river (Sacramento River Watershed Program, 2016). Other factors that have caused hydrologic alteration on the watershed include the presence of weirs, paved surfaces, and road crossings and historic land use changes that have contributed to changes in vegetation cover, soil composition and runoff, and loss of floodplain connectivity (Aalto et al., 2010).

In addition to the intricate system of dams, diversions and canals, the watershed also has a complex arrangement of water rights holders under the complicated California water rights system. Water rights, which are typically licensed by the State Water Resources Control Board, give the holders the right to use the water, not, explicitly, to own it. According to the California Water Code, anyone who takes water from a lake, river, or creek, or from underground supplies, for a beneficial use (defined in the Water Code) is required to have a water right. The current water rights system distinguishes between a water right permit and a license. A permit is an authorization to develop a water diversion and use project. A license can be acquired after the project is constructed and water consumption has begun, if water is being used beneficially and the operator is complying with all the conditions of the permit (State Water Resources Control Board, 2016).

Currently licensed appropriative water rights holders in the Bear Watershed include: Asian Pacific Group LLC., the Bethel Church of Nevada County, Morehead Land LLC., the Pine Lake Association, United Auburn Indian Development Corp., CDFW, Spring Valley Homeowner's Association, LCB Properties LLC., Smith and Smith Ranch, the Lakewood Association, and a large number of private landowners. The US Forest Service also has an appropriative license for 12 ac-ft/yr. The California Department of Transportation has an appropriative water right license that was revoked. Sierra Pacific Industries, Smith and Smith Ranch, Green Vista Holdings LLC., and Hidden Acres Limited Partnership, as well as private landowners, all have claimed water through a Statement of Water Diversion and Use (State Water Resources Control Board, 2016). The four largest appropriative water right license holders, in terms of quantity of water diverted, are the Camp Far West Irrigation District, Nevada Irrigation District (NID), Pacific Gas & Electric Company (PG&E), and South Sutter Water District (SSWD).

In addition to the presence of large numbers of dams and levees, a major component of water management on the Bear is the series of imports and exports of water from the adjacent watersheds. About 200,000 ac-ft (acre-feet) is imported annually from the Yuba and American Rivers through the Drum Canal, South Yuba and Lake Valley Canal systems. Conversely, about 290,000 ac-ft of water from the Bear is exported annually below Rollins through the Bear River Canal for use by the Placer County Water Agency (PCWA), Nevada Irrigation District (NID) ID, PG&E and the South Sutter Water District (SSWD).

## Groundwater Quality and Quantity

In the last ten years, SWRCB found 169 Bear Watershed groundwater wells with elevated levels of chemical contaminants (primarily carcinogenic hydrocarbons which are components of gasoline and/or industrial solvents, such as benzene and trichloroethylene; and mine-related heavy metals such as cadmium, arsenic and lead) above the drinking water standard for public supply wells. Subwatersheds with groundwater most likely to be heavily affected by contamination are Magnolia Creek, Best Slough, Grasshopper Slough, and Rattlesnake Creek-Wolf Creek. Subwatersheds with a lesser degree of contamination include Indian Springs-Dry Creek, Little Bear Creek, Camp Far West Reservoir, Vineyard Creek- Dry Creek, and Yankee Slough. Contaminated wells are mapped in the Bear Watershed Disturbance Inventory (Campbell *et al*. 2016), which also provides additional information on the contaminants found. Information on the precise sources of contamination, however, if known, was not available through SWRCB's Geotracker public database, and would be crucial for remediation efforts. USGS has an additional shallow assessment of Bear Watershed groundwater in progress, due to

be completed later this year. USGS plans to make a data series report, fact sheet, and scientific investigations report publicly available online.

The Lower Bear Watershed overlies portions of two groundwater sub-basins, for which studies have estimated the groundwater storage capacity to be approximately 5,190,000 acre-feet. DWR has classified these two sub-basins as high and medium priority in statewide importance for additional groundwater elevation monitoring. At the monitoring wells within the Bear River watershed, groundwater levels have generally remained stable or increased since 1980. When comparing historical low spring groundwater elevations from 1900-1998 against recent low spring groundwater elevations from 2008-2014, 85% (11/13) of wells exhibited recent groundwater elevations above the historical spring low and the remaining 15% (2/13) were near the historical spring low. No groundwater wells in the Bear River watershed were characterized as below the historical low, but some nearby wells to the north and south of the watershed were below the historical low and are hydrologically connected to the Bear wells within the same groundwater sub-basins. Additional Lower Bear Watershed groundwater data is expected to be available from USGS later this year. Yuba County Water Agency, South Sutter Water District and the Western Placer County Group are DWR's established partner Monitoring Entities for the sub-basins to which the Bear contributes, and they have created Groundwater Management Plans. Yuba County Water Agency and Sacramento Groundwater Authority are also classified by the state as Groundwater Sustainability Agencies.

## Fisheries

A variety of cold-water and warm-water species are found along the Bear River. Native species include steelhead/rainbow trout (*Oncorhynchus mykiss*), speckled dace (*Rhinichthys osculus*), Sacramento sucker (*Catostomus occidentalis*), and Sacramento pikeminnow (*Ptychocheilus grandis*). Non-native fish species include brown trout (*Salmo trutta*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), spotted bass (*Micropterus punctulatus*), striped bass (*Morone saxatilis*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), green sunfish (*Lepomis cyanellus*), redear sunfish (*Lepomis microlophus*), channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*), brown bullhead catfish (*Ameiurus nebulosus*), pond smelt (*Hypomesus nipponensis*), and golden shiner (*Notemigonus crysoleucas*).

Fifteen miles of habitat exist for anadromous salmonids on the Bear below Camp Far West Reservoir (National Marine Fisheries Service, 2014a), however a large portion of this habitat is not appropriate for spawning due to siltation of spawning gravels. In addition to siltation, inadequate stream flows (minimum release flows from Camp Far West Reservoir are 25 cfs in spring and 10 cfs at all other times) contribute to reduced streamflow and reduced habitat suitability in the reach (Jones & Stokes, 2005). While Chinook salmon and steelhead may migrate and spawn in the lower Bear River during heavy rain events, water temperatures are typically above the suitable level for steelhead rearing by mid-June or July. The 4 mile reach on

the Bear located just below Camp Far West Reservoir has poor riparian shade, resulting in quick warming of waters released from the reservoir and therefore increased mortality of Chinook salmon adults and eggs and steelhead eggs and juveniles (Jones & Stokes, 2005). Additionally, agricultural runoff that frequently occurs in the area and is likely to adversely affect water quality in this 15-mile reach as well as bioaccumulation issues with mining contaminants in the watershed.

Dry Creek has an opportunity for restoration of suitable salmonid habitat. Observations of juvenile Chinook salmon in Dry Creek have inspired further study of habitat conditions there by the USFWS Anadromous Fish Recovery Project(USFWS 2016), which is proposing habitat improvement projects and the removal of small movement barriers on this creek to increase spawning potential. Flows from Camp Far West that may affect salmon ability to enter Dry Creek from the lower Bear River are under discussion in the current FERC relicensing process for the reservoir.

Beyond Camp Far West, several other barriers (including upstream dams at Lake Combie and Rollins Reservoir) are barriers to migration and movement of other resident fish species. Additional habitat mapping and modeling to predict availability of suitable fish habitat was done as part of the FERC relicensing process for NID and PG&E's Yuba-Bear Drum-Spaulding (YBDS) Hydroelectric Project (NID and PG&E, 2011b).

## Riparian & Wetland Ecosystems

The vegetative diversity of the riparian community at any given location depends on the structural complexity of the floodplain, which often varies markedly along a channel, and through a watershed. In reaches with well-developed riparian terraces, or multiple channels, sandbar and other willows typically occupy the lower terrace. Tees such as cottonwood, Gooding's willow and riparian shrubs are found on the middle terraces, with valley and other oaks along the upper banks. In contrast, where stream channels are deeply incised (typical in many reaches), all these plant species compete with each other within a narrow band along the upper portion of the banks. There is little native vegetative diversity and erosion is often present.

Riparian plant communities, and the individual plants within the community, provide a variety of ecologically beneficial functions including:

- Increasing the stability of stream banks and floodplain areas by holding soils in place with their roots;

- Slowing high stream flow resulting in nutrient and sediment deposition in upland areas adjacent to the stream channel. These depositional events are crucial components to riparian plant reproduction;

- Improving aquatic habitats by increasing bank stability;

• Creating complexity in the channel when flows scour around root wads or trees that fall into the channel, causing pool and riffle areas to form which, in turn, provide a nutrient source to aquatic invertebrates with leaf fall;

• Providing a food source for fish through drop of insects onto the water surface;

• Reducing water temperatures by shading the waterways;

• Providing many of the fundamental components of upland habitats used by a variety of wildlife species. (Jones and Stokes Associates. 2004)

Most riparian systems in the Bear River watershed have been affected to varying degrees by gold mining, timber extraction, water management, agricultural development, flood management, gravel mining, grazing and/or urban development. Impacts in the riparian corridor have resulted in reduction in the quality of the stream channels, wildlife and aquatic habitats, species richness, structural complexity, function, and diversity of riparian plant communities. Habitats for special status species have been reduced or eliminated because of the artificially narrowed width of the riparian plant community.

The large volume of sediment and gravels from hydraulic diggings and mining stored in the river's main channel and tributaries are subject to continual erosion. Bank erosion increases riparian vegetation loss. In the lower watershed, the high volume of mining sediment, in combination with restricting levees, has caused the river's channel to become deeply incised, severely limiting the riparian ecotone. Areas with deep accumulation of gravel limit the ability of trees including Fremont cottonwood (*Populus fremontii*), Goodding's and red willow (*Salix gooddingii, S. laevigata*) and Oregon ash (*Fraxinus latifolia*), to establish. Downed woody debris from large trees is critical for river dynamics which creates floodplains and meadows, and improves plant and wildlife habitat. Large trees and shrubs provide critical shade, keeping water temperatures cool.

Flow, bank and floodplain dynamics are particularly significant for plants species associated with riparian areas and wetlands. Given the importance of riparian habitat and the floodplain region, the flooding regime and floodplain access are important measures of the health of a watershed. Most floodplains in the watershed have been greatly modified by human development Natural (unmanaged) Bear River flow patterns are typical of foothill streams with high winter and spring flows and very low summer and fall flows. Currently water flows are regulated almost entirely by several storage reservoirs, numerous diversions, irrigation canals and ponds. This creates artificially high summer flow which can have a negative impact on some native riparian plant species. For example, native riparian vegetation seed size (small), dispersal (wind) and seedling establishment strategies have evolved with low summer and fall flows, without heavy competition from other plants. High summer flows have favored

Himalayan blackberry (*Rubus armeniacus*), a non-native species that has heavily impacted riparian zones. This species has a negative impact on riparian plant community structure, diversity, and species composition as it commandeers native plant and tree recruitment strategies and can replace native understory plants and tree saplings. Some native wildlife species have benefited from the structure and food source, but the overall impact to wildlife habitat and species is considered detrimental.

Livestock management, as it is commonly practiced, has an overall negative impact on riparian plant communities. In the more intensively grazed areas, the understory is significantly reduced and few native tree seedlings occur. Some of the deeply incised channels may also be a result of grazing practices, which have resulted in erosion, degradation of the vegetative community and reduced reproduction of the trees and shrubs. Ranchers and other types of land managers usually need some assistance to select and implement successful practices for creating, enhancing, and restoring wildlife habitat along the riparian corridors on their properties (Lewis et al. 2009). The*Creekside Planting and Restoration in California Rangelands* Report published by UC Davis Department of Land, Air and Water Resources (Jackson, L.E., A.K. Hodson, K.J. Fyhrie, and V. Calegari. 2015) summarizes guidelines for determining the most effective mix of practicesand native species for stream restoration in California rangelands. It provides Habitat Restoration Practices and a Planning Worksheet for California Rangelands.

Few small patches of valley foothill riparian ecosystems (1.3% of the watershed's land area) are found within the Bear watershed, mainly at lower elevations within large patches of annual grassland and cropland (Klein *et al*. 2007). Valley foothill riparian areas typically contain winter deciduous trees that form a canopy cover of 20-80%. Lianas (wild grape), in absence of Himalayan blackberry, often comprise 30-50% of ground cover. Dominant species are Fremont cottonwood, Gooding's and red willow, California sycamore, valley oak, white alder, Oregon ash, wild grape, wild rose, California blackberry, poison-oak, buttonbrush, and willows. The plant and wildlife diversity supported by multiple canopy layers is critical habitat which provides food, water, migration and dispersal corridors, escape, nesting, and thermal cover for many wildlife species. At least 50 permanent or transient amphibian and reptile species, 147 nesting or winter visitant bird species, and 55 mammal species are known to utilize valley foothill riparian areas (CWHR, 1988). Valley elderberry long-horned beetle (*Desmocerus californicus dimorphus*) a Federal Threatened species is also dependent on mature blue elderberry (*Sambucus nigra ssp. caerulea*), which is found in this habitat.

Montane riparian ecosystems (0.023%of the watershed's land area) are found in the upper watershed above and below Bear Valley. Due to steep slopes below Bear Valley riparian forests are often restricted in width. These ecosystems are variable and structurally diverse, often consisting of broad-leaved winter deciduous trees and a sparse understory. Cottonwood, big leaf maple, dogwood, willows, white and thin leaf alders are found in this type. These upper

riparian zones are highly valuable for wildlife, providing water, thermal cover, migration corridors, nesting, and feeding opportunities (CWHR, 1988). These ecosystems were hydraulically and placer mined; thus have extensive diggings/gravels in waterways.

In most cases, activities that have changed the riparian community from its historic condition and distribution have had detrimental effects on the health and productivity of the riparian communities. Some of these alterations are, for all practical purposes, permanent changes in the plant communities. However, other changes are more transient, and opportunities to restore these riparian communities to a more historic condition are available. Restoration of riparian forests that are functional and provide the desirable characteristics for a variety of plant, wildlife and aquatic biota habitat is essential. Monitoring should be included in all work, as to inform science and best management practices

## Freshwater Wetlands:

The U.S. Fish & Wildlife Service's National Wetlands Inventory (https://www.fws.gov/wetlands/data/Mapper.html) was used to produce reconnaissance level information on the location, type, and size of wetland resources, prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery; Thus detailed on-the-ground surveys of known and unknown locations, and assessments is needed to give verify presence and level of function for these critical habitats (wetlands, meadows, vernal pools, seeps and springs) within the watershed. The total area of inventoried wetlands in the Bear watershed is 6,466 acres. Patches of wetlands in the Bear watershed are generally small, ranging in size from less than a tenth of an acre to 787 acres (Rollins Reservoir), with the vast majority of all wetland areas (68.5%) measuring under 1 acre. The total area of 6,466 acres covered by wetlands within the Bear River watershed is broken down by wetland type as follows:

1,148 acres freshwater emergent wetland (including herbaceous marsh, fen, swale, and wet meadow; 17.8%)

1,013 acres freshwater forested or shrub wetland (forested swamp or wetland shrub bog or wetland; 15.7%)

832 acres freshwater ponds (12.9%)

2,630 acres lakes or reservoirs (40.7%)

800 acres of riverine wetland (12.4%)

43 acres of other wetland types (farmed wetland, spring, vernal pool 0.007%)

Freshwater wetlands are considered one of the habitats more sensitive to change in hydrology and climate change since change in precipitation, evaporation, and evapotranspiration are likely to affect groundwater levels. Even minor fluctuations in water availability can affect the

suitability of habitat for some wetland plants (Kutner and Morse, 1996). As some of the most productive habitats in California, freshwater wetlands are utilized by numerous wildlife species for the food, cover, and water they provide.

## Meadows

Wet meadows can be found in the watershed in small patches adjacent to waterways as part of the floodplain, or they may occur due to topography as in montane meadows (0.048%). The wet meadow habitat is structurally simple, consisting of a layer of herbaceous plants. Species found in wet meadows are widely variable, but common genera include *Agrostis, Carex, Danthonia, Juncus, Salix,* and *Scirpus*. Wet meadows also provide important pollinator habitat. Hydrology is the most important determinant of vegetation stability in wet meadows, and channel erosion can lower the water table and result in succession to species favoring dryer habitats (CWHR, 1988). Wet meadows in the mid-elevations Sierra Nevada's have a long history of conifer encroachment, possibly as a result of fire suppression, change in hydrology, and soil compaction. Some wet meadows have resulted in a shift from a graminoid/herbaceous community to one dominated by woody species, potentially diminishing a meadow's water holding capacity and its ability to provide critical ecosystem services (Viers et al., 2013).

Mid-elevation areas (1500-3000 meters), which contain the bulk of montane meadows, will face many issues, such as decreasing snowpack (Null et al., 2010). Moreover, meadow systems will be particularly vulnerable to flashy water runoff events and increased sediment loads, particularly those already affected by channel and bank instability, incision, and decreased water tables, in effect turning wet meadows to dry meadows. Flash floods carrying heavy sediment loads and debris can tear away at unstable meadow stream channels, drastically increasing incision and erosion in single events, resulting in a continuous positive feedback of decreased ecological integrity (Viers et al., 2013). These effects could be further magnified in areas that have experienced forest fires, which are of increasing risk under climate change scenarios (Westerling & Bryant, 2008).

Bear Valley is an easily accessible montane meadow at the top of the watershed where both wet and dry meadow characteristics can be observed. State highway 20 divides the north and south portion of the meadow, diverting water to a culvert under the highway. Due to changes in hydrology, the south portion is an example of a dry meadow, with incised river banks and historic channelization of water through ditches across the meadow. This was likely historically done for grazing, but now the south dry meadow, owned by PG&E is used for other operations. The upper wet meadow hosts native wet meadow species such as sweet trillium, lemon's ginger, leopard lily, bog orchid. Being at the top of the watershed and the largest wet meadow in the watershed, restoration of Bear Valley is a project in the Bear River Restoration Plan.

Sierra Nevada fens are a hotspot of biodiversity, unique and sensitive plants, and important pollinator habitats. Fens are peat-forming wetlands that receive nutrients from sources other than precipitation: usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement. These systems are often covered by grasses, sedges, rushes and wildflowers. They provide important functions as holding water late into the season, improving water quality and providing habitat for unique plant and animal communities.

Disturbances to fen function can be divided into three main categories, direct physical damage to the fen surface often from cattle, change to watershed inputs, and direct influence on vegetation growth (Prichard et al., 1999). Fens should be identified and protected to every possible extent within the watershed. Fen areas should be assessed and rated on their Proper Functioning Condition, a qualitative method for assessing the condition of fen areas (Prichard et al., 1999), in order to assess current status and restoration priority of these critical habitats.

In meadows with relatively high water tables, anaerobic soils and slowly decaying plant material can cause soil carbon sequestration. When water tables are lowered as a result of management practices, meadow soils dry out and the carbon stored in the soil is rapidly decomposed and released into the atmosphere as carbon (Norton et al., 2011).

Widening of floodplains and restoration of impacts from ditching or channelization of water, head cuts, old roads, soil compaction, and conifer encroachment, is vital in protecting and restoring wetlands. Due to the small size of many meadow and fen ecosystems and conifer encroachment, aerial surveys are very limited. Data from the USFS Wetlands Inventory should be ground-verified. Other information to aid in detection of meadows and fens, such as using soil types, slopes, hydrology, and vegetation associations should be employed in desk-top analysis.

## Springs

There are also 39 recognized springs in the watershed, which are defined by the USGS as places where water seeps naturally from the ground. Not all springs are considered wetlands. That determination depends on the seasonality of water flow and associated vegetation. Rare plant potential is higher in spring systems. It is certain there are more than 39 springs in the Bear watershed. At least 12 were found in lower Steephollow sub-watershed in 2016 alone. Springs should be surveyed, mapped and assessed throughout the watershed, a project which could be in conjunction with federal land managers (USFS, BLM) and willing private land owners.

## Vernal Pools

Vernal pools are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall. These wetlands range in size from small puddles to shallow lakes and are usually found in a gently sloping plain of valley grassland in the lower Bear watershed. These specific vernal pool wetlands are dependent upon intact sub-watersheds, and the surrounding uplands that support those watersheds. Vernal pool habitat is a component of the larger grassland ecosystem of the California Great Central Valley.

The unique environment of vernal pools provides habitat for numerous rare plants and animals that are able to survive and thrive in these harsh conditions. Rare plants found in the Bear watershed's vernal pools include *Downingia pusilla* and *Legenere limosa* (Witham et al., 1998). Vernal pools are a valuable and increasingly threatened ecosystem as more than 90% of California's vernal pools have already been lost, largely replaced by agricultural land and grazed non-native grassland.

Beale Air Force Base is the home of numerous highly sensitive vernal pool wetlands and their associated wildlife species. The Base's Habitat Conservation and Management Plan (HCMP) defines what the Base will do to mitigate for all wetlands that will be disturbed in development areas in support of Beale's mission. Mitigation can be accommodated on the base's property and consists of "conservation areas," where preservation, management, and restoration of wetlands and wildlife habitat will occur. Conservation areas comprise 5,300 total acres, which is roughly 23 percent of the base's property. "Management areas" are those containing high-quality wetlands and threatened and endangered species habitat, but these wetlands are in areas identified for possible (but not likely) development in the future.

Also included in the HCMP are "restoration areas" where the construction of approximately forty acres of vernal pools and other aquatic areas will occur. These regions previously supported the vegetation types that will be restored there, but they had been degraded and destroyed by past agricultural and military practices.

Vernal pool habitat is a component of the larger grassland ecosystem of the California Great Central Valley as such they need to be managed in conjunction with each other. Monitoring of vegetation composition and residual dry matter of biomass in vernal pools and grasslands is used to inform cattle grazing regimes on the Base. Sustainable grazing practices can positively affect vernal pool health by removing competing non-native grasses and forbs (Marty, 2005).

Opportunities should be pursued to protect existing vernal pools, restore impacted vernal pools, and reconstruct obscured historical vernal pools where appropriate. Managed grazing practices such as those on Beale AFB should be implemented and monitored.

## Forest Health

Forest tree species in the upper and middle watershed are made up of Sierran mixed conifer (6.9%) with an assemblage of white fir, Douglas-fir, ponderosa pine, sugar pine, incense-cedar, and California black oak. Stands form multilayered closed canopies with close to 100% cover with shrubs common in the understory. Ponderosa pine (6.2%) varies from pure stands of ponderosa pine to mixed stands of 50% ponderosa pine. Associated species include white fir, incense-cedar, Jeffrey pine, sugar pine, Douglas-fir, canyon live oak, California black oak, Pacific madrone. White and Douglas fir (7.1%) Depending on soil type, moisture, topography and disturbance, associated plant species may include canyon live oak, Pacific madrone, sugar pine, ponderosa pine, black oak, and Pacific yew; Montane hardwood (10.3%) is found throughout the middle watershed. The structure of a montane hardwood habitat consists of a pronounced hardwood tree layer, a poorly developed shrub layer, and a sparse herbaceous layer. Typical associates include canyon live oak, Douglas-fir, Pacific madrone, California-laurel, California black oak, and foothill pine at mid- and lower elevations, and ponderosa pine, white fir, and Jeffery pine at higher elevations.

These ecosystems, comprising approximately 30.4% of the watershed's vegetation communities, are most prone to wildfire. There are many restoration opportunities, including the reintroduction of indigenous land management practices such as prescribed burning.

## Fire and Fuels

Fire, ignited by lightning and Native Americans, was common in the Sierra Nevada prior to 20th century suppression efforts. Pre-settlement fire return intervals were generally less than 20 years throughout a broad zone extending from the foothills through the mixed conifer forests (Stevens, 2014). This reduction in fire activity, coupled with the selective harvest of many large pines, produced forests which today are denser, with generally smaller trees, and have higher proportions of white fir and incense cedar than were present historically. These changes have almost certainly increased the levels of fuel, both on the forest floor and "ladder fuels"—small trees and brush which carry the fire into the forest canopy. Increases in fuel, coupled with efficient suppression of low and moderate intensity fires has led to an increase in general fire severity (Stevens, 2014).

Fire frequency is an indicator of both human disturbance to the forest landscape and larger climactic patterns. It can be affected by disease pressure, drought, fire management practices, logging, and climate cycles. Changing conditions can affect both the frequency of fires as well as their intensity. When comparing the observed fire frequency over the last 100 years to the expected fire frequency, the fire regime of the upper and lower watershed has diverged dramatically from historical conditions (Campbell et al. 2016)

Sierra Nevada forests are currently storing over 840 million tons of above ground biomass (Blackard et al. 2008). This is an increase from historic levels due in part to fire suppression and the reduction in harvesting on public lands. Increasing carbon storage in this way is a benefit to moderating the causes of climate change in the short term. However, in the longer term, it elevates the risk because dense forests are more likely to experience stand-replacing fires that kill many trees and so lead to a large release of carbon when fire killed trees decay.

Fire affects watersheds in multiple ways, including through a short-term release of soil nitrogen followed by nitrogen deficiency, increased erosion and return periods of floods, altered vegetation structure, and increased stream temperatures (Dennis, 1989). Particularly relevant to watersheds in Gold Country, which are heavily impacted by mercury mine-waste, fire has been shown to increase methylmercury concentrations (Amirbahman et al., 2004). This is presumably associated with faster rates of microbial metabolism due to rapid nutrient cycling following fire, and suggests that mercury clean-up efforts may be most pressing in areas recently affected by fire.

The area encompassed by the Lowell Fire in 2015 along Steephollow Creek is likely to experience some of these impacts. The vegetation communities affected primarily consisted of ponderosa pine forest, as well as small sections of montane hardwood conifer, montane hardwood, Sierran mixed conifer, and mixed chaparral. When disturbed by fire, ponderosa pine communities are sometimes converted to mixed chaparral habitat, or in moister areas of higher site quality, to mixed conifer stands (CWHR, 1988). Secondary succession in disturbed montane hardwood conifer habitat consists of shrubs and trees regenerating together, with conifers maturing in 30-50 years, and broad-leaved trees maturing in 60-90 years (CWHR, 1988). Growth of hardwoods is particularly slow, especially canyon live oak.

Current Sierra Nevada forest and fuel management is often focused on strategically reducing fuels without an explicit strategy for ecological restoration across the landscape matrix. Summarizing recent scientific literature, we suggest managers produce different stand structures and densities across the landscape using topographic variables (i.e., slope shape, aspect, and slope position) as a guide for varying treatments. Local cool or moist areas, where historically fire would have burned less frequently or at lower severity, would have higher density and canopy cover, providing habitat for sensitive species. In contrast upper, southern-aspect slopes would have low densities of large fire-resistant trees. For thinning, marking rules would be based on crown strata or age cohorts and species, rather than uniform diameter limits. Collectively, our management recommendations emphasize the ecological role of fire, changing climate conditions, sensitive wildlife habitat, and the importance of forest structure heterogeneity. (North et al, 2010)

## Timber Production

Often considered a subset of agricultural production, timber harvesting (silviculture) is a significant activity in the upper portions of the Bear River watershed in Nevada and Placer Counties. Within the Bear River watershed, 38,268 acres of privately-owned land for timber harvesting are held by a range of companies, trust funds and private owners (Cal Fire, 2012). PG&E owns 12,352 acres, mostly in Placer County at the very top of the watershed. The other major private company is Sierra Pacific Industries, which owns 10,802 acres, all in upper portion of the watershed, mostly in Nevada County. The top four private individual timber landowners collectively own over 4,000 acres in Nevada and Placer counties. In most cases the landowner and the timber owner are the same with some exceptions, such as where PG&E or NID partially own the land but not the timber, or where there are multiple owners of the land and timber who don't fully overlap.

## Sustainable Forestry

Evaluate existing timber inventory and management plan data, and supplement as appropriate.

Develop a watershed wide forest management plan and work with landowners to promote natural forest development and structural and physical diversity in forests for long-term ecological, economic, social, and cultural benefits.

Develop a watershed wide fuels management plan and work with landowners to ensure long-term forest health, and reduce fuel loading and fire hazard.

Increase capacity of employment for forest management, Economic jobs and training

Increase public and landowner education of best management practices

Evaluate post-fire logging operations to minimize plant, wildlife and soil impacts

Manage forest to improve resiliency to drought, pathogens and pests

**Carbon sequestration and emission in forests**

Analysis by the U.S. Forest Service predicts that standing biomass and associated carbon storage is at risk in the long-term. The analysis predicts California national forests will become net emitters of carbon by the end of the century because by mid-century forests will accumulate carbon at a slower rate than they lose it through wildfire, pest mortality and inter-tree competition. Carbon storage will be determined by how the forest is managed for those risks over the next 100 years (Goines and Nechodom, 2009).

Though most studies agree that active management to reduce wildfire and forest pest threats reduces carbon storage in the short term, there is less agreement about how and whether thinning improves the stability of carbon storage in the long term. A study found that forest

fuels treatments reduced loss of carbon to wildfire by 57% but that when carbon removed from the site is added to carbon loss to wildfire, total carbon loss is about 15% greater in treated forests than untreated. However, authors added that "If thinned trees were milled into lumber or the chips used as biofuel, a treatment's carbon loss could be reduced" (North, Collins, and Stephens, 2012).

Online Forest Resources:

The Fire Effects Information System, with plant-related links: http://www.fs.fed.us/database/feis/AboutFEIS/about.html

Cal Fire and Resource Assessment Program website: http://frap.fire.ca.gov/

Cal Fire Tree Mortality viewerhttp://egis.fire.ca.gov/TreeMortalityViewer/

Cal Fire Forest Practice Geographical Information System (GIS) captures current and historic timber harvesting activities http://calfire.ca.gov/resource_mgt/resource_mgt_forestpractice_gis

## Oak Woodland, Chaparral and Grassland Ecosystems

Annual grassland (15%) makes up a large portion of the lower Bear watershed, bridging croplands and pastures with oak and hardwood habitats. Introduced annual grass species dominate the type, including wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue. Forbs can include broadleaf filaree, redstem fillaree, turkey mullein, true clovers, bur clover, popcorn flower, and California poppy, among others. Many of the species found in annual grasslands also populate oak woodland habitats as understory plants.

Valley oak woodland (0.38%) is also found in the low to middle Bear watershed. Canopies of this habitat are dominated nearly exclusively by valley oaks, with habitat structure varying from savanna-like to forest-like stands. Tree associates may include interior live oak, and blue oak. When grazing is light or absent, a partial shrub layer of poison-oak, toyon, and coffeeberry may form. Valley oak woodland provides food and cover for many species of wildlife, including birds and animals that use acorns and browse.

The middle Bear watershed is largely Blue Oak Woodland (16.5%), Blue Oak-Foothill Pine (7.0%), and Mixed Hardwood/Conifer (4.4%) forests. In some areas blue oaks dominate the woodland, comprising 85-100% of trees present. Common associates in the savanna-like stands are interior live oak, poison-oak, coffeeberry, buckbrush, redberry, California buckeye, manzanita and annual grasses. Blue oak-foothill pine is similar. The structure of both these ecosystems is diverse vertically and horizontally, and provide optimal breeding habitat for 29 species of amphibians and reptiles, 57 species of birds, and 10 species of mammals. While it is clear that many wildlife species utilize and benefit from the use of these oaks, further research

into oak-wildlife relationships is needed before specific management recommendations can be made (CWHR, 1988).

Since the turn of the century there have been reports that certain species of oaks in California were reported, by Willis Jepson in 1910, to have regeneration problems including blue and valley oak. One theory claims that change in vegetation, from perennial bunchgrass to introduced nonnative annual grasses and tap rooted annual forbs, has created environmental conditions that make it more difficult for oaks to establish successfully. Livestock grazing began in the late 17th century and there is direct evidence that livestock contribute to reduced regeneration by browsing or trampling seedlings. Heavy grazing can indirectly affect oak recruitment because it increases soil compaction and reduces organic matter with can make it difficult for oak roots to penetrate the soil (Swiecki, Bernhardt 1998). Oak woodlands have long been impacted from firewood harvesting, agricultural conversions, intensive grazing and residential and commercial development.

A general pattern of inadequate sapling recruitment has emerged in some location. Since samplings are the trees that must be recruited into the mature size class when older trees die, there is worry that, if these trends continue, current population densities will decline. Owners and managers of hardwood rangelands need to evaluate their oak stands to determine if there is adequate recruitment for maintaining stand density or if steps need to be taken to establish new trees. (McCreary 2009)

A theory of changing fire frequencies due to fire suppression and lack of indigenous and/or ranchers' burning, has caused increase in brush and buildup of fuels in understories. Since foothill oaks evolved with and are adapted to fire, the change in the fire regimes may have adversely affected oak regeneration. (Swiecki, T. J.; Bernhardt, E. 1999)

Fire frequency in oak woodlands is an indicator of both human disturbance to the forest landscape and larger climactic patterns. It can be affected by disease pressure, drought, fire management practices, logging, and climate cycles. Changing conditions can affect both the frequency of fires as well as their intensity. Fire return intervals were compared to the observed fire frequency over the last 100 years using vegetation data. This reflected a current fire regime that differs dramatically from natural and historical patterns (Campbell *et al*. 2016).

Native Americans regularly burned oak woodland to keep areas open for hunting, stimulate the sprouting of plants used for various products, facilitate acorn collection and reduce populations of insects that damage acorns (Anderson, K. 2006). Traditional ecological knowledge and indigenous land management practices, including burning, could be implemented to support viable oak woodland and native grassland populations.

*Regenerating Rangeland Oaks in California*, a UC Sierra Foothill Research and Extension Center UCANR Publication 21601e; http://anrcatalog.ucdavis.edu (McCreary, D 2009) provides guidelines on how to propagate, plant and maintain oaks in restoration projects.

Promoting holistic rangeland management practices increases important ecosystem services, such as improved water quality, more stable stream banks and riparian soils which support hydrologic functions such as flood attenuation, higher carbon sequestration in soil and wood, and more diverse and productive plant communities (Jackson, L.E., A.K. Hodson, K.J. Fyhrie, and V. Calegari, 2015)and human communities by supporting working landscapes.

Mixed and montane chaparral (2%) can be found in patches, are structurally homogenous, and can be impenetrable thickets. Mixed chaparral is commonly comprised of scrub oak, ceanothus, and manzanita dominating the type. The plant and wildlife (especially bird, mammal, reptile, insect) diversity in these ecosystems is extremely high. Due to different soil types stands host various plant associations and may host rare plant species or natural communities, such as the gabbro serpentine rare plants and rare natural plant communities.

Chaparral can create heavy fuels loads and pose high fire risk near human structures. It is often completely cleared in fuel reduction projects with little regard to it diversity and habitat value. Instead of 'clearing', land management treatments could consist of selective thinning which lightens the fuel load but conserves diversity and wildlife habitat. Treatments could consist of prescribed burning, as long-term fire suppression can lead to stand senescence and decline in habitat value. The majority of animals using chaparral habitats reach peak densities 1-15 years post-burn (CWHR, 1988). Fire frequency for chaparral ranges from 30-150 years. Too frequent clearing and/or burning can lead to vegetation type conversion; often to non-native annual grasslands; which support less plant and wildlife habitat and diversity, and poses a different type of high fire risk.

Vegetation treatments for fuel reduction should aim to protect species composition, wildlife habitat, soil integrity and minimize non-native invasive plant threat.

## Rare and Threatened Habitat Types

Vegetation types provide key ecosystem services by maintaining water cycles, removing carbon dioxide from the atmosphere, and providing habitat for plant and wildlife species. Conversion and degradation of rare vegetation types can disrupt the integrity of the ecological functions of our natural environments, leading to the loss of sensitive plant and animal species and a corresponding decrease in biodiversity. The inherent values of vegetation have lead scientists and conservationists to make use of vegetation patterns as a surrogate for ecosystems for many years.

Rare plant (vegetation) communities are those communities that are of highly limited distribution. These communities may or may not contain special status plants. The most current version of the California Natural Diversity Database's *List of California Terrestrial Natural Communities* should be used as a guide to the names and status of communities https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities/List

## Rarity and Global and State Ranks:

One purpose of the vegetation classification is to assist in determining the level of rarity and imperilment of vegetation types. Ranking of alliances according to their degree of imperilment (as measured by rarity, trends, and threats) follows NatureServe's Heritage Methodology, in which all alliances are listed with a G (global) and S (state) rank. For alliances with State ranks of S1-S3, all associations within them are also considered to be highly imperiled. A question mark (?) denotes an inexact numeric rank due to insufficient samples over the full expected range of the type, but existing information points to this rank. Ranking is an ongoing process and we expect to provide association level ranks for all of the S3 or rarer entities in the future. This information can be accessed at: https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities/Background#codes

1 = Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.

2 = Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences.

3 = Rare, uncommon or threatened, but not immediately imperiled, typically with 21-100 occurrences.

4 = Not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences.

5 = Demonstrably widespread, abundant, and secure

| California Department of Fish and Wildlife Terrestrial Natural Communities List and Ranking | | |
|---|---|---|
| **Forest and Woodlands Alliances and Stands** | | **Global & State Rank** |
| *61.450.00 | *Acer macrophyllum (*Bigleaf maple forest*) Alliance* | G4 S3 |
| *75.100.00 | *Aesculus californica* (California buckeye groves) Alliance | G3 S3 |
| *81.300.00 | *Callitropsis macnabiana* (McNab cypress woodland) Alliance | G3 S3 |
| *61.960.00 | *Fraxinus latifolia* (Oregon ash groves) Alliance | G4 S3 |
| *72.100.00 | *Juglans californica* (California walnut groves) Alliance | G3 S3 |
| *37.413.00 | *Quercus chrysolepis* (Canyon live oak chaparral) Alliance | G3 S3 |
| *61.130.00 | *Populus fremontii* (Fremont cottonwood forest) Alliance | G4 S3 |
| *61.204.00 | *Salix lucida* (Shining willow groves) Alliance | G4 S3 |
| *61.205.00 | *Salix laevigata* (Red willow thickets) Alliance | G3 S3 |
| *61.204.00 | *Salix lucida* (Shining willow groves) Alliance | G4 S3? |
| *61.211.00 | *Salix gooddingii* (Black willow thickets) Alliance | G4 S3 |
| *61.310.00 | *Platanus racemosa* (California sycamore woodlands) Alliance | G3 S3 |
| *71.020.00 | *Quercus douglasii* (Blue oak woodland) Alliance | G4 S4 (some associations are high priority) |
| *71.040.00 | *Quercus lobata* (Valley oak woodland) Alliance | G3 S3 (some associations are high priority) |
| **Shrubland Alliances and Stands** | | **Global & State Rank** |
| *63.210.00 | *Alnus incana* (Mountain alder thicket) Alliance | G4 S3 |
| *63.300.00 | *Cephalanthus occidentalis* (Button willow thickets) Alliance | G5 S2 |
| *37.950.00 | *Corylus cornuta* var. *californica*(Hazelnut scrub) Alliance | G3 S2? |
| *37.911.00 | *Heteromeles arbutifolia* (Toyon chaparral) Alliance | G5 S3 |
| *63.310.00 | *Rhododendron occidentale* (Western azalea patches) Provisional Alliance | G3 S2? |
| *63.410.00 | *Sambucus nigra* (Blue elderberry stands) Alliance | G3 S3 |
| **Herbaceous Alliances and Stands** | | **Global & State Rank** |
| *45.416.00 | *Camassia quamash* (Small camas meadows) Alliance | G4? S3? |

| | | |
|---|---|---|
| *41.050.00 | *Danthonia californica* (California oat grass prairie) Provisional Alliance | G4 S3 |
| *42.007.00 | *Lasthenia fremontii - Downingia (bicornuta)* (Fremont's goldfields - Downingia vernal pools) Alliance | G3 S3 |
| *42.002.00 | *Layia fremontii - Achyrachaena mollis* (Fremont's tidy-tips - Blow wives vernal pools) Alliance | G3 S3? |
| *41.278.00 | *Muhlenbergia rigens* (Deer grass beds) Alliance | G3 S2? |
| *41.150.00 | *Nassella pulchra* (Purple needle grass grassland) Alliance | G4 S3? |

CDFW Biogeographic Data at: https://www.wildlife.ca.gov/Data/VegCAMP/Natural-Communities/List

Vernal pool communities provide habitat for numerous rare plants and animals that are able to survive and thrive in these harsh conditions. Vernal pools are a valuable and increasingly threatened ecosystem, often smaller than the bulldozer that threatens to destroy them. More than 90% of California's vernal pools have already been lost. Two rare plants found in the watershed's vernal pools include *Downingia pusilla* and *Legenere limosa* (Witham et al., 1998). Rare natural communities found in vernal pools include include *Lasthenia fremontii - Downingia* (*bicornuta*) (Fremont's goldfields - *Downingia* vernal pools) Alliance and *Layia fremontii - Achyrachaena mollis* (Fremont's tidy-tips - Blow wives vernal pools) Alliance.

Closed-cone pine-cypress communities are dominated by McNab cypress and found in the middle Bear watershed. Closed-cone pine-cypress habitats often occur as islands within a matrix of chaparral or forest types. Threats to cypress species in California include changes to the natural fire regime. Because cypress cones are serotinous, wildfire is an important natural disturbance. The heat produced by fire opens cones, resulting in a massive release of fertile cypress seeds. Although cypress trees have thin bark and typically do not survive fire, the seeds released by fire ensure the continuation of the stand. Human-induced changes to the natural fire regime have led to the disappearance of many of these tree stands. If the fire return interval is too short, trees are unable to reach reproductive age before the next fire, often causing them to be replaced by adjacent vegetation types. McNab cypress are found in several locations which have associated rare plant populations ofPine Hill Flannelbush (*Fremontodendrom californica decumbens*) and/or Stebbins' morning glory (*Calystegia stebbinsii*). Other CNPS listed species are found in this plant community, including Bacigalupi's perideridea (*Perideridia bacigalupii*) and Sanborn's onion (*Allium sanbornii*). These species are indicators of unique soil types including the ultra-maphic gabbro soils which are found within the Bear watershed in several locations. This is also habitat for California horned lizard (*Phrynosoma coronatum frontale*) a State Species of Special Concern.

The soil types present in the Bear watershed, illustrate the complex geology and biophysical processes at work in the watershed. Many endemic and/or rare plant taxa and/or natural communities are located exclusively on a specific soil or rock type, such as carbonate, serpentinite, basalt, or granite. Rare plants such as Stebbins' morning-glory, Pine Hill ceanothus, Pine Hill flannelbush, and Layne's butterweed, found in the American and Bear watersheds, are endemics and only associated only with ultra-maphic gabbro serpentine soils. The status of these species and natural communities in the Bear is unknown. Identification of unique soil types known to have associated rare plants, coupled with on the ground plant surveys, would assist in identifying areas for protection and restoration, and add to a much needed comprehensive plant inventory for the Bear.

## Rare and Declining Plant and Wildlife Species

Of the seven river basins within the boundary of the northern Sierra Nevada, those of the Feather and American Rivers have the greatest number of plant taxa, including endemic and rare taxa, with the American River having at least 46 rare taxa and 85 Sierran endemics. The Yuba River has at least 69 Sierran endemics and 45 rare taxa documented within the watershed (Millar et al., 1996). The data from the Yuba and American River watersheds shows the potential for plant taxa diversity and rare and endemic plant presence within the Bear watershed as well. The CNDDB list is limited to documented occurrences and is not a complete list of all sensitive plant species that may be found in the Bear watershed. There is a great need to increase the knowledge of rare plant diversity, abundance and location in the watershed and increase access to data that is already available.

Information on rarity and endemism for non-vascular plants, including lichens and bryophytes, for the Sierra Nevada is very speculative and fragmentary due to limited fieldwork and the small number of available collections. Many of these ensembles are located on unusual substrates or soils, occur in areas with high plant species diversity, or occur in uncommon habitats or vegetation types. There is a strong need to fill data gaps in non-vascular plant diversity, abundance, and location, throughout the watershed. For example, the structure of a lichen community in a forest (i.e., species presence and abundance) intrinsically provides a wealth of information about forest health, function, and local climatic conditions because some species are extremely sensitive to environmental change, a major reason for their popularity as bio-indicators for natural resource assessment (Nimis et al., 2002).

There are also data gaps in surveys and reporting of sensitive fungal species including branched collybia (*Collybia racemosa*), large cudonia (*Cudonia monticola*), and olive phaeocollybia (*Phaeocollybia olivacea*).

Plant species known to occur in the Wolf Creek watershed that have special status include Scadden Flat checkerbloom (CA Endangered), Brandegee's clarkia, brownish beaked rush, red-

anthered rush, Stebbins's morning glory, Follett's monardella, Pine Hill flannelbush (Federal Endangered), Cantelow's lewisia, Butte County fritillary, Norris's beardmoss, Elongate coppermoss, and Bog clubmoss

Two rare plants are documented in the lower watershed's vernal pools, include dwarf downingia (*Downingia pusilla*) and (*Legenere limosa*) (Witham et al., 1998). Observations of California linderiella (*Linderiella occidentalis)* and vernal pool fairy shrimp (*Branchinecta lynchi)* indicate likely suitable habitat for rare vernal pool plant species.

Brazilian watermeal (*Wolffia brasiliensis*) was observed at Camp Far West. Elongate copper moss (*Mielichhoferia elongate*) was observed near Dutch Flat.

Knowledge of species-specific occurrence patterns is essential for determining the impacts and threats to rare species in the Bear Watershed, as well as the conservation and restoration activities necessary to prevent their extirpation and help facilitate species recovery (Lesica and Allendorf, 1992; 1995). Surveys and reporting for special-status wildlife have been completed for only a small portion of the Bear River Watershed. Twenty special-status wildlife species had been documented in the Bear Watershed by CNDDB prior to 2016 and are discussed and mapped in Campbell *et al*. (2016), which also lists an additional nine special-status mammal species and nine special-status invertebrate species with potential to occur in the watershed. Forty-seven special-status bird species have been documented in the Bear River Watershed by CNDDB (2015) or a subset of curated experts at eBird (2016); these are listed and discussed in Campbell *et al*. (2016).

## Invasive Species

Invasive plant species can outcompete native plants and significantly alter plant and animal communities, threatening entire ecosystems. Restoration efforts are often limited by time and funding; therefore, the focus of invasive species control in the Bear River watershed should be on those posing the greatest threat to native ecosystems. WHIPPET, the "Weed Heuristics: Invasive Population Prioritization for Eradication Tool" (whippet.cal-ipc.org), draws on data from the Calflora database (www.calflora.org) to prioritize 200 Californian weeds for eradication based on the plant's potential impact, invasiveness, and feasibility of eradication. The WHIPPET tool emphasizes cost-effective efforts to control high-risk populations, therefore smaller populations and species that are easier to control are scored higher than populations that are larger or more difficult to control. Due to variations in invasiveness and feasibility of eradication, populations of the same species may receive different WHIPPET scores. However, species with consistently high scores in the Bear River watershed are *Lepidium latifolium* (perennial pepperweed), *Arundo donax* (giant reed), *Onopordum acanthium* (Scotch thistle), *Sesbania punicea* (scarlet wisteria), *Lythrum salicaria* (purple loosestrife), and *Rubus armeniacus* (Himalayan blackberry). Species that are commonly found in the Bear River watershed but

frequently received a lower WHIPPET score due to difficulty of eradication include: *Centaurea solstitialis* (yellow starthistle), *Centaurea stoebe ssp. micranthos* (spotted knapweed), *Cytisus scoparius* (Scotch broom), *Hordeum murinum* (hare barley), *Lolium multiflorum* (Italian ryegrass).

Weed Management Areas (WMAs) are local stakeholder groups, organized by county through county Agricultural Commissioners' offices, who develop a strategic plan that identifies top priorities for local weed management. The Bear River has two active WMAs, Placer/Nevada County and Yuba/Sutter County. WMAs plan and implement projects on-the-ground, collaborate on mapping and public education, and are likely to be a great resource.

Several animal species within the Bear River Watershed are introduced exotic species that prey upon, parasitize, and compete with native wildlife, and act as reservoirs for diseases that affect native wildlife. Invasive species currently impacting the Bear River Watershed include the American bullfrog (*Lithobates catesbeianus*), red-eared slider (*Trachemys scripta elegans*), spiny soft-shell turtle (*Apalone spinifera*), brown-headed cowbird (*Molothrus ater*), Eurasian collared-dove (*Streptopelia decaocto*), European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), wild pigs (*Sus scrofa*), and feral cats (*Felis catus*). Additional invasive animal species that are reproducing in watersheds adjacent to the Bear Watershed include New Zealand mud snails (*Potamopyrgus antipodarum*), Asian clams (*Corbicula fluminea*), northern water snakes (*Nerodia sipedon*), and southern water snakes (*Nerodia fasciata*). Non-native species such as these significantly reduce the survival and reproduction of native wildlife populations.

## Indigenous Communities, Cultural Resources and Cultural Restoration

Currently, three indigenous groups are based within portions of the Bear River watershed: the Colfax-Todds Valley Consolidated Tribe (Colfax Rancheria), the Nisenan of Northern California (Nevada City Rancheria), and the United Auburn Indian Community (Auburn Rancheria). All three of these tribes were historically recognized by the US federal government and the surrounding indigenous nations, but their federal recognition was terminated in 1958, 1964, and 1967, respectively. Federal recognition was restored to the United Auburn Indian Community in 1994. The Colfax and Nevada City Rancherias continue to petition for the reinstatement of their federal recognition, while members of all three tribes remain connected to their vital cultural heritage.

In Nevada County, approximately 52,069 acres, or about eight percent of the county has been subjected to archaeological survey with relatively "complete" systematic coverage. Within this total area, approximately 1,490 prehistoric and historic archaeological sites have been recorded to date (see Appendix E of the Nevada County Master Environmental Inventory). Considering the total number of sites recorded in the County and given the amount of acreage that has been surveyed, it can be estimated that the potential number of sites expected within Nevada County

number about 17,900, leaving about 16,400 potential archaeological sites yet undiscovered (Nevada County 1995).

For purposes of watershed restoration, sites and resources of significance to tribal groups should be identified and prioritized for protection. It is certain there are more areas of special significance to local indigenous people than are documented in the publicly-available data sources. Representatives of local tribal groups have expressed their view that all of their ancestral aboriginal territories are traditional cultural properties, and they do not agree with addressing these territories in accordance with the non-native perspective (NID and PG&E 2011f). For projects proposed in this plan, it will be important to consult with local tribal groups to identify if restoration is taking place on culturally significant land. If so, the restoration concepts and approaches will be discussed with local tribal groups to develop effective, meaningful, and culturally sensitive restoration practices.

## Agriculture

Working landscapes, both farms and ranches, are one of the most common land uses on private land in the Bear River watershed. Agriculture is both a major sector of the economy of the counties encapsulated by the watershed and a foundation of the cultural identity of many of its communities, particularly in the lower watershed (van Wagtendonk, 2013). According to county zoning data, almost 128,000 acres, over 40% of the watershed area, is zoned for general or exclusive agriculture. This includes almost all of Sutter, much of Yuba, and a large portion of central Nevada County, within the limits of the watershed. In addition, another almost 69,000 acres, over 20% of the watershed, are zoned as combined-agriculture (i.e. joint agricultural and industrial or residential).

Assessing the actual impacts of widespread agriculture on the ecological health of the Bear watershed is highly complicated, with a suite of potential positive and negative effects. On the one hand, working lands, particularly when well managed, can provide open space and critical habitat for a large number of species native to the Sierra foothills, particularly pollinators and migrating mammals (Department of Water Resources, 2013; van Wagtendonk, 2013). In addition, agricultural lands can provide land and water for wetlands restoration and can help control and improve the water quality of urban runoff. In contrast, the conversion of working lands to other, more developed uses can compromise the ability of the landscape to provide a range of ecosystem services including flood management, water conservation and groundwater recharge, food production, and carbon sequestration. In fact, climate models illustrate that a loss of agricultural lands may lead to a loss of biodiversity (Department of Water Resources, 2013). However, to fully reap the positive benefits of agricultural land, appropriate land stewardship and the adoption of ecosystem-friendly practices, as mentioned above, are critical.

The negative impacts of widespread agriculture, particularly using modern techniques at an industrial scale, are also well understood. The doubling of food production around the world in the last 35 years has been associated with an almost seven-fold increase in nitrogen fertilization and 3.5-times increase in phosphorous fertilization. This has resulted in dramatic changes in global nutrient cycling, which have severely eutrophied many aquatic ecosystems (Tilman, 1999). In turn, eutrophication can lead to a loss of biodiversity and fisheries value, shifts in the food web and colonization by invasive species. In addition, despite the potential of agricultural lands for carbon sequestration, industrial agriculture is also a major producer of potent greenhouse gas emissions, including methane from livestock and nitrous oxide from fertilizer application. Perhaps most detrimentally, large-scale agriculture has led to a homogenization and simplification of terrestrial systems, as complex ecosystems with thousands of species have been replaced by virtual monocultures (Tilman, 1999). When poorly managed, even smaller scale agriculture can lead to genetic simplification, wasteful water consumption, pollution and soil degradation. As of 2012, an average of ten times as much soil eroded from American farms than was replaced by natural formation processes. In turn, soil erosion can result in decreases in water quality, reduced reservoir capacity, increased flooding, and the destruction of critical terrestrial and aquatic habitat. Surface runoff of fertilizers and pesticides, in particular, can further impair water quality, while percolation of water through cultivated fields can potentially contaminate groundwater supplies (Trautmann et al., 2012). The extent to which these impacts have been felt in the Bear watershed specifically is not well understood and will require fine-scale mapping of agricultural practices.

## Land Use and Development

75% of the 303,500-acre Bear River Watershed is privately owned, highly fragmented, and vulnerable to increased habitat degradation from development and extractive land uses. Nearly 5% of the watershed is protected by the Bear Yuba Land Trust and Placer Land Trust with fee-title acquisitions and conservation easements. Many of these protected lands are strategically placed in a contiguous landscape for oak woodland protection in the Middle Bear subwatershed.

Exurban migration is the relocation of people from larger metropolitan areas to rural small town regions usually in seek of a better quality of life. The Sierra Nevada foothills region has been the locus of extensive exurban migration in the past decades since the 1960s. This population change has significantly altered the region's landscape, culture and economy. The jurisdictional landscape for watershed management in the Bear is complex, with a system of overlapping state, federal and regional authorities. Within the state government, the Bear watershed encompasses parts of California Senate Districts 01 (MTCAP) and 04 (Yuba), and parts of Assembly Districts 01 (MTCAP), 03 (Yuba) and 06 (NSAC). The Bear River watershed lies within four counties – Nevada, Placer, Yuba and Sutter. Portions of Nevada and Yuba

Counties form the northern side of the watershed, and portions of Placer and Sutter Counties form the watershed's southern side. A majority of the watershed is within Nevada County.

Counties have jurisdiction over land use and development decisions in their unincorporated regions. The overarching planning document for counties is the General Plan, which sets forth broad goals and policies regarding future community development, including intentions about housing, economic development, transportation, recreation, open space, agriculture, cultural resources and the environment. A review of the four pertinent county general plans reveals that all jurisdictions state a general intent to locate new development adjacent to already urbanized areas and preserve open space, sensitive habitats, cultural resources and aesthetic values within their regions. However, these counties are also experiencing growth that exerts pressure to convert open space and agricultural lands for the development of housing and associated commercial services.

Placer County is currently preparing a Conservation Plan which would designate permanently protected areas in the western county as well provide as a conservation strategy. This plan is scheduled to be finalized and available to the public at the end of 2016. The Placer County Conservation Plan (PCCP) is a County-proposed solution to coordinate and streamline the project permitting process by allowing local entities to issue state and federal permits (Placer County, 2014a). The proposed PCCP is a Habitat Conservation Plan (HCP). Sutter and Yuba Counties are jointly preparing a Regional Conservation Plan scheduled to be finalized in 2016. The Yuba-Sutter NCCP/HCP has goals regarding no net loss of wetlands, establishment of a resource conservation district and native plant use for revegetation and landscaping. Nevada County attempted to develop its version of a habitat conservation plan in the year 2000 through the Nevada Heritage 2020 project. Due to strong opposition from some segments of the population, this project was abandoned.

## Recreation

The Bear Watershed contains over 75 miles of public trails dispersed across at least 188 individual trails, which are mapped in Figure 47 of the Bear River Watershed Disturbance Inventory (Campbell *et al*. 2016). Trails vary in length from less than one mile to over 7 miles (excluding trail segments outside of the watershed), with the majority falling into the shorter range. Most public trails in the area are hiking and pedestrian trails, though many allow mountain biking and some are specifically designed for cycling. The largest concentration of trails occur in the Grass Valley area, along the mainstem Bear River between Rollins and Combie reservoirs, and within Dry Creek's Spenceville Wildlife Area. Several miles of additional trails have been proposed surrounding the community of Meadow Vista.

The use of off-highway vehicles (OHV) is prevalent throughout the watershed. Areas along Greenhorn and Steephollow Creek, and in mine diggings, are very popular for OHVs. Both

private and public lands (e.g., USFS, BLM) are heavily used in all regions of the watershed. There is great concern that the movement of sediments in mine soils and gravels will increase heavy metal input into waterways. OHVs can cause substantial erosion of the soils on which they travel. They can impact vegetation directly through trampling, soil compaction and pollution, which can be devastating to an area of the forest by resulting in fewer and less vigorous plants, reduced plant cover, lower plant diversity, adverse changes in plant species composition and disruptions to natural plant succession and nutrient cycling processes. OHV use can impact wildlife through direct mortality, general disturbance, noise impacts and habitat degradation. Aquatic habitat is also significantly affected through increased sedimentation, destruction of important aspects of aquatic systems through direct contact and decreased hydrologic health through the effects of pollution (Berry et al., 1996). It is unknown how many miles of permitted OHV trails are in the watershed, or the extent of OHV use on private land and unpermitted areas. Law enforcement and forest protection officers have increased surveillance and ticketing in Greenhorn Creek (The Union 2016b). Land impacted by OHV use may be most in need of restoration.

Additional popular outdoor recreation activities in the Bear River Watershed include camping, birdwatching, wildlife watching, botanizing, boating, and fishing.

## Climate Change

In a hotter and drier climate, ecosystems throughout the Bear River Watershed will be impacted by changing precipitation regimes resulting in reduced snow pack, increased stream temperatures, and decreased late-season flow. These climate-induced changes can directly impact water quality, fire hazard, and habitat condition for a number of unique, threatened, or endangered species. Water quality is often highly correlated with water temperature and flow. Increases in extreme flow events caused by altered precipitation patterns can carry higher concentrations of toxins and nutrient-rich sediments (Murphy 2010), contributing to algal blooms provoked by warmer summer temperatures and degraded water quality. Climate stress also directly impacts ecological functioning through the development of phenological mismatches. For example, increased early-season water temperature can cause detrimental cascading effects throughout aquatic communities as species adapt to altered abiotic conditions (Kratina et al. 2012).

Among the many conditions that climate change is expected to create, water quantity and water quality will have a large impact on myriad ecosystems and the linked flora and fauna. First, shifts in precipitation patterns with more extreme early season floods and lower late season flow from reduced snowpack result in reduced instream flows and associated wetland flooding. Second, expected climate change impact would be a decrease in water quality due to increased water temperature, lower water quantity, and increased nutrient throughput.

Climate change exacerbated California's drought conditions, with the 5-year drought creating circumstances that classified most of the state in Severe Drought (D2) to Exceptional Drought (D4) conditions (droughtmonitor.unl.edu). With the Bear River Watershed classified as Severe Drought to Extreme Drought (D3) in 2015, it is at risk for future impacts from continued drought conditions as a result of climate change.

Humans aren't the only ones struggling. The historic dry spell is reshaping the habitats of much of the state's wildlife. The drought has affected all of California's vast diversity of wildlife in different ways, and the most at-risk species include special status, threatened, and endangered species. Knowledge of species-specific occurrence patterns is essential for determining the impacts and threats to rare species in the Bear Watershed as a result of climate change-driven drought, as well as the conservation and restoration activities necessary to prevent their extirpation and help facilitate species recovery. Surveys for special-status species have been completed for only a small portion of the Bear River Watershed. Additionally, the wildlife corridors provided by healthy riparian ecosystems will be essential for enabling climate-induced migration of plant and wildlife species (Lenihan et al. 2003).

With the extreme drought and the last few years among the warmest ever recorded, landscape-level drought-stress has allowed native pine bark beetles to kill drought-weakened ponderosa pine trees throughout the Sierra Nevada, including the Bear and adjacent watersheds. Beetle populations have hit a critical threshold and trees have lost their ability to regulate beetle populations resulting in an epidemic. Fuel reduction and proper forest management can help trees resist these stressors.

The ongoing drought has impacted water flow, fire, and erosion regimes, as well as thermal stratification in larger water bodies, specifically impacting mobilization of mercury-laden sediment, mercury accumulation in reservoirs, and the rate of methylation. In particular, increased erosion following fires could be a large source of fresh mercury into the system after multiple years of drought. In addition, rising global temperatures, which affect dissolved oxygen, may increase the rate of methylation in local reservoirs.

Due to drought conditions, groundwater use is up in the California region. In 2014, Department of Water Resources (DWR) released the *Summary of Recent, Historical, and Estimated Potential for Future Land Subsidence in California*. Groundwater levels observed during the recent drought between spring 2013 and 2014 showed more variability within the Bear River watershed, with wells generally exhibiting recent groundwater elevations near the historical spring low.

# 3. Goals and Objectives

## Bear Watershed Stakeholder Group Goals and Objectives

The following goals and objectives for Bear River Watershed restoration were developed and refined at watershed stakeholder meetings in 2015 and 2016.

**Water Quality & Hydrology Goal**

Preserve, restore &sustain the resiliency of water quality and quantity in the watershed's streams, lakes, other wetlands, and groundwater, to support healthy ecosystems and healthy human communities. Achieve USEPA and CRWQCB water quality criteria or better throughout the entire watershed.

**Water Quality & Hydrology Objectives**

Evaluate & recommend potential solutions to:

a) Reduce concentrations of heavy metals, pesticides, and other toxic contaminants in the water column, stream and wetland sediments, watershed biota, and groundwater. Reduce these to concentrations lower than the maximum values recommended by the CRWQCB and US EPA, or better.
b) Lessen the conversion of elemental mercury to the more biologically available methylmercury in aquatic habitats.
c) Reduce aquatic concentrations of pathogenic bacteria, particularly in locations frequented by the public for aquatic recreation such as swimming, fishing, wading and boating. Decrease fecal coliform levels to less than a geometric mean of 200cfu/100 ml (CRWQCB 2016) and *E. coli* levels to less than a geometric mean of 100 cfu/100 ml (US EPA 2012), or lower.
d) Decrease anthropogenic sources of stream nitrates and phosphates. Decrease aquatic concentrations of nitrate to below 10 ppm (mg/L) and total phosphorus to below 0.1 ppm (mg/L), or lower.
e) Reduce turbidity and sedimentation in stream channels and reservoirs, to levels appropriate to the ecology and geomorphology of each site.
f) Improve the resiliency of the watershed's pH & conductivity patterns, within the ranges recommended by the CRWQCB (2016) as optimal for the majority of aquatic organisms (6.5-8.5 pH and less than 150 µS/cm conductivity).
g) Preserve dissolved oxygen levels high enough to support native aquatic species on a continuous basis: above 85% and above 7.0 mg/L (CRWQCB 2016), or better.

h) Sustain stream temperatures below 25 °C (CRWQCB 2016), with a frequency that supports aquatic life.
i) Identify and support ecosystem-sustaining stream flows.
j) Restore the natural hydrological functions of meadows, floodplains and riparian areas.
k) Protect headwaters from environmental impacts.
l) Encourage groundwater recharge.
m) Increase safe access to springs and other sacred waters for local indigenous peoples.
n) Improve the safety of natural drinking and swimming waters for all people and wildlife.
o) Improve public access to scenic waterways for low-impact, nature-based recreation.
p) Encourage water conservation.
q) Identify, plan and implement management actions necessary to improve aquatic ecosystem resiliency to the impacts of climate change.
r) Improve the understanding of water quality and quantity in the watershed through sound science.
s) Educate the community about water quality and aquatic ecology needs, impacts, conservation and restoration opportunities.

**Goal for Fisheries & Aquatic Life**

Preserve, restore & maintain thriving populations of diverse native fishes and aquatic invertebrates.

**Objectives for Fisheries & Aquatic Life**

Evaluate & recommend potential solutions to:

a) Improve water quality as discussed under water quality goal, especially in regard to temperature and flows.
b) Improve spawning, rearing, and holding habitat to increase emergence & survival of juvenile native fish.
c) Encourage structural habitat complexity in stream substrates and associated riparian habitats to support all life stages of native fishes and invertebrates (e.g., inter-gravel flow, cobbles, riffles, pools, large woody debris, shaded riverine aquatic habitat, emergent wetland vegetation, etc.).
d) Reduce barriers to upstream and downstream movement and migration of native aquatic species.
e) Support the downstream movement of a sufficient quantity and quality of gravels to support fish spawning and native benthic biota.

f) Support diversity and abundance of native aquatic invertebrates associated with healthy streams and other wetlands such as vernal pools.
g) Prevent or reduce the spread of exotic invasive species of aquatic plants, invertebrates, fish, and fish diseases, with an aim toward elimination.
h) Prevent entrainment of native fishes in stream diversions and intakes.
i) Improve safe and healthy human access to nontoxic fish catches at sustainable rates in lakes and streams.
j) Protect the cultural resource of native fish.
k) Improve aquatic ecosystem resiliency to climate change.
l) Preserve hardy, locally-adapted fish population genetics.
m) Improve the understanding of fisheries and aquatic ecology in the watershed through sound science.
n) Educate the community about local fish and aquatic ecology needs, impacts, conservation and restoration opportunities.

**Goal for Vegetation Communities**

Preserve, restore & maintain healthy, viable and diverse native plant communities which provide open space, wildlife habitat, and support terrestrial and aquatic ecological functions.

**Vegetation Community Objectives**

Evaluate & recommend potential solutions to:

a) Protect and restore native plant species, vegetation communities and ecosystems.
b) Identify, protect and increase populations of rare and special-status plant species
c) Identify and reduce non-native invasive plant species.
d) Identify, protect and increase populations of rare fungi and non-vascular plant species.
e) Improve data availability of plant species and vegetation community spatial locations.
f) Restore hydrological processes that support wetland plant communities.
g) Increase populations of plant species with special cultural significance to local indigenous people and provide access to gathering areas.
h) Protect and increase populations of important pollinator plants.
i) Preserve and restore healthy processes of upland soil water retention and infiltration, soil nutrient cycling and mycorrhizal relationships.
j) Restore natural fuel loads and fire regimes.
k) Protect and restore post-fire ecosystems.
l) Improve terrestrial ecosystem resiliency to emerging plant diseases and infestations.

m) Identify, plan and implement management actions necessary to improve terrestrial ecosystem resiliency to the impacts of climate change.
n) Improve sequestration of atmospheric carbon in native plant communities including oak woodlands, conifer forests, and soils.
o) Identify and address air quality impacts to the health of forests and other native plant communities.
p) Identify reference (control) sites to guide restoration prioritization and actions.
q) Manage appropriate vegetation communities in ways that support working landscapes.
r) Encourage a multi-ecosystem, watershed-scale approach to land use planning and management.
s) Preserve ecosystem connectivity by preserving a connected network of protected open space supporting view sheds and low-impact, nature-based recreation.
t) Improve the understanding of plant community ecology in the watershed through sound science.
u) Educate landowners, agencies and the public about the ecosystem services provided by native plant communities.

**Goal for Terrestrial & Riparian Wildlife**

Preserve, restore & maintain thriving populations and diversity of native birds, amphibians, mammals, reptiles, and invertebrates.

**Wildlife Objectives**

Evaluate & recommend potential solutions to:

a) Improve water quality, fisheries and vegetation communities as discussed with their goals, as they also affect wildlife.
b) Preserve large tracts of quality wildlife habitat through acquisitions, conservation easements, and conservation planning. Preserve natural areas large enough to support stable populations of species that require large home ranges (e.g., wolverine, bobcat, ringtail, etc.); smaller species will also benefit.
c) Protect wildlife movement corridors and habitat connectivity for species with seasonal overland migrations (e.g., deer on an elevational scale, turtles and amphibians on a smaller scale between waters and adjacent uplands). Protect habitat connectivity to facilitate successful dispersal of juvenile wildlife and the maintenance of genetic diversity.
d) In land use and conservation planning, include measures that account for potential shifts in wildlife species' geographic ranges and movements with climate change.

e) Prioritize the protection and restoration of riparian, wet meadow, vernal pool, and freshwater marsh habitats, as these cover a relatively small portion of the watershed but are of disproportionally large importance to many local wildlife species. They also hold significance beyond the watershed as stopover resting sites for migratory birds enroute to the north and south.
f) Improve habitat quality and complexity for wildlife species guild diversity in each of the watershed's ecosystems (e.g., oak woodland, coniferous forest, riparian, chaparral, meadow, marsh, vernal pool, etc.).
g) Identify, protect and restore populations of rare, native, special-status species and the specific habitat characteristics that best support their survival and reproduction (e.g., hydroperiod, water depth and flows, nest concealment, rookery sites, dens, snags, diverse multi-season food supplies, etc.).
h) Identify, protect and restore populations of wildlife species that hold special cultural and spiritual significance to local indigenous people and all people.
i) Protect populations of recreationally and/or economically important wildlife species.
j) Support diverse pollinator populations with larval host plants and long-season nectar sources.
k) Prevent or reduce the spread of emerging wildlife diseases and invasive wildlife species.
l) Restore a more natural trophic system by reducing human disturbances to the balance between apex predators, mesopredators, and prey species.
m) Improve air quality, as aerial pesticide drift has been shown to impact wildlife health.
n) Support wildlife-friendly agricultural practices with local farm partners to increase the quality and quantity of viable wildlife habitat.
o) Improve the understanding of wildlife ecology in the watershed through sound science.
p) Educate landowners, agencies and the public about local wildlife, their habitat needs and threats, conservation practices and restoration opportunities.

## CRWQCB Basin Plan Objectives

Following Section 13050 of the California Water Code and supported by Section 303 of the federal Clean Water Act, Basin Plans consist of a designation of beneficial uses to be protected in the waters of a specified area, water quality objectives and standards to protect those uses, and a program of implementation for achieving the objectives. The current, fourth edition of the Basin Plan for the Sacramento and San Joaquin River watersheds, which include the Bear River watershed, was revised by the California Regional Water Quality Control Board (CRWQCB) with federal Environmental Protection Agency (EPA)-approved amendments in July 2016 (CRWQCB 2016).

This Basin Plan includes water quality standards for both surface water and groundwater. Listed beneficial uses protected by the plan include drinking water supply, agricultural water supply, groundwater recharge, water contact recreation, wildlife habitat, fish spawning, and many others. In establishing water quality objectives to protect these beneficial uses, the Water Board considered economic limitations and the feasibility of controlling each water quality parameter via human activities, in addition to the science documenting water quality effects on beneficial uses. Basin Plan standards are established for bacteria, chemical constituents including heavy metals, dissolved oxygen and temperature, pH, pesticides, and other parameters. These standards are incorporated into the objectives of this Bear River Watershed Restoration Plan and are compared to available Bear watershed data in the Disturbance Inventory (Campbell *et al*. 2016).

As a result of failing to meet Basin Plan objectives and federal EPA standards, several water bodies within the Bear watershed are listed as impaired under Section 303(d) of the Clean Water Act (California Water Boards 2015).These include 21 miles of the lower Bear River (below Camp Far West Reservoir) listed for mercury, copper, and pesticide use (specifically diazinon and chlorpyrifos); all three major reservoirs (Camp Far West, Rollins Reservoir, and Lake Combie) and the middle Bear River mainstem (between Rollins and Camp Far West) listed for mercury; 23 miles of Wolf Creek and 2 miles of its tributary French Ravine listed for fecal coliform bacteria; and Yankee Slough in the lower watershed listed for the pesticide chlorpyrifos and an "unknown toxicity"(California Water Boards 2015).

## CABY IRWMP Goals and Objectives

The Integrated Regional Watershed Management Plan (IRWMP) for the Cosumnes, American, Bear, and Yuba (CABY) rivers region was adopted in May 2014.The following program areas, goals and objectives listed in the CABY IRWMP are within the scope of this Restoration Plan and are thus reiterated here for reference and to encourage collaboration. CABY program areas, goals and objectives that are within the scope of an IRWMP management plan but outside the scope of this Restoration Plan (e.g., development, lobbying) are not reiterated here, in order to focus this restoration planning stakeholder process and avoid excess duplication of efforts among watershed groups. More information on these and other program areas, goals and objectives is available within the CABY IRWMP (CABY 2014).

**Program Area: Water Quality**

Goal: Ensure sufficient water quality to support healthy ecosystems and dependent organisms.

Objectives:

- WQ-1: Remediate abandoned mining sites
- WQ-2: Remove legacy mining contaminants from region
- WQ-3: Increase the number of water bodies that can achieve water quality objectives
- WQ-4: Restore the natural sediment transport regime
- WQ-5: Assess the level of preparedness and prevention measures in place for wastewater spills
- WQ-6: Identify watersheds critical to major in-region urban areas' water supply
- WQ-7: Maintain watershed resilience
- WQ-8: Evaluate feasibility of a watershed and water quality "credit trading program"
- WQ-9: Improve habitat for aquatic biota

**Program Area: Environment and Habitat**

Goal: Preserve and restore watershed health.

Objectives:

- EH-1: Increase access to suitable spawning habitat for anadromous fish
- EH-2: Improve aquatic and riparian habitat
- EH-3: Quantify and/or secure habitat on rivers or tributaries with barrier-free ocean access
- EH-4: Enhance wet meadow-complex function
- EH-5: Increase fuel load management
- EH-6: Implement an Aquatic Invasive Species (AIS) Program
- EH-7: Implement coordinated non-native invasive plant education, prevention, and control actions

**Program Area: Climate Change**

Goal: Anticipate climate change needs and be prepared to respond adaptively to human and ecosystem needs.

Objectives:

- Objective: CC-1: Implement climate change adaptive management strategies
- Objective: CC-2: Increase alternative energy and energy efficiency

**Program Area: Human-Landscape Interaction**

Goal: Maintain and enhance functioning landscapes that provide sustainable services for humans.

Objectives:

- HL-1: Provide conservation stewardship for core and connected habitat
- HL-2: Increase involvement of Tribal entities in CABY activities
- HL-3: Implement flood risk reduction projects
- HL-4: Provide for permanent protection of open space
- HL-6: Increase recreational opportunities
- HL-9:Permanently protect agricultural lands

# 4. Proposed Projects and Strategies

## Bear Watershed Stakeholder Group Proposed Restoration Projects

If you are interested in working on a project or have details to add about the status, please update Appendix D: Restoration Project Status Updates with that information. Additionally, check Appendix D to see if the project is in progress and reach out to the appropriate contacts to become a collaborator.

Some projects below include a Project Development and Evaluation Form. These forms were completed by a group of stakeholders during a breakout session at a Stakeholder's Meeting. Please continue to add to these forms with relevant information or begin completing a form for a project that does not yet have one on file. A blank Project Development and Evaluation Form is found in Appendix F.

## Entire Bear Watershed

**Geospatial Assessment of Historical and Current Mines throughout the Watershed**

- **Project Description:** Beginning with the GIS maps of Bear Watershed mine locations, hydrography and land ownership published in the Bear Watershed Disturbance Inventory (Campbell *et al*. 2016), increase the mapped level of detail to include overlays of mine discharge transport systems and the sites which receive the most contaminants discharged from the mines (e.g., tunnels, sluice boxes, and sediment piles which may be on or off the actual mine property). Assess additional information layers identifying which mines were hydraulic mines vs. hard rock mines, data on which toxic heavy metals are known to occur at each site (e.g., cadmium, arsenic, lead, and other toxins in addition to mercury), and local tectonics. Utilize this increased level of detail to help prioritize cleanup and containment activities. This project could be performed in conjunction with the Storm Runoff Monitoring for Mercury Source Contamination project.

- **Project Objectives:** Prioritize sources of mine-related heavy metal contamination for future cleanup or containment.

- **Location:** Watershed-wide. The largest hydraulic mines in the Bear Watershed occur in the Upper Bear subwatershed between Greenhorn and Steephollow Creeks, and the largest hard-rock mines exist in the Wolf Creek subwatershed. However, the USGS Mineral Resources Data System (MRDS) lists 48 active and 426 historic MRDS mines (as of 2011), distributed across all five major subwatersheds of the Bear. The California Department of Conservation Principal Areas of Mine Pollution (PAMP) lists 74 additional PAMP sites throughout the Bear River watershed. Recent studies also suggest that more than 139 million cubic yards of hydraulic mining sediment remains stored throughout the watershed and is subject to remobilization during high flow events (Hunerlach *et al.* 1999).

- **Potential Project Partners:** USGS, California Dept. of Conservation, Sierra Streams Institute, Sierra Fund, Tahoe National Forest, BLM, Nevada County, City of Grass Valley, private property owners

- **Status Update:**

**Joint Powers Authority for Bear Watershed to Adapt to Climate Change**

➢ **Project Description:**

- **Background:**
  - Biomes shifting up 3000-4000ft, shift of composition and density of organisms
  - 12 month growing season in Bear
  - No freeze for germination of some plants
  - Evapotranspiration to 50% which changes base flows, 25% runoff change
- **Tasks:**
  - Assess biomass harvest potential in order to strategically place the plants
  - Identify jurisdictional authority
  - GIS modeling of target area

➢ **Project Objectives:**

- Biomass utilization and reduction in forests
- Sequester carbon as produced
- Reduce fire danger around human assets, subsidize reduction of fuels
- Water supply, studies on erosion, geomorphology changes
- Plan and implement strategically placed biomass plants to utilize Bear+Yuba+American Rivers

➢ **Location:**

- Bear Watershed. (Pilot project locations?)
- Hwy 80, 49, and 20 Freeway-sheds including areas that receive runoff from the freeways. (Explain why freeway degradation of water quality should be the basis of this JPA…)

➢ **Potential Project Partners:**

➢ **Status Update:**

**Reduce Point Source Pollution**

- **Project Description:** Contact the private company managers of the industrial point sources listed in the Point Source section above to encourage them to voluntarily upgrade their systems and reduce their discharges in exchange for community incentives. Discuss with those managers what incentives would be most motivating for them, and assess their feasibility. Seek state, federal, or other funding to assist the wastewater treatment plants also listed in the Point Source section above to upgrade plant technologies to reduce the amount of toxins they discharge into the watershed. Monitor toxic chemical concentrations above and below these sources and other sources of hazardous contaminants such as mine-related pollution. Use the data to assess the cumulative effects on the watershed of the many point sources, which may be more or less significant than the individual discharges themselves, and discuss with the CRWQCB to determine if additional 303(d) listings.

- **Project Objectives:** Reduce the amount of toxins released into the watershed from point source pollution.

- **Location:** The twelve Bear Watershed sites listed by FF Docket, NPDES, and TRI, first prioritizing the public service facilities (wastewater treatment plants & Empire Mine State Park), as they may be more feasible to partner with than the private manufacturing companies.

- **Potential Project Partners:** EPA, CRWQCB, SSI, WCCA, American Rivers, cities, counties, neighborhood associations served by the wastewater plants, engineering consultants with expertise on technologies to reduce toxic releases, and the point sources themselves.

- **Status Update:**
  - 2017: In progress- state & federal

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Nov 15, 2017
# Reduce Point Source Pollution

1. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
   Add any new updates to the project description
   Contaminants – Heavy Metal, Mercury
   Sources: 4 manufactured, 3 mines, 5 WWTP
   What permits are out there?
   Who is enforcing them?
2. **PAST PROJECT MODELS**
   Identify other past projects that could serve as models for this project.
   Work w/ regulators
   Citizens for a better environment – group with similar mission

3. **MEASURABLE RESULTS:**
   a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |

| | | |
|---|---|---|
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: | Other: | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: |
| | | |
| | | |

***b. Circle or list project deliverables: Partially complete***

Maps Plan Implemented Restoration Educational Materials Signs Assessment Monitoring Design Plan Mitigation Plan
Other: Project Profile – pollutant constituents, permit, monitoring, compliance, financial incentives

**4. OBJECTIVES: Not completed**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Fisheries and Aquatic Life Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Vegetation Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Terrestrial and Riparian Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan: Partially complete***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply
Water Treatment Groundwater Wastewater Treatment
Adaptation to Climate Change

Other: Community – public recognition

Increase Industry Standard,

5. **RESOURCES / SKILLS**

   a. **Team:**
   Circle those that apply and add
   Project Manager GIS Permitting Specialist Surveyor Designer
   Engineer Educator Outreach Coordinator
   Other:
   - Data monitor
   - Economist
   - PR
   - Lawyers
   - Industry specific specialists

   b. **Equipment: Not Complete**
   Circle those that apply and add
   Dewatering Equipment Ground Moving Equipment
   Other:

   c. **Funding Sources:**
   Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.
   - Legal
   - State/regional Board
   - Discharger (not foundation)
   - 5 star program
   - 309 program

6. **TASKS**
   PHASE 1 :

   1. Assessment & research - Identify : consituents, process, treatment, compliance regulations, permits

2. Create " Project file" for each point source
3. Interact w/ regulation - how people are complying with permits
4. Break into groups of similar dischargers (i.e. WWTP, hard rock mines, etc.) to work on pilot programs.

PHASE 2: (PER GROUP)

1. Prioritize which discharger is best for pilots
2. Identify specific goals for chosen pilot
3. Implement program
4. Evaluate effectiveness

**7. CONCEPTUAL COST / BENEFIT COMPARISON: Partially Complete**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs:

Benefits:

See measurable results

Hurdles: Cooperation, industry by in, regulators are already in charge of this, push back

**8. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

1. Bring everyone to compliance
2. Evaluate river health
3. If bad, does policy needs changing

**9. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

- Regulators
- Consultants - H&K , Stantec
- Industry associates- to determine incentives

- Chamber of commerce - Better business bureau – give awards , increase incentives
- Citizens for a Better Environment

**10. ANY ADDITIONAL NOTES:**

Incentives – No dischargers fees, public recognition, apply less for less rigorous permit.

**Groundwater Contaminant Remediation**

- **Project Description:** Provide financial and technical support to landowners whose wells are currently known to be contaminated with toxic chemicals, to help them remediate their wells and/or protect themselves with filters and improved upper seals. Remove buried gas tanks (a major historical source of contamination) from any remaining locations and replace with safer above ground storage tanks. Increase groundwater testing to identify additional wells in need of remediation.
  - Background Info:
    - The USGS is currently conducting a Shallow Assessment in the Yuba and Bear River Watersheds as a part of the Groundwater Ambient Monitoring and Assessment (GAMA) Program.
      - The Yuba/Bear Study Unit was sampled May 2016; 75 wells were sampled in equal area 12 $mi^2$ grid. The report is expected to become available by the end of summer 2017.
      - USGS Project Manager: Jennifer Shelton. Phone: 916-278-3068, Email: jshelton@usgs.gov.
      - Sampling Protocol: U.S. Geological Survey National Field Manual (https://water.usgs.gov/owq/FieldManual/)
      - Interactive Project Map: https://waterboards.maps.arcgis.com/apps/webappviewer/index.html?id=1ea24606744847f3b7f1222289264e53.
      - Areas to expand on study: Research human health effects of contaminates and treatments
    - GAMA Domestic Well Project Groundwater Quality Data Report Yuba County Focus Area, July 2010
      - Private domestic wells in Yuba County were sampled in 2002 as part of the GAMA Domestic Well Project. Yuba County was selected for sampling due to the large number of domestic wells located within the county and the availability of well-owner data. A total of 128 wells were sampled by Water Board staff, primarily in the valley and foothill areas of the county. The 128-well total includes wells sampled as part of an initial domestic well pilot project, and includes several wells in surrounding Sutter, Butte, Placer, and El Dorado Counties.

- **Project Objectives:** Restore contaminated wells to drinking water standards and prevent future groundwater contamination.
  - Phase I: Identify Wells
    - Submit an information request to DWR for all well logs they have on file for a study area - http://www.water.ca.gov/groundwater/wells/well_completion_reports.cfm

    - Contact Landowners – Ask to receive a copy of their well groundwater quality report (if they have recently had their well sampled) or ask for permission to sample their well.
    - Review USGS Report – Identify data gaps and future areas to study.
  - Phase Ii: Provide treatment options for contaminants found
  - Phase III: Identify Point Source
    - Map Wells: The goal is to get good geographic distribution. Strategically recruit additional landowners (or install wells) to achieve uniform distribution
    - Conduct Sampling Program: Gather GPS coordinates, wellhead elevation, analyze samples for volatile organic compounds (VOCs), pesticides/herbicides, common anions/cations, and metals
    - Analyze Data: Determine groundwater flow direction, identify impacted wells, and evaluate land use and potential contamination sources up gradient of impacted wells.
  - Phase IV: Remediate Point Source Pollution
  - Phase V: Establish ongoing monitoring program
    - Use monitoring information to inform on: regional groundwater recharge trends, land use changes, surface water interactions, new sources contamination, reservoir level operation decisions and/or water withdrawal decisions.

➢ **Location:** Watershed-wide, with priority focus areas in the Rattlesnake Creek area of the Wolf Creek subwatershed (near Grass Valley), the Magnolia Creek area of the Middle Bear subwatershed (near Lake of the Pines), and the Grasshopper Slough and Best Slough areas of the Dry Creek subwatershed (near Wheatland). Known contaminated well locations are mapped in the Bear Watershed Disturbance Inventory (Campbell *et al*. 2016).

➢ **Potential Project Partners:** SWRCB, USGS, private landowners, Steve Baker.

➢ **Status Update:**
  - 2017 - awaiting latest USGS data

**Riparian Habitat Restoration and Enhancement**

➢ **Project Description:** Improve habitat quality along streambanks & widen overall riparian corridors with direct on-the-ground restoration projects that would remove exotic plants, plant natives, stabilize banks, and improve the hydrology needed to sustain the restored riparian vegetation.

➢ **Project Objectives:**

- Reduce streambank erosion
- Increase shade to reduce stream temperatures to benefit a diversity of native fishes
- Increase availability of large woody debris to improve stream habitat complexity for fish and provide basking sites for native turtles, snakes & frogs
- Increase the abundance and nest survival of riparian tree/shrub-associated songbirds & raptors by increasing cover, width & density of riparian shrubs, trees and vines such as willows, cottonwoods & wild grape
- Increase the abundance and nest survival of freshwater marsh/floodplain-associated birds such as black rails, tricolored blackbirds, and other birds associated with by improving those habitats where applicable
- Increase habitat for valley elderberry longhorn beetles at applicable elevations (some landowners may desire a Safe Harbor Agreement prior to planting elderberries)
- Increase habitat for native pollinating insects with long-season riparian nectar sources and larval host plants

➢ **Location:** The first step would be to identify and prioritize available locations based on landowner participation, species presence, and current habitat conditions. This can be informed in part by:

- special-status species presence mapped in the Disturbance Inventory (Campbell *et al*. 2016);
- high-priority invasive plant populations mapped in the Disturbance Inventory;
- public lands & conservation easements mapped in the Disturbance Inventory; and
- private landowner relationships with NRCS, BYLT, Placer Land Trust, UC Extension & County RCDs;
- USFWS's recent study of potential salmon habitat on Dry Creek; and
- Studies associated with the Camp Far West FERC relicensing process.

➢ **Potential Project Partners:** SSI, USFWS, CDFW, Friends of Spenceville, Beale AFB, NRCS, BYLT, PLT, NRCS, Wildlands conservation bank, SSWD, NID, UC Extension, County RCDs, County Planning Depts., Placer Legacy.

➢ **Status Update:**

**Public Education for Riparian Habitat Stewardship**

- **Project Description:** Develop & distribute a public education program to inform private landowners of best management practices for stewardship of riparian areas, including agricultural buffer widths, grazing restrictions in riparian areas, native/invasive plant identification, the most effective removal & planting techniques, etc.

- **Project Objectives:**
  - Restore contaminated wells to drinking water standards and prevent future groundwater contamination.
  - Increase favorable biotic factors to improve habitat conditions.
  - Increase awareness of stewardship within the community of private landowners.

- **Location:** The first step would be to identify and prioritize available locations based on landowner participation, species presence, and current habitat conditions.

- **Potential Project Partners:** Private landowners**,** SSI, USFWS, CDFW, Friends of Spenceville, Beale AFB, NRCS, BYLT, PLT, NRCS, Wildlands conservation bank, SSWD, NID, UC Extension, County RCDs, County Planning Depts., Placer Legacy

- **Status Update:**

**Watershed-friendly Farming Collaborations**

➢ **Project Description:**

- Background: Seco is an example of sustainable farming outside the Bear watershed, and the Mokulumne watershed has good examples of programmatic safe harbor agreements and supporting native wildlife (birds, bats) that prey on agricultural pests, to both ecological and economic success.
- Collaborate with farmers on incentives and techniques to voluntarily reduce pesticide use, pesticide toxicity (product selection), and/or pesticide runoff while maintaining farm production and income. Collaborate with farmers on incentives and techniques to voluntarily reduce phosphate fertilizer use and/or runoff. NRCS, UC Extension, and other agricultural support organizations already administer these programs with great success, and the watershed could benefit from an expansion of their services to reach more farmers who are currently on the waiting list for NRCS support. Expansion could come in the form of increased funding for those existing NRCS/etc. organizations and programs, or potentially in the form of additional community organizations serving farmers that don't qualify for NRCS/etc. (e.g., enhancement vs. restoration). Leverage funds by producing demonstration projects that can serve as educational models for other farm sites.

➢ **Project Objectives:**

- Reduce pesticide use, toxicity, runoff, and aerial drift, especially of organophosphate insecticides but also of other insecticides and popular herbicides such as Roundup and Rodeo
- Reduce phosphate use & fertilizer runoff in watershed
- Reduce topsoil erosion and sedimentation of waterways
- Improve the habitat quality of riparian buffer zones and reduce stream temperatures with riparian shade
- Improve farm production & income
- Improve community support & market for local, eco-friendly farm products
- Increase the frequency of use of best management practices
- Strengthen regulatory policies on pesticide use & do so with farmers' input & recommendations

➢ **Location:** Most large-scale, intensive row crops, hay fields, orchards, herbicide & insecticide use occur in the Lower Bear subwatershed and the lower portion of the Dry Creek subwatershed, west of Camp Far West Reservoir, so this would likely be the highest-priority area. Additional, smaller-scale agriculture that may also benefit from this program occurs throughout the Bear watershed, with concentrations in the Chicago Park area and exurban home sites surrounding Grass Valley.

➢ **Potential Project Partners:** NRCS, County RCDs, County Ag Commissioners, UC Extension, Beale AFB, Farm Bureaus, County Farm Advisors, Farm Services Agencies, Cal-IPC, Dept. Pesticide Regulation, CRWQCB, Fish Friendly Farming non-profit organization, BYLT, PLT, SSI

➢ **Status Update:**

- 2017 - Some sites in progress - NRCS

**Agricultural Hedgerows for Wildlife Habitat, Native Plants, and Pollinators**

- **Project Description:** There is a formalized set of agricultural management practices that are recommended for vineyards, orchards & more. These practices can be seen at such locations as Sidehill Farms in Placer County, various farms in Sutter County, Llana Seco farms, and Mokelumne Watershed farms. This project would support wildlife friendly agricultural practices that include native plant hedgerows with local farm partners to increase viable habitats and educate and increase understanding of ecosystem services provided by healthy vegetation communities

- **Project Objectives:**
  - Protect and increase populations of important pollinator plants
  - Reduce pesticide drift to adjacent lands

- **Location:** Agricultural lands throughout the watershed.

- **Potential Project Partners:** Fish Friendly Farming, UCANR, NRCS, Sidehill Farms, Llano Seco farms in collaboration with USFWS or CDFW, Mokelumne Watershed farmers in collaboration with East Bay MUD

- **Status Update:**
  - 2017 - Some sites in progress - NRCS

**River Ambassador Program for Bear River**

➢ **Project Description:**

- **Background:** Due to a foreseeable increase in recreation and recreation's known impacts on the river, there is a planned need for management at trails connecting to the Bear.
- **Tasks:**
  - Apply the model of SYRCL's successful Yuba River Ambassador program to recreational sites in the Bear Watershed, educating recreators through one-on-one conversations about ways to minimize disturbance.
  - Erect signage and involve traditional and social media to spread the Leave No Trace message, particularly in relation to human and dog waste, litter, the recreational spread of invasive species (terrestrial and aquatic plants and animals), and accidental fire.
  - Erect, regularly empty and maintain portable toilets, dog waste bag dispensers, and trash bins at popular recreational destinations.
  - Launch an Adopt-a-Trail or Adopt a Swimming Hole citizen program similar to the Adopt-a-Highway program, where citizens and/or groups can pledge to help clean up and maintain their favorite sites on a regular basis and receive public accolades through signage and/or media as an additional incentive. Adopters could be taught to identify and properly remove invasive plants like Scotch broom at their sites in addition to picking up trash.
  - Increase Bear Watershed representation in the Great Sierra River Cleanup / Yuba River Cleanup annual events (five sites were represented in 2016). Also educate the public (with in-person discussions, signage and media releases) about the watershed's monitoring results, including recreator safety related to swimming at sites contaminated with bacteria and eating fish contaminated with mercury.

➢ **Project Objectives:**

- Prevent recreational degradation of the Bear River, especially at new recreation sites.
- Educate recreators on how to minimize disturbance.
- Educate and recruit Bear River stakeholders.
- Reduce the amount of bacterial contamination and litter at recreational sites.
- Prevent recreation-started wildfire and slow the spread of invasive species.
- Reduce the incidence of recreator illness caused by watershed contaminants.

➢ **Location:** Hidden Falls Ranch is a planned priority for Placer County. Other recreation sites that could benefit from this program include CDFW's Bear River Campground; Spenceville Wildlife Area; Empire Mine State Historic Park; Memorial Park; Wolf Creek at Wolf Road and Hwy 49, the water skiing club below Camp Far West, the mainstem Bear River at Hwy 49, Hwy 174, and Dog Bar Rd.; other known swimming holes; the watershed's reservoirs

and campgrounds, and the trails mapped in the Bear River Watershed Disturbance Inventory (Campbell *et al*. 2016).

- **Potential Project Partners:** SYRCL, WCCA, BYLT, Parks & Recreation and/or Planning departments of the four Counties, CDFW, State Parks, NID, YWCA, SSWD, The Sierra Fund, Friends of Spenceville, Sierra Academy of Expeditionary Learning, Colfax High School, Bear River High School, Bear River Key Club (adopts Bear River Crossing at Dog Bar Rd. for each year's Yuba River Cleanup event), Grass Valley Charter School (4th graders have adopted Bennett St. Meadow for the annual Yuba River Cleanup event) Wheatland High School, Marysville High School, Nevada Union High School, local homeowners associations, Lake Combie fishing club, Waste Management may provide dog waste bags or provide in-kind pick-up for public relations benefits or mitigation.

- **Status Update:**

**Identify and Protect Serpentine and Gabbro Soil Plant Communities Watershed-Wide Including Federally Endangered Stebbins Morning Glory**

- **Project Description:** Identify locations of federally rare plants such as Stebbins' morning-glory, Pine Hill ceanothus, Pine Hill flannelbush, and Layne's butterweed. Currently known Bear Watershed locations are documented by CNDDB and mapped in the Bear River Watershed Disturbance Inventory (Campbell *et al*. 2016). However, only a small portion of the watershed has been surveyed for these special-status plants, and more occurrences likely exist. This project would use soil surveys to locate areas potentially suitable for these species, contact willing landowners, and hold rare plant treasure hunts with the California Native Plant Society to survey for species presence. If new occurrences are found, incentives may be offered to landowners for conservation easements, habitat stewardship, and/or conservation acquisition. If the focal species are absent at locations where habitat quality is suitable, reintroductions may be considered.

- **Project Objectives:** To protect rare and endangered species and the ecosystems that support them.

- **Location:** Areas with appropriate soil types throughout the watershed.

- **Potential Project Partners:** CNPS, USFWS (also as a potential funder), CDFW, private landowners.

- **Status Update:**

**Invasive Terrestrial Plant Removal Projects**

- **Project Description:**
  - **Background:** There is a strong need to fill data gaps of targeted invasive plant species abundance and location throughout the watershed in order to prioritize invasive plant control needs. Invasive plant management is likely to become more crucial in the face of climate change.
  - **Tasks:**
    - Mitigate the expansion of invasive species and target & prioritize new infestations
    - Develop community outreach programs.
    - Engage local organization with California Invasive Plant Council (Cal-IPC) to assist with county and watershed wide invasive species reporting and data tracking.
    - Set up Early Detection Rapid Response strategies to new species threats.

- **Project Objectives:** Prioritize invasive species and locations; and include removal in all projects.

- **Location:** Identify locations of existing priority invasive terrestrial and aquatic species watershed wide

- **Potential Project Partners:**
  - Allan Eberhart, Gregg Bates, Chuck Carroll, USFWS, CDFW
  - Fire Safe Council - eg. Scotch Broom Days - Good public education opportunity
  - Weed Management Areas (WMAs) are local stakeholder groups, organized by county through county Agricultural Commissioners' offices, who develop a strategic plan that identifies top priorities for local weed management. The Bear River has two active WMAs, Placer/Nevada County and Yuba/Sutter County. WMAs plan and implement projects on-the-ground, collaborate on mapping and public education, and are likely to be a great resource.
  - Funding: Sierra Nevada Conservancy, foundations, WMAs

- **Status Update:**

**Improve Septic Systems in Existing, Infill, and New Development**

- **Project Description:** Launch a data collection initiative to precisely locate the sources of the watershed's known bacteria problems. Work with County planning agencies and other partners to discuss the location results and collaboratively craft a suite of potential remediation solutions. Solutions related to septic system sources of bacterial contamination will necessarily differ from solutions related to other sources. Follow up on a quarterly basis and/or when watershed monitoring indicates a change in conditions.

- **Project Objectives:** Improve water quality in watershed by reducing discharge and runoff from antiquated and new septic systems.

- **Location:** The Bacteria section above lists the watershed monitoring locations where monthly water quality data collection has identified bacteria problems. Additional types of data, potentially including PCR analyses, would be necessary to more precisely locate the sources of the bacteria. The geographic distribution of septic systems throughout the watershed may be documented at the four County planning agencies.

- **Potential Project Partners:** CNPS, USFWS(also as a potential funder), CDFW, private landowners.

- **Status Update:**

**Coordinated Response for Homeless Services and Watershed Protection**

➢ **Project Description:**

- **Background**: In September 2016, a cigarette at a homeless person's campsite reportedly accidentally started the 47-acre Auburn Fire in Grass Valley, between a residential neighborhood and the Empire Mine State Historic Park in the Wolf Creek subwatershed of the Bear (YubaNet 2016, CalFire 2016). The adjacent Yuba Watershed's 33,700-acre 49er Fire of 1988 was also reportedly started accidentally by a homeless person burning his toilet paper (The Union 2002, KNCO 2013). Although lightning strikes and other events start a larger percentage of wildfires than do accidents caused by people without homes, all sources of wildfire risk are of concern to home owners and to watershed health. Without easy access to indoor plumbing and waste pick-up services, people without homes may also pollute waterways with litter and bacteria from human waste, although the amount they contribute relative to other sources of watershed bacteria contamination and litter is unknown. This same group of people is also possibly the most vulnerable to the risk of illness from poor water quality, as clean treated or well water for drinking, cooking and bathing is less available without indoor plumbing and homeless people may be more dependent on creek water for these essential tasks. The current climate between homeless services agencies, fire prevention agencies, law enforcement, watershed protection organizations, home owners, and homeless people themselves is often polarized, and more coordinated communication toward a shared vision for watershed and community health may be helpful (The Union 2016a).
- **Tasks:** Hire a neutral, independent facilitator to bring together the disparate stakeholders involved with this issue for a sharing of information, perspectives, needs, constraints, and individual strategies. Collectively shape a shared, coordinated, sustainable strategy to improve watershed protection and the lives of homeless people at the same time. Include watershed concerns in the agendas of existing strategic planning efforts that address issues of homelessness.

➢ **Project Objectives:**

- Improve each stakeholder's understanding of the other stakeholders and the issues at hand.
- Decrease the risk of accidental wildfire sparked within homeless encampments.
- Reduce the pollution of water quality as related to trash and human waste.
- Reduce the incidence of water quality-related illness among all watershed residents.
- Increase the availability and accessibility of shelter, heat and indoor plumbing for all watershed residents, as this may reduce watershed risks as well as benefit people.
- Address the educational, vocational, social, substance abuse, mental health, economic and societal issues that affect some peoples' access to permanent homes, which in turn affects their interaction with the watershed.

- Create a plan to improve future conditions in the watershed and human community, with a shared commitment to implement.

➢ **Location:** Areas where the need is present in homeless communities.

➢ **Potential Project Partners:** California AML (contact Glenda Marsh), database used by USFS to share info, Hospitality House, Utah's Place, Divine Spark, Sierra Roots, Spirit Peer Empowerment Center, County Social Services, County Mental Health and Substance Abuse Services, CalFire, Grass Valley Fire Department, watershed-wide County and City planning and law enforcement, City Councils, County Boards of Supervisors, State Parks, BLM, homelessness consultant Robert Marbut, independent facilitator. Contact Bruce Herring.

➢ **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Nov 15, 2017
# Coordinated Response for Homeless Services and Watershed Protection

11. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**

    Add any new updates to the project description

    Where is the biggest problem? When?

    - Steephollow (lower)
    - BLM land
    - NID (ask Greg)

    Contact sheriff's Dept. for info

12. **PAST PROJECT MODELS**

    Identify other past projects that could serve as models for this project.

    Ask Richard Thomas

    New homeless housing project - NC

13. **MEASURABLE RESULTS:**

    a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions | # of volunteers | # $ increase in property values |

| | | |
|---|---|---|
| reduced | | |
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: Reduce trash | Other: Reduce fire hazards | # $ replacement cost of ecological services |
| | # of accidental fires reduced | # $ averted costs of wildfire fighting |
| | Increased shelter | Other: |
| | Increased conversation and connections b/w communities & homeless | |
| | | |

***b. Circle or list project deliverables:***

Stakeholder Group, Baseline Conditions

Maps Plan Implemented Restoration Educational Materials Signs Assessment Monitoring Design Plan Mitigation Plan
Other:

- Multiple project plans (Varies)
- Evaluations or monitoring results

**14. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

A C D F K M N O R S

**Fisheries and Aquatic Life Objectives:**

A C G I N

**Vegetation Objectives:**

J

**Terrestrial and Riparian Objectives:**

A E F G H I L O P

**b. *Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply Water Treatment Groundwater Wastewater Treatment Adaptation to Climate Change

Other: Fire Mitigation, Better community relations, safety, public health, education

15. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer Engineer Educator Outreach Coordinator

Other: Police enforcements, Social Services, Fire Dept
Outreach coordinator- Homeless Shelter Rep.
Project coordinator, WQ specialist

**d. Equipment:**

Circle those that apply and add

Dewatering Equipment Ground Moving Equipment

Other: Baseline equipment- Water Quality Supplies, GIS mapping

**e. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.

16. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: Assemble stakeholder's team: Project partner, existing programs, Possible projects.

Task 3: Evaluate existing condition

- WQ, Fire, # of homeless
- Recent fire data
- Baseline information
- Habitat quality

Task 4: Coordinated project implementation by individual discipline specific project partners in communication w/ each other.

Task 5: monitoring/ evaluation of project

Task 6:

Task 7: Project Reporting

**17. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs: Money needed for Coordinating groups, equipment, and time.

Benefits: Measurable results increased community health, argument for why this issue needs attention, provide quantitative results, resilience for homeless/community

Hurdles: Community interactions / getting people to help, funding for implementation.

**18. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

**19. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

- **NID**
- **BLM**
- **USFS**
- **Sheriff dept.**
- **Homeless shelter (Richard Thomas)**
- **Church**

**In addition to any project partners**

**20. ANY ADDITIONAL NOTES:**

**Bear Watershed Welcome Road Signage**

➢ **Project Description:**

- Install roadside signs on major highways and routes at the boundaries of the Bear Watershed indicating to drivers when they are entering or leaving the Bear River Watershed. Locations to post signs would include Hwy 49 (in Grass Valley and Auburn), Hwy 174 (near Colfax), Dog Bar Road (near Lake of the Pines), Hwy 20 (near headwaters), Hwy 65 and 70 (south of Olivehurst), Hwy 80, etc.
- Create a website that describes current restoration efforts, project background and ways for people to get involved. Include link to the resource publications in the Bear Watershed Stakeholder Group's Google Drive library. As a possible alternative to the cost of creating a new website, could simply update the Bear Watershed page on Sierra Streams Institute's website: http://www.sierrastreamsinstitute.org/BearRiver.html. Additional website name suggestions include BearWatershed.org, BearRestoration.org, BearRestorationCA.com, and others. BearRestoration.com is unavailable.
- List website on highway signs.

➢ **Project Objectives:** Increased public education, citizen awareness and community involvement related to the Bear River Watershed, its restoration needs and planned/completed restoration projects. Would apply to both residents of and visitors to watershed.

➢ **Location:** Major highways and routes at the boundaries of the Bear Watershed such as Hwy 49 (in Grass Valley and Auburn), Hwy 174 (near Colfax), Dog Bar Road (near Lake of the Pines), Hwy 20 (near headwaters), Hwy 65 and 70 (south of Olivehurst), Hwy 80, etc.

➢ **Potential Project Partners:** Watershed residents, Caltrans, Bureau of Reclamation, and conservation groups

➢ **Status Update:**

**Fish Consumption Advisories and Public Education**

- **Project Description:** Some fish from reservoirs and rivers in the Bear River Watershed and greater Sierra Nevada Watersheds contain high levels of mercury, which can cause health problems if consumed. Using the work of the Sierra Fund and others as a model and the Bear-specific mercury data collected by the USGS and others and summarized in the Bear Watershed Disturbance Inventory (Campbell *et al.* 2016), research, plan, and implement a public education program. This education program will include an open dialogue and participation from the community to include the needs and concerns of the stakeholders in the area.

- **Project Objectives:** Increase human health by decreasing human consumption of contaminated fish.

- **Location:** Rollins Reservoir, Combie Reservoir, Camp Far West Reservoir, Bear River Campground

- **Potential Project Partners:** Sierra Fund, CABY, NID and SSWD as the reservoir owners, OEHAA to administer the advisory and create signs, Lake Combie Fishing Club, CDFW Bear River Campground, private operators of the four campgrounds surrounding Rollins Reservoir, Tahoe National Forest (contact Carol Purchase), Sierra Streams Institute.

- **Status Update:**
  - 2017 - In progress- TSF

**Bear Watershed Data Accessibility**

- **Project Description:** Publish the results of watershed monitoring data through multiple public media outlets on a regular basis (quarterly, annually, and/or when significant changes are noted). Include local newspapers, radio, television, YubaNet, online social media, town posters, bill stuffers, and/or State of the Watershed events. Interpret the results in these publications to help non-scientists understand the data's import and what recommendations may help improve the watershed parameter being reported on. When possible, include suggestions for what the general public can do to help, in addition to what larger agency projects are proposed to address the issues at hand. Also improve and maintain public access to the stakeholder group's watershed publications library (currently on Google Drive and accessible online via the following link: https://drive.google.com/open?id=0B41PFmjcAZs-RDVBY1B5ckF1VWM), and continue to update this library with each new study that is published in the future.

- **Project Objectives:** Increase public understanding of watershed conditions and public concern for watershed health. Recruit volunteers and donors to support watershed monitoring and restoration. Facilitate additional collaboration and mutual understanding among stakeholders for restoration projects.

- **Location:** N/A

- **Potential Project Partners:** All stakeholders that collect environmental and ecological data in the watershed: SSI, WCCA, USGS, CRWQCB, USFS, USFWS, BLM, CDFW, NID, PCWA, SSWD, CNPS, Cal-IPC, Institute for Bird Populations, Point Blue Conservation Science, Sierra Foothills Audubon Society

- **Status Update:**

**Bear Watershed Restoration Symposium**

- **Project Description:** Organize a community conference and public education event that presents the Bear Watershed's ecology, human context, challenges, and opportunities, including the information provided in the Bear River Watershed Disturbance Inventory and project proposals presented in the Bear River Watershed Restoration Plan, and incorporating a wide range of presenting stakeholders.

- **Project Objectives:** Educate the community about the Bear Watershed stakeholder process. Increase public understanding of watershed issues and public concern for watershed health. Recruit volunteers and donors to support watershed restoration. Facilitate additional collaboration and mutual understanding among stakeholders for restoration projects. Educate the public about things they can do to benefit the watershed. Increase community participation in watershed conservation and restoration.

- **Location:** N/A

- **Potential Project Partners:** All stakeholders

- **Status Update:**

**Reducing the Spread of Invasive Aquatic Species (clams, algae, snails, etc.)**

- **Project Description:** Employ the following strategies to prevent infestations and transport.
  - Surveys for presence
  - Work with reservoir managers
  - Mandatory boat inspections
  - Provide boat washing stations
  - Education at reservoirs about aquatic invasives
  - Education in schools
  - Posting signs about invasive species along with fish advisory signs
  - Education among fishing clubs (both reservoir and stream)
  - Decontamination procedures for boots, waders and equipment among water quality monitors

- **Project Objectives:** Prevent the spread of invasive aquatic species in order to protect native species assemblages and infrastructure.

- **Location:** Rollins, Combie, Camp Far West, and Lake of the Pines reservoirs as well as NID waterways and recreational fishing sites along the main stem Bear River and tributary streams

- **Potential Project Partners:** NID, SSWD, Lake of the Pines Neighborhood Association, USFS, Gold Country Fly Fishers, Northern California Federation of Fly Fishers, Lake Combie Fishing Club, boating/fishing supply stores

- **Status Update:**

**Reducing Oil Pollution from Storm water on Roads and Parking Lots**

- **Project Description:** Refer to local storm water management plans. Promote the use of permeable surfaces in new road/lot construction & resurfacing projects. Work with USFS to decommission old logging roads where feasible. Work with counties, cities and developers on design techniques to minimize runoff on planned new roads. Promote the use of hybrid & electric vehicles, public transportation, carpooling, & human-powered transportation. Improve access to safe bike lanes to make bicycle commuting more feasible. Investigate the feasibility of mycoremediation in appropriate locations.

- **Project Objectives:** Reduce vehicle-related pollution of waterways.

- **Location:** Watershed-wide, with special focus on areas planned for new development

- **Potential Project Partners:** Cities, Counties, Caltrans, private developers

- **Status Update:**

**Diverting Disposal of Pharmaceuticals & Household Hazardous Waste for Water Quality**

- **Project Description:** Make proper disposal more convenient for community members, in order to increase the percentage of household hazardous wastes and pharmaceuticals that are disposed of properly instead of being flushed downstream with wastewater or placed in landfill-destined trash. Work with pharmacy owners and staff to provide on-site collection receptacles for patients to bring their expired medications (prescription and over-the-counter) for disposal, to keep these receptacles continuously available rather than only on scheduled collection events, and to amicably remind customers about proper disposal when they pick up their new prescriptions. Work with hardware stores, garden stores, and technology stores to establish similar programs for household hazardous wastes related to their products. Work with Waste Management to provide curbside pickup of household hazardous wastes in separate receptacles on recycling pickup days, provide neighborhood stations for convenient disposal, and/or receive these wastes at the local dump or transfer station daily or more often than the current system of periodic collection events. Educate community members about proper disposal of household hazardous wastes and pharmaceuticals with a friendly, positive tone. Monitor program results with community behavioral surveys, transfer station data collection, wastewater treatment plant testing, and/or creek testing for these specific chemicals, which are not funded by baseline water quality monitoring programs.

- **Project Objectives:** Prevent the disposal of household pharmaceuticals and household hazardous waste into wastewater that is discharged into rivers or leaks into groundwater.

- **Location:** Watershed-wide

- **Potential Project Partners:** pharmacies, hardware stores, garden stores, technology stores, Waste Management, counties, neighborhood associations

- **Status Update:**

**Prescribed Burns**

➢ **Project Description:**

- Identify locations in the Bear Watershed where the tool of prescribed burning would be expected to benefit ecosystem function without endangering homes or other structures.
- Implement prescribed burns with timing and management specifications that best meet the needs, existing conditions, and future goals for each site.
- Monitor the vegetation, wildlife community, and water quality at these sites and corresponding control sites to assess the projects' results and to inform adaptive management for the future.

➢ **Project Objectives:**

- At appropriate locations, low-severity prescribed burns can improve soil fertility, reduce thatch to improve rainwater infiltration, release seed banks, facilitate regeneration, and diminish fuel loads that would otherwise pose risks for high-severity wildfires.
- When performed in consultation with local Native American tribes, prescribed burns also provide an opportunity to blend science-based ecological restoration practices with traditional ecological knowledge, thus supporting cultural restoration as well as ecosystem restoration.

➢ **Location:** Area where prescribed burns would improve ecological conditions.

➢ **Potential Project Partners:** CalFire, NRCS, USFS, BLM, CDFW, Nisenan tribes of the Nevada City Rancheria and Colfax Rancheria, United Auburn Indian Community, BYLT, PLT, SSI, and private landowners where appropriate

➢ **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Aug 2, 2017
# Prescribed Burns

1. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
   Add any new updates to the project description
   - Needs contractor skilled/permit
   - Distance remediation from waterways?
   - Need to prioritize site → homeowner Insurance → ie. Lowel Fire area.
   - Use Lidar to find site.
   - Recent Burn areas would be buffer zones
   - Prior need to do thinning

2. **PAST PROJECT MODELS**
   Identify other past projects that could serve as models for this project.
   - Look into TNF, BLM, State Park, Cal Fire as partners in  Fire Safe Council

3. **MEASURABLE RESULTS:**
   - ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, health | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |

| | | |
|---|---|---|
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced - Study? | | # $ averted from maintenance or repair of infrastructure damage |
| Other: | Other: | # $ replacement cost of ecological services |
| Reduce risk wildfire scorch habitat | Protection of rural community | # $ averted costs of wildfire fighting |
| | | Other: |
| | | Fire Insurance |
| | | Economic: Biochar, Chips, Biomass Energy |

- ***Circle or list project deliverables:***

Maps: Homeowner Insurance Plan: "THP" Timber Harvest Plan CEQA.
Implemented Restoration Educational Materials Signs
Assessment Monitoring: Long term management plan Design Plan Mitigation Plan
Other:

4. **OBJECTIVES:**
   - ***Bear River Restoration Plan Objectives***
     Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

D E F H I J K L N O Q S

**Fisheries and Aquatic Life Objectives:**

A B D

**Vegetation Objectives:**

A B C D E F G H I J L M Q R S U

**Terrestrial and Riparian Objectives:**

A B C D E F H I J K L

- ***Multisector Benefits - Other Benefits Outside the Bear River Plan:***
  How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply Water Treatment Groundwater Wastewater Treatment Adaptation to Climate Change

Other:

5. **RESOURCES / SKILLS**

- **Team:**
  Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer Fire Engineer Educator Outreach Coordinator

Other:

- CCC
- Fire Specialist
- Economist + Forester RPF → Tie into carbon forest & carbon banking #'s
- Agency Collaboration
- Forester

**b. Equipment:**
Circle those that apply and add
Dewatering Equipment Ground Moving Equipment

Other:

- Chipper
- Lider

**c. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind etc.

SNC, Prop 1, Cal Office Emergency Service, CFIP through Cal Fire, Homeowners Association, CABY IRWMP

6. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: Permitting, Planning

Task 3: Education Outreach

Task 4: Prioritize sites (Lowell; Buffer zone; pilots) → Homeowners Association; designate fire safe community

Task 5: Thinning the area, remove or burn pile, Masticating

Task 6: OUTPUT: Biomass/Biochar uses → La Bar Meadows; Wood product (biofibers, chips) → UCD with CCC ;

Task 7: Monitoring (Pre & Post)

Task 8: Prescribe Burns

Task 9: Project Reporting

**7. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs: Expensive!

Forest Service: Need to address 5,000 AC/Yr, only get to 10 AC/YR

Benefits:

Hurdles:

**8. SEQUENCING *Not Completed***

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

9. **DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

   **NID** → Greg, All the agencies on Page 1

10. **ANY ADDITIONAL NOTES:**
    - **UCB Department of Forestry now owns PGE lands in upper watershed**

**Create a Bear Watershed Breeding Bird Atlas**

➢ **Project Description:**

- Modeled on and including data from the in-progress Nevada County Breeding Bird Atlas, map the breeding ranges of each bird species present in the Bear River Watershed. Publish the results along with information on public lands where recreational birdwatchers can look for these species. Compare the results to past and future datasets to analyze change in the watershed's avian community over time.

➢ **Project Objectives:**

- Increase public awareness of and interest in bird conservation. Provide watershed-scale data with which to evaluate correlations in bird species ranges and their changes over time with climate change, development, habitat protection, spread of invasive species, fire, and other parameters. Support conservation measures for rare and special-status species by locating hot spots in their geographic ranges.

➢ **Location:** Watershed-wide

➢ **Potential Project Partners:** Sierra Foothills Audubon, Sierra Streams Institute, Institute for Bird Populations, Point Blue Conservation Science, USFS, BLM, BYLT, PLT, Counties

➢ **Status Update:**

- 2017 - Nevada County in progress- Audubon

**Plan to Support Vegetative Communities and Micro-habitats that Adapt to Climate Change**

➢ **Project Description:**

- Measure endemic ranges
- Use USGS climate models to predict next 100 years
- Use existing data on climate-related shifts in the geographic ranges of plant and animal species and communities
- Research Technical Guides and work with UCANR
- Provide vegetation habitats for changes in wildlife geographic ranges (e.g., tricolored blackbirds moving up in elevation)
- Prioritize early detection and control or eradication of invasive species (e.g., star thistle) at the growing upper elevational boundaries of their range
- Plan for long-term habitat connectivity among conservation easements and acquisitions
- Consider long-term landscape connectivity when new developments are proposed
- Plan and plant species that reflect changes in plant micro-habitats under climate change; ideally use local plant stock

➢ **Project Objectives:**

- Protect and restore common native plant species, vegetation communities and ecosystems
- Improve vegetation community resiliency to plant diseases and pests
- Improve vegetation community resiliency to the impacts of climate change
- Improve sequestration of atmospheric carbon in vegetation communities including oak woodlands, conifer forests, and soils
- Guide vegetative restoration for adaptation to climate change
- Ensure that wildlife continue to have functional movement corridors, given this long-term change in their home ranges & habitats.

➢ **Location:**

- Relevant to entire watershed. Prioritize data collection and planning for special-status species and populations that are expected to be more highly fragmented or more vulnerable to future fragmentation (e.g., vernal pool species, serpentine endemics, wet meadow obligates, special-status amphibians, carnivores with large home ranges).

➢ **Potential Project Partners:**

- Sierra Nevada Research Station Browns Valley, Universities, Bear Yuba and Placer Land Trusts, CDFW, USFS, Counties

➢ **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Plan to Support Vegetative Communities and Microhabitats that Adapt to Climate Change
# Nov 15, 2017

21. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**

Add any new updates to the project description

Project Priorities:

Keystone species and habitat
Vernal pools
Riparian areas/springs/fens/wetlands
Increase resilience of vegetation species
Riparian wildlife habitat foothill yellow legged frog, Chat, etc.
Rare Natural Communities
Rare Plant Species

22. **PAST PROJECT MODELS**

Identify other past projects that could serve as models for this project.

-Need to identify other projects in Sierra Nevada regarding species response to climate change

23. **MEASURABLE RESULTS:**

a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction – Sensitive not resource protection | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites | # Yr. level of flood protection | # $ increased due to more spending |

| | | |
|---|---|---|
| improved habitat<br>-Wildlife corridor | | near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: increased resilience and sensitive plant species and vegetation communities protected | Other: | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps Plan Implemented Restoration Educational Materials Signs Assessment Monitoring Design Plan Mitigation Plan
Other:

**24. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:** NOT DONE!

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Fisheries and Aquatic Life Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Vegetation Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Terrestrial and Riparian Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply Water Treatment Groundwater Wastewater Treatment Adaptation to Climate Change

Other: Protecting sensitive plants and habitats for the Sierra Nevada

25. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer Engineer Educator Outreach Coordinator

Other: CDFW, NID, TNF, BLM, Private Landowners, Bear Yuba and Placer Land Trusts

**f. Equipment:**

Circle those that apply and add

Dewatering Equipment Ground Moving Equipment

Other: GPS, GIS, maps,

**g. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.

-USFWS Section 6 rare plants and wildlife habitat

- CDFW – Land acquisition

26. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: Identify priority species and habitats; Include research on other similar projects in Sierra Nevada or look at species specific studies

Task 3: Identify current and potential landowner involvement

Task 4: Survey sites, determine threats, and identify additional land needed to support migration

Task 5: Identify management needs, actions, and best management practices

Task 6:

Task 7: Project Reporting

**27. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs:

Benefits:

Hurdles: Identifying best management and protection practices to support vegetation communities in light of unknown climate change impacts and vegetation responses

**28. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

Need to prioritize data collection to identify most important sites or species.

**29. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

Greg- NID- Geological Maps for potential rare plant sites
CDFW- land acquisition funds: acquire essential lands for rare species protection and migration
Placer and Bear Yuba Land Trust - Conservation easements for essential lands allowing for shift in ranges or habitats

**30. ANY ADDITIONAL NOTES:**

- Riparian , North facing slopes
- Stantec / Morgan- Has information on using existing data on climate related shifts in the geographic ranges of plant and animal species and communities
- Address threats that are compounding climate change - prioritize protecting these areas; overgrown/competing forests
    - How can we remove additional stressors
- Which communities? Keystone species/habitats? Specific sites?
    - Springs/riparian/fens/wetlands/vernal pools
    - Reliant animal corridors
    - Upper watershed, meadows, Serpentine (limited meadows in the bear, not much snow pack)
- Find and use existing data on climate movements
- Determine microhabitat with most benefit (ie. Water storage, biodiversity)
- Finding endangered species on land easements, communication with landowners
- Bear river disturbance inventory wetlands map
- Assisted migration? Plantings? Who would we collaborate with?
- Purchase habitat for connectivity movement corridors
- Purchase conservation easements BYLT and PLT
    - Prioritize conservation easement locations

**Implementation of Plan for Ecosystem Adaptation to Climate Change**

➢ **Project Description:**

- **Background**:
  - How to adapt to climate change, its associated droughts, fires, and tree mortality; and the consequent upslope movement of species and ecosystems?
  - How to incorporate this issue into land acquisition (& easement) planning for conservation? Need more data & predictive models to help prioritize where the next "conservation hot spots" may be. Consider climate change when evaluating locations at the fringes of an ecosystem or species' geographic range, and when evaluating locations in the interior of a geographic range that are otherwise at the fringes of a species or plant community's ideal microclimate conditions (consider slope, aspect, hydrology, etc.). Consider the likely future drought resiliency of parcels when prioritizing acquisitions & easements, as well as forest health & bark beetle resiliency if applicable.
  - How will climate change affect the forest succession process after logging and fire?
  - Develop outreach materials and educational programs to encourage landowners, developers, hardware stores and plant nurseries to focus on drought-tolerant native plant species and to avoid the use of invasive species.
  - Develop outreach materials and educational programs to share best management practices with neighboring landowners to help steward ecosystems. In ranching areas, these may include stream setbacks, livestock exclusion fencing & rotations.
- **Tasks**:
  - Use planning for vegetation migration under climate change outcomes to implement vegetative management.
  - Consider increased impacts of drought, pests and pathogens
  - Use prescribed burns
  - Provide training areas
  - Local Models: Demonstration Forests UC Field Station Grouse Ridge

➢ **Project Objectives:**

- Implement Vegetation Plan for Bear watershed vegetative communities adaptation under climate change

➢ **Location:** Watershed-wide

➢ **Potential Project Partners:** NRCS, CDFW, USGS mercury researchers, Hawkins Canyon residents and BLM, Fire Safe Council, UC Berkeley Demonstration Forest, USFS, Todds Valley, Colfax, Spenceville wildlife area

➢ **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Aug 2, 2017
# Implementation of Plan for Ecosystem Adaptation to Climate Change

1. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
   Add any new updates to the project description
   - Focus on upper watershed is suggested due to landowners however, this discredits valuable ecosystems in the lower watershed.
   - Upper Bear First
   - Possibility of apocalyptic change
   - Pick Upper Bear - Low fruit phase
   - Define ecosystem with stakeholders.
   - Bear River is a good pilot watershed for climate change studies: Below snow zone. Foothills and upper valley ecosystems. Foothills _ with climate change there will be a shift in biodiversity ranges. Test case – assume movement of organisms' upslope and North. Establish refugia and test cases.
   - Best area for pilot study in the Bear Watershed is upper Bear watershed between Bear Valley and Rollins – UC Berkeley School of Forestry (owns most of land, has owned it for less than a year, no planning process yet, mostly biomass mgt for forest health and fire protection, managing toward old growth) So would be possible to have one plot which is starved for fire, overstocked and not managed and compare to test plots that have been burned. US forest service, Blm and a few landowners having ownership of other land there. Otis Wolan is funded to converse about these possibilities.
   - Important for first steps to find out what are the valuable resources in these areas that need to be preserved Compare areas.
   - Ideas to put in plan:
     - Carbon flow – need it to be sequestered. Bio-char so we can tap into C sequestration funding.
     - Talk to Chris Paulis – retired chief battalion officer.

2. **PAST PROJECT MODELS**
   Identify other past projects that could serve as models for this project.
   - Bay Area Climate Change Initiative

- TBC3 - Terrestrial Biodiversity climate Change Collaborative
- Tahoe Management Plan
- PG&E Management Plan now that it is divested Stewardship Council
- UC Berkeley constraints
- Model with similar goals: Bay Area Climate Change Initiative – broke out different ecosystems and looked at land managers within each. Who are they? First identify important people. Used Climatic deficit modeling to find out where there is most projected water deficit and ecosystem change.
    - Also included maps that showed higher and lower risk zones. This would help us figure out where the highest priorities for restoration are.
    - Morgan Kennedy worked on this. Knows other scientists in state to talk to about Climate Change model. Will contact us.
- USGS Loraine and Alan Flint developed Climate Change deficit model.

3. **MEASURABLE RESULTS:**
    a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| **ENVIRONMENT** | **COMMUNITY** | **ECONOMY** |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |

| | | |
|---|---|---|
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: Watershed Yield - so we can get NID into the fold if more water downstream. Let them figure it out. Potential for increased hydro and water supply revenue partnerships. | Other: BLM to be Partner | # $ replacement cost of ecological services |
| Local Acre ft price | | # $ averted costs of wildfire fighting |
| | | Other: |
| | | |
| | | |

***b. Circle or list project deliverables:***

Plan: Watershed Impact, Land Use, Scientists (continued monitoring to inform land rights)
Assessment Monitoring: Baseline
Restoration
Other:

- Climatic Water Deficit Models - Projection for 100 years based on water and biodiversity including resource values to these areas.
- Integrating concept under the conditions of Catastrophe. Have to ratchet it up. Reuse existing plans to adapt to extreme stuff.
- Creating a forum. Scientific forum for unveiling. Creating a symposium - speakers.

**4. OBJECTIVES: ****Not Completed****

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

**Fisheries and Aquatic Life Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

**Vegetation Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

**Terrestrial and Riparian Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply
Water Treatment Groundwater Wastewater Treatment
Adaptation to Climate Change

Other:

5. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer
Engineer Educator Outreach Coordinator
Other: Hydrologist, Ecologist, Geomap, Modelers

**b. Equipment: *Not completed***

Circle those that apply and add
Dewatering Equipment Ground Moving Equipment

Other:

**c. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind etc.

Collaboration of land owner funding and resource agencies (eg. open space, land trust, etc.)

6. **TASKS *See RED document for Diagram***

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: Plan for Land Managers. Symposium (Single event). Identify "test lab" sites.

Task 3: Identify time frame (present and future). Yearlong Stakeholder Dialogue. Work with

landowners to agree to "test lab" sites.

Task 4: Monitoring to inform process & planning. Pilot Upper Bear

Task 5: Set agencies input on what they need to see in a land management plan to be useful.

Guidebook - Public Info

Task 7: Project Reporting

FOR PLAN:

- Invite landowners and key personnel to gather information about what is happening on the upper Bear land and also what scientific studies have been done. Then make next steps for climate change plan. What do we have and where can we go with this right now?
- Should we target high value hotspots through modeling? Pull together data and overlap it all. Need spots that have lots of data to measure change to know how to manage land. Test plots to see if management is working.
- Test plot in Upper Watershed because fewer landowners.
    - Area is large enough and have owners who can talk about crisis management due to climate change
- Invite Nevada County biomass group leader.
    - Are there a different way cost effectively to deal with biomass, tree death. Think creatively. Nevada County Biomass taskforce: get info from Otis. Steve Eubanks impt to contact about this.
- Steephollow would be good test plot in upper watershed.
- Talk to Lauren Clark. Legacy Program. Placer Legacy did a huge amt of education to stakeholders. County wide plan - Failed. Got a conversion fee for

western placer developments. Fees only allowed to be used in that area. Look at Placer Conservation plan. Also go back 20 years to Legacy plan to see projects. PCCP is funded by 2/3 fees. County has to come up with other funding for plan. Contact Loren Clark.

- Otis and others are thinking about forming Friends of Placer Legacy to revive those legacy projects. And to make Placer County put in their 1/3 of the funding. Look to see if there are projects that are in the Bear watershed.
- To write plan:
    - We need stakeholder dialogue about old plans to make a new climate change plan.
    - What are gaps to understanding climate change? What do we do with biomass?
    - We need a group to oversee implementation of plans.
- We also need a guide for land managers to explain what climate change looks like and how they could manage their land better while dealing with climate change. Could go thru the elements needed. Could be adapted as time goes on. Educates public and can be for everybody. Use the pilot studies in Upper bear to discuss how to manage land and write about it in guidebook. One developed for N Bay. Landowners contributed.
    - Morgan Kennedy will provide products that were produced in North Bay.
- On Bearriver.us: There is a map of Bear Valley to Rollins. Map of pilot area for our test case. Carbon sequestration project?

**7. CONCEPTUAL COST / BENEFIT COMPARISON *Not Completed***

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs:

Benefits:

Hurdles:

**8. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

More than one project/Multi-phased
Test Pilot suggested in Upper Watershed - Steephollow

**9. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

**YES - Funded by Wildlands Foundation to do this well into 2019.**
**otiswollan@gmail.com**

**10. ANY ADDITIONAL NOTES:**

- What are known climate land management practices?
- Quantify ecosystems and resources within
- land management - low lying fruit of lands easy to access
- Develop forum with landowners and key personnel to assess need and develop peace - Symposiums are already happening
- Literature review and outreach; many of projects have already been developed in other regions of CA.
- Note: Define climate change - this process has shown me that there are very broad and different perspectives - especially in regards to timeframe - of how climate change is perceived.
- Water Supply partners: NID, PCWA
- Climate change is catastrophic. Therefore - apply techniques for management, planning, and success monitoring at organizations such as FEMA & OES. “Normal” planning is not feasible for catastrophic conditions.

**Joint Powers Authority for Bear Watershed to Adapt to Climate Change**

- **Project Description:**
  - **Background:**
    - Biomes shifting up 3000-4000ft, shift of composition and density of organisms
    - 12 month growing season in Bear
    - No freeze for germination of some plants
    - Evapotranspiration to 50% which changes base flows, 25% runoff change
  - **Tasks:**
    - Assess biomass harvest potential in order to strategically place the plants
    - Identify jurisdictional authority
    - GIS modeling of target areas
    - Identify a community - feasible, infrastructure as a management tool to prevent runoff; monitor it to see if it improves water quality
      - Pilot for county wide infrastructure to implement on roads
      - Pilot studies that citizens help implement
    - Outreach and education to gain community participation and private owner behavior change

- **Project Objectives:**
  - Biomass utilization and reduction in forests
  - Sequester carbon as produced
  - Reduce fire danger around human assets, subsidize reduction of fuels
  - Water supply, studies on erosion, geomorphology changes
  - Plan and implement strategically placed biomass plants to utilize Bear, Yuba, and American Rivers

- **Location:** Watershed-wide

- **Potential Project Partners:** USFS, BLM, NRCS, private landowners

- **Status Update:**

**Erosion Control**

- **Project Description:**
  - Preserve and restore the forest and watershed function to slow sediment gathering in the river during high precipitation events.

- **Project Objectives:**
  - Improve forest health
  - Improve water quality

- **Location:** Overgrazed pastures, dirt roads, post-fire areas

- **Potential Project Partners:** Resources agencies, NID, NRCS, County

- **Status Update:**

**Road Disturbance Inventory**

- **Project Description**:
  - Preserve and restore the forest and watershed function to slow sediment gathering in the river during high precipitation events.
  - Preserve and restore processes of water infiltration and nutrient cycling in soils which support vegetation communities

- **Project Objectives:**
  - Improve forest health
  - Improve water quality

- **Location:** Dirt roads watershed wide

- **Potential Project Partners:** CalTrans (funding), Green Sticker (funding), resources agencies, NID, USFS, BLM, PG&E, Nevada Placer Counties

- **Status Update:**
  - USFS, AR, & SSI- implementing in neighborhood watershed

**Rare Plant and Plant Community Protection**

➢ **Project Description:**
- Identify, protect and increase populations of special-status plants species and rare natural communities

➢ **Project Objectives:**
- Educate and increase understanding of ecosystem services provided by healthy vegetation communities

➢ **Location:** Identify soils, nearby populations, background data, and vegetation maps to guide field surveys
- Prioritize surveys of gabbro and serpentine soil plant communities
- Populate plant species and vegetation community location data quantitatively and qualitatively throughout watershed using GIS, CalFlora, CNDDB/BIOS
- Revisit CNDDB sites to confirm observations and document

➢ **Potential Project Partners:** CNPS, BLM, USFS, collaboration with local colleges and student theses, USFWS Partners Program (funding)

➢ **Status Update:**

**Phytoremediation of Heavy Metal Contaminants**

➢ **Project Description:**

- Develop a project to reduce the amount of, and exposure to, toxic heavy metal contamination at the source by implementing a pilot phytoremediation research project in the Bear River Watershed. This project would begin by measuring the amounts of heavy metals currently within the plant tissues, associated soils and adjacent waters at existing sites where willows and other plants with known or potential phytoremediation properties are currently growing within mine tailings, along mine-associated drainages, hydrologically connected springs, and/or other potential discharge sites of heavy metals.
- It would then take a further step to experimentally plant known hyper accumulating species at a contaminated site and a control site and monitor plant growth, metal concentrations in plant tissues, soil metal concentrations, and water quality at these sites over time. Use Sierra Streams Institute's phytoremediation study at Providence Mine as a model, as well as other relevant studies.

➢ **Project Objectives:**

- Reduce heavy metal contamination downstream of legacy mining activities.
- Improve water quality, stabilize soils, and increase native vegetation cover.
- Publish the results in a scientific journal to advance the state of the science, thus benefitting future remediation efforts in the Bear watershed and elsewhere

➢ **Location:** Several potential sites exist throughout the Bear River Watershed, primarily but not exclusively in the Upper Bear and Wolf Creek subwatersheds. Potential sites for the first-stage plant surveys include willows growing in the Idaho-Maryland Mine tailings near Peaceful Valley Farm Supply in downtown Grass Valley; the Bennett Street meadow and other sites within or adjacent to Empire Mine State Historic Park; along the banks of Greenhorn and Steephollow Creeks below the Red Dog-Chalk Bluff complex of hydraulic diggings; privately owned spring-fed ponds and drainages that are hydrologically connected to the Red Dog-Chalk Bluff diggings and where sulfur-releasing, potentially mercury-methylating bacteria have been detected; along the banks of Million Dollar Creek on Tahoe National Forest lands within the Steephollow subwatershed; and more.

➢ **Potential Project Partners:** Sierra Streams Institute, Sierra Fund, TNF, BLM, USGS, Empire Mine State Historic Park, the City of Grass Valley, university researchers, and private property owners (some of these private landowners have already agreed to partner with SSI to aid ecological data collection and/or restoration on their property)

➢ **Status Update:**

**Phytoremediation of Nonmetal Contaminants**

➢ **Project Description:**

- Develop a project to reduce the amount of, and exposure to, toxic hydrocarbon contamination by implementing a pilot phytoremediation research project at one or more contaminated sites and paired control sites in the Bear River Watershed. Phytodegradation and phytostimulation, two types of phytoremediation where plants and/or their associated microbes take up pollutants from the soil and degrade them into nontoxic components, are typically more successful for hydrocarbon-based pollutants than other types of pollutants. Fungal species have also been identified that successfully perform this service. Start with an evaluation of whether any of the known Bear Watershed locations with hydrocarbon-contaminated groundwater wells have associated topsoil-level contamination that could potentially benefit from phytoremediation, and whether any of the applicable public or private landowners would be willing to participate in such a study.
- Design experimental plantings in a statistically defensible manner and measure the results in plant tissue, soil, and water runoff. Also consider among the watershed's many roads, where experimental roadside phytoremediation plantings, bioswales and the like may be most effective at reducing the transport of petroleum runoff from roads into local waterways. Prioritize experimental roadside sites based on land ownership, traffic volume, topographic and hydrological considerations related to the paths of expected contaminant runoff, and current roadside conditions related to the feasibility of planting and maintenance.

➢ **Project Objectives:**

- Reduce hydrocarbon contamination in the Bear watershed. Improve water quality, stabilize soils, and increase native vegetation cover. Publish the results in a scientific journal to advance the state of the science, thus benefitting future remediation efforts in the Bear watershed and elsewhere.
- **Location:** Watershed-wide potential, specific pilot sites to be determined

➢ **Potential Project Partners:** Sierra Streams Institute, NRCS, County RCDs, Caltrans, County and City Public Works departments, university researchers, USGS, private landowners with contaminated groundwater wells and soils, local wastewater treatment plants, and experts from the Humboldt State University/City of Arcata partnership which successfully purifies wastewater via phytoremediation

➢ **Status Update:**

## Above 2,000-ft Elevation in Multiple Subwatersheds

### Planning for Fuels Reduction in the Bear Watershed

➢ **Project Description:**

- Review Bear data to prioritize treatment areas based on high fire risk and proximity to communities, infrastructure or high potential to impact water quality or forest
- Cal Fire's Fire Hazard Severity Zone Maps for SRA's
- Review timber harvest plans
- Review similar fuel reduction projects completed or proposed in watershed
- Review emerging data on wildlife response to fuels reduction treatments and make recommendations for how to balance fuels reduction with wildlife habitat structural complexity and diverse food sources (e.g., berries from key understory hardwoods, flowering shrubs of special importance to pollinators)
- Produce prioritized treatment plan for the Bear Watershed

➢ **Project Objectives:**

- Protect and restore common native plant species, vegetation communities and ecosystems;
- Preserve and restore processes of water infiltration and nutrient cycling in soils;
- Improve vegetation community resiliency to plant diseases and pests;
- Improve vegetation community resiliency to the impacts of climate change;
- Improve sequestration of atmospheric carbon in vegetation communities including oak woodlands, conifer forests, and soils
- Conserve wildlife habitat with a nuanced approach

➢ **Location:**

- Cal Fire has prioritized areas across the state for fuels reduction and forest health treatment needs. Evaluate how these locations overlap with the Bear Watershed, and perform additional prioritization mapping at the subwatershed scale, with particular attention to the Wildland Urban Interface (WUI).
- NID is also concerned about fire risk on BLM lands above Rollins

➢ **Potential Project Partners:**

- Cal Fire: CA Forest Improvement Program; SRA Fire Prevention Fund and Tree Mortality Grant Program
- Fire wise committees
- BLM, TNF and other State and Federal land management agencies
- NRCS
- UC Berkeley Demonstration Forest
- SSI, BYLT and other non-profit organizations

➢ **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Nov 15, 2017
# Planning for Fuels reduction in the Bear River Watershed

31. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**

No Timber

Meadow Restoration Bear Valley

- Infrastructure
- Buffer around Wilderness Urban Interface
- Water Quality Concerns
- Mine Sites
- Beetle Kill and high tree mortality sites
- Power Lines
- Federal Energy Regulation Commission (FERC)Requirements
- High Environment Consequences

32. **PAST PROJECT MODELS**

Identify other past projects that could serve as models for this project.

-Don't have details but there are many projects. They are models in which to start, but improvements can be made.

Tahoe National Forest projects

NID Scotts Flat projects

33. **MEASURABLE RESULTS:**

a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated (WCCA, C of GV) | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction (high; soil testing) | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |

| | | |
|---|---|---|
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: | Other:Near proposed trails | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps Plan Implemented Restoration Educational Materials Signs
Assessment Monitoring Design Plan Mitigation Plan
Other:

**34. OBJECTIVES: NOT COMPLETED**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circlethe corresponding letters.

**Water Quality and Hydrology Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

**Fisheries and Aquatic Life Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

**Vegetation Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

**Terrestrial and Riparian Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W XY Z

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply
Water Treatment Groundwater Wastewater Treatment
Adaptation to Climate Change

Other: Water Quality Turbidity and Heavy Metals

35. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer
Engineer Educator Outreach Coordinator
Other: CALFIRE Land Owners

**h. Equipment:**

Circle those that apply and add

Dewatering Equipment Ground Moving Equipment
Other: Fuel Reduction contract crews have equipment

**i. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.
-NID, SNC, CALFIRE, Greenhouse Gas Reduction Funds

36. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: Identify Partners (Federal and State Agencies, private landowners, Cities, Counties)

Task 3: Identify Locations and Prioritize (near communities, water or other utility infrastructure, mines)

Task 4: Environmental Analysis (Determine permit needs) NEPA, CEQA, California Dept of Fish and Wildlife

Task 5: Project Design and Treatment Actions

Task 6: Implementation: Find contractors

Task 7: Project Reporting

**37. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs: Permitting, Contractor labor crews,

Benefits: Water Quality, forest and vegetation health, wildlife habitat protection

Hurdles: Cost, access, land ownership, environmental analysis and permitting

**38. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

- Look at the landscape level then identify priorities and get details

**39. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

BLM, SPI, PG&E, TNF, NID

**40. ANY ADDITIONAL NOTES:**

Prioritization map should include areas with high environmental consequences

Some Project ideas

- Brunswick Idaho Maryland is in Wildland Urban Interface

Location, homeless; BYLT ; NID easement
3-4 Acres – Categorical exemption, No permitting
Add grass valley sections

- Bear Yuba Land Trust NRCS project areas in middle Bear
- PG&E, NID, BYLT - Below Spaulding upper water shed
- NID powerhouses
- Drum Fore Bay – Chicago ditch flat

**Improve Forest Resiliency to Drought and Beetle Infestations**

➢ **Project Description:**
- Coordinated management, information sharing, and monitoring on public lands and private land trust lands with trees at risk of mortality from the recent bark beetle epidemic.
- Implement forest health practices to increase tree vigor and resiliency.
- Public education program to advise residential landowners facing this issue.
- To the extent feasible, retain snags killed by past beetle infestations, as they provide important wildlife habitat.
- Remove snags that pose public hazards.
- Help landowners to remove small groups off trees using "Splat," a commercially available chemical that mimics an anti-aggregation pheromone produced by the type of bark beetles that attack sugar pines and lodge pole pines (not ponderosa or Jeffrey pines) to deter beetle colonization.

➢ **Project Objectives:**
- Maintain forest health
- Restore natural fuel loads and fire regimes
- Protect wildlife habitat and public safety

➢ **Location:** Prioritize sites based on the Tree Mortality Maps created by CalFire and USFS

➢ **Potential Project Partners:** CalFIP and Tree Mortality grants are possible, and cost sharing may also be possible with other agencies.

➢ **Status Update:**

## Below 3,000-ft Elevation in Multiple Subwatersheds

### Watershed-Friendly Ranching Collaborations

➢ **Project Description:**

- Collaborate with ranchers on incentives and techniques to voluntarily reduce livestock impacts on riparian areas (fecal contamination, herbivory on riparian vegetation, & soil impacts) while maintaining livestock access to water and shade. Encourage rotational grazing management to promote native plant species in oak woodlands and grasslands while reducing invasive plant species. NRCS, UC Extension, and other agricultural support organizations already administer these programs with great success, and the watershed could benefit from an expansion of their services to reach more ranchers who are currently on the waiting list for NRCS support.
- Expansion could come in the form of increased funding for those existing NRCS/etc. organizations and programs, or potentially in the form of additional community organizations serving ranchers that don't qualify for NRCS/etc. (e.g., enhancement vs. restoration). A public education program could also include a plenary at the Food and Farming Conference sponsored by Sierra Harvest and/or other public events. Also collaborate regarding grazing management in the summer range, often in upper elevation meadows and forests, where impacts can occur.

➢ **Project Objectives:**

- Reduce pathogenic bacteria abundance in watershed
- Reduce streambank erosion & soil compaction
- Reduce stream temperatures with riparian shade
- Protect & restore riparian habitats in rangelands
- Increase carbon sequestration in oak woodland and grassland soils and vegetation
- Improve the habitat quality of riparian buffer zones
- Improve ranch production & income
- Improve community support & market for local, eco-friendly ranch products

➢ **Location:** Most livestock ranching takes place in the Middle Bear and Dry Creek subwatersheds at grassland/oak woodland elevations, especially in the areas between Camp Far West and Hwy 65.

➢ **Potential Project Partners:** NRCS, County RCDs, County Ag Commissioners, UC Extension, Beale AFB, BYLT, PLT, SSI, Farm Bureaus, Cattlemen's & Cattlewomen's Associations, County Farm Advisors, Farm Services Agencies, Cal-IPC, Dept. Pesticide Regulation, CVWRCB, Sierra Harvest, NID, UC Field Station Browns Valley, Placer County Planning Department, PCCP, CDFW, Friends of Spenceville, United Auburn Rancheria.

➢ **Status Update:**

- 2017 - Some sites in progress- NRCS

**Foothill Oak Woodland Protection and Restoration**

➢ **Project Description:**
- Protect and restore common native plant species, vegetation communities and ecosystems
- Identify, protect and increase populations of special-status plants species and rare natural communities
- Increase populations of plant species with cultural significance to local indigenous people, increase access to gathering areas, and use Traditional Ecological Knowledge, for vegetation management

➢ **Project Objectives:**
- Identify and eradicate priority non-native invasive plant species
- Restore natural fuel loads and fire regimes
- Improve sequestration of atmospheric carbon in vegetation communities including oak woodlands, conifer forests, and soils
- Control wild pigs to minimize impacts to native plant communities.

➢ **Location:** Beale, Spenceville, Land trust conservation easements, private landowners

➢ **Potential Project Partners:** Land trusts, CDFW, Friends of Spenceville, UC Field Station Grass Valley, NRCS, Wildlands Foundation

➢ **Notes:** Establish Blackheaded Grosbeak Liberation Front as the figurehead for springtime celebration of The Range of Light

➢ **Status Update:**
- 2017 - Some sites in progress- BYLT, PLT

**Vernal Pool Protection (Acquisitions & Easements)**

➢ **Project Description:**
- Outreach and fundraising to acquire land or conservation easements for land containing vernal pools and special-status vernal pool species.

➢ **Project Objectives:**
- Protect sensitive vernal pool ecosystems & populations of rare vernal pool plants & crustaceans.

➢ **Location:** Beale, Spenceville, Land trust conservation easements, private landowners

➢ **Potential Project Partners:** Private landowners with vernal pool species mapped in Disturbance Inventory, BYLT & PLT to acquire land or easements, Carol Witham, USFWS habitat acquisition funds for sites with rare plants

➢ **Status Update:**
- 2017 - Some sites in progress- Placer Co.

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Aug 2, 2017
# Vernal Pool Protection

1. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
   Add any new updates to the project description
   - Occupancy rates of Vernal Pools for mitigation areas quality
   - Acres - Quality
   - How many pools are actually protected? What is acreage?

2. **PAST PROJECT MODELS**
   Identify other past projects that could serve as models for this project.
   - Spenceville
   - Placer County Conservation
   - Beale
   - Mitigation Banks - monitoring

3. **MEASURABLE RESULTS:**
   a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |

| | | |
|---|---|---|
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: | Other: | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps Plan Implemented Restoration Educational Materials Signs Assessment Monitoring Design Plan Mitigation Plan

**4. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:** *Not Completed*

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Fisheries and Aquatic Life Objectives:** *Not Completed*

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Vegetation Objectives:**

A B E

**Terrestrial and Riparian Objectives:** *Not Completed*

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

***Protecting whole natural communities**

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan:*** *Not Completed*

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply
Water Treatment Groundwater Wastewater Treatment
Adaptation to Climate Change

Other:

5. **RESOURCES / SKILLS**

   a. **Team:**
   Circle those that apply and add

Project Manager: Land trust GIS Permitting Specialist Surveyor Designer
Engineer Educator Outreach Coordinator
Other: Botanist

   b. **Equipment:** *Not Completed*
   Circle those that apply and add
   Dewatering Equipment Ground Moving Equipment

Other:

   c. **Funding Sources:**
   Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.
   Mitigation funding, PCCP, NFWF, In Lieu FCE

6. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: LIDAR Data for mapping - PCCP Depressional Wetland Index Ecorp.

Task 3: Outreach Landowners - Loren

Task 4: Buffer Areas impacting Vernal Pools

Task 5:

Task 6:

Task 7: Project Reporting

**7. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs: High Land values

Benefits: Increase Environmental Biodiversity

Hurdles: Educated Community/Splash, Counties need Conservation Plans

**8. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.
Identify - Inventory, PCCP, Acquisition

**9. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

**Placer County, Yuba County, Placer County Land Trust**

**10. ANY ADDITIONAL NOTES:**

- Placer County Land Trust - Project Prioritization - Vernal Pools!
- Yuba County - Management plan - Look into this!
- HCMP - Anything on Vernal Pools?
- Identify locations
- Carol Witham - Inventory of vernal pools

## Upper Bear Subwatershed (including Greenhorn Creek & Steephollow Creek)

### Storm Runoff Monitoring for Mercury Source Contamination

➢ **Project Description**:

- Background: Using Dr. Alpers' work on Greenhorn Creek as a model, fill in gaps of a non-continuous monitoring of mercury contamination by storm runoff from the USGS. This project would identify locations for monitoring, include stakeholder outreach to private property owners to obtain access and work with neighbors in the area, and create a monitoring program that includes volunteer stakeholders.
- Tasks: Strategically sample to determine which tributaries are contributing mercury and how much (synoptic mercury). Assess amounts of methyl mercury and follow consistent USGS protocols with sampling in Yuba Watershed and Tahoe National Forest and testing with an accredited lab. Training may be provided by Sierra Fund to be consistent with other work in the area. This project could be performed in conjunction with the Geospatial Assessment of Historical and Current Mines throughout the Watershed project.

➢ **Project Objectives:**

- Locate and evaluate sources of mercury contamination for future cleanup or containment. Establish a priority ranking of mines for future reclamation to reduce mercury impacts in the watershed.

➢ **Location:** watershed-wide if funding allows, but with special focus on the upper watershed where the most hydraulic mining sites (and expected mercury sources) occur

➢ **Potential Project Partners:** USGS, Sierra Fund, SSI, Tahoe National Forest, BLM, private property owners

➢ **Status Update:**

**Containing and Removing Mercury from Old Transport Systems from Hydraulic Mining**

➢ **Project Description:**

- This project would be a multi-phased project including planning, implementation, and post-project monitoring at multiple sites in the Bear River Watershed. Tasks would include a) assessing the map and list of mines from the Bear Watershed Disturbance Inventory (Campbell *et al*. 2016), the USGS Greenhorn Creek Mines Report (the biggest concentration of mercury in the state), and other sources; b) map where water is running through the sites; c) sample the discharge of the sites (this may be at the mines themselves or on nearby properties to which mine tunnels or sluice boxes lead or to which mine sediment piles have been transported); d) evaluate the costs and benefits of different options for clean-up; e) assess if diversion of water is feasible through topographic maps; f) consider a specialized sediment basin to stop the erosion of contaminated sediment. This project would include an evaluation of each site on a case-by-case basis by considering the state of the mine, its effect on nearby waterways, the conditions surrounding the mine, and current management.

➢ **Project Objectives:**

- To determine which of the many mines in the watershed are the greatest sources of mercury contamination into the main stem of the Bear River (a function of discharge and hydrology in addition to the amount and type of on-site contamination), consolidate the source locations assessment into one map and document, and evaluate the costs and benefits of various potential cleanup plans and/or other options to halt mercury transport.

➢ **Location:** Watershed-wide, with special focus on the Upper Bear subwatershed and Greenhorn Creek

➢ **Potential Project Partners:** USGS (contact Dr. Charles Alpers), SSI, Sierra Fund, CABY, Nevada County, private landowners

➢ **Status Update:**

**Assess Mine Source Contamination in Steephollow Creek**

➢ **Project Description**:
- Using the past USGS reports for Greenhorn Creek (Alpers *et al*. 2005) and Dutch Flat (Hunerlach *et al*. 1999) as models, create a report for the Steephollow Creek watershed concentrating on abandoned mines, the Lowell fire area, public and participating private lands. This report will include recommendations for planning, implementation, and pre-/post-restoration or containment monitoring.

➢ **Project Objectives:**
- Reduce heavy metal source contamination into Steephollow Creek and the Bear River, downstream of legacy mining activities.

➢ **Location:** Steephollow Creek, including the Red Dog – You Bet – Chalk Bluff Diggings (a portion of which drained into Steephollow while another portion drained into Greenhorn), Hawkins Canyon, Birdseye, Little York Diggings, Million Dollar Mine, etc.

➢ **Potential Project Partners:** USGS, Sierra Streams Institute, Tahoe National Forest, BLM, PG&E, NID, and participating private landowners in the Steephollow watershed

➢ **Status Update:**

**Soil & Slope Stabilization in Lowell Fire Drainages**

- **Project Description**: Preliminary surveys of Steephollow Creek within the Lowell Fire perimeter have identified one small landslide and several seasonal drainages where slugs of fine sediment are eroding into the creek. This project would stabilize the slopes in those target areas to conserve soil, improve water infiltration rates into the soil to improve forest health and post-fire regeneration, and reduce turbidity & fine sediments in Steephollow Creek and the downstream Rollins Reservoir.

- **Project Objectives:** Improve water quality in Steephollow Creek and reduce fine sediments in benthic creek habitat for native fish and wildlife. Reduce volume of sediment entering Rollins Reservoir to protect downstream human water supply. Conserve soil & improve water infiltration to support forest health & post-fire regeneration.

- **Location:** Lower third of 2,300-acre Lowell Fire within the Steephollow Creek subwatershed (upper Bear)

- **Potential Project Partners:** Sierra Streams Institute, contact Denise Della Santina, Restoration Ecologist, NRCS, BLM, CDFW, private landowners; USFS if extend further up watershed

- **Status Update:**
  - 2017 - SSI developed project in lower portion of fire, seeking funding, project for upper portion not yet developed.

**Reducing Water Quality Degradation by Pot Farms in the Steephollow & Greenhorn Subwatersheds**

- **Project Description**: Apply the model of SYRCL's successful Growing Green campaign to the Bear Watershed. Extend outreach for their monthly Best Management Practice workshops and Remediation Toolbox. Include strategy of conversations between growers, medicinal and recreational users, and supervisors. Also follow examples from Mendocino and Humboldt Counties.

- **Project Objectives:** Improve education, volunteer compliance with improved practices, and involvement in restoration among pot farmers. Educate landowners and garden managers about ways to protect and/or restore the non-cultivated portions of their rural properties. Reduce cultivation impacts associated with water diversions, soil recontouring, fertilizer runoff and pesticide use. Improve water quality, protect and/or restore soils and native plant communities, and clean up trash. Increase awareness of County planners regarding the landscape-scale land conversion, forest habitat loss, habitat fragmentation and watershed effects associated with this and other types of exurban land use in the region. Reduce impacts to riparian habitat.

- **Location:** Work with public agencies and community members to determine locations and level of need. Steephollow Creek and Greenhorn Creek subwatersheds in the Upper Bear appear to have a greater concentration of large grows than other Bear subwatersheds.

- **Potential Project Partners:** SYRCL, Americans for Safe Access, Nevada County Growers, Women's Grower's Group, USFS, You Bet Community, CDFW, BLM, County Sheriff,and commercial garden stores where growers buy supplies.

- **Status Update:**
  - 2017 - In progress in neighboring watershed- SYCRL

**Reducing Water Quality Degradation by OHV Users and Protecting Wildlife Habitat in Steephollow & Greenhorn Creeks**

➢ **Project Description:**

- Follow the model of the Rubicon Trail all-terrain/off-highway vehicle (ATV/OHV) users and outreach; the volunteer compliance strategy of conversations between recreators, county supervisors, and federal land managers; lessons learned from USFS experience in Greenhorn Creek. Use boulders and/or gates to physically block vehicle access to the creek beds at known OHV access points such as the Greenhorn Creek crossing at Red Dog Road and the three main Steephollow Creek access points at Lowell Hill Road, Chicago Park Powerhouse Road, and the diggings south of Christmas Hill.
- Evaluate the potential for other creek access points to be adopted once these are closed, and proactively block them as well. Encourage greater use of designated OHV areas outside the creek beds as recreation alternatives with fewer environmental impacts. Learn from OHV users what features attract them to the creek beds rather than designated sites, and upgrade designated sites to provide these features to the extent feasible. Learn from OHV users what watershed issues they feel more resonance with or resistance to and what other factors motivate their actions.
- Engage environmentally responsible OHV users and clubs to lead an educational effort as leaders among their peers. Help clubs become environmental stewards. Engage responsible OHV users to help with ecological restoration projects in creek areas previously impacted by illegal OHV use, in addition to the help they provide maintaining designated areas (as is done in the Stanislaus National Forest). Increase law enforcement at locations where problems continue to persist after public outreach and gate/boulder blockades (see The Union 2016b).

➢ **Project Objectives:**

- Improve education, volunteer compliance, and involvement in restoration among off-highway vehicle (OHV) users. Reduce trespass, streambank erosion, soil degradation, stream turbidity, wildlife collisions, and impacts to egg masses of frogs, toads, fish, and turtles in the streambeds and banks of Greenhorn and Steephollow Creeks. Limit OHV use to designated OHV use areas, which have been chosen by USFS due to the lesser level of impacts with potential to occur there.

➢ **Location:** Steephollow Creek and Greenhorn Creek in the Upper Bear subwatershed

➢ **Potential Project Partners:** OHV clubs such as the Rubicon Trail Users club and the Auburn Jeepers Jamboree, the You Bet Community, USFS, BLM, Nevada County, NID

➢ **Status Update:**

**Bear Valley Meadow Restoration**

- **Project Description**: Stabilize and remediate headcuts, erosion and incision of the Bear River near its headwaters. Restore the floodplain dynamics of the meadow's waterways, soils and vegetation.

- **Project Objectives:**
  - Restore hydrological processes that support riparian and wetland plant communities
  - Protect and increase water quality and quantity
  - Protect and improve plant and wildlife habitat
  - Protect and increase populations of important pollinator plants
  - Increase carbon sequestration
  - Identify, control or eradicate priority non-native invasive plant species

- **Location:** Upper Bear Watershed near Highway 20

- **Potential Project Partners:** American Rivers, Bear Yuba Land Trust, PG&E, Sierra Streams Institute, Tahoe National Forest, Institute for Bird Populations, National Fish and Wildlife Foundation, Sierra Nevada Conservancy

- **Status Update:**
  - 2017 - AR & BYLT awaiting PG&E approval

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Aug 2, 2017
# Bear Valley Meadow Restoration

1. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
   Add any new updates to the project description
   - American Rivers and the Bear-Yuba Land Trust have proposed this project to the current landowner (PG&E), who declined to participate. Project work cannot move forward until either PG&E grants permission to complete the project or the ownership of the meadow changes hands.
   - Several of PG&E's lands in the vicinity of Bear Valley Meadow are in the process of changing hands, through the Stewardship Council, to be owned by the State of California and managed by the UC Berkeley School of Forestry, with conservation and recreation easements to be held by the Bear Yuba Land Trust. As far as we know thus far, these land transfer plans do not include the Bear Valley Meadow itself, so PG&E will be the landowner whose permission is needed for the foreseeable future.
   - Allan Eberhart said that the reasons for the head cuts and channelization problems within the meadow are the extremely high flows that occur when PG&E has a large spill from their infrastructure upstream. This may be the reason PG&E is not electing to change the ownership of the meadow. This may also affect the potential for restoration success on site even if the owner's permission to implement the project was granted. Long-term success may be dependent on changes to the source problems – the upstream water management system may have to be restored in order for the meadow restoration to have longevity, or an endowment may be needed to perform additional restoration work in future years after substantial spill events create new erosion problems.
   - From American Rivers' Bear Valley Report: "Currently, the Bear River in the Bear Valley Meadow serves as a water delivery channel for the Drum-Spaulding hydroelectric project. PG&E's current operations…" [prior to the most recent YBDS FERC relicensing agreement] "typically result in discharges from the Drum Canal and South Yuba Canal into the Bear River above the meadow at magnitudes of 250 cfs or more for a variety of purposes, including drawing down Spaulding Reservoir in anticipation of significant inflows during winter and spring." [FERC relicensing may have resulted in changes to the management of flows in the meadow. The FERC agreement will need to be reviewed prior to

future restoration planning at this site, and…] "any channel that is created or restored must accommodate future flow regimes." Allan Eberhart's memory of the FERC agreement is that the maximum spill prior to relicensing reached 600 cfs and the FERC agreement placed a limit at 200 cfs.

2. **PAST PROJECT MODELS**

Identify other past projects that could serve as models for this project.

- American Rivers developed a Bear Valley meadow restoration proposal in the past, which is in the Bear Valley Meadow subfolder in the "Data, Publications and Info" folder of the Bear Watershed Stakeholders library on Google Drive and in the Info folder on the Sierra Streams Institute server. American Rivers has additional meadow restoration experience at other sites.
- Stewart Feldman mentioned that the Granite Bay Flycasters group did some restoration work in Bear Valley several years ago, and that Gregg Bates of the Valley Foothill Watersheds Collaborative and Dry Creek Conservancy may be a good contact to learn more about their work and the lessons they learned. Frank Rinella from the Northern California Federation of Fly Fishers may also be a good resource to learn about that project.
- SYRCL is currently restoring several meadows in the Yuba watershed, including Loney Meadow and Van Norden Meadow, among others. The project team consists of SYRCL's Rachel, Karl & Betsy as project manager, hydrologist and botanist, plus UC Davis' Ryan Peek for amphibians and Tahoe Institute for Natural Sciences' Will Richardson for other wildlife, primarily birds.
- The Perazzo Meadow restoration project, which used plug-and-pond techniques and has been further enhanced by beaver activity, has been a phenomenal success to increase habitat quality for endangered willow flycatchers and other meadow-associated bird species. However, because this technique increases the depths and duration of surface water throughout the meadow, it has also decreased habitat quality for endangered Sierra Nevada yellow-legged frogs at other sites because of its increased habitat quality for predatory fish. At any potential meadow restoration site including Bear Valley, the design must fit the unique suite of biology, hydrology, geology, resources, goals, opportunities, and constraints of that individual site.
- The Institute for Bird Populations (IBP) has collaborated with several state, federal and non-profit agencies involved with meadow restoration. IBP has studied bird diversity, populations and habitat conditions at every meadow in the Sierra and southern Cascades with public access and known historical or current populations of willow flycatchers and/or great gray owls.

- UC Davis Center for Watershed Sciences has compiled a wealth of information on meadow restoration projects throughout the state. These resources are publicly available at https://meadows.ucdavis.edu.

3. **MEASURABLE RESULTS:**
   a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated – if add an educational program or signage as part of the project; the site is highly visible from Hwy 20; may be easy to connect the site to the existing interpretive amenities at the Sierra Discovery Trail upstream off Bowman Rd by adding signage there about the meadow | # acre feet of water with reduced need for water treatment |
| # acres of meadow restored – this is the project's purpose | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation – depends on the site's post-restoration management plan; additional recreational amenities are not the purpose of this project but could be included as a secondary component; the site is currently a popular cross-country ski area, which could eventually be altered if the meadow's hydrology is not restored and the forest continues to encroach into the drying soils | # acre feet of water retained or slowed for later slower release to the river – this is a high-priority benefit linked to the project's purpose, but is difficult to estimate or measure |
| # of sites improved habitat – | # Yr. level of flood protection – Allan | # $ increased due to |

| | | |
|---|---|---|
| this is a high-priority benefit linked to the project's purpose | Eberhart can introduce us to Ron Stork, an expert in flood management who predicted the Oroville dam failure and may have insight on how meadows may help to slightly reduce downstream flood risk or severity by holding water during high flows for later release | more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected – this is a high-priority benefit linked to the project's purpose | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced – SYRCL and a lab at the Univ. of Nevada in Reno are studying this potential benefit at other nearby meadow restoration sites | # of volunteers – depends on restoration design and maintenance/stewardship plan, as some components may require professional skills while other components may be appropriate for volunteers | # $ increase in property values |
| # greenhouse case emissions to new carbon sink – SYRCL and a lab at the Univ. of Nevada in Reno are studying this potential benefit at other nearby meadow restoration sites | # of disadvantaged communities improved – only if include site-based educational programming that targets these groups of people | # $ of energy costs conserved |
| # air quality contaminants reduced | Other: | # $ averted from maintenance or repair of infrastructure damage |
| Other: Wildlife & plants: # | | # $ replacement |

| | | |
|---|---|---|
| species present on site, # species with potential to benefit from the project, # special-status species, # currently extirpated species with potential to return to the site once restored, etc. | | cost of ecological services |
| # acre feet of water retained or slowed for later slower release to the river – this high-priority benefit was discussed in the economy column but is also highly relevant to the watershed's environment – the habitat quality and ecological function within the meadow and downstream may be improved – in addition to acre feet, this benefit may be measured by flow velocities, seasonal timing of flows and flow temperatures – also regarding acre feet, how might this project fit as a partial component of the multi-project Combined Action Alternative proposed by some groups to meet regional water supply needs without the proposed Centennial dam? | | # $ averted costs of wildfire fighting – look to Cal Fire for statistics regarding forest fire-fighting costs per acre and how those may be reduced with wet vs. dry meadow fire breaks |
| How might this project fit within the climate change puzzle? How might its | | Other: |

| | | |
|---|---|---|
| success be affected by climate change, and how might its greenhouse gas and habitat protection components help increase the region's resiliency to climate change? | | |
| Ability to capture and regulate snowmelt – #1 priority | | |
| Potential water quality effects | | |

*Our breakout group did not have time to address questions 3b – 7. We resumed at question 8.*

**8. SEQUENCING**

- Combine this project with forest health and aspen regeneration projects in the landscape surrounding the meadow. These projects would further benefit the meadow.

**9. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

- Everyone in our breakout group said yes: Stewart Feldman, Joy Waite, Allan Eberhart, Karl from SYRCL, and Kristen Hein Strohm (but Kristen only if the issues described in question #1 are addressed first).

**10. ANY ADDITIONAL NOTES:**

- SYRCL and UC Davis should be added to the potential project partners list in the Restoration Plan's project description.
- The Nisenan tribe should be added to the potential project partners list in the Restoration Plan's project description. This site has tremendous cultural significance to the Nisenan of the Colfax Todds Valley Rancheria, and is likely to also have cultural significance to other nearby tribes.
- This may be an excellent location to establish an educational program about Native American culture, if the tribe would be in support of doing so at this location. They may also prefer that the site's history and spiritual significance remain more private. Whether or not an education program is to be established, the tribe should be consulted as part of the design of any work done in the meadow.

- Allan Eberhart mentioned that the occasionally elevated nutrient levels found in water quality testing of the Bear River at the Bear Valley Meadow may be coming from the PG&E staging area community on Bowman Rd upstream of the meadow, as well as winter road salts applied by CalTrans on Hwy 20.
- It may be helpful to review historical maps and/or photos of the meadow to learn more about its historical size and extent, as well as its hydrology and meanders, the age and progress of headcut erosion, etc. Even photos from a short time ago may provide insight into headcut dynamics and the timing of conifer encroachment into the meadow edges, associated with meadow drying. Conditions before the 19th century mining, logging and grazing will be more difficult to assess.
- Allan Eberhart mentioned that the Boardman Diversion Dam (upper? lower?) is located at the bottom of the Bear Valley meadow (viewable from the PG&E service road), with effects both upstream and downstream. PCWA and/or PG&E spill events associated with this dam are of interest. Stewart said there is some controversy among the fisheries community as to whether that dam is beneficial or detrimental to native fish populations in the meadow and/or downstream. Legal questions may also apply regarding the holding of water, as was the case in Van Norden.
- David Wright is an architect that lives next to the meadow and may be a helpful supporter of restoration, as may other neighboring homeowners. Allan Eberhart can introduce us.

***3b. Circle or list project deliverables:***

- Our breakout group didn't have time to address this at the meeting.

**4. OBJECTIVES:**

- Our breakout group didn't have time to address this at the meeting.

5. **RESOURCES / SKILLS**

- Our breakout group didn't have time to address this at the meeting.

6. **TASKS *SEE PROJECT OBJECTIVES***

- Our breakout group didn't have time to address this at the meeting.

**7. CONCEPTUAL COST / BENEFIT COMPARISON**

- Our breakout group didn't have time to address this at the meeting.

**Steephollow Canyon Fuels Reduction**

- **Project Description**: Identify forested areas of Steephollow Canyon where tree density is high enough to cause excessive competition and weaken tree health, increasing susceptibility to drought stress and bark beetle infestations. Selectively thin the tree density in these areas to promote the vigor of the remaining trees.

- **Project Objectives:**
  - Restore natural fuel loads and fire regimes, reduce risk of high intensity fire
  - Improve vegetation community resiliency to plant diseases and pests
  - Preserve and restore processes of water infiltration and nutrient cycling in soils which support vegetation communities
  - Improve vegetation community resiliency to the impacts of climate change
  - Improve sequestration of atmospheric carbon in vegetation communities including oak woodlands, conifer forests, and soils
  - Educate and increase understanding of ecosystem services provided by healthy vegetation communities
  - Protect water quality and quantity
  - Protect plant and wildlife habitat

- **Location:** Steephollow Creek, tributary to the Bear River while prioritizing fire threats

- **Potential Project Partners:** BLM, NID, USFS, private land owners , SNC, CalFire

- **Status Update:**
  - 2017 - SSI developed project in lower portion of fire seeking funding, project for upper portion not yet developed.

**Hawkins Canyon Fuels Management, Healthy Forest and Groundwater Recharge**

➢ **Project Description**:
- Thin the tree density in overstocked forest slopes of Hawkins Canyon as a pilot project for the larger Steephollow Creek Fuels Reduction project. Bury some of the felled trees as water bars and use additional on-site materials to slow, spread and sink rainwater to increase infiltration and groundwater recharge. Monitor year round before and after the thinning treatment to determine whether the water holding capacity of the soils has increased sufficiently during the wet season to result in slower releases and increased creek flows during the dry season.

➢ **Project Objectives:**
- Protect forest and plant community resilience to fire and other stressors
- Recharge groundwater through increased water infiltration, thereby increasing spring and summertime flow due to improving holding capacity of the soils and slower flow release (Increased water supply in spring and summer dry season could cool temperatures and dilute contaminants.)
- Improve water quality by reducing erosion and filtering water through soils
- Preserve and restore processes of water infiltration and nutrient cycling in soils which support vegetation communities
- Restore natural fuel loads and fire regimes, reduce wildfire risk
- Improve vegetation community resiliency to plant diseases and pests
- Improve vegetation community resiliency to the impacts of climate change
- Improve sequestration of atmospheric carbon in vegetation communities including oak woodlands, conifer forests, and soils
- Educate and increase understanding of ecosystem services provided by healthy vegetation communities

➢ **Location:** Hawkins Canyon is a tributary of Steephollow Creek.

➢ **Potential Project Partners:** Private landowners, You Bet Red Dog communities, Bureau of Land Management, Universities, NRCS, UC Berkeley Demonstration Forest
- Funding: Sierra Nevada Conservancy; possibly NID if the project would improve the timing of flows into Steephollow Creek and therefore Rollins Reservoir

➢ **Status Update:**

**Mercury Removal at Greenhorn Creek Narrows**

- **Project Description**: Hansen Brothers Enterprises is currently applying for permits to unplug the tunnel outlet at the Narrows on Greenhorn Creek, which is currently plugged with gravel from Birdseye and the Star Mine. This is an opportunity to remove mercury from the gravel, restore more natural streambed morphology and stream flows for this tributary, and continue a positive local public relations campaign for Hansen Brothers Enterprises. A portion of the project costs could be offset for the Hansen Brothers by the value of any gold that may be amalgamated with the mercury that is removed. Among the permit requirements would likely be a stipulation to ensure that unplugging the tunnel would not increase the ability of upstream contaminants to pass through it and increase downstream contamination.

- **Project Objectives:** Reduce the amount of mercury at the Narrows site and flowing downstream from the site, contaminating the Greenhorn Creek and Bear River waterways.

- **Location:** Greenhorn Creek

- **Potential Project Partners:** Holdrege and Kull geology and engineering consultants, with which Hansen Brothers contracts for mercury testing; NID, which owns both banks of the creek downstream of the bridge; the You Bet community of Greenhorn and Steephollow Creek watershed residents (contact Sandy Jansen); USGS (contact mercury expert Dr. Charles Alpers)

- **Status Update:**

## Wolf Creek Subwatershed (including Rattlesnake Creek, Peabody Creek & French Ravine)

### Restoration of Grass Valley Meadow and South Fork Wolf Creek

- **Project Description:** To reclaim a key piece of open space near downtown Grass Valley as well as South Fork Wolf Creek that flows through it by bringing back native vegetation, restoring the Creek and wildlife habitat. The restored creek and meadow will be an important destination for residents and visitors who seek to learn conservation and stewardship while deepening their knowledge of the rich history of the area. It will be a model for similar ecosystem restoration projects elsewhere in the Sierras.

- **Project Objectives:**
  - In Phase 1 (preparation): a) conduct soils and ground water testing; b) obtain a wetland delineation; c) obtain hydrologic and geologic surveys and recommendations; d) conduct a CEQA review including cultural survey; e) contract with a planner to help us design the park with public access and trails protective of wildlife habitat, design educational signage and kiosks; f) solidify partnerships; g) obtain all relevant permits.
  - In Phase 2 (implementation): a) hydrologic restoration of the stretch of South Fork Wolf Creek that flows through the meadow, and provide riparian buffer zones along the creek banks to prevent erosion and sedimentation into the creek; b) remove non-native invasive plants and grasses according to recommended best practices; c) replant native vegetation that is appropriate to the site; d) protect secluded habitat for songbirds and other wild native species; and e) build connecting nature trails, boardwalks, and footbridges as required for the terrain; f) install educational signage and kiosks.
  - Phase 3 will focus on facilities to allow for public access, and Phase 4 will encompass ongoing maintenance and monitoring.

- **Location:** approximately 20 acres in Empire Mine State Historic Park in Grass Valley, at Bennett St and Slow Poke Lane, in the South Fork Wolf Creek subwatershed.

- **Potential Project Partners:** CA State Parks, Bear Yuba Land Trust, Sierra Streams Institute, SYRCL, American Rivers, Nevada City School of the Arts, Bitney Springs College Prep, Sierra College, Sierra Foothills Audubon Society, CA Native Plant Society, CA Conservation Corps, Boy Scouts, Girl Scouts, City of Grass Valley, Nevada County.

- **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Aug 2, 2017
# Restoration of Grass Valley Meadow and South Fork Wolf Creek

8. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
   Add any new updates to the project description
   - Cultural Meaning of Grass Valley
   - Property Owned Empire Mine SP (Supportive)
   - Could restoration help with heavy metal contaminants and greenhouse gas emissions

9. **PAST PROJECT MODELS** *Not Completed*
   Identify other past projects that could serve as models for this project.

10. **MEASURABLE RESULTS:**
    a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored - .5 miles | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, meadow restored – 20 acres | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers - WCCA & Kids | # $ increase in property values |

| | | |
|---|---|---|
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved - Possible | # $ of energy costs conserved |
| # air quality contaminants reduced | Cultural Meaning | # $ averted from maintenance or repair of infrastructure damage |
| Other: | Other: | # $ replacement cost of ecological services |
| Native Grasses | Trails/ADP Access | # $ averted costs of wildfire fighting |
| | Tribal Importance: Grinding Rocks/Gathering Spot | Other: |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps: Trail Plan: Restoration Implemented Restoration Educational Materials: Trails Signs
Assessment Monitoring: Ongoing Design Plan Mitigation Plan
Other:

- Soil Assessment
- Environmental Review
- Flora/Fauna Assessment
- County Permits
- Trails ongoing monitoring

**11. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

A E F G J L M O Q R S

**Fisheries and Aquatic Life Objectives:**

A B C D F G I J K L M N

**Vegetation Objectives:**

A B C E F G H L M R S T U

**Terrestrial and Riparian Objectives:**

A E F O P

**b. *Multisector Benefits - Other Benefits Outside the Bear River Plan:***
How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction - Possible Flood Reduction Outdoor Recreation
Water Supply Water Treatment Groundwater Wastewater Treatment Adaptation to Climate Change

Other:

- Education
- Native Plants

12. **RESOURCES / SKILLS**

**a. Team:**
Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer
Environmental Engineer Educator Outreach Coordinator

Other:

- Soil Scientist/Geologist
- Hydrologist
- Native Vegetation Specialist

**b. Equipment:**
Circle those that apply and add
Dewatering Equipment Ground Moving Equipment

Other:

**c. Funding Sources:**
Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.
Water SMART (Bureau of Reclamation), Disadvantage, Cultural Significance, State Park, Jerry Brown

13. **TASKS *SEE PROJECT OBJECTIVES***
Phase 1 (preparation):

a) Conduct soils and ground water testing (include heavy metal assessment);
b) Obtain a wetland delineation;
c) Obtain hydrologic and geologic surveys and recommendations;
d) Conduct a CEQA review including cultural survey;
e) Contract with a planner to help us design the park with public access and trails protective of wildlife habitat, design educational signage and kiosks;
f) Solidify partnerships;
g) Obtain all relevant permits.
h) Design restoration plan

Phase 2 (implementation):

a) Hydrologic restoration of the stretch of South Fork Wolf Creek that flows through the meadow, and provide riparian buffer zones along the creek banks to prevent erosion and sedimentation into the creek;
b) Remove non-native invasive plants and grasses according to recommended best practices;
c) Replant native vegetation that is appropriate to the site;
d) Protect secluded habitat for songbirds and other wild native species; and
e) Build connecting nature trails, boardwalks, and footbridges as required for the terrain;
f) Install educational signage and kiosks.
g) Design monitoring plan

Phase 3

a) Develop facilities to allow for public access
b) Conduct community outreach and engagement

Phase 4 will encompass ongoing maintenance and monitoring.

**14. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Lack of Action Results:

- Creek continues to insize
- Meadow continues to dry out
- Native Grasses compete with non-native

Hurdles: Funding?

**15. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

AFTER:

- Keep developing (also for sale) restoration downstream. Partner with Bus depot
- Property acquisition of downstream property

**16. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

**Yes**

**17. ANY ADDITIONAL NOTES:**

- Potential Project Partners: Grayson (Tsi-akin), Sheli Covert, WCCA, Dan Lubin (Park Ranger Biologist)

**Wolf Creek Parkway Trailhead**

- **Project Description:** Development and restoration of parking area, trailheads, maps, & interpretive signage at the confluence of Wolf Creek and Olympia Creek. This lot was recognized as an ideal trailhead location (in several directions) in the 2006 Conceptual Plan for the Wolf Creek Parkway (trail system with pocket parks along Wolf Creek in Grass Valley).

- **Project Objectives:**
  - Protect this amazing spot from development
  - Showcase the confluence of two creeks
  - Have a bona fide start to the languishing parkway project
  - Clean up an area now heavily utilized by homeless people
  - Create educational and recreational opportunities close to downtown

- **Location:** 3.5 acres at the corner of Idaho-Maryland Road and Sutton Way in Grass Valley; Wolf Creek and Olympia Creek subwatersheds

- **Potential Project Partners:** Bear Yuba Land Trust and the City of Grass Valley
  - Project Proponents: Wolf Creek Community Alliance, contact Bruce Herring
  - Potential Funding Sources: private donations and grants

- **Status Update:**
  - 2017 - In progress- GV & WCCA

**Memorial Park – Magenta Drain Restoration**

- **Project Description:** Restore 850 feet of the Magenta Drain through Memorial Park, remove fencing that currently prohibits creek access, remove non-native plant species and replace with native species, regrade the channel to a more natural stream/creek slope, and provide educational signage along the creek.

- **Project Objectives:** Restore the existing Magenta Drain to a more natural creek environment, providing some accessibility and educational elements. Benefit soil conservation, creek flow, water quality, and aquatic and riparian habitat for native species. Supports CABY objectives WQ-3, WQ-7, EH-7, HL-5, HL-6, and OV-1. Restore creek to natural condition. Provide educational and recreational access to the creek.

- **Location:** 5 acres owned by the City of Grass Valley as a public-access park at 441 Memorial Lane and 350 Race Street, in the Wolf Creek subwatershed.

- **Potential Project Partners:** American Rivers, Wolf Creek Community Alliance, Boy Scouts/Girl Scouts
  - Project Proponent: City of Grass Valley, contact Tim Kizer, Public Works Dept.
  - Potential Funding Sources for project planning and/or implementation: City funding for design and environmental work.

- **Status Update:**
  - 2017 - Is this in progress by GV?

**Wolf Creek Watershed Disturbance Inventory**

- **Project Description:** To conduct a three-phase, science-based analysis of the restoration potential for the Wolf Creek watershed. Beginning with a stream corridor disturbance inventory and assessment, WCCA will engage a biologist to lead this project and coordinate the activities of WCCA volunteers to: a) inventory and document new and existing data on the current and historical disturbances in the Wolf Creek watershed; b) conduct an assessment of current physical habitat conditions using the input and data collected by WCCA, stakeholders, and partners; and c) work with SSI to integrate the Inventory and Assessment with the Bear River Watershed Restoration Plan.

- **Project Objectives:** This project is a disturbance inventory specific to the Wolf Creek watershed, which will significantly aid restoration planning for the Bear River watershed and ultimately benefit water quality, ecological processes, and the human community.

- **Location:** Wolf Creek is 23 miles long and its watershed covers over 50,000 acres. Wolf Creek is a major tributary to the Bear River; its watershed is one of five sub-watersheds in the Bear River watershed. The Wolf Creek watershed impacts the Bear River because of past mining and logging, and its present population density especially in the City of Grass Valley close to the headwaters.

- **Potential Project Partners:** Sierra Streams Institute, American Rivers, City of Grass Valley, Nevada County, Bear Yuba Land Trust, private property owners
  - Project Proponent: Wolf Creek Community Alliance (WCCA), contact Jonathan Keehn, President
  - Potential Funding Sources: private foundations, State and Federal grants

- **Status Update:**
  - 2017 - In progress- WCCA & SSI

**Native Fish Viability in Wolf Creek**

- **Project Description:** To study native fish populations in streams in the Wolf Creek watershed, assess the conditions necessary for native fish to live and reproduce in Wolf Creek, and plan a restoration program which focuses on the return of native fish populations that once thrived in the Wolf Creek watershed. Wolf Creek is a major tributary of the Bear River. A restoration program that brings back native fish populations to this important Sierran stream will be a model for similar ecosystem restoration projects elsewhere in the Sierras.

- **Project Objectives:**
  - Phase I:
    - analyze existing historical water quality data for habitat suitability
    - collect and analyze additional flow data in the reaches
    - identify target species
    - prepare implementation plan
    - identify barriers (physical and environmental)
  - Phase II: restoration and implementation of plan
  - Phase III: ongoing monitoring and maintenance

- **Location:** Wolf Creek is 23 miles long and its watershed covers over 50,000 acres. Wolf Creek is a major tributary to the Bear River; its watershed is one of five sub-watersheds in the Bear River watershed. The Wolf Creek watershed impacts the Bear River because of past mining and logging, and its present population density especially in the City of Grass Valley close to the headwaters.

- **Potential Project Partners:** Fly fishers/anglers, CA State Parks, Bear Yuba Land Trust, Sierra Streams Institute, SYRCL, Nevada City School of the Arts, Bitney Springs College Prep, Sierra College, Sierra Foothills Audubon Society, CA Native Plant Society, CA Conservation Corps, Boy Scouts, Girl Scouts, City of Grass Valley, Nevada County.
  - Project Proponent: Wolf Creek Community Alliance (WCCA), contact Jonathan Keehn, President
  - Potential Funding Sources: private foundations, State and Federal grants, foundations, local fundraising efforts

- **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Nov 15, 2017
# Native Fish Viability in Wolf Creek

41. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
    Add any new updates to the project description
    Homeless camp @ mining museum – adding human impact(floor , e. coli)
    Which native species will change

42. **PAST PROJECT MODELS**
    Identify other past projects that could serve as models for this project.
    Little ceer creek- - Gravel projects
    TEK0 use that as baseline
    Prologging/ mining
    Post NID /sewer treatment

43. **MEASURABLE RESULTS:**
    a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction- only if you know what native fish | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |
| # greenhouse case emissions | # of disadvantaged communities | # $ of energy costs conserved |

| | | |
|---|---|---|
| to new carbon sink | improved | |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: | Other: com. Awareness, visability imrove . | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps Plan Implemented Restoration Educational Materials Signs
Assessment Monitoring Design Plan Mitigation Plan
Other: REMEMBER that depend on what phase of project.

**44. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Fisheries and Aquatic Life Objectives:**

B D F H J L

**Vegetation Objectives:**

C D I J P Q U

**Terrestrial and Riparian Objectives:**

A B C F I K L O P

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply
Water Treatment Groundwater Wastewater Treatment
Adaptation to Climate Change

Other: wastewater treatment- snowball effect

45. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer
Engineer Educator Outreach Coordinator

Other: Fisheries – fish & wildlife collaboration
GCFF club- educators & watchdays

**j. Equipment:**

Circle those that apply and add

Dewatering Equipment Ground Moving Equipment

Other: Use stream gauge – might be able to use NID release

**k. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.

46. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: Phase 1: Whats historically there, what are needs of specific species. Baseline monitoring .

Task 3: Community awareness of program and also wolf creek

Identifying and engage relevant stakeholders collaborators

Task 4: TEK

Task 5: CEQA/NEPA Planning permit 1600

Task 6: Maps, Materials to educate

Task 7: Project Reporting

**47. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs:

Benefits:

Hurdles:

**48. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

Muliphase project
(4 Phases) –look at overview

**49. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

**Ralph & Lisa Cutter**
**Peter Moyel**
**Some info in the FERQ**
**GCFF**

**WC**
**Sierra FUND (TEK)**
**Nisenan**
**SSI**

**50. ANY ADDITIONAL NOTES:**

Phase 1 :

- Pre implen.
- baseline vs suitability
- Parameters of temp, NQ, barriers
- Identify target species – historically occurring v presently viable fish pop.
- Climate change impacts on fish species assembly (EG. Has h20 temp impacted assemblages?)

What species are present in the bear that could utilize additional habitat in wolf creek.

**Pre- and Post-Restoration Water Quality Monitoring**

- **Project Description:** Monthly water quality monitoring and stream walks at 30 sites in the Wolf Creek watershed - from the headwaters to the confluence with the Bear River - in order to provide enhanced pre- and post-restoration data regarding the physical, chemical, and biological conditions of Wolf Creek.

- **Project Objectives:** Engage a monitoring coordinator to: a) recruit, train, schedule and supervise volunteers; b) obtain property owner permissions for sites located on privately held land; c) collate data, maintain monitoring database, and produce reports.

- **Location:** Wolf Creek is 23 miles long and its watershed covers over 50,000 acres. Wolf Creek is a major tributary to the Bear River; its watershed is one of five sub-watersheds in the Bear River watershed. The Wolf Creek watershed impacts the Bear River because of past mining and logging, and its present population density especially in the City of Grass Valley close to the headwaters.

- **Potential Project Partners:** Sierra Streams Institute, American Rivers, City of Grass Valley, Nevada County, private property owners
  - Project Proponent: Wolf Creek Community Alliance (WCCA), contact Jonathan Keehn, President
  - Potential Funding Sources: private foundations, State and Federal grants

- **Status Update:**
  - 2017 - In progress- WCCA

**Peabody Creek Restoration Project**

- **Project Description:** The overall goal of this project is to improve the hydrologic and ecologic function of Peabody Creek in Grass Valley while addressing local flooding issues, incorporating green infrastructure stormwater management elements, and actively engaging local community members in stewardship. Details can be downloaded at this link: http://www.water.ca.gov/irwm/grants/docs/Archives/Prop84/Submitted_Applications/P84_Round2_Implementation/The%20Sierra%20Fund%20(201312340017)/Attachment%203.%20(cont)%20-%20Att3_IG2_WorkPlan_6of9.pdf

- **Project Objectives:**

- **Location:** Peabody Creek, which is a tributary to Wolf Creek

- **Potential Project Partners:** City of Grass Valley, Wolf Creek Community Alliance
  - Project Proponent: American Rivers, contact Julie Fair, California Restoration Associate

- **Status Update:**
  - 2017 - In progress- GV, AR, SSI

**Grass Valley Sewer System Improvements for Water Quality Crisis Prevention**

➢ **Project Description:**
- Plan and implement upgrades to the Grass Valley sewer system
- Monitor water quality before implementing improvements to help demonstrate the need for funding; continue monitoring after implementation to determine whether the project was successful in reducing surface water contamination.
- Educate the public about what they can do to ease the burden on the sewer system (e.g., bioswales, greywater use, etc.).

➢ **Project Objectives:**
- Prevent water quality crises due to antiquated Grass Valley sewer system prone to big breaks causing river contamination.
- Prevent long-term chronic leaks of the Grass Valley sewer system that contaminate the river, raw water delivery, and recreational areas.
- Engage the community in long-term stewardship of their water.

➢ **Location:** City of Grass Valley Sewage System

➢ **Potential Project Partners:** City of Grass Valley, wastewater treatment plant, WCCA, EPA, SWRCB, consultants with expertise in upgrading sewer systems

➢ **Status Update:**

**Public Stewardship Campaign for Public Spaces within the City of Grass Valley**

- **Project Description:** Similar to the Bear River Ambassador program but focused on users of the urban sphere, rather than nature-seeking recreators on the river and trails. Through public education programs at schools, City events like the downtown farmer's market and Cornish Christmas, signage at bus stops and other places where people congregate on a regular basis, and one-on-one "ambassador" conversations at these locations, help people to understand that litter dropped in the city (and oil from leaking cars) is carried by storm drains and wind into Wolf Creek and the Bear River.

- **Project Objectives:** Facilitate a stewardship ethic toward the creek, river, city, and the human and animal communities that dwell therein. Reduce litter and similar pollution.

- **Location:** the area between the Grass Valley Post Office and its nearest Bus Stop, other local bus stops and parking lots, city parks, and downtown city event.

- **Potential Project Partners:** Wolf Creek Community Alliance, City of Grass Valley, Nevada Union High School

- **Status Update:**

**Scadden Flat Checkerbloom Conservation and Restoration**

➢ **Project Description:**
- Communicate with landowners to survey and protect extant populations of this state-endangered plant.
- Identify and protect suitable locations for suture reintroduction.

➢ **Project Objectives:**
- Identify, protect and increase populations of special-status plants species and rare natural communities
- Restore hydrological processes that support riparian and wetland plant communities
- Identify new sites with habitat conditions suitable for potential future reintroduction.

➢ **Location:**
- Two of the known populations (documented by CNDDB and mapped in the Bear River Watershed Disturbance Inventory, Campbell *et al*. 2016) are west of Grass Valley along the south side of Highway 20 on private land and on land owned by the California Department of Transportation. These populations together are the largest known occurrence of the species and some plants at this occurrence were transplanted here in the past. These locations are in the Wolf Creek subwatershed.
- Identify new sites with habitat conditions suitable for potential future reintroduction.

➢ **Potential Project Partners:** CNPS, CalTrans, NorCal Botanists, City of Grass Valley
- Potential Funding Sources: CDFW, CalTrans mitigation

➢ **Status Update:**

## Middle Bear Subwatershed (including Wooley Creek, Magnolia Creek, Little Wolf Creek & Rock Creek)

### Little Wolf Creek Habitat Protection at Sanford Ranch

- **Project Description:** Purchase a conservation easement on 150 acres of the historic Sanford Ranch. The permanent protection and monitoring of this Blue Oak Woodland and savanna landscape will also protect a critical flood plain habitat for listed species such as California Black Rail, as well as beaver, raptors and other important creek corridor animals. The healthy flood plain function is critical to for water quality and flows into the Bear River, 1 mile downstream. The property also contains 13 springs with feed Little Wolf Creek. This property is also rich with historic and archeological features including the Emigrant Trail. It is also a part of the Bear River Conservation Landscape, an already protected 10,000-acre corridor of connected properties by a collaboration between Placer Land Trust, Bear Yuba Land Trust and the Trust for Public Land. This area is under extremely high development risk and conversion to subdivisions. Nearly all the land downstream along Little Wolf Creek has been protected already and 11 river miles of the Bear River. This conservation corridor includes one of the most biodiverse areas of the world, and a critical north-south migration corridor for a number of species including mule deer, mountain lion and migratory birds and waterfowl.

- **Project Objectives:** Permanently protect and improve water quality and supply by prohibiting development and performing annual monitoring of Little Wolf Creek. To take remedial actions as necessary to improve creek and wetlands resources as necessary to maintain the highest landscape integrity and water quality over decades into the future. Add to the permanent protection of land in the Lower Bear River, from Highway 49 to Camp Far West Reservoir and all the tributaries that feed into it. Curtailing development on prime agricultural and highly biodiverse rangeland resources.

- **Location:** (Subwatersheds, Tributaries, & Acreage): Sanford Ranch encompasses Little Wolf Creek and several perennial and ephemeral streams feeding into it, which flow into the Bear River less than one mile away. The Bear River flows into Camp Far West Reservoir and onto the Central Valley. The site is approximately 150 acres and is located in the Middle Bear subwatershed.

- **Potential Project Partners:**
  - Project Proponent: Bear Yuba Land Trust, contact Marty Coleman-Hunt
  - Funding Sources: Private donations for planning and implementation are secured.

- **Status Update:**
  - 2017 - BYLT developed project, seeking funding

**Kirk Ranch**

- **Project Description:** Work with private landowner to establish a conservation easement, ecosystem restoration and stewardship for 150 acres of oak woodland. In addition to Kirk Ranch, this project may include easements near Hidden Falls and/or near Cottonwood Dam. It may also include acquisitions and/or easements for other new properties.

- **Project Objectives:** Support regeneration of blue oak woodland and plant community

- **Location:** Bear River Watershed near Camp Far West

- **Potential Project Partners:**
  - Project Proponent: Placer County, contact Kally Kedinger-Cecil, Planning Dept.

- **Status Update:**

**Garden Bar Preserve Wetland Habitat Restoration Project**

- **Project Description:** Restore a 0.77-acre wetland along Little Wolf Creek within the wildlife-rich Garden Bar Preserve, a location strategically important for the health of the Middle Bear River watershed. Implementation of this project will enhance the quality of the water flowing from Little Wolf Creek into the Bear River. A restored viable wetland will aid in filtering toxins and other pollutants and will also provide increased habitat for wildlife, including the threatened California black rail. This threatened bird species is found in adjacent ponds and wetlands and is in desperate need of expanded and enhanced wetland habitat.

- **Project Objectives:**
  - Restoring the natural hydrological functions and dynamics of the wetland's floodplain;
  - encouraging healthy soil water retention, infiltration, and groundwater recharge by slowing and spreading wetland flows;
  - improving water quality by filtering sediment, nitrates and phosphates through the restored wetland's vegetation and reducing downstream turbidity;
  - providing structural habitat complexity on the landscape scale by restoring emergent marsh habitat which is relatively rare in the foothill region;
  - protecting and restoring wetland plant communities;
  - reducing the spread of exotic invasive plant species;
  - supporting native pollinator populations by expanding the availability of wetland-associated larval pollinator host plants;
  - improving the habitat quality of the Little Wolf Creek riparian corridor for seasonal wildlife movements between higher and lower elevations;
  - providing high-quality nursery habitat for juvenile native fish, Pacific chorus frogs and garter snakes with fine-stemmed emergent marsh vegetation for concealment; and
  - Providing high-quality wetland nesting and foraging habitat for a diverse community of native birds, including species listed under the California Endangered Species Act and by CDFW as California Species of Special Concern.

- **Location:** Garden Bar Preserve is a 652-acre ranch located along the north side of the Bear River in Nevada County. The property was acquired in fee title in 2013 by Bear Yuba Land Trust and provides perpetual protection to the variety of foothill habitats found on the Preserve, such as oak woodland, emergent wetland and riparian. The area is critically important as a migration corridor for wildlife between Placer and Nevada Counties and is at the heart of the agricultural lands in our area. 57 bird species have been documented on site by SSI, many of which would directly benefit from the proposed wetland restoration project.

➢ **Potential Project Partners:** Bear Yuba Land Trust landowner and project proponent, Restoration Resources for implementation, Sierra Streams Institute for water quality and bird monitoring

➢ **Status Update:**

- 2017 - BYLT developed project, seeking funding

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Nov 15, 2017
# Garden Bar Preserve Wetland Habitat Restoration Project

51. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**

Wildlife Biologist Delineated wetlands and restoration.
-ask Erin if anything is written up

Audubon society to help with bird counts – Christmas bird count

52. **PAST PROJECT MODELS**

Identify other past projects that could serve as models for this project.
Sierra Fund – Meadow restoration work
American River- meadow accessment

53. **MEASURABLE RESULTS:**

a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored<br>-2 miles on Bear<br>- | # of people educated<br>-Citizen Science, Bio blitz, plant identification | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored<br>-.77 acres | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction – soil health reduced, nutrients leached | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers – non profits<br>-20 for restoration | # $ increase in property values |
| # greenhouse case emissions | # of disadvantaged communities | # $ of energy costs conserved |

| | | |
|---|---|---|
| to new carbon sink<br>-Uptake by plans | improved | |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: restoration could include different H2O sources to reduce trampling | Other: | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: Ranchers seeing economic benefit |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps Plan Implemented Restoration Educational Materials Signs Assessment Monitoring Design Plan Mitigation Plan
Other:

**54. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

D E F G H I J K L M N O P Q R S

**Fisheries and Aquatic Life Objectives:**

A B C D F G H J K L M

**Vegetation Objectives:**

A B C D E F G H I J K L M N O P Q S T U

**Terrestrial and Riparian Objectives:**

A C E F G H I J K L M N O P

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply Water Treatment Groundwater Wastewater Treatment Adaptation to Climate Change

Other: Natural shelter

55. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer Engineer Educator Outreach Coordinator

Other: Restoration ecologist / Project manager- BYLT /Permitting specialist – Stream bed alteration

Educator - Schools

**l. Equipment:**

Circle those that apply and add

Dewatering Equipment Ground Moving Equipment

Other: Monitoring/ Assessment Equipment

**m. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.

-Placer County, Society for Range Management Jan 25- Feb 2nd (Sparks)

-Ask Golf course to fund

-RCPP for this area – find out if in the group. Dec.

Bring out donors

-CA Rangeland conservation coalition - Tracy Shore UC job, ask Louise Jackson

Go to workshops ^^

56. **TASKS**

2 Part – Ask for funding/Planning > Implementation

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2:

Assessments – Groundwater, wildlife, hydrological etc. & list Project

Task 3: Restoration Plan with work plan

Small scale- Include burns, reduce fuels, Nisenan Traditional Ecological Knowledge, prescribed targeting grazing with goats?, Permitting?

Task 4: Add Phase 1 2 & 3 for this section or sequencing

Task 5:

Task 6:

Task 7: Project Reporting

**57. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs:

- Permanent fencing to prevent cattle in there.
- Piping water – irrigation plan – troughs away from river

Benefits:

- Restored habitat – diversity
- Lowered greenhouse gas

Hurdles:

- Future plans at restoration beyond this small wetland
- Logistic hurdles with grazer (but willing)
- Ease of access to site – (people and equipment)
- Access- stream crossing – not easy when rains
- Do vehicles harm health?

**58. SEQUENCING**

Does this project require another project to be done first?

Should it come after another project? Please identify projects in sequence.

Could be divided into two
Next oak woodland creation, more restoration along river after this

**59. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

SSI
BYLT
NISENAN

**60. ANY ADDITIONAL NOTES:**

ADD TO PROJECT DESCRIPTION – ADD ABOUT GRAZING – HARMED HABITAT

**Combie Reservoir Sediment and Mercury Removal Project**

- **Project Description:** With funding from the Sierra Fund and CABY, NID has collaborated with USGS to monitor mercury concentrations in fish tissues and reservoir sediments as well as water quality in Rollins and Combie Reservoirs. Planning and permitting have also been completed for an innovative and important project to remove mercury from the sediments at Combie. $6,000,000 are needed to implement this shovel-ready project, which could also reduce the methylation of mercury in the reservoir and could also provide cleaned benthic gravels for use in downstream streambed augmentation to benefit native fish. USGS mercury monitoring will continue throughout the life of the project. Monitoring funds are currently secure until 2017, when additional monitoring funds will be needed. This project could be used as a model for other reservoirs in the area.

- **Project Objectives:** To reduce methylated mercury and sedimentation in Combie Reservoir, thus improving water supply reliability, water quality, ecosystem restoration, and recreation. Sediment removal will also improve and protect the reservoir's water storage capacity.

- **Location:** Combie Reservoir

- **Potential Project Partners:** NID, USGS, Sierra Fund, CABY

- **Status Update:**
  - 2017 - In progress, NID,USGS, TSF

**Informational Signage Delineating Proposed Inundation**

- **Project Description:** At public recreation locations where all or a portion of the area would be inundated by the proposed Centennial Reservoir, erect signage delineating where the new high water mark would be if the dam project is implemented. Include interpretive signage describing the plant and wildlife species, migration corridors, oak woodland and river ecology, historical and indigenous cultural resources that currently reside in the area that would be inundated.

- **Project Objectives:** Increase public understanding of the landscape that would be altered if Centennial Dam is built.

- **Location:** Bear River Campground, CDFW Bear River Fishing Access, Bear River at the Dog Bar Bridge, BLM lands within the footprint of the proposed reservoir, and the network of trails on the east side of the Bear River within the proposed inundation zone

- **Potential Project Partners:** Foothills Water Network, Sierra Club, SYRCL, BLM, CDFW, homeowners, students

- **Status Update:**

## Dry Creek Subwatershed

### Develop Salmon Refugia on Dry Creek as Sacramento River Warms with Climate Change

➢ **Project Description:** Depending on funding availability, the following components could be implemented as separate stand-alone projects or as one multi-step long-term project. They share the same goal.

- **Background:** Dry Creek- high priority for aquatic restoration
  - Juvenile salmon observed in Dry Creek in 2016
  - Not hydraulically mined, but copper mined
  - Mercury has been removed to some degree
  - No major, high dams for hydropower and water storage
- **Tasks:**
  - Reduce man-made barriers to salmon migration
  - Regulate flow and water temperature to support salmon life stages
  - Prevent entrapment and entrainment of salmon in water diversions
  - Improve quality of substrate gravels to support egg laying and juvenile rearing
  - Support maintenance of native vegetative cover for salmon refugia and temperature management

➢ **Project Objectives:**

- Make Dry Creek a salmon refugia to support salmon adaptation to climate change as the Sacramento River warms.
- Increase survival of juvenile salmon rearing in Dry Creek.
- Remove barriers to salmon migration in Dry Creek.
- Increase habitat suitability for salmon spawning in Dry Creek.
- Improve habitat quality for a diverse assemblage of native fish species.

➢ **Location:** Dry Creek below Spenceville's Shingle Falls (a natural barrier to salmon migration) and the Bear River below the Dry Creek confluence

➢ **Potential Project Partners:** USFWS, NMFS, CDFW, SSI, Foothills Water Network, Beale AFB, SSWD (Bear River flows between Feather River & Dry Creek), NID (flows from Tarr Ditch into Dry Creek), California Sportfishing Protection Alliance, Sierra Club, American Rivers, Friends of Spenceville, Trout Unlimited, Gold Country Fly Fishers, Northern California Federation of Fly Fishers, Nevada City Rancheria Tribal Council, American Whitewater, private landowners on the banks of Dry Creek & Lower Bear

➢ **Status Update:**

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Nov 15, 2017
# Develop Salmon Refugia on Dry Creek as Sacramento River Warms with Climate Change

61. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
    Add any new updates to the project description
    NMFS + Wildlife service have done a lot of word, Ask Katie at SSI.,

    Passage on Dry Creek up to Beal

    Katie – Beth Campbell@ FWS
    Beal Project

62. **PAST PROJECT MODELS**
    Identify other past projects that could serve as models for this project.
    Carol Reeb , another fish guy- Mark Gard
    Fish Ladder Modification- Deifications example
    Carmel river – Check Union newspaper article
63. **MEASURABLE RESULTS:**
    a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored – FR/Beal to bear RWER | # of people educated – volunteer, base, spenceville visitors | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved – hiking , fishing | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat – spenceville | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |

| | | |
|---|---|---|
| # of tons of sediment removed | # people protected from health threats | # jobs created- temp |
| # Greenhouse Gas emissions reduced | # of volunteers – Beale volunteers, friends of spenceville | # $ increase in property values |
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |
| Other: | Other: | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: Fishing |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps Plan Implemented Restoration Educational Materials Signs Assessment Monitoring Design Plan Mitigation Plan
Other: Remove Dam + Restoration @ spenceville

**64. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

A E K O

**Fisheries and Aquatic Life Objectives:**

A B D E J K M N

**Vegetation Objectives:**

A E F G H K M U

**Terrestrial and Riparian Objectives:**

A C D E H I O P

**b. *Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply
Water Treatment Groundwater Wastewater Treatment
Adaptation to Climate Change

Other:

- Improvement of fisheries
- Fall run chimook + Steelhead seen
- Groundwater – might reduce groundwater percolation could slow down water

65. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add **ALL**

Project Manager GIS Permitting Specialist Surveyor Designer
Engineer Educator Outreach Coordinator

Other:

- Surveyor – Mark Gard
- Spenceville Habitat rest- citizen led
- Education/Outreach coordinator – Friends of spence ville
-

**n. Equipment:**

Circle those that apply and add

Dewatering Equipment Ground Moving Equipment

Other:

**o. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.

Beale AF. State Dept. of FTW service, NMFS
Friends of spenceville – Fly fisherman, SSI
CA Fisheries foundation

66. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2: Gathering of information/ update of project

Task 3: Meeting with partners

Task 4: Evaluate whats been done and fill in gaps = assessment

Assessment of spenceville

Task 5: Design next tasks after information gathering

Task 6:

Task 7: Project Reporting

**67. CONCEPTUAL COST / BENEFIT COMPARISON ( BR WORST IMPACTED RIVER IN CA)**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs: sediment released, possible contaminated
Need healthy tributaries

Benefits: Fishery, Restoration for Chinook Salmon + Stealhead
Stealhead were in spenceville
Resource benefit analysis= benefit of an endangered species
Benefit of dam – holds back sediment possibly contaminated
Check with- Eric M

Hurdles: what is the risk of the dam breaking? Will it go away?
Eric Marsh at Beal did analysis of sediment (heavy metals)

**68. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

Need to see prior documents
Talk to past experts about sequencing

**69. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

**For outreach + restoration with SSI, Friends of spenceville**
**Volunteers for restoration + public outreach**

**70. ANY ADDITIONAL NOTES:**

**Riparian Habitat Protection at Spenceville Wildlife Area**

- **Project Description:** Fencing of Dry Creek to prevent cattle from grazing in riparian area; also fencing of priority areas to support blue oak woodland regeneration. CDFW leases cattle grazing rights on much of Spenceville, and have greatly improved their program management in recent decades. However, many old fences from the original ranches of which Spenceville is now comprised have been removed or are in disrepair. Of concern regarding the potential to return salmon to Dry Creek is that little to none of the creek riparian zone is fenced to exclude cattle. Should the situation arise that a coordinated effort to return salmon to Dry Creek (up to the natural barrier of Fairy Falls) is undertaken with timely increased water flow and temperature modification measures, projects could include fencing where appropriate, and provision of alternate watering facilities (in addition to existing stock ponds in the area) to reduce grazing impacts on the riparian zone.

- **Project Objectives:** Protect riparian habitat, water quality, restore salmonid habitat

- **Location:** Approximately 6 miles along Dry Creek within Spenceville Wildlife Area

- **Potential Project Partners:** CDFW, contact Mark Carroll
  - Project Proponent: Friends of Spenceville, contact Richard Thomas

- **Status Update:** Developed, In Process of Uploading Evaluation Sheet

**Further Testing & Possible Further Reclamation of Spenceville Copper Mine**

- **Project Description:**
  - Background: It is unclear whether the past reclamation efforts at the Spenceville Copper Mine have resulted in an adequate reduction in watershed contamination to maintain the health of the Dry Creek ecosystem. Every year, California Department of Fish and Wildlife (CDFW) receives calls reporting a "white substance" in Dry Creek near Spenceville Wildlife Area. In February 2015, in response to a citizen's concern, turbid water sample was collected from Dry Creek below the bridge near the parking area at Spenceville Wildlife Area. The sample location outside the mine pit footprint, was collected from a ponded pocket of water that was isolated from the main streamflow; however, this site is subject to connection with streamflow during rain and high flows. The water sample was analyzed by the Water Pollution Control Lab in Rancho Cordova, and results show a copper concentration of 4770 ug/L. Steve Reynolds (DOC Geochemist) who accompanied Ross Atkinson (RWQCB) and Mark Carroll (CDFW) on a site visit to this area in December 2014, declared that this is a naturally occurring geochemical formation in the creek consisting [in part] of aluminum hydroxide. Other minerals such as copper ore with sulfide, copper pyrite, and zinc oxide outcrops, are common geology in this area. The Regional Water Quality Control Board has signed off on the mine clean-up, and the monitoring wells were destroyed.
  - Tasks: This project would test the downstream waters for heavy metals, and if problematic concentrations are found, would propose a second phase of remediation. Conduct a thorough site reconnaissance and collect three or more samples from 1) any seep from the mine area that enters the creek, 2) Dry Creek upstream of the mine (approximately 200' above any potential mine impacts), 3) Dry Creek adjacent to the mine or just below any inflow of any seep into the creek, 4) Dry Creek approximately 200' downstream of the mine site. Run each sample for total and soluble copper, pH, TSS (total copper sample) and whatever other metals have been detected at or above RWQCB listing levels in the past. Depending on the results it would be good to get several samples at different times of the year and different flows. The standard protocol would be at least quarterly sampling for one year.

- **Project Objectives:** Reduce heavy metal contamination in the Dry Creek watershed and downstream watersheds (Lower Bear, Feather, Sacramento, Delta)

- **Location:** Spenceville copper mine

- **Potential Project Partners:** Bureau of Reclamation, California Department of Fish and Wildlife, Sierra Streams Institute, Sierra Fund, Friends of Spenceville

- **Status Update:**

## Lower Bear Subwatershed (including Best Slough & Yankee Slough)

### Levee Setbacks

➢ **Project Description:** Assess the potential to plan and implement levee setbacks at additional locations on the mainstem Bear River and/or tributary sloughs in the Lower Watershed, similar to the 2005 mainstem Bear levee setback project successfully implemented (which was funded by the second Proposition 13 for flood control). Expand on the success of this past project by replicating it nearby.

➢ **Project Objectives:**

- decrease flood risks associated with potential levee failures (the 2005 setback achieved a 200-year level of flood protection)
- restore floodplain riparian habitat between the setback levees to benefit myriad wildlife, plant and fish species, including salmonids and other special-status species
- provide riparian habitat connectivity with the CDFW preserve and other adjacent riparian habitats on the Bear and Feather Rivers near their confluence
- improve fluvial geomorphology by restoring a more natural meander and floodplain width between the levees
- improve water quality by reducing the erosion, sedimentation and turbidity associated with levee bank scouring during high-flow events

➢ **Location:** Mainstem Bear River and/or tributary sloughs in the Lower Watershed, below Camp Far West

➢ **Potential Project Partners:** Three Rivers Levee Improvement Authority (TRLIA), Yuba County Water Agency (YCWA), River Partners, Student Landowner Environmental Watershed Stewardship (SLEWS) program, Environmental Science Associates (Additional Potential Project Partners: CDFW, USFWS Anadromous Fish Recovery Program and Neotropical Migratory Bird Treaty Act program, NMFS, DWR, Reclamation Districts, Sierra Streams Institute, American Rivers, Sierra Foothills Audubon, Institute for Bird Populations, Point Blue Conservation Science, The Nature Conservancy)

- Project Proponent: The Sierra Club, contact Allan Eberhart

➢ **Status Update:**

**Land Acquisitions and Conservation Easements**

Projects of this type are discussed in detail within their respective subwatersheds, and are cross-referenced here in order to provide quick access for building partnerships and pursuing funding opportunities to implement this specific type of project. Simply click on the project name below to be taken to the corresponding project description within this document.

Wolf Creek Subwatershed: Wolf Creek Parkway Trailhead

Middle Bear Subwatershed: Little Wolf Creek Habitat Protection

Lower Bear Subwatershed: Kirk Ranch

In addition, Placer County is looking for private landowners willing to enter into conservation easements with them over 3,000 acres in support of the Placer County Conservation Plan.

The Nature Conservancy may help with funding habitat acquisitions, especially around Dry Creek or the levee setback area of the lower main stem. They are active in the Sacramento River corridor.

The Resource Legacy Fund was a great help to the Marin Agricultural Land Trust and may also help with conservation acquisitions in the Bear Watershed.

There is a need to map the areas most threatened by potential future development to help prioritize acquisitions & easements for conservation.

**Stakeholder Brainstormed Project Ideas Needing Further Development**

The following project ideas were discussed at stakeholder meetings but have not yet been developed into full project descriptions with defined locations, partners, objectives, and tasks designed to meet those objectives. We have asked Stakeholders to further develop these projects outside of Stakeholder Meetings. Refer to Appendix E for a list of those who have shown interest in continuing project development for each project.

- Drone for surveys, monitoring of habitat
- Strategies educating landowners will be different between large and small landowners (have different access to resources)
- Gravel augmentation on Dry Creek
- Assess barriers @ different flows
    - Fish may be able to make it up during high flows
- Invest in art installation projects
    - Fish ladders/osprey nesting platforms...) to involve community and boost recreational and scenic opportunities
- Develop educational program and long term monitoring program for the community about bioaccumulation/mercury levels
    - Clarify to the public who is doing this work
- How does dredging of sediments in reservoirs impact levels of toxins (mercury), temperatures, reservoir fish
- Restoration/enhancement of anadromous fish habitat and migration on Dry Creek (with monitoring)
- Participation (with eye towards mitigation) of camp far west FERC relicensing process
- Hemphill Dam? Others (related to objective D)
- Fish ladder cut installation- demonstration of successful restoration sites
- Citizen Science Monitoring, iNat Project Database: diversity database of occurrences of species of populations
- Increase coordination between public and private landowners
- Youth Corps and Senior Corps
- Study places where dams have been removed (ex. the elwa)
    - How other counties deal with water security and the interfaces between human and ecosystem needs/health
- Need in line reservoir effects on water quality (temperature) and hydrology
    - New reservoir effects on setbacks of current homes etc...
- Study effects of Rollins dam and impoundment on all environmental aspects
    - Water quality, sedimentation, wildlife, mercury, erosion
    - Use in determining efficiency of future projects
- Economic considerations - supporting businesses, jobs, work, education and stewardship; helps get people invested (can be tied in throughout watershed)
- Willow planting

- Pollinator garden network
- UC Grouse Ridge Field Station BMPs for timber harvest development
    - Training, employment opportunities, program development (Sierra Harvest for Ag as model)
- Find property for each ecosystem, demonstrating restoration and ideal conditions-> Education and engagement
- Plant nurseries, do not sell invasive plants
- GIS data/layer on all ecosystems; maps to focus attention
- Native American/Restoration Inspired art installation
- Within bed and banks of stream, reduce sedimentation throughout watershed, specifically Rollins (ex. Santa Fe River, New Mexico)
- Collaborative relationships, recreation and restoration hand in hand
- Use projects already in progress
- Ongoing public report of data gathered... at least annually
- Interagency collaboration on joint watershed goals
- Investigate/understand professional forestry practices and priorities w/in watershed
- Involve and educate landowners, landscapes, architects, farmers in riparian zones and counties
- Investigate better wildlife-friendly fence practices/techniques
- Small landowners need information/resources (ex. bill stuffers)
- Field trip on the Bear River
- Pollinator gardens
- Dogs vs. wildlife studies- educate public to impacts of dogs running loose
- Bear River Canal and Wise Canal create deer mortality; need more crossings, escape ramps etc...
- Get USFS/Cal Trans wildlife migration report across Hwy 80
- Involvement/participation in FERC relicensing (for Camp Far West)
- Road kill studies (database), UC Davis; use in planning
- Protection of predatory species and balance between predators and prey
- Encourage public education and enjoyment of wildlife
- Education of smaller landowners (through NRCS?)
- Encourage more set aside areas for wildlife like Grouse Ridge Roadless Area
- Consolidation of public lands currently in checker board
- Study NID conveyance systems and water releases and impacts to wildlife
- Add amphibian objectives (flows, temps etc...)
- Education in PG&E bills, other bills stuffers, phone companies
- Manage livestock in such a way as to enhance riparian areas, exclude when appropriate
- Support and encourage holistic livestock and range management practices
- Educate livestock owners about coexisting with predator species
- Increase points of public access along the Bear River Watershed through private property, NID and public lands

## Bear Watershed Stakeholder Group Identified Data Gaps and Proposed Research Project Concepts

Throughout the Bear Watershed stakeholder meetings and the development of the Bear Watershed Disturbance Inventory (Campbell *et al*. 2016), several data gaps became apparent and several research project concepts were identified by stakeholders to address those data gaps. This section expands on six topic groups where data gaps emerged, including Water Quality, Water Quantity, Aquatic Habitat, Riparian and Terrestrial Habitat, Wildlife and Aquatic Resources, and Cultural Resources. Within each group there are issues/concerns underlined with stakeholder-suggested project concepts to address the data gaps. Data Gaps are bulleted with an arrow for each project concept.

## Water Quality

Climate Change

- Effects of Climate Change on water quality
    - ➢ Changes to water quality over time

Water Quality Monitoring

- Natural parameters of the Bear River and tributaries
    - ➢ Research natural turbidity
- Estimates are rough
    - ➢ Augmenting current water quality models with better statistics
- Access to monitoring sites
    - ➢ Work with public and private landowners to access more on the ground monitoring
- Comprehensive water quality data missing
    - ➢ Supplement prior reports and studies of BMI and other water quality parameters
    - ➢ Site expansion into tributaries
    - ➢ Continue macroinvertebrate sampling
- Mercury pollution
- Lake Combie NID removal project- will determine benefits of removing mercury (ie, reduction in downstream methyl-mercury, in-reservoir sediment reduction) vs. apparent risks
- Erosion at spill points
    - ➢ Effects on water quality
    - ➢ How has the Lowell Fire + storm runoff impacted mercury methylation

Water Temperature

- Long term, watershed-wide water temperature data
  - ➢ Identify and map existing temperature gauges, consolidate data
  - ➢ Install new temperature gauges to start collecting data in unrepresented areas
  - ➢ Study if temperatures are changing with climate change
  - ➢ Supplement data where only 2 months of one year are available

Groundwater

- Quality and Quantity
  - ➢ Map existing wells
  - ➢ Study effects of ground water usage over time
  - ➢ Study interactions between surface and groundwater flow
  - ➢ Groundwater monitoring at BAFB

Human Activity Impacts and Population Growth

- Effects of recreational activities including power watercraft in reservoirs
  - ➢ Conduct specific water quality monitoring in and downstream of reservoirs
- Effects of proposed NID restoration – gravel skimming above Rollins
  - ➢ Water quality monitoring throughout the project
- Effects of Current and Historic Mining
  - ➢ Low-resolution imagery data, creating delineated maps, not just points
  - ➢ Map remaining tailings, checking for debris where debris dams and failed debris dams are located
  - ➢ Identify potential erosion of contaminated mine tailings
  - ➢ Where old mining sites can be accessed, study to see if they are contributing sediment
  - ➢ Polar Star Mine clean-up on water quality
  - ➢ Identify point sources of contamination and potential clean-up projects for mercury levels in Greenhorn Creek
  - ➢ Effects of ground-mining from Blue Lead Mine (Need baseline data)
  - ➢ Compounded effects if mining on adjacent BLM land approved (Need baseline data)
  - ➢ Effects of hydraulic mining and mapping remaining sites

    - ➢ Effects of Copper Mining: Collection of water or substrate samples for copper analysis
    - ➢ Restoration related to copper mine
- Effects of Marijuana Grows
    - ➢ Identify legal and illegal grows using aerial imagery
    - ➢ Monitor water quality in stream near identified grows to assess effects of operations on water quality
- Effects of Transient and Homeless Camps Effects of Historic Mining
    - ➢ Using Social services, Police, local Homeless shelters, and Parks and Rec to identify the areas of homeless camps. Conduct water quality monitoring to assess where they are having the greatest effect on water quality from garbage, sanitation, and bacterial issues
    - ➢ Assess health of forested areas to assess fire concerns
- Historical ditches
    - ➢ Map and ground truth ditches and monitor if maintained and impacts on water
- Effects of roads, railroads, and pipelines
    - ➢ Study the effects of transportation lines on water quality

## Water Quantity

Climate Change

- Effects of Climate Change
    - ➢ Changes in water quantity over time

Hydrology

- Sources of Bear River
    - ➢ Mapping of the structure of the headwaters, especially springs and where the water rises
- Stations tend to be located at reservoirs or canals- hydrologic cycle not monitored for much of rest of watershed
    - ➢ Install stream flow gauging stations
- Bear Valley meadow's surface water hydrology
    - ➢ Used GCM model to analyze climate change rather than delta T. Build model that incorporates spills
- Impact of regulated system on flow levels
    - ➢ Consolidate data, find gaps, build models
- Dry Creek water levels between Beale and Highway 65
    - ➢ Who is diverting the water in this reach? Conduct surveys to obtain GPS data on diversions, pipe sizes, uses. How much are people diverting and are they doing it legally?
    - ➢ Create a water balance model for Dry Creek

Groundwater

- Quality and Quantity
    - ➢ Map existing wells
    - ➢ Study effects of ground water usage over time
    - ➢ Study interactions between surface and groundwater flow
    - ➢ Groundwater monitoring at BAFB
- Bear Valley meadow's subsurface water storage capabilities

Human Activity Impacts and Population Growth

- Regions water supply needs
    - ➢ an evaluation of the region's water supply needs

    - ➢ an evaluation of the full suite of means by which those needs may be met
    - ➢ an evaluation of the potential environmental impacts of proposed water supply projects
    - ➢ an evaluation of the potential water supply impacts of proposed restoration projects
- Diversion and Storage capabilities
    - ➢ Consolidate data
    - ➢ Study trends and build models
    - ➢ Are water transfers between watersheds sustainable?
    - ➢ Ecological effect of high flows in typically low-flow seasons
    - ➢ New licensing process equals new studies: Draft monitoring plan for YBDS process- how can group fit into that process? Note: for the extent of FERC relicensing
- Effects of Marijuana Grows
    - ➢ Identify legal and illegal grows using aerial imagery
    - ➢ Monitor water usage near identified grows to assess effects of operations on water quantity
- Effects of de-watering with Blue Lead Mine and Compounded effects if mining on adjacent BLM land approved
    - ➢ Monitoring point downstream of mine: monitor water quality/quantity

## Aquatic Habitat

Climate Change

- Effects of Climate Change
    - ➢ Changes in habitat

Bear River levee Setback Project

- Effects of setback project
    - ➢ Need to monitor effects or find out if someone may already be doing this?

Vernal Pools

- How does watershed health affect the migratory fowl populations that rely on vernal pools?
    - ➢ Study on relationship between health of Bear River watershed and vernal pool health

In-Stream Habitat

- Effects of NID mercury removal Project
    - ➢ Assessment and monitoring of water quality in regards to mercury
    - ➢ Assessment and monitoring of bioaccumulation rates
- Physical Habitat Surveys gaps throughout the watershed: width, depth, substrate, cover, sinuosity, slope, human influence, instream habitat complexity, and riparian vegetation
    - ➢ Conduct physical habitat surveys
- High levels of sediment as a result of mining outdated
    - ➢ Conduct surveys to compare to old data
- Mining
    - ➢ How is gravel mining by Hansen brothers impacting macroinvertebrate communities

Suitability for Fish Habitat

- Reduced quality of brown and rainbow trout fisheries
    - ➢ Re-operation of the river for a cold water fishery via increased releases, reduced diversions, and/or modified storage operations
- On the ground surveys to document habitat suitability gaps
    - ➢ Conduct physical habitat surveys

Human Activity Impacts and Population Growth

- South Sutter Water District FERC relicensing
    - ➢ Potential effects on aquatic habitat and communities

## Riparian and Terrestrial Habitat

Climate Change

- Effects of Climate Change on wildlife, plant and aquatic resources
    - ➢ Changes in habitat

Water Supply

- Ecological damage during canal outage high flows through Bear Valley
    - ➢ Collect appropriate data
- Functioning wetland and other ecosystems
    - ➢ Effects of Climate Change data gathering, monitoring, assessment
    - ➢ Effects of CA drought data gathering, monitoring, assessment

Fire

- Using Fire Maps
    - ➢ Identify area where thinning/fuels reduction projects could take place
    - ➢ Plan post-fire restoration
    - ➢ Fire impacts on erosion
- Effects of Transient and Homeless Camps
    - ➢ Collect data for fire danger

Erosion

- Sedimentation loads into creek
    - ➢ Mapping of erodible soils
    - ➢ GIS modeling of soils & mining tailings
    - ➢ Superfund sites (Spenceville put in lower section)
    - ➢ County soils mapping and management
    - ➢ What is the potential for pollution via erosion
- Canal Spills causing landslides
    - ➢ Consequences of canal failures
    - ➢ Continued negotiations in FERC relicensing
- Effects of Mining: Historical data of gravels in highly impacted tributaries (Greenhorn, Steephollow, Little greenhorn, Clipper Creek)
    - ➢ Comparison of historic vs. current state?

Plant Communities in General

- Needs Ground-Truthing from list of plant communities
    - ➢ Conduct surveys to ground-truth plant communities
- Pesticide use by PG&E under transmission lines
    - ➢ Development of a vegetation management plan
- Effects of Grazing on Bear Valley Meadow
    - ➢ Continued monitoring of Granite Bay Fly Fisher's work
- Timber harvest/clear cutting: No information on number or percentage of trees that are being removed
    - ➢ Use aerial imagery to identify extent of clear cutting
- Little known about effect of BAFB activities on oak woodlands. Dry Creek watershed– oak woodland and native grasses habitat.
    - ➢ Weed mapping @ BAFB
    - ➢ Invasive control (Spenceville, Beale)- Giant Reed, Best Slough, Parrot feather

Non-Native and Invasive Plants

- Maps of current distribution and change over time
    - ➢ Restoration projects
    - ➢ Use aerial imagery to map some invasive species (e.g., yellow star thistle)
- Data on non-federal lands
    - ➢ Assessments on non-federal lands

Endangered and Special Status Plant Species

- Surveys only conducted within buffer region of specific features (trails, reservoirs, powerhouses, etc.)
    - ➢ Expand surveys of endangered and special status plant species
- Surveys only conduced upstream of Lake Combie
    - ➢ Expand surveys of endangered and special status plant species

California Endangered Plant Species

- Surveys only conducted within buffer region of specific features (trails, reservoirs, powerhouses, etc)
    - ➢ Expand surveys of plant species
- Surveys only conduced upstream of Lake Combie

- ➢ Expand surveys of endangered and special status plant species
- ➢ Is Stebbins' morning glory (federally and state endangered) in the footprint of the proposed Centennial Dam?

<u>Human Activity Impacts and Population Growth</u>

- Mining
  - ➢ Identify which historic mining sites are in greatest need of restoration/clean-up
  - ➢ Where might mine waste have the greatest impact on streams/human health via contact with trails etc.
- Centennial Dam
  - ➢ If Centennial is put in, how will we mitigate for the habitat lost? What species and habitat types will need to be considered?
- Consolidate County Planning Department documents
  - ➢ Population growth potential
  - ➢ Work with Counties to identify Potential effects: increased infrastructure, decreased water availability, decreased water quality
- Powerlines: Pesticide use by PG&E under transmission lines
  - ➢ Track how management plans are changing with FERC relicensing
  - ➢ Development of a vegetation management plan
  - ➢ Bird monitoring around powerlines
- Rail Traffic- What is being transported? Especially important to know oils, gasses, and chemicals
  - ➢ Outreach to railroad (potentially not cooperative) or to City of Colfax
- High Pressure Fuel Line
  - ➢ Who owns it
  - ➢ Monitoring potential leaks
- Unregulated OHV use on BLM land near Greenhorn Creek
  - ➢ Impacts on riparian habitat and communities
- What are the effects of NID water deliveries ion riparian habitat and communities
  - ➢ Conduct surveys and assessments on riparian habitats vs. water deliveries
- Updated data of Parcel Subdivision
  - ➢ Increased difficulty with conservation actions

- Increased population pressures

## Wildlife & Aquatic Resources

Climate Change

- Effects of Climate Change on wildlife and aquatic resources
    - ➢ Changes in habitat availability and behavior

Animals Communities in General

- Barriers to wildlife movement
    - ➢ Create exhaustive list from available data
    - ➢ Ground truth surveys

Mammal Species

- Needs ground-truthing of the list of mammals that may occur in watershed
    - ➢ Collect survey data of mammal species
- Bat Species
    - ➢ Conduct health surveys of bat species from past bat surveys

Fish Species

- List of known fish species is not exhaustive
    - ➢ Updated surveys
    - ➢ Snorkel survey and/or seine surveys in different reaches and above & below dams and major diversions to document fish communities
- Barriers to fish movement
    - ➢ Conduct survey of barriers of fish barriers
    - ➢ Develop maps to show migration of juvenile salmon
- Maintaining and improving fisheries
    - ➢ Find data gaps
- Fish Entrainment- Extrapolation only takes number of fish caught at Dutch Flat No. 2 and flow into account
    - ➢ Snorkel survey and/or seine surveys in different reaches and above & below dams and major diversions to document fish communities
- Habitat inventory for salmon spawning is not exhaustive
    - ➢ Conduct habitat surveys
    - ➢ Determine impact of rice farms

- ➢ Restoration potential for Dry Creek for increased quality of juvenile salmon rearing habitat and spawning habitat

Amphibian and Reptiles

- Fire and sedimentation
  - ➢ How has the Lowell Fire impacted sedimentation of FYLF egg masses in Steephollow -- effects on survival?
- Chytrid distribution in amphibians throughout the watershed
  - ➢ More extensive surveys
- Western Pond Turtles
  - ➢ More extensive surveys
- Red Legged Frog
  - ➢ More extensive surveys

Bird Species

- Transect location information not available online
  - ➢ Find sources of data and potentially put online
- Osprey
  - ➢ More extensive surveys

Endangered and Special Status Species

- Steelhead, Chinook salmon, and green sturgeon in Dry Creek
  - ➢ Conduct surveys for data on adult numbers
  - ➢ Effectiveness of ladder on Beale Air Force Base dam
  - ➢ Water temperature limiting factors
  - ➢ Instream flow study in Dry Creek
  - ➢ Carcass surveys
- Valley Elderberry Longhorn Beetles
  - ➢ More extensive surveys of suitable habitat for elderberry plants
- Foothill Yellow Legged Frog Relied solely on visual encounter surveys (low probability of detection in sparsely populated areas). Surveys too early for this elevation?
  - ➢ Conduct scientific robust surveys
- Surveys of habitat suitability of reported observed special status species

Human Activity Impacts and Population Growth

- Effects of marijuana grows
    - ➢ Collect data about where they are located
    - ➢ Collect data about what pesticides are used

## Human Culture/Resources

Tribal Communities

- What are the needs of the tribal communities for access
    - ➢ Prioritization of restoration of Native American sites
    - ➢ Engage tribes in stewardship
    - ➢ Outreach and education about tribal use of the Bear Watershed
- Archaeological remains present
    - ➢ Get input from local tribal communities
    - ➢ Conduct more surveys required for future work
- Plants/animals hold importance to tribal members and should be a conservation priority
    - ➢ Survey the community and the landscape

Recreation

- Effects of power vehicles on water quality
    - ➢ Conduct scientific studies on effects
- Trail Access to and alongside streams
    - ➢ Conduct surveys
- Community demand for Trails
    - ➢ Conduct surveys of need
    - ➢ Impact of recreational trails
    - ➢ Conduct survey of unsafe access to trails during high flow and high snow scenarios
- Boating Access
    - ➢ Map boat access to waterways
    - ➢ Survey effects on watershed habitats
- Sediment load from road and trail use
    - ➢ Trail and Road surveys

Archaeological Resources

- Effects of NID mercury removal project
    - ➢ Ground truth proposed mitigation measure for potential disturbance

Selling of Drum Canal

- Effects of Sale
    - ➢ Conduct monitoring and studies

<u>Land Transfers</u>

- Effects of Land Transferred
    - ➢ What are the and how to mitigate land transfers

## CABY IRWMP Projects in the Bear Watershed

The following projects listed in Appendix Ia of the CABY IRWMP's 2014 Update are directly relevant to the restoration of the Bear River Watershed and are thus reiterated here (omitted projects were focused on the Cosumnes, American, or Yuba River watersheds). Some of these projects were ready to proceed at the time of the IRWMP's publication and are currently in progress, while others were at a conceptual level at the time of the IRWMP's publication and are in need of further development before they can be implemented.More information on these projects is available within the CABY IRWMP and by contacting the project sponsors and key partner organizations that are listed below each project title.

**CABY Programmatic Area 1: Water Supply**

- Water Efficiency and Water Quality: Canal Lining; Gauging Stations; Water Efficiency Education
    - Nevada Irrigation District and Placer County Water Agency
- Grass Valley Drainage System Repairs: Flood Protection Improvement
    - City of Grass Valley
- Grass Valley Drainage System Repairs: Matson Creek Flooding, Sedimentation, and Enhancement Improvements
    - City of Grass Valley
- Grass Valley Drainage System Repairs: Reduction of Sedimentation and Localized Flood Protection
    - City of Grass Valley
- Grass Valley Water System Repairs: Elimination of Leaks
    - City of Grass Valley
- Grass Valley Wolf Creek Flood Control Project
    - City of Grass Valley
- Water Conservation through the Expansion of the IMS Program
    - Placer County Water Agency
- Regional Water System Reliability and Conservation Project
    - Placer County Water Agency, Nevada Irrigation District

**CABY Programmatic Area 2: Water Quality**

- Combie Reservoir Sediment and Mercury Removal Project
    - Nevada Irrigation District

- CABY Mercury and Sediment Abatement Initiative
    - The Sierra Fund, Tahoe National Forest, South Yuba River Citizen's League, Yuba Watershed Institute, Bureau of Land Management, Nevada Irrigation District
- Grass Valley Sewer Collection System: Reduction of Infiltration and Inflow
    - City of Grass Valley
- Grass Valley Sewer System Repairs: Replacement of Aged Infrastructure
    - City of Grass Valley
- Grass Valley Public Works Vactor Truck
    - City of Grass Valley
- Water Quality/Quantity Technical Assistance to Small-acreage Working Landscapes
    - Placer County RCD
- Quantifying Sediment Loading from Native Roads, Diversion Ditches, and Mines to Identify and Prioritize Future Restoration Projects
    - California Association of RCDs

**CABY Programmatic Area 3: Environment and Habitat**

- Meadow Enhancement and Restoration in the Yuba, Bear and American River Watersheds
    - South Yuba River Citizens League, Tahoe National Forest (Yuba River and American River Ranger Districts), American Rivers, American River Conservancy
- Removal of Scotch broom in Nevada and Placer Counties by community group sponsors to reduce the wildfire hazard and invasive weed spread throughout watersheds
    - Fire Safe Council of Nevada County
- Native Conservation Corps
    - Sierra Native Alliance
- Aquatic Invasive Species Prevention
    - South Yuba River Citizen's League

**CABY Programmatic Area 5: Human-Landscape Interaction**

- Peabody Creek: Flood Management, Creek Restoration and Green Infrastructure in a Disadvantaged Community
    - American Rivers, City of Grass Valley and Wolf Creek Community Alliance

- Livestock and Lands Program
    - County RCDs
- Fish Friendly Farming Program
    - County RCDs

**CABY Programmatic Area 6: Overarching Objectives (Education and Outreach, Monitoring and Data Analysis, Regional Planning and Land-use)**

- Outreach and education to citizens and stakeholders in the Wolf Creek watershed
    - Wolf Creek Community Alliance
- Hands-on Watershed Science Program for Students in Grades 6-12 and College
    - Sierra Streams Institute
- Expanding Watershed Education and Outreach
    - South Yuba River Citizens League
- Erosion and Sediment Control: An illustrated field guide for construction workers
    - Wolf Creek Community Alliance
- Wolf Creek Monitoring
    - Wolf Creek Community Alliance
- Measuring Impact: a Citizen Monitoring Project
    - South Yuba River Citizens League
- Consolidation and Expansion of Regional Stream Monitoring using Multiple Chemical, Physical and Biological Parameters
    - Sierra Streams Institute
- Development of Sierra Nevada Foothills Regional Watershed Laboratory
    - Sierra Streams Institute
- Analysis of Water Quality Monitoring Data, and Program Planning
    - Wolf Creek Community Alliance
- Disturbance Inventory of the Wolf Creek Watershed
    - Wolf Creek Community Alliance
- Finalize Viability of Critical, High-impact Wolf Creek Watershed Improvement Projects and Prepare Ranked Projects for Implementation
    - Wolf Creek Community Alliance

- Wolf Creek Parkway: Phase 1 Implementation of Alignment Study and Master Plan
    - Wolf Creek Community Alliance
- Grass Valley Meadow- Phase I
    - Wolf Creek Community Alliance
- Flow Reliability Assessment for the Wolf Creek Watershed
    - Wolf Creek Community Alliance
- Assessing In-stream Flow Requirements to Protect Aquatic Biota During Dry and Critically Dry Years
    - South Yuba River Citizens League and American Rivers
- The Heat is On
    - American Rivers
- Groundwater Response to Climate Variation
    - County Water Agencies
- CABY Region Data Analysis Project
    - Sierra Streams Institute
- Mercury trapped behind dams: deposition, methylation and transport study
    - Sierra Streams Institute
- Community-based Watershed Action Plans
    - South Yuba River Citizens League
- CABY Conservation OneSTOP – Working Lands Technical Assistance Virtual Collaborative
    - Placer RCD
- CABY Region Green Infrastructure
    - American Rivers
- Water-use Efficiency/Water Neutrality
    - American Rivers
- Resource Management in Constrained Economic Times- Citizen Stewards
    - CABY

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# 6. Appendices

## Appendix A. Acronyms

| Acronym | Definition | Description |
|---|---|---|
| ac-ft | Acre Feet | Unit of measure for water volume defined as the volume of one acre of surface area to a depth of one foot |
| BLM | Bureau of Land Management | Department of the Interior agency, formed in 1946, that administers public lands in the US and the federal government's subsurface mineral estate |
| BMI | Benthic Macroinvertebrate | Organisms without backbones that are big enough to be seen with the naked eye and spend at least part of their lives in or on the bottom of a body of water |
| CABY | Cosumnes, American, Bear, Yuba | A cooperative planning effort aimed at bringing diverse stakeholders together. Currently more than 30 member organizations. Serves as a vehicle for bringing funding into the region. |
| Cal EPA | California Environmental protection Agency | Cabinet level state agency, formed in 1991, with the mission to restore, protect, and enhance the environment and ensure public health, environmental quality and economic vitality |
| CALPIP | California Pesticide Information Portal | Database of the California Department of Pesticide Regulation that provides public access to the department's pesticide use and label information, Groundwater Protection Area information, and Pesticide Regulation's Endangered Species Custom Real-time Internet Bulletin Engine |
| CASGEM | California Statewide Groundwater Elevation Monitoring | Monitoring program established by the state legislature that requires local agencies to monitor the elevation of their groundwater basins to help better manage the resource |
| CDEC | California Data Exchange Center | Online database of the California Department of Water Resources that installs, maintains and operates the state's hydrologic data collection network and provides a centralized location for hydrologic information gathered by various |

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| | | cooperators in the state |
| CDFG | California Department of Fish and Game | **See* CDFW |
| CDFW | California Department of Fish and Wildlife | Department within the California Natural Resources Agency, formed in 1909 as the California Department of Fish and Game (CDFG), that manages and protects the state's fish, wildlife, plant resources and native habitats. |
| CDPR | California Department of Pesticide Regulation | Department within the California Environmental Protection Agency with the mission to protect human and environmental health by regulating pesticide sales and use and educating landowners on pesticide management |
| CESA | California Endangered Species Act | Law enacted by the state in 1970 to protect and conserve endangered species and their environments; currently lists 49 animals and 132 land plant species as endangered |
| cfs | Cubic feet per second | Unit of measure expressing the rate of discharge of flow of water; equal to the discharge through a one-foot cross section at a rate of one foot per second |
| CNDDB | California Natural Diversity Database | Online database of the Department of Fish and Wildlife's Habitat Conservation Planning Division that inventories the locations of the state's rarest species and natural communities |
| CNPS | California Native Plant Society | California-based environmental non-profit that seeks to increase understanding of the state's native flora and protect it for future generations |
| CRMP | Coordinated Resources Management Plan | A plan created by a consensus decision-making process |
| CRWQCB | California Regional Water Quality Control Board | Nine semi-autonomous bodies of the State Water Resource Control Board, created in 1949 that are responsible for protecting the surface, ground and coastal waters of their region |
| CWD | Coarse Woody Debris | Term used for fallen dead trees and the remains of large branches on the ground in forests, rivers or |

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| | | wetlands |
| CWHR | California Wildlife Habitat Relationships | Information system that contains life history, geographic range, habitat relationships and management information of 712 species known to occur in California |
| DO | Dissolved Oxygen | The microscopic bubbles of gaseous oxygen that are mixed in water and available to aquatic organisms whose concentrations serves as important indicator of water quality |
| DPS | Distinct Population Segment | Smallest division of a taxonomic species permitted to be protected under the Endangered Species Act |
| DWR | California Department of Water Resources | Department within the California Natural Resources Agency, formed in 1956, that is responsible for the state's management and regulation of water usage |
| EPA | Environmental Protection Agency | Agency of the federal government created in 1970 to protect human health and the environment by writing and enforcing environmental regulations |
| ESA | Federal Endangered Species Act | 1973 legislation that serves to carry out the provisions of The Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| FDA | US Food and Drug Administration | Federal agency in the Department of Health and Human Services that is responsible for protecting and promoting public health through the regulation of food safety, among other things |
| FERC | Federal Energy Regulatory Commission | The federal agency with jurisdiction over the licensing of hydropower dams |
| FFDOCKET | Federal Facility Hazardous Waste Compliance Docket | Document that contains information reported to the EPA by federal facilities that manage hazardous waste or form which hazardous substances, pollutants or contaminants may be been released |
| FOS | Friends of Spenceville | Non-profit formed to help preserve and educate the public about the Spenceville Wildlife Area |

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| FRAP | Fire and Resources Assessment Program | Program of the California legislature that has required CALFIRE to produce periodic assessments of the forests and rangelands of California since the 1970s |
| GAMA | Groundwater Ambient Monitoring & Assessment | Program of the State Water Resources Control Board that provides data, information and tools to enable assessment of groundwater quality and quantity |
| GIS | Geographic Information System | Computational system designed to capture, store, manipulate, analyze, manage and present all types of spatial or geographical data |
| GWPA | Groundwater Protection Area | One-square mile areas of land sensitive to the movement of pesticides, where pesticide use is restricted, established by the Department of Pesticide Regulation |
| GSA | Groundwater Sustainability Agency | Local agencies created under the Sustainable Groundwater Management Act that have the responsibility of assessing conditions in their water basins and adopting locally-based management plans within 20 years |
| HUC | Hydrologic Unit Code | Unique code to identify hydrologic features consisting of two to eight digits based on the four levels of classification in the hydrologic unit system of the USGS |
| IBI | Index of Biotic Integrity | Scientific tool used to identify and classify water pollution programs that associated anthropogenic influences and biological activity in a water body |
| ILRP | Irrigated Lands Regulatory Program | Program of the State Wate Resources Control Board, established in 2003, to control and assess the effects of discharges from irrigated agricultural lands |
| IRWMP | Integrated Regional Water Management Plan | A comprehensive planning document to encourage regional strategies for management of water resources. |
| IUCN | International Union for Conservation of Nature | International organization, founded in 1948, with the goal of influencing, encouraging and assisting society to conserve nature and the sustainable use of |

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| | | natural resources |
| LCC | Landscape Conservation Cooperative | Applied conservation science partnerships which promote collaboration and provide the science and technical expertise needed to support conservation planning at landscape scales – beyond the reach or resources of any one organization. |
| MAS/MILS | Minerals Availability System/Mineral Industry Location System | Database begun in the 1960s by the US Bureau of Mines that classifies mineral resources according to their extraction technologies, economics and commercial availability |
| MMI | Multi-metric Index | Index of biotic integrity that integrates an array of metrics that each provide different information on a biological attribute |
| MRDS | Mineral Resources Data System | USGS Mining Database, with data from other agencies, containing information on mine name, location, deposit type, mineral age, commodities and local tectonics |
| NCCP | Natural Community Conservation Plan | Program of the California Department of Fish and Wildlife that encourages broad-based ecosystem approaches to planning for the protection of biological diversity |
| NCRCD | Nevada County Resource Conservation District | Local resource conservation non-profit mandated by the California Public Resources Code to promote responsible resource management in Nevada County |
| NHD | National Hydrography Dataset | Digital GIS dataset operated by the USGS that contains hydrographic features, designed for general mapping and the analysis of surface water systems |
| NID | Nevada Irrigation District | Independent agency, formed in 1921, that provides water for much of Nevada County and portions of Placer and Yuba County for irrigation, municipal and domestic purposes |
| NOAA | National Oceanographic and Atmospheric | Scientific agency within the US Department of Commerce that assesses, monitors, predicts, and educates the public about the conditions of the |

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| | Administration | ocean and atmosphere |
| NPDES | National Pollutant Discharge Elimination System | Permit system within the Clean Water Act for regulating point sources of pollution into surface waters |
| NRCS | National Resources Conservation Service | Agency within the US Department of Agriculture, founded in 1932 as the Soil Conservation Service, that provides technical assistance to farmers and landowners to protect natural resources on private lands |
| NWIS | National Water Information System | Database designed to make USGS water data publically available |
| OEHHA | California Office of Environmental Health Hazard Assessment | Specialized department within the California Environmental Protection Agency that is responsible for evaluating health risks from environmental chemical contaminants |
| PAMP | Principle Areas of Mine Pollution | California Department of Conservation Database of mining operations in CA and their potential water quality problems |
| PCCP | Placer County Conservation Plan | County-proposed solution to coordinate and streamline the permitting process for local entities that serves as the county Habitat Conservation Plan under the Endangered Species Act |
| PCPA | Pesticide Contamination Prevention Act | California law enacted in 1985 designed to prevent further pesticide pollution of groundwater aquifers |
| PCWA | Placer County Water Agency | Primary water resource agency for Placer County that supplies irrigation an drinking water and hydroelectric energy |
| PG&E | Pacific Gas and Electric Company | Utility company, founded in 1905, that provides natural gas and electricity to most of the northern two-thirds of California |
| QAPP | Quality Assurance Project Plan | A document that outlines the procedures that those who conduct a monitoring project will take to ensure that the data they collect and analyze meets |

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| | | project requirements |
| SGMA | Sustainable Groundwater Management Act | State legislation passed in 2014 that provides a framework for the sustainable management of groundwater supplies by local authories |
| SSI | Sierra Streams Institute | A non-profit organization dedicated to promoting community stewardship and scientific knowledge of Sierra watersheds through monitoring, research, restoration, and education. |
| SSWD | South Sutter Water District | Primary water agency for south Sutter County, formed in 1954, that develops, stores and distributes surface and groundwater to western Placer and southern Sutter counties. |
| SWAMP | Surface Water Ambient Monitoring Program | The monitoring program of the CA State Water Resources Control Board. Conducts monitoring directly and through collaborative partnerships |
| TEK | Traditional Ecological Knowledge | Indigenous knowledge regarding management and sustainability of local resources. |
| TMDL | Total Maximum Daily Load | Regulatory concept from the Clean Water Act, describing a value of the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards |
| TNF | Tahoe National Forest | US National Forest located northwest of Lake Tahoe, operated by the US Forest Service, located in parts of six counties including Placer, Nevada and Yuba counties |
| TRI | Toxic Release Inventory | Publically available database developed by the EPA, containing information on toxic chemical releases and other waste management activities in the US |
| USDA | United States Department of Agriculture | US federal executive department responsible for developing and executing government policy on farming, agriculture, forestry and food |
| USEPA | United States Environmental | **See* EPA |

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| | Protection Agency | |
| USFS | United States Forest Service | Federal agency within the US Department of Agriculture, formed in 1905, with the mission of sustaining the health, diversity and productivity of public forests and grasslands |
| USFWS | United States Fish and Wildlife Service | Federal agency within the US Department of Interior, formed in 1940, dedicated to the management of fish, wildlife and their natural habitats |
| USGS | United States Geological Survey | Scientific agency, without regulatory responsibility, within the Department of the Interior that studies the landscape and natural resources of the country and the natural hazards that threaten it |
| WAF | Watershed Assessment Framework | Method of reporting on key indicators of watershed health over time to guide watershed management, outlined in the 2006 California Watershed Action Plan |
| WBD | Watershed Boundary Dataset | Digital GIS dataset operated by the USGS that defines the areal extent of surface water drainages and identifies them by a unique Hydrologic Unit Code |
| WCCA | Wolf Creek Community Alliance | A volunteer-run nonprofit based in Grass Valley, CA with the mission of protecting, enhancing and restoring Wolf Creek and its tributaries |
| WHIPPET | Weed Heuristics: Invasive Population Prioritization for Eradication Tool | Online database produced by the California Invasive Plant Council that prioritizes weed infestations for eradication based on potential impact, potential spread and feasibility of control |
| YBDS | Yuba Bear Drum Spaulding | Joint relicensing program through FERC of NID's Yuba-Bear and PG&E's Drum-Spaulding Hydroelectric projects |
| YCWA | Yuba County Water Agency | Public agency, established in 1959 with the primary functions of developing and selling hydroelectric power, flood control, storage and supply of water, recreation and conservation. |

## Appendix B. Stakeholder Contact Information for Restoration Project Partnerships

The contact person listed below is the person who has participated in the stakeholder process thus far, by attending stakeholder meetings, emailing restoration project proposals, or both. This isn't necessarily the head of the organization or department, although it is in some cases.

| ORGANIZATION | CONTACT PERSON | EMAIL | PHONE |
|---|---|---|---|
| **RESTORATION PLAN LEADERSHIP TEAM** | | | |
| Bear Watershed Stakeholder Group Phase 1 Project Manager, Sierra Streams Institute | Kristen Hein Strohm | kristen@sierrastreams.org | 530-265-6090 |
| Bear Watershed Stakeholder Group Phase 2 Project Manager, Sierra Streams Institute | Katy Janes | katy@sierrastreams.org | 530-265-6090 |
| Stakeholder Meeting Facilitator, Independent Contractor | Julie Leimbach | julieleimbach@gmail.com | 530-919-3102 |
| **FEDERAL AGENCIES** | | | |
| US Forest Service - Tahoe National Forest | Carol Purchase | cpurchase@fs.fed.us | 530-478-6239 |
| US Fish and Wildlife Service | Beth Campbell | elizabeth_campbell@fws.gov | 209-403-1344 |
| Beale Air Force Base Conservation Corps | Chuck Carroll | carrollck@sbcglobal.net | 530-559-0241 |
| Bureau of Land Management | Peggy Cranston | pcransto@blm.gov | 916-941-3136 |
| US Geological Survey | Kim Taylor | ktaylor@usgs.gov | 916-825-6264 |
| Bureau of Reclamation | Tom Hawes | thawes@usbr.gov | 916-978-5271 |
| Bureau of Reclamation | Laurie Sharp | lsharp@usbr.gov | 916-978-7271 |
| Bureau of Reclamation | Shelly Hatleberg | shatleberg@usbr.gov | 916-978-5050 |
| National Marine Fisheries Service | Larry Thompson | larry.thompson@noaa.gov | 530-930-3613 |
| National Marine Fisheries Service | Tom Holley | thomas.holley@noaa.gov | 530-930-5592 |
| National Marine Fisheries Service | Gretchen Umlauf | gretchen.umlauf@noaa.gov | |

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| Natural Resources Conservation Service & Point Blue | Kelly Weintraub | kweintraub@pointblue.org | 530-272-3417 |
| **STATE AGENCIES** | | | |
| CA Department of Fish and Wildlife | MaryLisa Lynch | marylisa.lynch@wildlife.ca.gov | 916-358-2921 |
| CalFire | Karen Villalobos | karen.villalobos@fire.ca.gov | 530-277-2325 |
| State Water Resources Control Board | Diane Barclay | diane.barclay@waterboards.ca.gov | 916-341-5585 |
| State Water Resources Control Board | Jan Stepek | jan.stepek@waterboards.ca.gov | 916-341-5777 |
| State Water Resources Control Board | Aaron Button | aaron.button@waterboards.ca.gov | 916-341-5777 |
| Sierra Nevada Conservancy | Lynn Campbell | lynn.campbell@sierranevada.ca.gov | 530-823-4695 |
| Sierra Nevada Conservancy | Chris Dallas | Chris.Dallas@sierranevada.ca.gov | 530-823-4673 |
| Sierra Nevada Conservancy | Andy Fristensky | andy.fristensky@sierranevada.ca.gov | |
| **COUNTIES** | | | |
| Nevada County | Tyler Barrington | tyler.barrington@co.nevada.ca.us | 530-470-2723 |
| Nevada County | Randall Yun | randall.yun@co.nevada.ca.us | 530-265-1449 |
| Placer County | Kally Cecil | kkedinge@placer.ca.gov | 530-745-3034 |
| Placer County | Jennifer Byous | jbyous@placer.ca.gov | 530-745-3008 |
| Placer County | Loren Clark | lclark@salixinc.com | 530-368-0906 |
| Placer County | Brittany Weygandt | bweygand@placer.ca.gov | 916-759-9792 |
| Sutter County | Danelle Stylos | dstylos@co.sutter.ca.us | 530-822-7400 |
| Sutter County | Guadalupe Rivera | grivera@co.sutter.ca.us | 530-822-7400 |
| Yuba County | Roger Abe | rabe@co.yuba.ca.us | 530-749-7510 |
| Yuba County | Dan Peterson | dpeterson@co.yuba.ca.us | 530-749-5642 |
| **CITIES** | | | |
| Grass Valley (Public Works) | Tim Kiser | timk@cityofgrassvalley.com | 530-274-4351 |
| Wheatland (City Council) | Joe Henderson | jhenderson@wheatland.ca.gov | 530-656-2318 |
| Colfax (Public Works) | Wes Heathcock | wes.heathcock@colfax-ca.gov | |
| **TRIBES** | | | |
| Nevada City Rancheria - Nisenan Tribe | Shelly Covert | shelly@nevadacityrancheria.org | 530-570-0846 |
| Colfax Rancheria - Nisenan Tribe | Steve Prout | colfaxrancheria@aol.com | |

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| Auburn United Indian Community | Tristan Evans | tevans@auburnrancheria.com | |
| **RECLAMATION DISTRICTS** | | | |
| Reclamation District 784 (Plumas Lake) | Steven Fordice | steve@rd784.org | 530-742-0520 |
| Reclamation District 1001 (Nicolaus) | Joe Henderson | RD1001@syix.com | 530-656-2318 |
| Reclamation District 2103 (Wheatland) | Dean Webb | | 530-633-4072 |
| Reclamation District 2103's Engineer | Richard Reinhardt | reinhardt@mbkengineers.com | |
| Reclamation District 817 (Carlin) | Roger Abe | rabe@co.yuba.ca.us | 530-749-7510 |
| **WATER& ELECTRICITY PROVIDERS** | | | |
| Nevada Irrigation District | Tim Crough | crough@nidwater.com | 530-271-6826 |
| Nevada Irrigation District | Sue Sindt | sindt@nidwater.com | 530-271-6883 |
| Nevada Irrigation District | Nancy Weber | nancyvweber@sbcglobal.net | 530-265-0424 |
| Nevada Irrigation District | Neysa King | kingn@nidwater.com | 530-271-6881 |
| Placer County Water Agency | Andy Fecko | afecko@pcwa.net | 530-823-4490 |
| South Sutter Water District | Brad Arnold | sswd@hughes.net | 530-656-2242 |
| Camp Far West Irrigation | Jack Gilbert | jjgilbert@earthlink.net | 530-701-8873 |
| Pacific Gas & Electric | Willie Wittlesey | nnw4@pge.com | |
| **AGRICULTURE** | | | |
| Placer County Dept of Agriculture | Josh Huntsinger | jhuntsin@placer.ca.gov | 530-889-7372 |
| Placer County Dept of Agriculture | Ed King | eking@placer.ca.gov | 530-889-7375 |
| Yuba Sutter Farm Bureau Water Quality Coalition | Claudia Street | bys@ysfarmbureau.com | 530-673-6550 |
| **NON-GOVERNMENTAL ORGANIZATIONS** | | | |
| Bear Yuba Land Trust | Marty Coleman Hunt | marty@bylt.org | 530-272-5994 |
| Bear Yuba Land Trust | Erin Tarr | erin@bylt.org | 530-272-5994 |
| Bear Yuba Land Trust | Laura Peterson | laura@bylt.org | 530-272-5994 |
| Bear Yuba Land Trust | Cathy Shirley | cathy@bylt.org | 530-272-5994 |
| Placer Land Trust | Jeff Ward | jward@placerlandtrust.org | 530-887-9222 |
| Placer Land Trust | Jim McBride | jim.mcbride@placerlandtrust.org | 530-889-9222 |
| Wolf Creek Community Alliance | Jonathan Keehn | jbkeehn@sierraemail.com | 530-913-2347 |

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| Wolf Creek Community Alliance | Jane Pelton | janepelt@gmail.com | 530-763-7168 |
| Wolf Creek Community Alliance | Debra Worth | dedneby@sbcglobal.net | 530-263-8996 |
| Wolf Creek Community Alliance | Joy Waite | calhounclan@yahoo.com | 530-613-3156 |
| Wolf Creek Community Alliance | Josie Crawford | josie.w.crawford@gmail.com | 530-268-1474 |
| Wolf Creek Community Alliance | Bruce Herring | bruce@bruceherring.com | 530-575-1093 |
| Sierra Streams Institute | Kristen Hein Strohm | kristen@sierrastreams.org | 530-265-6090 |
| Sierra Streams Institute | Katy Janes | katy@sierrastreams.org | 530-265-6090 |
| Sierra Streams Institute | Denise Della Santina | denise@sierrastreams.org | 530-265-6090 |
| Sierra Streams Institute | Joanne Hild | joanne@sierrastreams.org | 530-265-6090 |
| Sierra Streams Institute | Justin Wood | justin@sierrastreams.org | 530-265-6090 |
| Sierra Streams Institute | Kyle Leach | kyle@sierrastreams.org | 530-265-6090 |
| Sierra Streams Institute | Sheli Meylor | sheli@sierrastreams.org | 530-265-6090 |
| Friends of Spenceville | Richard Thomas | randtthomas@sbcglobal.net | 530-264-6740 |
| American River Watershed Institute | Otis Wollan | otiswollan@gmail.com | 530-320-6841 |
| NorCal Federation Fly Fishers | Frank Rinella | sierraguide@sbcglobal.net | 530-906-4116 |
| Gold Country Fly Fishers | Wilton Fryer | barwf@hotmail.com | 530-432-6515 |
| Sierra Foothills Audubon | Don Rivenes | rivenes@sbcglobal.net | |
| The Sierra Fund | Kelsey Westfall | kelsey.westfall@sierrafund.org | 530-265-8454 |
| American Rivers | Max Odland | modland@americanrivers.org | 530-478-0206 |
| South Yuba River Citizens League | Peter Burnes | ahugetrout-2@yahoo.com | 650-400-7139 |
| The Sierra Club | Allan Eberhart | vallialli@wildblue.net | 530-268-1890 |
| Native Plant Society-Redbud Chapter | Bill Wilson | wilsonb@mjc.edu | |
| Foothills Water Network | Traci Sheehan | traci@foothillswaternetwork.org | 530-919-3219 |
| Sierra Watch | Peter VanZant | pvanzant@sierrawatch.org | 530-478-9163 |
| Yuba Watershed Institute | Tom Van Wagner | tvwywi@gmail.com | |
| Forest Trails Alliance | Zachi Anderson | zachi@casaditerra.net | |
| North Fork American River Alliance | Ron Gould | rgould@northforktrails.com | 530-878-9232 |
| Valley Foothill Watersheds Collaborative | Gregg Bates | dcc@surewest.net | 916-773-6575 |

| | | | |
|---|---|---|---|
| Synergia Learning Ventures | Debra Weistar | debra@synergialearning.org | 530-265-5490 |
| Synergia Learning Ventures | Tom Weistar | ropes@synergia.us | |
| Bear Yuba Watershed Defense Fund | Damon DeCrow | damongv@gmail.com | 530-574-7345 |
| Bear Yuba Watershed Defense Fund | Sandy Jansen | ybalert@gmail.com | 530-263-0096 |
| **CONSULTANTS** | | | |
| Stantec Consulting | Morgan Kennedy | morgan.kennedy@stantec.com | 916-316-6992 |
| Stantec Consulting | Poyom Riles | poyom.riles@stantec.com | 510-290-7567 |
| Michael Baker International | Joyce Hunting | jhunting@mbakerintl.com | 916-231-2265 |
| **ADDITIONAL RESIDENTS** | | | |
| Watershed Resident | Stewart Feldman | aex@garlic.com | 530-878-7123 |
| Watershed Resident | Stephanie Curin | curinvalley@copper.net | 530-210-0842 |
| Watershed Resident | Karyn Furry | karyn.furry@gmail.com | |
| Watershed Resident | Jessica Meylor | jmeylor@pdx.edu | 530-863-6100 |
| Watershed Resident | Jim Ricker | jvricker51@gmail.com | 530-389-8344 |
| Watershed Resident | John Meylor | jmeylor@usamedia.tv | 530-305-3575 |

## Appendix C. Stakeholder Responses to the Question, "What does watershed restoration mean to you?"

The following responses were written by stakeholders at the April 6, 2016 Bear Watershed stakeholder meeting.

- Protection and enhancement of ecosystems to support healthy and functioning ecological and human communities.
- Restoring natural processes, improving resiliency, maintaining and /or restoring all the key components of the watershed.
- Clean, healthy, functioning waterways and uplands that serve the wildlife and human community. Restoration efforts would aim toward serving the above goal. Can include, but not be limited to: mercury clean up, sustainable river flows, weed control, wildlife corridors etc.
- Includes support for the diverse needs of each member of the ecosystem; transforming degraded systems to resilient ones; forests with healthy soils; plant communities with high diversity of native species and bringing back populations of endangered species; diverse wildlife with safe movement corridors and support for feeding, breeding and thermoregulatory needs; clean water with complex aquatic habitat and native species; vibrant, interconnected open space and opportunities for humans to enjoy the benefits of wild places for spiritual grounding as well.
- An ongoing process of returning a watershed to an ecologically and culturally healthy condition through remediation of past damage and protection of its healthy, functioning existing components.
- To restore, preserve and enhance ecological integrity while improving and maintaining viable resources over time.
- Permanently protecting areas for wildlife corridors; cleaning up toxic sites; regenerating fish habitat; using fire in a responsible, ecosystem-supporting way; changing development practices so roads are built in a way that pollutes less and so buildings and structures have net zero water and energy use, etc, etc.
- Improving conditions – physical, ecological and cultural - to their natural, undisturbed state; addressing anthropogenic impacts to the environment through restoring natural processes.
- Improvement of health and protection of ecosystems within a watershed. Steps to achieve this could include: monitoring and assessment prior to work; creation of plan, including formation of disturbance inventory (data available in area);

implementation; monitoring and assessment to evaluate success and create future plans/next steps.

- Restoration assumes damage; presume human caused. Restore damage so the watershed can function as a full system.
- Improving an impaired condition with an activity that has some chance of success.
- Projects that encompass many/all aspects of an area: humans, wildlife, fish, recreation, vegetation. Realistic and takes into account problems/solutions within and outside the watershed and the region. Projects that can bring together partners, agencies and community members to work collaboratively. Clear goals and step outlined to make goals happen. Overcoming challenges by considering all visions. Clearly planned vision for future projects/goals. Realistic timing.
- Returning habitat/ecosystems to a self-sustaining, healthy and functioning state. Supporting ecosystems/communities that are ecologically sustainable, and sustainable within areas with multiple land use goals. Improving ecosystems through considerations to wildlife, vegetation communities, fish, hydrology, human health, nutrient cycling, etc, etc.
- Clean up major disturbances/events: quarry, mining, floods, trash, bridges. Implement: trails, funding for rangers, bathrooms. Maintain science studies.
- Mediating environmental and water quality disturbances from natural processes (fire, flood and other) and human activities (construction, pollution, obstructions, invasive species, etc). Managing future activities (plans and interventions) to maximize health of the watershed.
- Includes thorough assessment of existing conditions with honest assessment of human systems' effects on sustainability for biodiversity. Looking at each part of the system, analyzing impacts and needs to support sustainability of each part and the entire system in perpetuity. Includes mitigating impacts of humans and reducing impacts.
- Restoring ecosystem function throughout landscapes to improve overall watershed health and water quality.
- Goal is clean, abundant water based on natural, ecological principles (not man-made engineering) and all the systems that define a watershed. Includes soils, forest, oak woodland and grasslands resources and hydrological functions. Includes reduction of sedimentation and point source pollution runoff. Includes animal migration corridors and habitat to protect these (birds, mammals). Includes native aquatic species health as part of a healthy ecosystem. Removes invasive plants and encourages indigenous plant communities.

- Returning damaged streams and environments to a natural state to support wildlife (including fish) and plant life.
- Take the "big picture" view of entire watershed and all encompassed therein. Very much includes humans and all human activities within. Take the "long view" time consideration.
- Evaluating the human impact on the watershed, recognizing the effects of the impact, looking for ways to reduce the impact based on new insights of our place in the ecosystem and our responsibility to the other life forms and work toward balance. Recognizing mistakes of the past with eyes to the future. The work we do today is of importance to everyone as water is essential to life.
- To identify and quantify resources, habitats, recreational opportunities, impacts, community concerns and stakeholders in a watershed. To prioritize goals and objectives and specific projects to address impacts, protect or improve existing conditions and raise awareness within the community. To implement specific projects in a coordinated way with local involvement, integrate projects and monitor results to get the most out of resources expended and raise awareness.
- Any action that improves the viability of endemic species, including no action. The fulfillment of all possible actions that establishes a trend toward a theorized habitat(s) supportive of endemic species.
- Affects change in local government agency land use planning to adhere to Restoration Plan goals and objectives for all future development and use permits. A new regional agency or assigning an existing agency or NGO to enforce the above. Finding undeveloped or partially undeveloped parcels within watershed, contiguous, to implement a pilot program of restoration to prove the efficacy of the Restoration Plan. Conservation easements of the properties (above) held by new regional agency/ NGO (above) to ensure future generations' compliance with the Restoration Plan. Education of all continuing to promote the Restoration Plan.

The following answer was put forth by the Society for Ecological Restoration (SER, www.ser.org).

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed. It is an intentional activity that initiates or accelerates an ecological pathway—or trajectory through time—towards a reference state.

Ecological restoration has as its goal an ecosystem that is resilient and self-sustaining with respect to structure, species composition and function, as well as being integrated into the larger landscape and supporting sustainable livelihoods. Many healthy ecosystems are a

product of human endeavors over very long time periods and therefore restoration commonly requires the participation of resource dependent communities. In this respect ecological restoration supports conservation and sustainable development efforts worldwide.

There are two major challenges involved when undertaking ecological restoration. One is how to undertake restoration across large areas comprising a variety of land-uses. The second is how to equitably balance the trade-offs between improving biodiversity conservation and improvements in human well-being.

**SER Guiding Principles**

**Ecological restoration is an engaging and inclusive process**. Restoration embraces the interrelationships between nature and culture, engages all sectors of society, and enables full and effective participation of indigenous, local and disenfranchised communities.

**Ecological restoration requires the integration of knowledge and practice**. Science and other forms of knowledge are essential for designing, implementing and monitoring restoration projects and programs. At the same time, lessons learned from practical experiences are essential for determining and prioritizing the scientific needs of the field.

**Ecological restoration is policy-relevant and essential**. Restoration is a critical tool for achieving biodiversity conservation, mitigating and adapting to climate change, enhancing ecosystem services, fostering sustainable socioeconomic development, and improving human health and well-being.

**Ecological restoration is practiced locally with global implications**. Restoration takes place in all regions of the world, with local actions having regional and global benefits for nature and people.

**Principles of good ecological restoration practice include:**

***Ecosystems***

- Incorporating biological and environmental spatial variation into the design.
- Allowing for linkages within the larger landscape.
- Emphasizing process repair over structural replacement.
- Allowing sufficient time for self-generating processes to resume.
- Treating the causes rather than the symptoms of degradation.
- Include monitoring protocols to allow for adaptive management.

***Human systems***

- Ensuring all stakeholders are fully aware of the full range of possible alternatives, opportunities, costs and benefits offered by restoration.
- Empowering all stakeholders, especially disenfranchised resource users.
- Engaging all relevant sectors of society and disciplines, including the displaced and powerless, in planning, implementation and monitoring.
- Involving relevant stakeholders in the definition of boundaries for restoration.
- Considering all forms of historical and current information, including scientific and indigenous and local knowledge, innovations and practices.
- Providing short-term benefits leading to the acceptance of longer-term objectives.
- Providing for the accrual of ecosystem goods and services.
- Striving towards economic viability.

## Appendix D. Restoration Project Status

**Status Key**

| |
|---|
| Not Yet Developed |
| Developed and Evaluated |
| In Progress |

| Title | Status |
|---|---|
| **Entire Bear Watershed** | |
| Geospatial Assessment of Historical and Current Mines throughout the Watershed | |
| Joint Powers Authority for Bear Watershed to Adapt to Climate Change | |
| Reduce Point Source Pollution | In progress- state & federal, Project developed and evaluated- 2017 Bear River Stakeholders Meeting |
| Groundwater Contaminant Remediation | Awaiting latest USGS data |
| Riparian Habitat Restoration and Enhancement | |
| Public Education for Riparian Habitat Stewardship | |
| Watershed-friendly Farming Collaborations | Some sites in progress- NRCS |
| Agricultural Hedgerows for Wildlife Habitat, Native Plants, and Pollinators | Some sites in progress- NRCS |
| River Ambassador Program for Bear River | |

| | |
|---|---|
| Identify and Protect Serpentine and Gabbro Soil Plant Communities Watershed-Wide Including Federally Endangered Stebbins Morning Glory | |
| Invasive Terrestrial Plant Removal Projects | |
| Improve Septic Systems in Existing, Infill, and New Development | |
| Coordinated Response for Homeless Services and Watershed Protection | Project developed and evaluated-2017 Bear River Stakeholders Meeting |
| Bear Watershed Welcome Road Signage | |
| Fish Consumption Advisories and Public Education | In progress- TSF |
| Bear Watershed Data Accessibility | |
| Bear Watershed Restoration Symposium | |
| Reducing the Spread of Invasive Aquatic Species (clams, algae, snails, etc.) | |
| Reducing Oil Pollution from Storm water on Roads and Parking Lots | |
| Diverting Disposal of Pharmaceuticals & Household Hazardous Waste for Water Quality | |
| Prescribed Burns | Project developed and evaluated-2017 Bear River Stakeholders Meeting |
| Create a Bear Watershed Breeding Bird Atlas | Nevada County in progress- Audubon |
| Plan to Support Vegetative Communities and Micro-habitats that Adapt to Climate Change | Project developed and evaluated-2017 Bear River Stakeholders Meeting |

| | |
|---|---|
| Implementation of Plan for Ecosystem Adaptation to Climate Change | Project developed and evaluated-2017 Bear River Stakeholders Meeting |
| Joint Powers Authority for Bear Watershed to Adapt to Climate Change | |
| Erosion Control | |
| Road Disturbance Inventory | USFS, AR & SSI<br>implementing in neighboring watershed |
| Rare Plant and Plant Community Protection | |
| Phytoremediation of Heavy Metal Contaminants | |
| Phytoremediation of Nonmetal Contaminants | |
| **Above 2,000-ft Elevation in Multiple Subwatersheds** | |
| Planning for Fuels Reduction in the Bear Watershed | Project developed and evaluated- 2017 Bear River Stakeholders Meeting |
| Improve Forest Resiliency to Drought and Beetle Infestations | |
| **Below 3,000-ft Elevation in Multiple Subwatersheds** | |
| Watershed-Friendly Ranching Collaborations | Some sites in progress- NRCS |
| Foothill Oak Woodland Protection and Restoration | Some sites in progress- BYLT, PLT |
| Vernal Pool Protection (Acquisitions & Easements) | Some sites in progress- Placer Co. |
| **Upper Bear Subwatershed (including Greenhorn Creek & Steephollow Creek)** | |

| | |
|---|---|
| Storm Runoff Monitoring for Mercury Source Contamination | |
| Containing and Removing Mercury from Old Transport Systems from Hydraulic Mining | |
| Assess Mine Source Contamination in Steephollow Creek | |
| Soil & Slope Stabilization in Lowell Fire Drainages | SSI developed project in lower portion of fire, seeking funding, project for upper portion not yet developed |
| Reducing Water Quality Degradation by Pot Farms in the Steephollow & Greenhorn Subwatersheds | In progress in neighboring watershed- SYRCL |
| Reducing Water Quality Degradation by OHV Users and Protecting Wildlife Habitat in Steephollow & Greenhorn Creeks | |
| Bear Valley Meadow Restoration | AR & BYLT awaiting PG&E approval, Project developed and evaluated- 2017 Bear River Stakeholders Meeting |
| Steephollow Canyon Fuels Reduction | SSI developed project in lower portion of fire, seeking funding, project for upper portion not yet developed |
| Hawkins Canyon Fuels Management, Healthy Forest and Groundwater Recharge | |
| Mercury Removal at Greenhorn Creek Narrows | |
| **Wolf Creek Subwatershed (including Rattlesnake Creek, Peabody Creek & French Ravine)** | |
| Restoration of Grass Valley Meadow and South Fork Wolf Creek | Project developed and evaluated-2017 Bear River Stakeholders Meeting |

| | |
|---|---|
| Wolf Creek Parkway Trailhead | In progress- GV & WCCA |
| Memorial Park – Magenta Drain Restoration | Is this in progress by GV? |
| Wolf Creek Watershed Disturbance Inventory | In progress- WCCA & SSI |
| Native Fish Viability in Wolf Creek | Project developed and evaluated-2017 Bear River Stakeholders Meeting |
| Pre- and Post-Restoration Water Quality Monitoring | In progress- WCCA |
| Peabody Creek Restoration Project | In progress- GV, AR, SSI |
| Grass Valley Sewer System Improvements for Water Quality Crisis Prevention | |
| Public Stewardship Campaign for Public Spaces within the City of Grass Valley | |
| Scadden Flat Checkerbloom Conservation and Restoration | |
| **Middle Bear Subwatershed (including Wooley Creek, Magnolia Creek, Little Wolf Creek & Rock Creek)** | |
| Little Wolf Creek Habitat Protection at Sanford Ranch | BYLT developed project, seeking Funding, |
| Kirk Ranch | |
| Garden Bar Preserve Wetland Habitat Restoration Project | BYLT developed project, seeking funding, Project developed and evaluated-2017 Bear River Stakeholders Meeting |
| Combie Reservoir Sediment and Mercury Removal Project | In progress- NID, USGS, TSF |

| | |
|---|---|
| Informational Signage Delineating Proposed Inundation | |
| **Dry Creek Subwatershed** | |
| Develop Salmon Refugia on Dry Creek as Sacramento River Warms with Climate Change | Project developed and evaluated-2017 Stakeholders Meeting |
| Riparian Habitat Protection at Spenceville Wildlife Area | Developed, In progress of uploading evaluation sheet-2017 Bear River Stakeholders Meeting |
| Further Testing & Possible Further Reclamation of Spenceville Copper Mine | |
| **Lower Bear Subwatershed (including Best Slough & Yankee Slough)** | |
| Levee Setbacks | |

## Appendix E. Grouping Projects with Notes and Votes

**Mine & Industrial Contaminants (Watershed-wide)**

- Geospatial Assessment of Historical and Current Mines throughout the Watershed – 4
- Storm Runoff Monitoring for Mercury Source Contamination - 5
- Containing and Removing Mercury from Old Transport Systems from Hydraulic Mining – 4
- Assess Mine Source Contamination in Steephollow Creek – 2
- Mercury Removal at Greenhorn Creek Narrows – 3
- Further Testing & Possible Further Reclamation of Spenceville Copper Mine – 0
- Combie Reservoir Sediment & Mercury Removal Project *(in progress- NID, USGS, TSF)- 2*
- Reduce Point Source Pollution *(in progress- state & federal) – 9*
- Phytoremediation of Heavy Metal Contaminants - 2

**Bacteria, Oil, & Household Waste (Watershed-wide)**

- Grass Valley Sewer System Improvements for Water Quality Crisis Prevention
- Improve Septic Systems in Existing, Infill, and New Development – 2
- Reducing Oil Pollution from Stormwater on Roads and Parking Lots – 0
- Road Disturbance Inventory, paved road oil components – N/A
- Phytoremediation of Nonmetal Contaminants – 3
- Diverting Disposal of Pharmaceuticals & Household Hazardous Waste for Water Quality – 5
- Coordinated Response for Homeless Services and Watershed Protection – 6
- Groundwater Contaminant Remediation *(awaiting latest USGS data)- 0*

**Watershed-wide Habitat Projects Needing Sites**

- Riparian Habitat Restoration & Enhancement – 7
- Rare Plant and Plant Community Protection – 1
- Invasive Terrestrial Plant Removal Projects – 3
- Erosion Control – 1
- Prescribed Burns – 10
- Implementation of Plan for Ecosystem Adaptation to Climate Change – 11
- Plan to Support Vegetative Communities and Micro-habitats that Adapt to Climate Change – 8
- Joint Powers Authority for Bear Watershed to Adapt to Climate Change - 1

**Upper Bear Ecosystems (Forest Health & Meadows)**

- Improve Forest Resiliency to Drought and Beetle Infestations - 4
- Planning for Fuels Reduction in the Bear Watershed – 8
- Hawkins Canyon Fuels Management, Healthy Forest and Groundwater Recharge -3
- Reducing Water Quality Degradation by OHV Users and Protecting Wildlife Habitat in Steephollow & Greenhorn Creeks - 5
- Road Disturbance Inventory, forest road erosion components *(USFS, AR & SSI implementing in neighboring watershed) – 1*
- Soil & Slope Stabilization in Lowell Fire Drainages *(SSI developed project in lower portion of fire, seeking funding, project for upper portion not yet developed) - 7*
- Steephollow Canyon Fuels Reduction *(SSI developed project in lower portion of fire, seeking funding, project for upper portion not yet developed) – 3*
- Bear Valley Meadow Restoration *(AR & BYLT awaiting PG&E approval) - 14*

**Wolf Creek Ecosystems (Riparian & Aquatic Habitat)**

- Restoration of Grass Valley Meadow and South Fork Wolf Creek – 12
- Native Fish Viability in Wolf Creek – 9
- Scadden Flat Checkerbloom Conservation and Restoration – 1
- Memorial Park – Magenta Drain Restoration *(is this in progress by GV?) – 1*
- Wolf Creek Watershed Disturbance Inventory *(in progress- WCCA & SSI) – 3*
- Pre- and Post-Restoration Water Quality Monitoring *(in progress- WCCA) – 2*
- Peabody Creek Restoration Project *(in progress- GV, AR, SSI)- 2*
- Wolf Creek Parkway Trailhead *(in progress- GV & WCCA) - 7*

**Middle Bear Ecosystems (Riparian, Oak Woodland & Chaparral Ecosystems)**

- Identify and protect serpentine and gabbro soil plant communities, including habitat for the federally endangered Stebbins' morning glory – 1
- Foothill Oak woodland protection and restoration *(some sites in progress- BYLT, PLT) – 5*
- Little Wolf Creek Habitat Protection at Sanford Ranch *(BYLT developed project, seeking funding) – 6*
- Garden Bar Preserve Wetland Habitat Restoration Project *(BYLT developed project, seeking funding) – 7*
- Kirk Ranch - 0

**Dry Creek & Lower Bear Ecosystems (Riparian & Vernal Pools)**

- Develop Salmon Refugia on Dry Creek - 6

- Levee Setbacks – 8
- Riparian Habitat Protection at Spenceville Wildlife Area - 9
- Vernal Pool Protection w/ Acquisitions & Easements *(some sites in progress- Placer Co)- 12*
- Vernal Pool Stewardship *(some sites in progress- Beale) – N/A*

**Targeted Landowner Education Programs (Watershed-wide)**

- Public Education for Riparian Habitat Stewardship – 1
- Reducing Water Quality Degradation by Pot Farms in Steephollow & Greenhorn *(in progress in neighboring watershed- SYRCL) – 3*
- Agricultural Hedgerows for Wildlife Habitat, Native Plants and Pollinators *(some sites in progress- NRCS) – 0*
- Watershed-friendly Farming Collaborations *(some sites in progress- NRCS) – 2*
- Watershed-friendly Ranching Collaborations *(some sites in progress- NRCS) - 5*

**General Public Education Programs (Watershed-wide)**

- Bear Watershed Welcome Road Signage – 4
- Bear Watershed Restoration Symposium – 1
- Bear Watershed Data Accessibility - 3
- Create a Bear Watershed Breeding Bird Atlas *(Nevada County in progress- Audubon) - 1*

**Recreator Education Programs (Watershed-wide)**

- River Ambassador Program for Bear River - 0
- Public Stewardship Campaign for Public Spaces within the City of Grass Valley - 0
- Reducing the Spread of Invasive Aquatic Species (clams, algae, snails, etc.) - 4
- Informational Signage Delineating Proposed Inundation – N/A
- Fish Consumption Advisories and Public Education *(in progress- TSF) - 1*

## Appendix F. Ideas Needing Further Development with Stakeholder Interest

- Drone for surveys, monitoring of habitat _____
- Strategies educating landowners will be different between large and small landowners (have different access to resources) _____
- Gravel augmentation on Dry Creek _____
- Assess barriers @ different flows _____
- Fish may be able to make it up during high flows _____
- Invest in art installation projects _____
- Fish ladders/osprey nesting platforms...) to involve community and boost recreational and scenic opportunities _____
- Develop educational program and long term monitoring program for the community about bioaccumulation/mercury levels _____
- Clarify to the public who is doing this work _____
- How does dredging of sediments in reservoirs impact levels of toxins (mercury), temperatures, reservoir fish - **Morgan Kennedy**
- Restoration/enhancement of anadromous fish habitat and migration on Dry Creek (with monitoring) _____
- Participation (with eye towards mitigation) of camp far west FERC relicensing process - **Traci Sheehan, FWN + Morgan Kennedy**
- Hemphill Dam? Others (related to objective D) _____
- Fish ladder cut installation- demonstration of successful restoration sites _____
- Citizen Science Monitoring, iNat Project Database: diversity database of occurrences of species of populations - **Josie Crawford, WCCA + Morgan Kennedy**
- Increase coordination between public and private landowners _____
- Youth Corps and Senior Corps _____
- Study places where dams have been removed (ex. the elwa) - **Traci Sheehan, FWN**
- How other counties deal with water security and the interfaces between human and ecosystem needs/health _____
- Need in line reservoir effects on water quality (temperature) and hydrology _____
- New reservoir effects on setbacks of current homes etc... _____
- Study effects of Rollins dam and impoundment on all environmental aspects _____

- Water quality, sedimentation, wildlife, mercury, erosion

  _____
- Use in determining efficiency of future projects _____
- Economic considerations - supporting businesses, jobs, work, education and stewardship; helps get people invested (can be tied in throughout watershed)

  _____
- Willow planting - **Morgan Kennedy**
- Pollinator garden network - **CNPS Redbud Chapter (Possibly)**
- UC Grouse Ridge Field Station BMPs for timber harvest development

  _____
- Training, employment opportunities, program development (Sierra Harvest for Ag as model) _____
- Find property for each ecosystem, demonstrating restoration and ideal conditions-> Education and engagement _____
- Plant nurseries, do not sell invasive plants _____
- GIS data/layer on all ecosystems; maps to focus attention - **Morgan Kennedy**
- Native American/Restoration Inspired art installation _____
- Within bed and banks of stream, reduce sedimentation throughout watershed, specifically Rollins (ex. Santa Fe River, New Mexico) _____
- Collaborative relationships, recreation and restoration hand in hand

  _____
- Use projects already in progress _____
- Ongoing public report of data gathered... at least annually - **Morgan Kennedy**
- Interagency collaboration on joint watershed goals _____
- Investigate/understand professional forestry practices and priorities w/in watershed

  _____
- Involve and educate landowners, landscapes, architects, farmers in riparian zones and counties _____
- Investigate better wildlife-friendly fence practices/techniques

  _____
- Small landowners need information/resources (ex. bill stuffers)

  _____
- Field trip on the Bear River _____
- Pollinator gardens _____
- Dogs vs. wildlife studies- educate public to impacts of dogs running loose

  _____
- Bear River Canal and Wise Canal create deer mortality; need more crossings, escape ramps etc... _____

- Get USFS/Cal Trans wildlife migration report across Hwy 80 _____
- Involvement/participation in FERC relicensing (for Camp Far West) - **Traci Sheehan, FWN + Morgan Kennedy**
- Road kill studies (database), UC Davis; use in planning _____
- Protection of predatory species and balance between predators and prey _____
- Encourage public education and enjoyment of wildlife _____
- Education of smaller landowners (through NRCS?) _____
- Encourage more set aside areas for wildlife like Grouse Ridge Roadless Area _____
- Consolidation of public lands currently in checker board _____
- Study NID conveyance systems and water releases and impacts to wildlife _____
- Add amphibian objectives (flows, temps etc...) _____
- Education in PG&E bills, other bills stuffers, phone companies _____
- Manage livestock in such a way as to enhance riparian areas, exclude when appropriate _____
- Support and encourage holistic livestock and range management practices _____
- Educate livestock owners about coexisting with predator species _____
- Increase points of public access along the Bear River Watershed through private property, NID and public lands - **Traci Sheehan, FWN**

**Contact:**

- **Traci Sheehan - (530) 919-3219**

## Appendix G. Template for Project Development and Evaluation

# PROJECT DEVELOPMENT AND EVALUATION
# Bear River Watershed Group Stakeholder Breakout Groups
# Aug 2, 2017

71. **ANY ADDITIONAL KNOWNS OR UNKNOWNS**
Add any new updates to the project description

72. **PAST PROJECT MODELS**
Identify other past projects that could serve as models for this project.

73. **MEASURABLE RESULTS:**
   a. ***Identify measurable results for this project using measurable units: example: #s of living organisms/ecosystems affected, and # people impacted, etc.***

| ENVIRONMENT | COMMUNITY | ECONOMY |
|---|---|---|
| # river miles restored | # of people educated | # acre feet of water with reduced need for water treatment |
| # acres of floodplain, forest, vegetation, restored | # of citizens water supply improved | # acre feet of water retained from storm runoff reducing municipal costs for flooding and stormwater |
| # sediment or pollutant load reduction | # of river miles with improved access or recreation | # acre feet of water retained or slowed for later slower release to the river |
| # of sites improved habitat | # Yr. level of flood protection | # $ increased due to more spending near improved access or recreation |
| # acre-feet of groundwater increased / protected | # people built capacity for new skills | # Yr. level of flood protection |
| # of tons of sediment removed | # people protected from health threats | # jobs created |
| # Greenhouse Gas emissions reduced | # of volunteers | # $ increase in property values |
| # greenhouse case emissions to new carbon sink | # of disadvantaged communities improved | # $ of energy costs conserved |
| # air quality contaminants reduced | | # $ averted from maintenance or repair of infrastructure damage |

| | | |
|---|---|---|
| Other: | Other: | # $ replacement cost of ecological services |
| | | # $ averted costs of wildfire fighting |
| | | Other: |
| | | |
| | | |

***b. Circle or list project deliverables:***

Maps Plan Implemented Restoration Educational Materials Signs Assessment Monitoring Design Plan Mitigation Plan
Other:

**74. OBJECTIVES:**

***a. Bear River Restoration Plan Objectives***

Identify the objectives from the Bear River Watershed Restoration Plan that this project meets. Please circle the corresponding letters.

**Water Quality and Hydrology Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Fisheries and Aquatic Life Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Vegetation Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

**Terrestrial and Riparian Objectives:**

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

***b. Multisector Benefits - Other Benefits Outside the Bear River Plan:***

How does or could this project provide benefits to other sectors beyond the restoration goals of the Bear River Restoration Plan? Circle one or write in:

Greenhouse Gas Reduction Flood Reduction Outdoor Recreation Water Supply
Water Treatment Groundwater Wastewater Treatment
Adaptation to Climate Change

Other:

75. **RESOURCES / SKILLS**

**a. Team:**

Circle those that apply and add

Project Manager GIS Permitting Specialist Surveyor Designer
Engineer Educator Outreach Coordinator
Other:

**p. Equipment:**

Circle those that apply and add

Dewatering Equipment Ground Moving Equipment
Other:

**q. Funding Sources:**

Examples include Grant funding sources, contracting sources, donors, volunteers, in-kind ect.

76. **TASKS**

Task 1: Project Setup, Contracting, Project Management Meetings, Project timeline, Financial Accounting

Task 2:

Task 3:

Task 4:

Task 5:

Task 6:

Task 7: Project Reporting

**77. CONCEPTUAL COST / BENEFIT COMPARISON**

List **Conceptual** Costs and Benefits of Project. If you know numbers, include the $ but otherwise, just list ideas. Can use question 2a to help guide this.

Costs:

Benefits:

Hurdles:

**78. SEQUENCING**

Does this project require another project to be done first?
Should it come after another project? Please identify projects in sequence.

**79. DO YOU WANT TO COLLABORATE ON PLANNING AND / OR IMPLEMENTING THIS PROJECT?**

**80. ANY ADDITIONAL NOTES:**