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Acronyms and Abbreviations Used in This Report

ADA	Americans with Disabilities Act
ARRA	American Recovery and Reinvestment Act of 2009
BDT	Bone-dry Tons
BMPs	Best Management Practices
CABY	Cosumnes American Bear Yuba
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CHIPS	Calaveras Healthy Impact Product Solutions
CVP	Central Valley Project
CWP	California Water Plan
DAC	Disadvantaged Community
DO	Dissolved Oxygen
EBMUD	East Bay Municipal Utility District
EID	El Dorado Irrigation District
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GCM	Global Climate Models
GHG	Greenhouse Gas
GIS	Geographic Information System
MAC	Mokelumne/Amador/Calaveras
MHI	Median Household Income
MID	Modesto Irrigation District
NID	Nevada Irrigation District
OPR	Governor's Office of Planning and Research
PCWA	Placer County Water Agency
PG&E	Pacific Gas and Electric Company
RWMG	Regional Water Management Group
SBA HUBZones	Small Business Administration - Designated Historically Underutilized Business Zones
SMUD	Sacramento Municipal Utility District
SNC	Sierra Nevada Conservancy
SWEEP	Sierra Nevada Watershed Ecosystem Enhancement Project
SWP	State Water Project
SWRCB	State Water Resources Control Board
USACE	U.S. Army Corps of Engineers
USFS	U. S. Forest Service
USFS	USDA Forest Service
VAMP	Vernalis Adaptive Management Program
WRCC	Western Region Climate Center
WUE	Water Use Efficiency

Mountain Counties Area

Mountain Counties Area Summary

Introduction

As the State works to solve the water crisis in California, the potential for redirected impacts in the Mountain Counties Area is acute. It is critical that the State recognize the significance and importance of the Sierra Nevada mountain range to the local communities, the environment, the Delta, and all of California, now and for future generations.

Water resource managers are working with elected officials, governmental agencies, businesses, farmers and conservationists on innovative programs for watershed management, water use efficiency, conservation, reuse, and recycling. Water managers and others in the region are actively balancing the water supplies that support both a vibrant economy and a healthy environment. They are also continually improving the management of surface and groundwater sources to sustain this important balance for this region and California.

Statewide Significance

Water is the number one resource exported from the Sierra Nevada, and the 16-county Mountain Counties Area is the primary source for most of that exported water. The Mountain Counties Area is over 15,700 square miles and represents 9.9% of the state. More than 40 percent of California's developed water supply originates in the Mountain Counties area serving end users throughout the state.

- The reservoirs in the region produce hydroelectricity to supply homes and businesses in the western United States. Mountain Counties has more hydroelectric generation facilities than any other region in California.
- Agriculture in this region feeds the state and the world and is an economic driver for California's economy.
- Recreation and tourism in the Sierra Nevada mountains help communities thrive economically as guests come from all over the world to hike, ski, fish, raft, and boat.
- Water stored behind designated reservoirs in the ten major watershed areas have dedicated in-stream flow releases designed to meet the many beneficial uses for the environment, agriculture, and urban users and provides storage to reduce the magnitude of flood flows.

Water Supply Challenges

There are many water supply challenges of regional and statewide significance including watershed health, aging critical infrastructure, more stringent regulations, long-term drought, catastrophic fire, climate change, and the Sacramento-San Joaquin Delta issues. This Mountain Counties Area regional report contains the details, recommendations, and strategies to reflect leadership and partnership that will assist the State to solve the Delta issues and to provide a reliable water supply for all of California.

Water Supply and Reliability

Water is the essential element of the economic and environmental well-being in the Mountain Counties Area. It requires continued Area of Origin and County of Origin protections, healthy forests, and headwaters to ensure reliable water supply and high-water quality for the region and the entire state.

Forest Management/Fire

Large damaging fires resulting from forest stands that are severely overstocked and contain heavy fuel loads are a threat to water and air quality and the many other benefits provided to the state by forested watersheds. These overstocked forests strain federal and State budgets preparing for and suppressing catastrophic wildfires.

Wildland fires in the state's largest natural winter reservoir, the Sierra Nevada, can decimate the landscape, whereby the soil becomes sediment that impacts the carrying capacity of both the watershed and reservoir storage. This changed landscape accelerates runoff and increases flooding and places further pressure on the state's levee system. This scenario would reduce statewide water supply, degrade water quality, effect hydropower generation, the environment, recreation, and tourism.

Climate Change

Projected warmer temperatures are likely to contribute to changes in the hydrologic cycle. Potential changes include reduced snow accumulation, higher snow elevations, change in runoff timing, more frequent rain-on-snow events, more frequent and higher peak flows, and lower summer stream flows and groundwater levels. These impacts can negatively affect key benefits Californians count on from the state's forested watersheds. Upstream ecosystems, local water supplies, hydroelectric power generation, downstream water supplies, and the operation of major multi-purpose dams could all be affected. Climate change and reoccurring drought in the Sierra Nevada will only increase the frequency of catastrophic wildland fires. This will lead to devastating water supply consequences for Delta inflows.

Recommendations

Statewide Significance

State, federal and local governments should acknowledge that the Mountain Counties area, along with the rest of the Sierra Nevada, holds significant regional and statewide solutions critical to California's water supply and water quality and flood management needs. In acknowledging this fact State, federal and local governments should elevate the stewardship and health of the Sierra Nevada watersheds and sustainable watershed management as a priority to achieve statewide goals through the following actions.

Water Supply and Reliability

For more than six decades, the leadership at the State and federal level has been unequivocal in their commitments to the understanding that water that originates in the Area of Origin must always be available to meet the needs of water users in the watershed. It is important that California maintain these assurances.

Elevated recognition of the importance of this region and increased State investments in ecosystem conservation and water infrastructure above the Sacramento-San Joaquin Delta must be a priority to counter regional effects of long-term drought and climate change. Addressing issues such as surface storage and Delta conveyance are likely components of any long-term water solution developed for California, and the same is true for the forests, meadows, lakes, and streams of the Sierra Nevada.

Investment in the watershed and headwaters of the Sierra Nevada and protecting resilient forests are needed to maintain the vitality of the source water supply and overall system for providing adequate water quantity and water quality for the entire state. This region has fewer options than coastal regions where desalinization might have priority. Continuing to adhere to the Areas of Origin Water Rights will maintain adequate water supplies for local needs.

Forest Management/Fire

Develop and implement sustainable resource management strategies including adaptive forest management practices, effective fuels reduction programs, and enhanced watershed protection practices to protect natural resources throughout the Mountain Counties Area and the entire Sierra Nevada.

Alternative Energy Opportunities

Make better use of Mountain Counties' potential for alternative energy production, such as biomass,, as a resource to meet statewide greenhouse gas (GHG) reduction and renewable energy goals and as a mechanism for investment in needed infrastructure (both natural and built) and other local needs.

Research and Project Support

Identify and implement on-the-ground projects to create empirical evidence needed to justify investment in the upper watersheds to enhance water storage and delivery efficiencies throughout the region.

Partnerships

Establish and maintain effective collaborative partnerships with State and federal agencies and others to develop comprehensive strategies thereby ensuring a viable water future for future generations of Californians.

Purpose of Hydrologic Regions, Overlay Areas, and Regional Reports

The California Water Plan (CWP), is a valuable reference and planning document for all regions within the state. It provides information for decision-makers, water managers, and other interested stakeholders to use in administering the state's considerable water-related resources.

In addition to providing background and identifying specific water management strategies for the state, the CWP Updates, beginning with Update 2005 included separate regional reports containing more detailed information on specific geographic areas. The individual regional reports cover each of the ten hydrologic region study areas in the state, defined by Department of Water Resources (DWR) based on topographic and hydrologic characteristics, as well as two overlay areas of statewide significance: the Sacramento-San Joaquin River Delta (Delta), and the Mountain Counties Areas.

DWR developed the concept of overlay areas to acknowledge that common water issues or interests often cross boundaries from one hydrologic region to another. The purpose of the overlay areas is to collect and provide information that will better enable planners and decision-makers to address issues in areas of special interest where the following criteria apply.

1. The area is of statewide significance — meaning that water management strategies and actions taken in one area affect much of the remainder of the state.
2. Common water management conditions exist in the area — meaning that issues and integrated planning opportunities span more than one of the 10 hydrologic regions.

PLACEHOLDER Figure MC-1 Mountain Counties Area Boundaries Showing Watersheds County Boundaries, Water Boundaries, Major Roads, and Cities

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

The current Mountain Counties Area includes three DWR water-planning areas: 508, 604, and 610 that cover parts of both the Sacramento River and San Joaquin River hydrologic regions (see Figure MC-1 Mountain Counties Area). There are unifying economic and environmental drivers of statewide significance affecting the Mountain Counties Area that cross those hydrologic boundaries and are, therefore, better addressed from the regional perspective afforded through the Mountain Counties Area. These include, but are not limited to:

- The concentration of public and private forests that provide important natural products and services including habitat, carbon storage, and alternative energy production.
- Watershed headwaters and other natural and recreational resources and the need to protect those resources for the benefits they provide at the statewide scale.
- Limited groundwater storage in fractured rock formations.
- Anticipated climate change impacts including more severe fires, the potential for long-term drought, an increase in the intensity of severe rain events, a change in the timing of mountain stream run-off, and a reduced accumulation of snowpack at higher elevations.
- Downstream water rights appropriations.
- Socioeconomic issues such as high proportions of disadvantaged or underserved communities and relatively constrained revenue and economic development opportunities or limited job sector bases.
- Land use issues associated with rural populations such as agriculture-based and sparsely distributed populations across the landscape, management of public lands, coordination with tribal councils, and positive and negative impacts associated with development pressures.

When people in California turn on the tap, eat local produce, go camping in the woods, or visit one of the area's many historic parks or cultural sites chances are good that they are enjoying bounty that comes from the Mountain Counties Area. Water is the number one renewable resource exported from the region, but it is not the only asset that sets the Mountain Counties apart. The area also contains vast forests and other natural, cultural, and historic resources uniquely woven together with recreational opportunities, hydropower generation, tourism, agriculture that warrant special consideration related to resource planning and management. In addition, there are Tribal issues of local and statewide significance that also should be considered when making planning and management decisions.

Healthy watersheds and forests, such as those in the Mountain Counties Area, provide a wide variety of benefits to all of California. In many parts of the area, however, the degraded state of forests and watersheds and their increasing vulnerability to a changing climate has put these abundant benefits at great risk of fire and the subsequent associated losses thereafter. It is essential for the State to retain and restore ecological health and resilience to this area in order to continue realizing the benefits and services it provides, both within the region and the rest of the state.

The Mountain Counties Area regional report is intended to inform decision-makers better about the complexity and value of the natural and cultural resources within this overlay area. The report is designed to frame the question of California's water reliability in terms of the protection, management, and enhancement of the natural infrastructure, the people, organizations, and agencies rooted in these watersheds whose efforts are focused on protecting and improving the region for a sustainable future. The report describes the unique, substantial, and critical role Mountain Counties plays as the primary source of the state's water. It identifies the critical challenges, needs, and opportunities unique to the area, and it presents a vision for the future as well as strategies for how people — both within and outside the Mountain Counties area — can work together to realize the vision and achieve specific regional and statewide goals including coordination and implementation of policies and management strategies set forth elsewhere in the CWP.

Statewide Significance

The Mountain Counties Area, along with the rest of the Sierra Nevada, holds significant regional and statewide interest critical to California. The Mountain Counties Area provides many resources and services of statewide significance, but foremost among those is water. The Mountain Counties Area is California's primary source of water with more than 40 percent of the state's developed water supply originating in the rivers and watersheds of the Mountain Counties Area, more than from any other single source (DWR). This total increases to more than 60 percent of the state's developed water supply when combined with other waters from sources within the entire Sierra Nevada. The larger Sierra Nevada Region is the source of water for 23 million Californians!

PLACEHOLDER Photo MC-1 Picture of Sutter's Mill

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Water from the Mountain Counties Area has played a critical role in the development of California since the discovery of gold in a channel leading to a water-powered sawmill (Sutter's Mill) in Coloma in 1848 (see photo MC-1).

Gold, water, and timber products exported from this region built Sacramento, San Francisco, and other cities. Development of streams and other resources in the region over the past 150-plus years has met regional and statewide demands by capturing water where it falls (as rain or high-elevation snow) and moving it to where the demand is (primarily urban areas and the vast agricultural lands of the Central Valley). This complicated plumbing system is a combination of natural waterways and federal, State, and local projects (including dams, diversions, hydropower generation facilities, and water treatment plants), several of which were built and paid for by resident communities through bond assessments.

Clean water from Sierra forests flows downhill to fuel California's economy and support human, plant, and animal communities from the crest of the Sierra to the sea, or to Nevada. Sierra forests do more than just supply water; they store water and distribute the runoff over the spring and summer months fairly equally. Much of the state's precipitation falls in the winter as snow and is stored during the wet winter months. The slow and steady melting of snow in the spring provides the water necessary for forest vegetation and to grow crops in California's renowned Central Valley. The Mountain Counties Area provides essential cold-water habitat for resident and anadromous fisheries including listed species, as well as regular flows of water for the wide variety of downstream beneficial uses. With an average annual water supply content of over 11 million af, the Sierra snowpack is California's largest storage reservoir, providing natural infrastructure that augments the capacity of built facilities downstream (DWR). Water managers from around the state rely on this natural storage and the subsequent spring runoff to meet water needs across much of California, making protection of the Sierra snowpack a critical part of any long-term statewide solution to ecosystem health and water supply reliability.

The multiple benefits and services provided by the Mountain Counties Area to local residents, California, and beyond are often not recognized or easily quantified. In addition to water, the area provides habitat for thousands of species, many identified as endangered or rare. The area's forests and rangelands provide food, energy, timber, and other renewable resources that can be sustainably produced. The Mountain Counties Area also offers a unique service in helping to achieve statewide policy goals, such as reductions in GHG emissions, by storing large amounts of carbon. The area's natural, historic, cultural, and archaeological features — ranging from the early tribes to the Gold Rush emigration, the growth of cities, and post-war suburbs to the birth of the high-tech industry, and more — teach Californians about the past, the present, and the future. These features also provide needed respite and recreational opportunities for residents and citizens from around the world. In addition, the rural communities and historic towns of the Mountain Counties Area are home to many generations of pioneers and continue to attract new residents and visitors each year.

Yet, these extraordinarily valuable resources are imperiled by forest conditions that are increasingly susceptible to large, high intensity fires. As noted by the U. S. Forest Service (USFS) in its March, 2012 General Technical Report, *Managing Sierra Nevada Forests*," fire is a "fundamental ecosystem process in the Sierra Nevada that was largely eliminated in the 20th Century." As a result, the forests are unnaturally dense thus providing "fuel rich conditions that are conducive to intense forest fires that remove significant amounts of biomass" (USFS PSW-GTR-237). Moreover, changing climatic conditions may already be increasing the severity and frequency of Sierra Nevada fire. According to USFS Chief Thomas Tidwell in his testimony before the Senate Committee on Energy and Natural Resources, the fire season is now "60 or 70 days" with "much more severe fire behavior than we've ever experienced in the past (Tidwell 2012)." These conditions severely threaten the state's water quality and diminish its quantity, as water that historically infiltrated the soil and filled streams is lost overhead to evapotranspiration and sublimation in the dense vegetation.

The remnants of historic mining communities and features, such as mine shafts, adits, tunnels, water conveyance systems, and open scars on the land also play an important role in the Mountain Counties Area and impact water resources in many ways. Open scars continue to erode contributing to higher levels of sediment in the area's waterways. Shafts, adits, and tunnels are ready conduits for naturally occurring and introduced contaminants. Toxic substances associated with legacy mining, in particular mercury, have far reaching impacts to water quality and water supply within the area and downstream to the Sacramento-San Joaquin Delta and the San Francisco Bay.

Understanding the issues facing this region and making thoughtful, effective, and broadly supported changes is not easy. Land use management and planning in this rural region is complicated by the size and ownership of the land with myriad local, State, and federal agencies governing everything from energy and infrastructure to environmental quality, species, and human health and safety. Unresolved conflicts over land management policies and practices has in some instances led to single-issue solutions, which can have unintended negative consequences on the resources and communities in the region. The diversity of state and local interests that depend on the health of the Sierra watersheds and ecosystems of the Mountain Counties Area is enormous.

Current State of the Region

General Setting

PLACEHOLDER Figure MC-2 Context of Mountain Counties Area with Respect to the State

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The Mountain Counties Area encompasses the western slope foothills and mountains of the Sierra Nevada and a portion of the Cascade Range, extending from the southern tip of Lassen County to the northern part of Fresno County and overlays the eastern portions of the Sacramento River and San Joaquin River hydrologic regions as can be seen in Figure MC-2.

The total size of the Mountain Counties Area is approximately 15,750 square miles, of which 60 percent is contained in eight National Forest units and three National Parks (DWR CWP 2009). Approximately 30 Native American tribes in the Mountain Counties Area are federally recognized whose land areas cover less than 0.1 percent of the total area (DWR CWP 2009). The economies of these mountain and foothill areas have historically been tied to the land. Today, tourism, ranching, timber harvesting, limited mining, and agriculture continue as an economic base for many communities.

There are 16 counties, or portions thereof, in the area including Alpine, Amador, Butte, Calaveras, El Dorado, Fresno, Lassen, Madera, Mariposa, Nevada, Placer, Plumas, Sacramento, Sierra, Tuolumne, and Yuba (see Figure MC-1 Counties in the Mountain Counties Area). These counties range in elevation from 100 feet near the edge of the valley floor to nearly 14,000 feet at peaks along the crest of the southern Sierra Nevada.

The major rivers in the overlay area include the Sacramento, Feather, Yuba, Bear, and American rivers in the Sacramento River Hydrologic Region and the Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, Fresno, and San Joaquin rivers in the San Joaquin River Hydrologic Region. Major reservoirs providing water supply, hydropower, and flood control are concentrated in the middle and lower elevations including:

- Shasta.
- Oroville.

- Folsom.
- French Meadows.
- Hell Hole.
- Union Valley.
- New Bullards Bar.
- Englebright.
- Combie.
- Fordyce.
- Bowman.
- Camp Far West.
- Spaulding.
- Ice House.
- Caples.
- Pardee.
- Comanche.
- New Hogan.
- Donnells.
- Beardsley.
- Lyons.
- Strawberry.
- New Melones.
- Don Pedro.
- Hetch Hetchy.
- New Exchequer.
- Hidden Lake.
- Millerton (Friant).
- Jenkinson.
- Mammoth Pool.
- Pine Flat.
- Wishon.
- Isabella.
- Rollins.

These reservoirs and hundreds of small lakes provide fishery and recreation resources (see Figure MC-1). Additional resources value is gained by portions of the Feather, Yuba, Bear, American, Stanislaus, Tuolumne, Merced and San Joaquin rivers being designated by the State or federal governments as Wild, Scenic, or Recreational Rivers or as Wild Trout Waters.

With elevations in the Mountain Counties Area rising up to 14,000 feet, the Sierra Nevada Mountain Range orographically removes atmospheric water from eastward-bound storm events by cooling the air and wringing out the moisture as rain or snow. The Sierra Nevada naturally collects millions of af of water as storm systems move across the Pacific Ocean and make landfall on the continental United States. The higher mountain elevations hold millions of af of water in the form of snowpack, which melts and runs off the mountains into rivers and reservoirs, and will be released later in the year when water resources are needed most.

The watersheds within the area, which range in size from under 100 to 3,600 square miles, account for an average of 17 million acre-feet (maf) of water per water year, or about one quarter of all natural river runoff in California (DWR CWP 2009). About two-thirds of this runoff volume originates in the northern half of the Mountain Counties Area, and the rest comes from the southern half. The natural flow is seasonal with river runoff typically peaking during winter in the lower elevation northern watersheds and in spring in the higher elevation southern watersheds. The area also contributes more than half of all snowmelt runoff in the state, which is used to fill reservoirs after flood control restrictions ease. By late summer, natural river flow recedes to very low levels and reservoir releases provide a significant portion of the downstream water supply, including flows for the Bay Delta system, the Central Valley Project (CVP), and the State Water Project (SWP). For more information on these rivers and watersheds, see the Sacramento River and San Joaquin River regional reports.

The northern part of the Mountain Counties Area borders the volcanic Cascade Range and Diamond Mountains of the Basin and Range Province. South of the volcanic plateau surrounding Lassen Peak, the soils become increasingly granitic and the topography is characterized by rugged, steep canyons with gradients often exceeding 100 feet per mile. Such gradients often lead to heavy sediment loads during high flow events, especially following forest fires. These canyons become extremely deep in the glacier-carved terrain of the southern Sierra Nevada, exemplified by the U-shaped valleys of Yosemite and Hetch Hetchy. While the Sierra Nevada range is dominated by granitic rock, it also includes many types of igneous, sedimentary and metamorphic rocks. The geologic record consists of hundreds of millions of years of uplift, erosion, volcanism, and glaciations.

The area is influenced by the Mediterranean climate of California, which varies greatly given the wide range of topographic features and elevation change. The climate is generally characterized by warm-to-hot, dry summers and mild-to-cool, wet winters. The average annual precipitation is 55 to 65 inches (DWR CWP 2009). The typical lower snow levels have historically been near 3,500 feet elevation in the winter and sometimes reach as low as the valley floor. Snow accumulation varies by elevation and can average depths of over ten feet in elevations above 7,000 feet.

Water

Following the Spanish and Mexican eras, the genesis of California's wealth and water development can be traced in large part to the Mountain Counties Area, with water manipulation in the Sierra Nevada foothills enabling the gold extraction that helped to capitalize the development of the state and lead to subsequent investments in rail, agriculture, city building, and other commercial ventures. These water supply systems represent some of the earliest consolidated water rights in the history of water development in California. While local use of water originating in this overlay area comprises only a small fraction of the total statewide population, Mountain Counties residents are the primary stewards of much of the state's water.

Water is the number one renewable resource exported from the Sierra Nevada based on the $1.3 billion monetary value of the individual water rights involved (SNEP 1996). Although $1.3 billion may be the market value for the Mountain Counties water, the economic value is likely much greater. Mountain Counties' water irrigates much of the Central Valley of California's agriculture, which was recently valued at $34 billion (CDFA 2011). The economic value of Mountain Counties' water could be quantified by applying a multiplier to the revenue it creates for California's agriculture.

The Mountain Counties Area is the primary source for most of the state's exported water. The region now faces formidable challenges, both politically in terms of water rights and flows required to restore the Sacramento-San Joaquin Delta, and from nature,, due to anticipated effects of climate change and the potential for long-term droughts that could devastate the state's economy, and the Mountain Counties communities' way of life.

Total regional inflows and outflows for 2010 are summarized in Figure MC-3.

PLACEHOLDER Figure MC-3 Mountain Counties Regional Inflows and Outflows in 2010

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Water Budget/Water Balance Summary

Figure MC-4 summarizes the total developed water supplies and distribution of the dedicated water uses within this overlay region from 2001 through 2010. As indicated by the variation in the horizontal bars for wet (2006) and dry (2007) years, the distribution of the dedicated supply to various uses can change significantly based on the wetness and dryness of the water year. The more detailed numerical information about the developed water supplies and uses is presented in Volume 5, *Technical Guide*, which provides a breakdown of the components of developed supplies for agricultural, urban, and environmental purposes and water portfolio data.

PLACEHOLDER Figure MC-4 Mountain Counties Water Balance by Water Year, 2001-2010

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Dedicated environmental water for instream fishery flows in the Mountain Counties Area dominates the developed water use. Urban and agricultural water uses are a much smaller portion of the total. The water supply portion of Figure MC-6 also indicates that most of the water supply in this region is from surface water flows from the Sierra Nevada with significant amounts of water reuse by downstream users. Groundwater usage is very minor in this region because the Mountain Counties Area does not overlay or have access to any significant large groundwater aquifers.

Table MC-1 presents information about the total water supply available to this region for 2001 through 2010 and the estimated distribution of these water supplies to all uses. The annual change in the region's surface and groundwater storage is also estimated as part of the balance between supplies and uses. In wetter years, water will usually be added to storage and during drier water years, storage volume may be reduced. Of the total water supply to the region, more than half is either used by native vegetation, evaporates to the atmosphere, provides some of the water for agricultural crops and managed wetlands (effective precipitation), or flows to other states, the Pacific Ocean, and salt sinks like saline groundwater aquifers. The remaining portion, identified as consumptive use of applied water, is distributed among urban and agricultural uses and for diversions to managed wetlands. For some of the data values presented in Table MC-1, the numerical values were developed by estimation techniques because actual measured data are not available for all categories of water supply and use.

PLACEHOLDER Table MC-1 Mountain Counties Water Balance Summary, 2001-2010

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Water Quality

The water quality in surface water and groundwater in this region is somewhat different. Generally, Mountain Counties' surface water is of extremely high quality, as the source water comes from snowmelt, rainfall (depending on elevation), and freshwater springs. Groundwater is generally of good quality. However, groundwater varies much more in quality from place to place, and typically has higher total dissolved solids (salts) content.

Surface Water Quality

The raw (untreated) surface water rushing down from these watersheds is of very high quality for the following reasons:

- Low turbidity except during high flow events.
- Cold temperatures and high dissolved oxygen saturation for most of the year in most flowing rivers and streams.
- Low level of total dissolved solids, electrical conductivity, sodium, and chlorides.
- Low levels of nitrates, phosphates, pesticide residues, other agricultural and industrial chemicals, alkalinity, hardness, taste, odor, color, humic and fulvic acids, total trihalomethanes and other chlorinated organics, and fecal coliforms.

The California Department of Public Health (CDPH) requires every drinking water purveyor that uses surface water to provide CDPH with a sanitary survey of the untreated surface water source every five years. Further information about the water quality of the Mountain Counties rivers can be obtained by reviewing the respective watershed's sanitary survey available from either CDPH or the drinking water purveyor in the watershed. Surface water is exported for use throughout California where, in the area of use, it is often blended with poorer quality waters for municipal and agricultural uses. The following are the most significant surface water quality concerns in the Mountain Counties):

- Metals from mining (mercury, copper, and cadmium). Erosion and sedimentation.
- Temperature (SWRCB 2010).

Inorganic mercury enters waterways when soils erode, atmospheric dust falls to the ground, and mineral springs discharge. Additionally, several million pounds of mercury were transported from the Coast Ranges to the Sierra Nevada and introduced to the environment to facilitate gold recovery during the Gold Rush. In various aquatic environments, inorganic mercury can be converted to methylmercury, which is a potent neurotoxin. Methylmercury is readily absorbed from water and food and, therefore, concentrations increases sharply between ambient water concentrations, microorganisms, macroinvertebrates, fish species, and top predators of aquatic food chains.

The cumulative result of this bioaccumulation is more than a million-fold increase in concentrations of methylmercury in predatory fish such as bass and fish-eating wildlife such as terns and eagles (SRWP 2010). The production of methylmercury and uptake in the food chain is influenced by natural factors and by many human activities. Fish with elevated concentrations of methylmercury pose a risk to people and wildlife that eat the fish. Many streams and reservoirs in the Mountain Counties contain fish with elevated concentrations of organic mercury in muscle and liver tissues.

Copper mining in the Upper Feather River watershed has caused copper, cadmium, and zinc impairments in several of the Upper Feather River tributaries. The largest mine in this area is the Walker Mine, an inactive copper mine about 12 miles east of Quincy, in Plumas County. Acidic and metal-laden water (acid mine drainage) discharging from the mine portal and tailings impoundment has long affected the nearby streams of Dolly Creek and Little Grizzly Creek. The discharge was reported to have eliminated aquatic life in Dolly Creek, downstream from its confluence with the mine drainage, and in Little Grizzly Creek downstream from its confluence with Dolly Creek for a distance of approximately ten miles from the mine. Little Grizzly Creek flows to Indian Creek, a tributary to the North Fork of the Feather River.

The “copper belt” in the lower Sierra Nevada foothills is an area with natural copper deposits and spans roughly from Amador County to Tuolumne County. Discharges from abandoned mines contain levels of copper, arsenic, pH, and salts, which are a concern for aquatic life.

Erosion and sediment are additional concerns in the Mountain Counties. Erosion occurs through land and water use practices such as ranching, mining, timber harvest, road construction/maintenance, rural residential development, and recreation. In the North Fork Feather River watershed alone, an estimated 1.1 million tons of sediment are transported annually out of the watershed. Sedimentation impairs fisheries, reduces storage capacity and, by virtue of the characteristics of many organic and inorganic compounds that bind to soil particles, serves to distribute and circulate toxic substances through the riparian, estuarine, and marine systems (SRWP 2010; CVRWQCB 2011a).

Temperature impairments have been identified in the North Fork of the Feather River and the South Fork of the Yuba River (SWRCB 2010). The activities of fish are controlled by temperatures in the aquatic environment. Extremes of temperature, whether hot or cold, produce adverse effects in fish. The tolerance of fish to temperature extremes varies with the life stage, whether egg, fry, fingerling, smolt, or adult. In addition to direct effects of temperature on fish, indirect effects due to temperature also occur that can limit fish populations. Such effects include altered food abundance and conversion efficiency, increased predation, temperature-mediated disease, dissolved oxygen, and increased toxicity of various compounds (DWR 1988).

Salinity is not an issue of concern within the Mountain Counties area, which receives sufficient precipitation to supply the water needs of the area as well as dilute any salinity impacts. However, a portion of the salts originating in the waters of the Mountain Counties area eventually reach the Delta pumps and contribute to salinity problems in the San Joaquin Valley and other regions of the state (WEF 2009).

Groundwater Quality

Groundwater in the Mountain Counties Area is generally found in fractured rock systems and is generally of good quality. The following are contaminants of concern found in groundwater in this area:

- Arsenic.
- Gross alpha particle activity and uranium.
- Localized contamination has been identified for nitrates (SWRCB 2012a; USGS 2010).

The most common groundwater contaminant is arsenic. The primary source of arsenic in groundwater is minerals eroded from the volcanic and granitic rocks of the Sierra Nevada. Gross alpha particle activity and uranium were found in raw and untreated water for many of the public water systems in the Mountain Counties Area. These radionuclides are typically naturally occurring, but are a concern because of the potential for health effects. Localized contamination by nitrates was identified in Oakhurst and Ahwahnee, both in Madera County. Based on land use in this area, the likely cause of the nitrates are discharges from septic systems.

Some residents in the Mountain Counties Area that use groundwater over fractured rock basins are concerned about degraded water quality caused by the use of residential, salt-recharged, ion exchange water softeners. Periodically, the ion exchange systems flush used salt out into residential septic tanks. The septic tanks overlie fractured rock, and thus contribute to elevated levels of salt in the groundwater. Because of the increased corrosivity of the salt content in the groundwater, surrounding neighbors tend to have water leaks and other plumbing problems.

Drinking Water Quality

In general, drinking water systems in the region deliver water that meets federal and State drinking water standards. Recently the State Water Resources Control Board (SWRCB) completed a statewide assessment of community water systems that rely on contaminated groundwater (SWRCB 2013). Contamination of local groundwater resources results in higher costs for rate payers and consumers due to the need for additional water treatment. The report identified 42 community drinking water systems in the region that rely on at least one contaminated groundwater well as a source of supply (see Table MC-2). A total of 75 community drinking water wells are affected by groundwater contamination and the most prevalent contaminants are gross alpha particle activity, arsenic, and uranium all naturally occurring contaminants (see Table MC-3). These wells were found to exceed the Maximum Contaminant Level (MCL) for the respective constituent listed in Table MC-3. The assessment used MCLs to identify (1) the contaminants that exceeded a primary MCL on two or more occasions, and (2) the associated community waters that served the contaminated groundwater.

All of the affected systems are small water systems, which often need financial assistance to construct a water treatment plant or alternate solution to meet drinking water standards. Small water systems face unique financial and operational challenges in providing safe drinking water. Given their small customer base, many small water systems cannot develop or access the technical, managerial, and financial resources needed to comply with new and existing regulations. These water systems may be geographically isolated and their staff often lack the time or expertise to make needed infrastructure repairs, install or operate treatment, or develop comprehensive source water protection plans, financial plans or asset management plans (USEPA 2012).

PLACEHOLDER Table MC-2 Summary of Small, Medium, and Large Community Drinking Water Systems in the Mountain Counties Area that Rely on One or More Contaminated Groundwater Well(s)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

PLACEHOLDER Table MC-3 Summary of Contaminants Affecting Community Drinking Water Systems in the Mountain Counties Area

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Forestry

Historically, the Sierra Nevada Region has been challenged when addressing forest management as myriad interests and perspectives come into play. Moving beyond traditional arguments by shifting focus to mutually agreeable principles will allow the region to emerge as a national leader in collaborative forest management.

Timber

The Sierra Nevada produces up to half of the state's annual timber supply, much of which comes from the forests in the Mountain Counties Area (SNFCI). In addition, the giant conifer forests of the Mountain Counties store large amounts of carbon, absorbing more than twice the amount of carbon than either tropical rainforests or temperate forests.

Fire

Fire has been an important element in ecosystem processes in the Sierra Nevada and Mountain Counties Area for thousands of years. Pre-European civilizations in the region deliberately ignited forest fires on a regular basis. These fires cleared the forest undergrowth, promoting the health of the large trees and the growth of important vegetation used for food and fiber. Small, cool fires helped prevent the large high-severity, stand-replacing wildfire events which now threaten the region's fuel-choked forests as a result of decades of fire suppression policies.

Large complex fires can have catastrophic impacts on the region's ecosystems, communities, and economies. In addition to taking lives and destroying private property, such fires expose the watershed to erosion, reducing the ability of the soil to absorb water. Consequently, this increases the speed at which water runs off the bare soil, which carries sediment with it into streams and reservoirs and causes flooding in local communities. Large wildfires also release carbon stored in trees and soil, damage critical habitat for wildlife and fish, compromise the transmission, supply, and delivery of water and electricity, and cost millions of dollars for fire-fighting and restoration.

Different types of vegetation have different "fire return intervals," defined as the length of time between naturally occurring fires. Research compiled by the *Sierra Nevada Ecosystem Project* in the mid-1990s tracked median fire return intervals for specific vegetation zones and compared them with the years since the last fire in that zone. In almost all cases, the period of time since the last fire was several times larger than the fire return interval for that zone. This indicates that almost all of the region's forests are overstocked with fuel, creating the conditions for high-severity wildfires. See Figure MC-5 for a map of the Wildfire Hazards of the Mountain Counties Region. These severe fires, which were once rare events, have now become the commonplace.

PLACEHOLDER Figure MC-5 Wildfire Hazard Map of the Mountain Counties Region

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The unhealthy conditions of the region's forested lands are directly related to historic management practices including intensive logging activities and fire suppression. These activities have resulted in forest stands that are severely overstocked (too high of a tree density) and contain heavy loading of ground and ladder fuels (vegetation that provides a pathway for fire into the upper canopy of trees). In addition, areas planted as even-aged stands (e.g., plantations) to replace harvested trees are often overgrown to the point where they have become wildfire hazards and also leave the forest highly susceptible to disease, insect attack, and drought. The California Forestry Association estimates that the density of trees in Sierra Nevada forests in the Gold Rush period was 50 – 70 trees per acre, while the density in 2010 was 400 trees per acre.

Led by science and public policy, forest management practices now strive to restore these lands to an uneven-aged and fire-adapted ecosystem that will be more resilient to disturbances and provide habitat for old growth species. This restoration approach also includes the use of fire, which in low and moderate intensity, has many beneficial impacts for ecosystem health. Pre-treatment (mechanical and hand thinning), however, is often necessary to keep these fires from becoming high-severity events which can be destructive to forest health and wildlife habitat.

Unique Characteristics

The Mountain Counties Area has many unique characteristics that are must be understood to determine the best strategies for ensuring that these watersheds continue to provide ecosystem services of value to the entire state.

Population

The overall population of the Mountain Counties Area is currently 611,983, which is a scant 1.64 percent of population of the state as a whole (CENSUS 2010). This area has experienced a 9.7 percent increase from the 2000 population of 557,768, more or less consistent with the growth rate of the state.

Trends

However, this growth has not been consistent over the region. Table MC-4 below shows population growth for the Mountain Counties Area by county. This table indicates that the less developed, more rural counties, such as Alpine, Plumas, Sierra and Yuba are experiencing an actual loss of population, where other counties such as Nevada, Amador, Tuolumne, and Mariposa are gaining population, but at a slower pace than the region or the state as a whole. El Dorado and Placer Counties, with developed corridors along major transportation routes, are fueling the growth of the region.

The Mountain Counties Area does not include the complete area of each of the counties listed above. Counties such as Lassen and Sacramento are only partially included in the region. The numbers in the table above reflect population estimates for only the portions of each county included in the Mountain Counties Area.

PLACEHOLDER Table MC-4 Population Estimates for Mountain Counties Area

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Population Density

For purposes of water planning, the overall population is less significant than the developmental patterns for that population. In the Mountain Counties overlay (including only those counties in which the region includes a significant percentage of the overall county area), about one-third of the population lives in parcels between zero and two acres, which could be deemed to be towns or communities. Table MC-5 shows the population by acre size.

PLACEHOLDER Table MC-5 Population Acre Size Percentage

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These relatively high-density population areas need to be served by water and wastewater systems. In some areas where development is recent, these systems may be in place and in good condition. However, in the more rural counties, systems may be out of compliance with current standards or may not exist at all.

As can be seen from the Figures MC-6 , these higher density communities with smaller parcel sizes are located for the most part in the foothill area of the region and along the major transportation corridors. Planners wishing to identify those areas on a regional basis that are most at risk for needing and not being able to afford infrastructure improvements can overlay this map/figure with the subsequent map of disadvantaged communities in the region.

PLACEHOLDER Figure MC-6 Parcel Size Map

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Rural Community Character

Many of the area's present-day communities were founded immediately after the discovery of gold in 1848. The area as a whole has seen unprecedented change from the Gold Rush's effects on the native populations to the growth of the new technology- and service-based economies. As resource conditions and community needs have changed over time, both locally and throughout the state, the utilization of this region's basic resources and the impacts on the Mountain Counties' communities have also changed.

The Mountain Counties Area's many distinct towns, cities, and communities each depend on natural resources to some degree for community development, job creation, recreation, and community character. All of these factors are also driven by the diverse social values that local residents bring to the region and its resources. These values are reflected in the region's schools, markets, conservation ethic, systems of law and land use, and the way in which these systems bring order and well-being to the region's communities.

Disadvantaged Communities

Figure MC-7 shows census block groups within the Mountain Counties Area and their status as disadvantaged communities, which are defined by the State as those having a median household income (MHI) of 80 percent or less of the State MHI. The Figure MC-10 also shows which areas descended into disadvantaged community (DAC) status between 2000 and 2010 and which areas climbed out of that status.

PLACEHOLDER Figure MC-7 Disadvantaged Communities

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Roughly one-third of census block groups in the Mountain Counties Area meet the DAC definition. The central portion of the area appears to be doing better than the far north and south. Placer, El Dorado, Amador, and Alpine counties, as well as Plumas County in the north and the portions of Fresno County included in the region now have very few DAC block groups. Counties that have high DAC areas include Butte, Sierra, Nevada, Tuolumne, Mariposa, and Madera.

Land Ownership/Use

Land ownership is a mix of private and public, which on a map resembles a one-mile square “checkerboard” of public and private ownership throughout much of the overlay area, a remnant of historic railroad development. Private lands in the overlay area constitute approximately 41 percent of the area, while 57 percent is owned and managed by federal agencies, such as USDA Forest Service, Bureau of Land Management, Bureau of Reclamation, U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service, National Park Service, and Bureau of Indian Affairs. Other public land managers or regulators include a variety of State and local agencies, such as special districts, NGOs, counties, and cities. Private ownership in the western part of the overlay area consists mostly of residential and/or agricultural holdings, while in the upper watersheds, timber companies own a large percentage of the private lands, which they manage for commercial timber production.

The USDA Forest Service (USFS), Bureau of Land Management, and National Park Service are the major public land managers in the area, especially in the higher elevation watershed lands. These public lands provide recreational opportunities for people throughout the state and beyond. Large private land holdings for timber production of softwood forests exist in areas designated as Timberland Preservation Zones. Management of national forest land for multiple uses is addressed in forest plans prepared by the United States Department of Agriculture, Forest Service. Forest management practices such as fuels reduction, access road policy, and logging methods affecting the risk of forest fires have a large impact on water quality and supply in these watersheds.

Three-fourths of the irrigated land area is pasture in the northern Sierra, but the growing season length is suitable for a variety of crops at lower elevations including grain, wine grapes, apples, and other deciduous fruit (DWR CWP 2009). The shift to viticulture continues, especially in the central Sierra Nevada, where it is the major crop. Open spaces, such as wetlands, meadows, fens, and marshes provide recharge areas, filtration, and flood attenuation that benefit downstream interests. The shift continues from historical land uses, such as timber harvesting, livestock grazing, and irrigated agriculture, to residential, commercial, and recreational developments.

Water

Governance

More than 100 local governmental agencies and districts, most serving from 1,000 to more than 100,000 customers, deliver water and treat wastewater for water users in the Mountain Counties Area. In addition, many city and county governments manage land use zoning, building permitting, and other activities related to water resources development and utilization, such as treated and raw water management plans and drought plans. County general plans provide direction for these activities. East Bay Municipal Utility District (EBMUD) and Hetch Hetchy Water & Power export water from the Mokelumne and Tuolumne rivers to the San Francisco Bay Area. These agencies are managed by governing bodies elected by their customers who live outside the Mountain Counties Area. The SWP and the federal CVP also export water from the area and numerous Central Valley water agencies manage additional reservoirs to divert water from the western edge of the area. Finally, several State and federal agencies exercise regulatory control over water management activities. Table MC-6 lists some of the major types of organizations involved in the governance and planning of water resources in this area.

PLACEHOLDER Table MC-6 Water Governance and Planning in the Mountain Counties Area

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In addition to the government and public agencies with responsibility for managing water resources, the Mountain Counties Area is home to several regional planning organizations seeking to identify future trends, such as climate change and their challenges. These groups are working on issues of land use, housing, environmental quality, economic development, wetlands, water reliability, watershed management, groundwater management, water quality, fisheries, and ecosystem restoration. The Mountain Counties Water Resources Association assists water agencies and local governments in coordinating water resource matters important to the area and interfaces with applicable State officials and departments on these matters. Formed in the 1950s, its members include 17 water agencies and local governments who meet bimonthly. Existing and developing integrated regional water management (IRWM) planning groups are discussed later in this report.

FERC Relicensings

Hydropower is an important source of renewable energy. However, the building and operation of hydroelectric power projects can affect the natural environment and result in changes to land use. The Federal Energy Regulatory Commission (FERC) has the exclusive authority under the Federal Power Act to license nonfederal hydropower projects on navigable waterways and federal lands. Recent and ongoing FERC project relicensings throughout the Mountain Counties Area require extensive review of the balancing of watershed-wide environmental and human goals in order to best utilize available water resources for multiple uses. Such uses include adequate water supply storage, hydroelectric power generation, agricultural and domestic use purposes, and recreation while ensuring instream flows, reservoir levels, bypass flows, and upstream diversions provide environmental protections including the protection, mitigation, and enhancement of fish and wildlife habitat in the downstream reaches.

Special Designations

The Mountain Counties Area contains many important resources that have been recognized and protected through special designations. Some of these designations set management conditions that affect instream flows for the benefit of the environment and recreation throughout the Mountain Counties. For example, the Vernalis Adaptive Management Program (VAMP) , San Joaquin River Restoration Program, Yuba River Accord, and the Water Forum Agreement for the Lower American River, all affect and control the flow of water for numerous beneficial purposes, including fish flows for listed species. Flow is further regulated by conditions on existing diversions imposed by the SWRCB for upstream Clean Water Act (Section 401) requirements, as well as other upstream public trust values.   See "Applying the Public Trust Doctrine to River Protection" in Volume 4 of *California Water Plan Update 2005* for an excellent discussion on this topic.

There are streams within the Sierra Nevada ecosystem, such as the Middle Fork of the Stanislaus above New Melones Reservoir, which are designated by the State as Wild Trout Streams (California Fish and Game Code Section 1726 et seq.). Such designation recognizes the unique fishery values and requires specific flow standards for projects located on affected rivers to maintain a healthy, self-sustaining wild trout population. Similarly, some streams within the Mountain Counties Area are protected as Wild and Scenic Rivers under federal or State laws designed to balance the need for water development with the need to protect some of the few remaining free-flowing rivers that have other outstanding values, such as recreational, scenic, geologic, wildlife, historic or cultural. Management efforts, such as setting minimum flows, help to protect the conditions that existed at the time the river was designated as a Wild and Scenic River.

Water Rights

Water in California is considered to be the property of all citizens, and its use is governed by the State through the granting of permission, or "water rights," to individuals and entities by way of the rule of priority right. This means that the holder of a senior appropriative water right is "entitled to fulfill his needs before a junior appropriator is entitled to use any water." This control was established in the California Constitution (Article X Section 2) as a way of ensuring that this valuable resource would be used in ways that are reasonable and beneficial. Beneficial use is broadly defined as any use that is considered to be consistent with the public interest, e.g., agriculture, domestic use, industry, fish and wildlife, recreation. Reasonable use is the use of water without excessive waste. Unlike a land right, the holder of a water right owns the benefit of the water and not the water itself. In 1913, the Legislature passed the Water Commission Act, creating a State agency to determine whether proposed appropriations should be allowed. The Water Commission Act became effective in 1914 and then, the priority date for each appropriative right is determined by the date of application to the State for such right. Prior to 1914, priority was established by posting and recording notice of the intended appropriation and the construction and use of facilities to appropriate the water. Many water rights held by agencies in the Mountain Counties have pre-1914 priority as the water was originally appropriated for mining in the 19th Century. This water continues to be used for agricultural and municipal purposes and is vital to the health and safety of local communities. For further information, see the water rights section in Volume 1, *The Strategic Plan*, Chapter 4, "Strengthening Government Alignment."

Interestingly, much of the water supply originating in Mountain Counties is unavailable for local use due to prior water rights appropriations for downstream or out-of-basin users. Many of the reservoirs in the

Mountain Counties Area were constructed for the purpose of serving out of basin users as can be seen in Table MC-7. For example, in the early 1900s, Bay Area water agencies were granted rights to export supplies from the Mokelumne and Tuolumne rivers to meet anticipated demands. Later, the State and federal water projects, Central Valley water agencies, and the USACE were granted rights to build the major foothill multipurpose reservoirs from Lake Oroville to Millerton Lake, which enable delivery of water for use in other regions of the state through canals, aqueducts, and the Delta. Other Mountain Counties rivers have received State or federal Wild and Scenic designations, and therefore, cannot be developed for water supply and hydroelectric purposes.

A 1928 amendment to the California Constitution mandated that holders of all water rights, including riparian, must use the water and do so reasonably and beneficially. Failure to do so results in loss of the right. The Legislature passed the County of Origin Act in 1931, and the Area of Origin Act in 1933, prior to construction of the State and federal water projects. These legal mandates were provided to upstream communities so that their future needs for adequate water, as well as that of their watersheds, would not be compromised by operation of the projects and their export of water outside the areas where the water originated. The Area of Origin statutes are in the California Water Code (CWC) Sections10505, 10505.5, 11128, 11460, 11463, and 12200-12220.

PLACEHOLDER Table MC-7 Reservoirs in the Mountain Counties Area

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In-Region Use

Total consumptive use of water in the Mountain Counties Area is less than 3 percent of the 117 maf of water that leaves the area in an average year and about 1 percent of total statewide consumption. The overall consumptive water use is about 71 percent agricultural with the remainder urban use, but it varies widely between counties.

To understand the unique situation underlying water use in the Mountain Counties Area better, it helps to know a little bit about the history of water development in the region. The mining operations of the Gold Rush Era marked the beginning of much of the water supply development for the foothill and mountain areas, especially hydraulic mining. Subsequently, Pacific Gas and Electric Company (PG&E) and several water agencies developed an extensive hydroelectric power and consumptive water use delivery system throughout the Sierra Nevada, often incorporating old mining ditches.

Most of the early water conveyance facilities were later purchased or transferred to local water agencies for consumptive water deliveries. Some of these water agencies still use the ditch systems as a primary means of water delivery to both their water treatment plants and to some individual water users along the route to the treatment plants. There are still other areas that divert untreated water directly from raw-water ditch systems, supplemented by bottled water deliveries, for residential use. Significant early water development within the Sierra Nevada took place during the era immediately following the discovery of gold up through the late 1940s. Most of these early diversions and reservoirs were relatively small and, with few exceptions, served local communities within the Mountain Counties watersheds.

The primary, and in some cases exclusive, sources of water for use within Mountain Counties communities are the rivers and streams in which these on-stream diversions and storage facilities have been constructed with local financing. As a result, local water supplies vary seasonally and year to year, depending on the amount and timing of precipitation and the corresponding large fluctuations in runoff. Many hundreds of public and private water systems supply water for uses within the Mountain Counties Area, with locally developed surface water accounting for approximately 90 percent of the local consumptive use (DWR). The remainder of the water is provided from federal water facilities, individual groundwater wells, small private surface storage, locally developed imports from adjacent hydrologic regions, and reclaimed wastewater.

Out-of-Region Use

Early water development, secured by pre-1914 or "senior" water rights, was cumulatively small compared to the water resource development era beginning after 1950, which was geared more toward moving water to more developed areas outside of the Mountain Counties Area. A full 80 percent of the present reservoir capacity in the Sierra Nevada was completed after 1950 (SNEP).

Water stored upstream provides an essential safeguard downstream for agriculture, the environment, and domestic purposes during dry years, as well as protection against salinity intrusion, floods, and catastrophic levee failure in the Delta. Upstream storage in the Mountain Counties sustains the spawning and rearing habitat of anadromous and resident fisheries, including listed species, by releasing instream flows of cold, clean water. The interregional connection and the ability to move water from north to south in times of drought or other crisis, such as levee failure, should be a key component in the California water portfolio. Complex State and federal regulations and insufficient storage capacity upstream can lead to shortages, degraded water quality, warm water harming fish, and fallowed crop land. requiring the State to import more food from other places that lack the State's high quality control standards.

The 2011-2012 water year is a case-in-point. Despite an extremely dry winter, carryover storage in the Mountain Counties reservoirs helped to normalize water deliveries statewide. While the carryover storage helped normalize statewide water deliveries, the existing reservoirs alone were not adequate to retain the substantial rainfall from the previous water year.

Groundwater

While groundwater only constitutes roughly 15 percent of the overlay area's water supply, it is an important source for rural single family homes as well as public and private water supply systems (DWR). Groundwater availability is often limited to fractured rock and small alluvial deposits immediately adjacent to the area's many streams. In the rural areas, many individual residences are not connected to a municipal water system and are wholly dependent upon individual wells for domestic use, which are often unreliable during drought periods. Some farms and many of the vineyards have developed wells with enough production to irrigate their lands in all but the driest of years. Larger groundwater basins occur in the high valleys of the upper Feather River. Sierra Valley, the largest valley in the watershed, contains a large aquifer that has suffered from overuse in recent decades. For more information, see DWR's *California's Groundwater Update 2003*.

Water Use and Efficiency

Water agencies within the Mountain Counties Area employ water-saving technologies to their consumers and provide public outreach programs to enhance community awareness of the value of water within the region.

Water use efficiency includes the widespread utilization of water smart technologies and practices that deliver equal or better results with less water. Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. Accounting for water and minimizing water system losses are essential steps toward ensuring that California's water supplies are sustainable. This is best accomplished when water suppliers meter use by their customers and monitor their own operations and downstream water system deliveries. Metering helps to identify system losses between the water treatment plant outflow readings and the usage measured by the customers due to leakage. Metering also provides the foundation on which to build an equitable rate structure to ensure adequate revenue to operate the system and to ensure conservation-based tier structure pricing.

Typically, water conservation has been associated with curtailment of water use and doing more with less water during a water shortage, such as a drought. By conserving water and by purchasing more water efficient products, water consumers can help mitigate the local effects of drought and also save money on their water and energy bills. Using water more efficiently helps retain water supplies at safe levels, protects human health and the environment, and ensures reliable water supplies today and for future generations. The Nevada Irrigation District (NID) and Placer County Water Agency (PCWA), both located within the Mountain Counties Area, aggressively implement water conservation programs to ensure water supplies are available in the future.

Within their current water conservation program, NID implements water conservation measures at the district level using supply management and at the consumer level using demand management. The demand management measures currently utilized include:

1. Water survey programs.
2. System water audits, leak detection, and repair.
3. Metering with commodity rates for new connections and retrofit of existing connections.
4. Large landscape conservation programs and incentives.
5. Public information and school education programs.
6. Conservation pricing.
7. Water waste prohibition.

Since 1968, NID's treated water connections have been fully metered and billing rates have been based on the volume of water used.. In 2000, NID began a 5-year retrofit program to replace aging meters within the system to improve accuracy of meter readings and continue water efficiency practices. Also, NID hired a full-time water conservation coordinator/water efficiency technician in 2011 to provide technical expertise to NID's water conservation program, water distribution, and production activities and to implement activities to improve water use efficiency within NID's service area (NID 2010).

PCWA offers on-site water efficiency survey services such as rebate programs, water wise house calls, water wise business calls, and landscape irrigation surveys. PCWA offers residential and commercial rebates ranging from $50 to $300 for installing high-efficiency washing machines or toilets, hot water demand whole house recirculation systems, point-of-use hot water heaters, waterless urinals, and replacing lawns with non-water consuming material. The water wise house and business calls send a water efficiency specialist to a home or business to review indoor and outdoor water needs, recommend water efficiency measures, and install water saving devices. The landscape irrigation surveys currently conducted include a water yield analysis on irrigated lands greater than one acre within PCWA's service area. PCWA also provides water educational and agricultural programs to customers. Water education programs for kindergarten through 8th grade students are available upon request and PCWA participates in many public outreach and educational programs. The agricultural programs available include soil moisture monitoring and collection and distribution of evapotranspiration data for agricultural and landscape water users, farm advisors, and irrigation specialists to use for determining their agricultural water needs and for efficiently scheduling irrigation (PCWA 2011).

Water recycling (see Box MC-1) has become a method to use the available water more than once and is related to the overall efficiency of water use.

PLACEHOLDER Box MC-1 Recycled Water Use

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Agriculture

Local agriculture, including farming and ranching, is critical to the economies, natural environment, and health and well-being of communities throughout the Mountain Counties. Local water supplies and delivery systems have been developed over many years to meet the needs of agriculturists in the Mountain Counties Area. Local agriculture has continued to develop and overcome temporal challenges, such as declining commodity markets and catastrophic disease, to generate a sustainable industry of agrotourism, direct marketing, and local consumption.

Crops, such as deciduous orchards, wine grapes, and Christmas trees are commonly permanent along while livestock grazing and other ranching activities. Topography limitations and management constraints, due to smaller acreages, limit the production of seasonal crops that can be fallowed.

As an example, Table MC-8 shows gross crop value on a yearly basis for six of the 16 counties that make up the Mountain Counties Area.

PLACEHOLDER Table MC-8 Gross Crop Value

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In addition to direct crop values, agriculture has a significant impact on the local economy through indirect retail. For example, the local economy in El Dorado County saw an additional $360 million in sales as a result of agriculture. This includes wineries and agricultural tourism, like Apple Hill. Agriculture also has a strong impact on the local workforce. From 1990 to 2006, Amador County saw a 147 percent increase in the number of people working in agriculture.

Land suitable for dry farming in the area is already maximized. Therefore, much of the remaining farming relies on groundwater. Utilizing groundwater in the Mountain Counties Area creates acreage size limitations, which, in turn, lead to necessarily small farming operations, most of which are owned and operated by families who live on the land and have a strong connection to its environmental resources.

Many farms market directly to the public through tasting rooms, cider mills, u-pick orchards, and other means that support a vibrant agrotourism industry, and are also the food source of local communities. These working lands provide open space and critical habitat for plants and animals and preserve the natural function of the watershed. Their existence largely depends upon continued reliable water source.

In many areas of the Mountain Counties, lands in agricultural production are increasing, as is the dedication of water supplies for irrigation. For example, in El Dorado and Calaveras Counties land use projections call for agricultural irrigation water deliveries to increase within each county by 30,000–40,000 acre-feet per year within several decades. This reflects the dedication of large tracts of open space to agricultural production consistent with the counties' general plans and growing demand for agricultural irrigated lands. As a result, open spaces of important habitat and naturally functioning watersheds will be preserved for the benefit of both communities within and downstream of the Mountain Counties.

Recreation/Tourism

The Mountain Counties Area offers world-class recreational opportunities and draws millions of visitors annually from around the world for everything from hiking, skiing, fishing, biking, rafting (see photo MC-2), or mountain climbing to more tranquil activities like sight-seeing, picnicking, or photography. From the Sierra Nevada to the Sacramento-San Joaquin Delta, lakes and rivers among forests, farms, and cities create an experience like no other.

The significance of recreation to the Mountain Counties Area is demonstrated by the fact that the number of people of many areas within the Mountain Counties vary greatly due to recreational use. Many recreationists visit State, national, and regional parks as wells as State, federal and private forest lands. In some communities in the Mountain Counties, the resident population may be significantly smaller than the peak (winter and/or summer) recreational number of people.

Much of California's rich history is connected to the agricultural productivity of the Sierra Nevada foothills region. While thousands of migrants flooded into to the area in search of gold, many also came to grow and supply food to the prospectors. The favorable climate and excellent soils of the region produced a wide variety of fruits and vegetables, which quickly gained popularity beyond the local areas and were shipped across the country. Many of the farms and ranches established during the birth of California are still producing a wide variety of products ranging from grass-fed beef to Mandarin oranges to apples and an array of award-winning wines. The variety and quality of the region's agriculture have inspired the growth of a tourism economy that appeals to travelers from around the world to experience locally grown and prepared food and wines. Those culinary attractions are often paired with opportunities to participate in authentic western cattle drives or harvesting and crushing fruit. Much of what built California and its iconic connection to the American West can still be experienced in the foothills of the Sierra Nevada.

PLACEHOLDER Photo MC-2 Photo of Rafting in the Mountain Counties Area

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Environment

Fish, wildlife, and native plants including a number that are rare, threatened, or endangered, depend on water to thrive. The snow and rain that falls in the region serves a delicate ecological system, which is supported through actively managed conservation work. The rivers within the Mountain Counties Area also play a critical role in the lifecycle of anadromous fish, including salmon and steelhead. These fish, which are born in freshwater rivers, migrate to the ocean and spend most of their lives there. They return to fresh water to reproduce and need healthy home watersheds for spawning.

PLACEHOLDER Box MC-2 Forest, Water, and Fire Management in the Mokelumne River Watershed

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Ecosystem Services

Watersheds comprised of large, uninterrupted expanses of forests and meadows, intact soils, lakes, and rivers provide ecological services such as water and carbon retention or sequestration, groundwater absorption, water filtration, and the production of oxygen and nutrients on a life-sustaining scale. Other benefits of the area’s natural systems include climate regulation, flood control, habitat for plants and wildlife, and pollination as well as market-based products such as food, construction material, and medicines.

There are various efforts taking place to recognize the economic value of the goods and services that nature provides and to incorporate that value into natural resource management decisions. Such recognition includes development of ways to measure the economic value of those services. This can be important information for water managers who normally see only the costs of ecosystem protection and restoration, but not the benefits, in their budgets. The services considered in these projects include water supply, wood products, carbon sequestration for GHG mitigation, hydropower generation, land subsidence reversal, and fish and wildlife preservation. The water supply from the Sierra Nevada, which is estimated at 11.2 million acre-feet annually, could be valued at about $20.1 billion a year at an assumed value of $1,800 per af. Moreover, Sierra Nevada streams produce enormous water-related economic benefits to downstream communities beyond the mountain counties, shown below in 2013 dollars, including these examples:

- $640 million of irrigation water annually.
- $412 million of municipal water annually.
- $868 million of energy production annually.

Despite these benefits of more than $1.9 billion per year, there is very little outside reinvestment in the Sierra Nevada ecosystem to continue providing these and other important benefits.

Efforts are being made to invest in meadow restoration in order to gain these ecosystem benefits. Box MC-3 discusses this strategy in more depth. Photo MC-3 shows the landscape before and after a meadow restoration effort.

PLACEHOLDER Box MC-3 Meadow Improvements in the Sierra

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

PLACEHOLDER Photo MC-3 Meadow Restoration Photo – Before and After

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Energy

Hydropower

There are well over 100 hydroelectric projects within the Sierra Nevada that are licensed by FERC under the authority of the Federal Power Act, with license periods extending up to 50 years. The associated reservoirs and water conveyance facilities produce renewable energy at a lower cost and higher reliability than solar or wind power systems. Water supply and timely releases are key factors in proper operation of this critical infrastructure. Through the FERC relicensing of many of these projects were achieved through multi-year collaborative negotiations with stakeholders representing a wide array of environmental, recreational, water supply, federal and State interests. As a result, the environmental and recreational benefits of operating such projects have increased dramatically. Higher instream flow requirements and other habitat improvements for the fishery and other ecological resources as well as pulse flows for rafting. Other improvements are Americans with Disabilities Act (ADA) accessibility structures to campgrounds and boating facilities. Listed below are just a few of many examples of improvements.

- Large hydroelectric projects in the Mountain Counties Area.
- El Dorado Irrigation District Project 184.
- Placer County Water Agency Middle Fork American River Project.
- Sacramento Municipal Utility District (SMUD) Upper American River Project.
- DWR), Modesto Irrigation District (MID), Turlock Irrigation District (TIDPG&E, and Southern California Edison Feather, American, Yuba, Bear, Stanislaus projects including large pumped storage facilities.

Several small in-pipe hydroelectric generation projects are also scattered throughout the region. There is potential for 1,000 megawatts (MW) of additional in-conduit hydrogeneration in the foothills through the development of small, renewable projects, typically less than one MW in capacity, which represents a prime target to help achieve the governor's goal of 12,000 MW of distributed renewable energy by 2020 (see Governor's Clean Energy Jobs Plan). Moreover, these renewable opportunities that use existing water facilities on the tributaries to the State and federal projects, provide an integrated solution to advancing DWR's stated goal of reducing its reliance on coal-fired power to operate the SWP while creating critically important revenue streams for economically disadvantaged communities in the Mountain Counties.

Biomass

Biomass utilization is a critical element of California's energy future. Current inventory information indicates that in-forest fuels reduction may provide one of the largest sources of biomass fuel for power production in California. According to the California Energy Commission, removal of excess biomass from Sierra Nevada forests to achieve public safety and environmental benefits could produce more than 30 million bone-dry tons (bdt) of biomass annually. Approximately 18 million bdt of this would come from commercial and non-commercial forest management.

Assuming that this volume of biomass could be environmentally and economically available, it would comprise nearly eight times the biomass volume from all sources currently consumed for biomass power production in California. The potential for power production would be substantial — 30 million bdt could produce over 3,000 megawatts of power. Current biomass power production in California stands at about 650 megawatts annually, with a total capacity of approximately 750 megawatts (Biomass LCA Technical Summary 2005). Biomass energy contributes 15 percent of the renewable power currently produced in the state, but has the potential to provide considerably more.

California policy currently calls for 33 percent of its energy to be produced from renewable sources by 2020, with 20 percent of all renewable energy to be generated from biomass resources. Energy produced from biomass currently provides only 3 percent of the overall in-state energy produced. Estimates indicate that the greatest abundance of potential biomass feedstock in California — up to 41 percent — could come from forestry biomass. Clearly, the opportunity for a significant contribution of renewable biomass energy — and the creation of jobs and economic opportunity for its residents — exists in the region, and is consistent with sustainable forest management.

Value Added Wood Products

Maintaining existing facilities that process traditional dimensional wood products is critical to the long-term economic sustainability of the region. In addition to creating energy, opportunities also exist for production of a variety of wood products from the biomass removed from the forests. These products include wood pellets used for heating, posts and poles, and other specialty wood products. Developing appropriately-scaled infrastructure to process and create value-added products from the materials removed to restore forest health is essential for the region to achieve a sustainable economy in forest communities.

In order to protect existing resources, address potential threats, and take advantage of the additional contributions the region makes to the state's energy production, economic development and emission reduction goals, a coordinated initiative is needed to focus attention on this region, increase investment, guide policy, and measure success. For more information, the Sierra Forest Technologies Cluster provides a framework.

Ditch Systems

Ditch systems are directly associated with mining and hydroelectric power industries, land settlement, community development, agriculture, and logging and played a substantial part in the economic and corporate development of the region and the rest of the state. Ditch systems provide water for many beneficial uses, defined in CWC Section 1243.

Ditch systems provide water for many beneficial uses. Such uses include, but are not limited to

- Living history.
- Recreational opportunities.
- Wetland and water quality enhancement.

- Cultural significance.
- Wildlife, terrestrial, and aquatic species habitats.
- Groundwater recharge.
- Fire protection.
- Stormwater collection.
- Aesthetic values.
- Economic asset from agriculture.
- Infrastructure asset.
- Hydroenergy generation.
- Remote storage.
- Heritage tourism.
- Water delivery during power outages
- Contribution to unique quality of life.

Tribes and Tribal Issues

Tribes and tribal entities within the Mountain Counties Area include:

- Berry Creek Rancheria.
- Calaveras Band of Miwok Indians.
- Chicken Ranch Rancheria of Me-Wuk Indians.
- Chukchansi Indians.
- Chukchansi Tribe.
- Chukchansi Tribe of Mariposa.
- Chukchansi Yokotch Tribe.
- Enterprise Rancheria.
- Greenville Rancheria of Maidu Indians.
- Konkow Valley Band of Maidu.
- Mooretown Rancheria.
- Nevada City Rancheria – Nisenan Tribe.
- North Fork Band of Mono Indians.
- Picayune Rancheria.
- Shingle Springs Rancheria.
- Su-tye Band of Wintun Indians.
- Southern Sierra Miwok Nation.
- T'si-akim Maidu.
- Tuolumne Algerine Band of Yokut.
- Tuolumne Band of Me-Wuk Indians.
- United Auburn Indian Community of the Auburn Rancheria.
- United Maidu Nation.
- Yahmonee Maidu of Si Lom Kuiya.
- Washoe Tribe of Nevada and California.

Many of the tribes, federally recognized and others, within the Mountain Counties Area face complex issues related to water that have culminated over many years. These include unascertained water rights, access to clean potable water, access to and protection of sacred sites near water, changes in water flows and landscapes that support plants and animals of cultural significance, and many contamination issues including mercury in fish and plants. Overcoming these challenges is important to watershed health and water supply within the area.

Solutions to challenges imposed by these issues juxtapose desirably with many of the solutions for challenges facing all other user groups and interests in the Mountain Counties Area. Federal, State, and local government agencies are finding that early consultation and cooperation with tribal interests have very beneficial outcomes. Prime examples in the Mountain Counties Area are the Combie Reservoir and Sediment Removal Project in Nevada County, the Calaveras Healthy Impact Product Solutions (CHIPS) project on the Calaveras District of the Stanislaus National Forest, and collaborative achievements between the North Fork Band of Mono and the Sierra Nevada Conservancy. Each of these examples is a product of an inclusive, collaborative process that included federal, State and local agencies, non-profit organizations, and tribal councils and members. These instances are exemplary in that tribal knowledge was a key component of the project development. Early meaningful consultation was put in practice resulting in a more desirable outcome for all interests and is described more fully in Box MC-4

PLACEHOLDER Box MC-4 Early Consultation and Cooperation with Tribal Interests

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Although it is recognized that there is a specific regulatory framework for tribal inclusion and consultation practices, it is also known that the process for consultation varies greatly agency by agency. The State has initiated a Tribal Consultation Policy for departments within the Natural Resources Agency. A similar non-regulatory uniform consultation guidance policy for local agencies would improve communication benefitting the agencies and the tribes as well as water and watershed projects within the Mountain Counties Area.

Unique Challenges

The Mountain Counties Area faces many unique challenges that are important to understand as decision-makers consider the best ways to protect the watersheds and the ecosystem services they provide to the state.

Forest Management

One of the biggest and most serious challenges facing the Mountain Counties Area is the risk of large, damaging wildfire. Although fire plays a key role in a healthy ecosystem, the kind of catastrophic fires that can result from overloaded fuels and extremely dry conditions can be very harmful to human communities and the overall health of the forested watersheds that provide so many benefits to Mountain Counties residents and the rest of the state.

Funding Limitations and Economic Shifts

Public land agencies such as the USFS have adopted new approaches to land management focusing on the ecological restoration of resilient forests. Although such agencies recognize the importance of this work to prevent wildfires and acknowledge the need to increase the pace and scale of treatment across the region, limited funding is a serious factor. Previously, public land managers treated overstocked forests by designating areas to be logged through timber sales. Successful bidders won the right to harvest large trees of high value, but were required in addition to monetary payment, to provide non-monetary forest services, such as the maintenance of roads or fuels management through the clearing of excess underbrush. This economic system reduced the need to spend public dollars on fuel reduction efforts. In recent years, however, the harvest of large-diameter trees has been challenged on environmental grounds, reducing the value of the trees in these timber sales. This value was further reduced by the slump in the housing market, and thus a decrease in the demand for timber products, in the economic recession of 2008–2011. This has made it more difficult to market timber successfully , and has thus increased the proportion of fuel management costs that need to be treated by public funding. The California Forestry Association estimates that from 1990 to 2009 there was a 90 percent decrease in harvest from California public forest land.

In response to these economic challenges, several agencies have focused on the development of a new “restoration economy” which removes the small diameter timber, brush, and other biomass to create healthy forests and fire safe landscapes projects. The Sierra Nevada Conservancy, the Sierra Business Council, local fire safe councils, and other entities are working with communities in the region to create “integrated campuses,” which are industrial parks for biomass processing. Often located on the site of abandoned lumber mills, these campuses are frequently anchored by bioenergy facilities that can use chips from the lowest-value biomass (brush, limbs, and small-diameter trees) to produce renewable energy. Higher-value biomass is utilized at other processing businesses on site for firewood, post and pole manufacturing, furniture making, etc. In this way, the smaller trees and other woody biomass is given economic value, which can reduce the public funds otherwise needed for its removal from the forest.

Climate Change and Drought

Fire interacts with the atmosphere (oxidizer) and vegetation (fuel) in predictable ways. Understanding the atmosphere-fire-vegetation interactions is essential for addressing the regional issues associated with climate change, particularly the potential to manage what we can manage — the overgrown woody biomass.

A warming climate generally encourages wildfires through a longer summer period that dries fuels, promoting easier ignition and faster spread. Researchers have found that in the last three decades the wildfire season in the western U.S. has increased by 78 days, and burn durations of fires greater than 1,000 hectares have increased from 7.5 to 37.1 days, in response to a spring-summer warming of 0.87°C (Westerling et al. 2006). This increase in wildfire activity has been greatest at higher elevations like those associated with the Mountain Counties Area.

Wildfire activity in California has greatly increased in recent years, as has its economic impact. This increase has been particularly acute in western forests, including those encompassed within the Mountain Counties Area of the Sierra Nevada. Scientists attribute this increase in forest wildfires to warmer spring and summer temperatures, reduced precipitation associated with warmer temperatures, reduced snowpack and earlier spring snowmelts, and longer, drier summer fire seasons in some middle and upper elevation forests. These trends are projected to continue under plausible climate change scenarios, implying a further increase in the risk of large, damaging forest wildfires in forested areas of the region.

In contrast, future grass and shrubland wildfire risks under climate change scenarios are less clear. Active wildfire periods in these ecosystems tend to be strongly associated with particularly wet growing seasons a year or more prior to the fire season, and less influenced by drought concurrent with the fire season itself. Precipitation tends to be somewhat more variable than temperature across global climate models and scenarios, implying greater uncertainty for non-forest wildfire risks. Overall, more wildfire events with increased severity are expected in the Mountain Counties Area for the foreseeable future.

Drought is a serious concern, especially for the area's smaller water systems that are dependent on the groundwater from fractured rock or small surface streams in the foothills. Since many of these small systems are relatively isolated in rough terrain where it is impractical to build interties with other systems or create economies of scale, their options are limited and their alternatives can be expensive in a water shortage emergency. Furthermore, drought exacerbates the risk of wildfire in the surrounding forests and grasslands and increases the need to reserve water for firefighting.

Drought preparedness planning is addressed in various city and county urban water management plans, IRWM plans, water agency plans, and county general plan safety elements throughout the Mountain Counties Area. For example, the Nevada Irrigation District adopted a Drought Contingency Plan in 2007 that identifies drought caused water supply shortages and water demand reduction goals during a prolonged drought (NID 2010). Also, the El Dorado Irrigation District (EID) adopted a Drought Preparedness Plan in 2008 that summarizes drought stage water supply conditions, objectives, and response actions, such as water use reduction targets, during a drought. EID also proactively prepares for a drought with their plan implementation program by monitoring, providing public outreach, and applying resource management practices during non-drought years (EID 2008).

Implications for Watershed Health

Flooding and Sedimentation

High severity wildfires can leave a watershed completely devoid of vegetation and ground cover. Surface soils are then exposed to the direct impact of rain drops, which break up fine particles that seal the surface, increasing surface runoff. High surface temperatures during a fire can also cause physical, chemical, and biological changes to soils that reduce infiltration and make them more susceptible to erosion. Increased soilwater repellency due to fire has been documented in a wide variety of climates and soil types. In the most severe cases, high temperatures will destroy soil structure, leaving a fine powdery surface that is easily eroded. Rainfall that is normally used in transpiration by vegetation instead becomes runoff. The combined effect is a rapid concentration of runoff with very high sediment loads, increasing the probability and magnitude of flooding and potentially resulting in debris flows. A modeling study of the Mission Creek watershed in Santa Barbara showed that flood discharges equivalent to the Federal Emergency Management Agency (FEMA) 100-year flood were four to 20 times more likely after a wildfire (Bren 2009).

Post-fire debris flows are common in mountainous environments and can occur in response to short duration, low-frequency rainfall events. Researchers have shown that most post-fire debris flows result from intense runoff that furrows the surface of the soil (called rilling) and causes large amounts of sediment and water to wash into the stream channel. The stream channels then undergo intense bed and bank erosions as in-channel sediment is picked up and transported downstream in a highly destructive pulse of water, sediment, and debris. Post-fire flooding and debris flows can plug culverts, damage bridges and levees, and increase silt in reservoirs. For instance, as of 2010, Denver Water was still spending millions of dollars on reservoir dredging and watershed restoration from the Haymen Fire of 2002.

Water Yield and Baseflow Timing

The impact of vegetation management projects on water yield has not been conclusively determined. Long-term maintenance of treatment effects is a key consideration in managing Sierra Nevada forest ecosystems to meet water resource priorities. The Sierra Nevada Watershed Ecosystem Enhancement Project (SWEEP) is one example of proposed forest vegetation management projects that makes the case that upstream management of Sierra Nevada forests can significantly increase the value of downstream water resources by shifting water towards higher value uses and optimizing the timing of runoff. SWEEP proposes to test the contention that forest management can be optimized to increase total water yield and extend the spring snowpack by implementing forest management and treatment strategies, i.e., selective thinning and vegetation manipulation through mastication, resulting in greater forest canopy spacing, show that increased snowpack could result in increased water volume and at the same time reduce the threat of catastrophic fire (SWEEP 2011). Treatments that remove water-competing vegetation allow residual vegetation to respond with increased vigor. In the long-term, these healthier ecosystems maintain a balanced hydrologic regime in which infiltration, evapotranspiration, and runoff provide for the magnitude and timing of stream flows that are beneficial for aquatic ecosystems and downstream water users.

Water Quality

Water quality indicators most impacted by high intensity wildfire include sediment, dissolved oxygen (DO), temperature, and turbidity, or the relative clarity of the water. These four indicators are also very important to aquatic organisms. Excessive fine sediments in rivers can destroy spawning habitat, smother eggs, fill in foraging pools, and result in an overall loss of habitat. Loss of canopy cover by fire can increase water temperatures and decreases DO that fish need to breathe. Temperature effects can last for decades until enough canopy cover is reestablished to provide the necessary shading. When forest management involves thinning or controlled burning of riparian areas, best management practices (BMPs) are used to reduce the effects of such thinning near riparian areas. Thinned forests, whose woody materials have been sent to biomass energy facilities, can greatly reduce the emissions of federal Clean Air Act criteria air pollutants, such as, carbon monoxide, nitrogen oxides, volatile organic compounded (precursors to ozone), and particulate matter as well as the protection of basin visibility. Conversely, uncontrolled, high intensity wildfire has the potential to increase erosion and sediment transport, increase turbidity, and elevate aquatic temperatures, thus reducing suitable spawning and rearing habitat and negatively affect aquatic organisms.

Algae blooms are water quality problems, which occur more often in lakes rather than rivers and streams. These blooms are a concern due to reduced desirability of water-related activities and health hazards associated with contact recreation, as well as potentially lethal effects on other aquatic life. Algae blooms can result from excessive nutrients (nitrogen and phosphorous) delivered from the watershed in solution and become attached to sediments. Through increased erosion and introduction of ash during the first flush of the watershed after a fire, nutrient levels in downstream lakes can be expected to increase, exacerbating any potential algae problems.

Analysis of Avoided Costs from Reduction in Wildfire Hazards

As federal and State budgets continue to diminish, the ability for public land managers to maintain healthy forests is compromised. The Mokelumne Avoided Cost Analysis Group was formed in response to the fire severity and size trends occurring throughout the West and the damage those fires have incurred on users of those ecosystems' services. The group is comprised of the primary landowners and stakeholders in the Upper Mokelumne watershed, the Bureau of Land Management, the East Bay Municipal Utility District, the Environmental Defense Fund, PG&E, the Sierra Nevada Conservancy, Sierra Pacific Industries, Sustainable Conservation, The Nature Conservancy, and the USFS.

This group is working to analyze the potential avoided costs that may result from forest health treatments that reduce fire severity in the Upper Mokelumne River watershed. Topics to be analyzed include, among others, water yield, fire risk, snowpack accumulation and retention, black carbon, flood risk, sedimentation, and water temperatures. Though this research is just beginning, it has the potential to provide a supportable model for engaging downstream water beneficiaries that support the costs of upper watershed management by showing that the avoided costs of wildfire response and cleanup greatly outweigh such preventive expenditures. The avoided cost analysis will also illustrate how cost avoidance can be used in decision-making and setting priorities.

Rural/Urban Politics

The Mountain Counties Area is also affected by certain unique political considerations. Statewide policy-making and funding decisions tend to be focused on urban centers, even when the well-being of urban dwellers is directly tied to the health and services of the forests, woodlands, and rangelands of the Mountain Counties Area. Political representation from the Mountain Counties Area at the statewide level is limited due to the area’s small population, meaning that urban interests receive the bulk of the benefits from legislative activities. Most Californians, if asked where their water comes from, would say “the tap.” However, other more informed Californians would say that their water comes from “the Delta”. The true source of water for 23 million Californians is the Sierra Nevada watersheds. Decision-makers need to be aware of the rural perspective and needs so that actions they take are sensitive to and protective of the services provided by the Mountain Counties to the rest of the state.

Climate Change

For more than two decades, the State and federal government have been preparing for climate change effects on natural and built systems with a strong emphasis on water supply. Climate change is already impacting many resource sectors in California, including water, transportation and energy, infrastructure, public health, biodiversity, and agriculture (USGRCP 2009; CNRA 2009). Climate model simulations using the Intergovernmental Panel on Climate Change's 21st Century Climate Scenarios project increasing temperatures in California with greater increases in the summer. Projected changes in annual precipitation patterns in California will result in changes to surface runoff timing, volume, and type (Cayan 2008). Recently developed computer downscaling techniques indicate that California flood risks from warm-wet, atmospheric river-type storms may increase beyond those that have been known historically, mostly in the form of occasional more-extreme-than historical storms seasons (Dettinger 2011).

Enough data exists currently to warrant the importance of contingency plans, mitigation (reduction) of GHG emissions, and incorporating adaptation strategies; methodologies and infrastructure improvements that benefit the region at present and into the future. While the State is taking aggressive action to reduce future impacts of climate change through GHG reduction and other measures (ARB 2008), global impacts from carbon dioxide and other GHGs that are already in the atmosphere will continue to impact climate through the rest of the century (IPCC 2007).

Resilience to an uncertain future can be achieved by implementing adaptation measures sooner rather than later. Because of the economic, geographical, and biological diversity of the state vulnerabilities and risks due to current and future anticipated changes are best assessed on a regional basis. Many resources are available to assist water managers and others in evaluating their region-specific vulnerabilities and identifying appropriate adaptive actions (EPA/DWR 2011; Cal EMA/CNRA 2012).

Observations

Climate change impacts observed in California in the past 100 years include an increase in average temperatures of approximately one degree F, a decrease in the average early snowpack in the Sierra Nevada of about ten percent, which equates to a loss of 1.5 million acre-feet of snowpack storage (DWR 2008). Based on data available from the Western Region Climate Center (WRCC) similar increases in air temperatures have been recorded in the Mountain Counties Area during this time period. The Mountain Counties Area primarily overlaps the WRCC Sierra and Northeast regions with the lower elevation portions slightly overlapping with the North Central, Sacramento-Delta and San Joaquin Valley regions. Mean temperatures in the WRCC Sierra Region have increased about 0.8-1.9 °F (0.4-1.1 °C) with minimum values increasing more than maximums [1.7-2.7 °F (0.9-1.5 °C) and -0.3-1.3 °F (-0.2-0.7 °C), respectively]. Temperatures in the WRCC Northeast Region also show a warming trend with a mean increase of 0.8-2.0 °F (0.4-1.1 °C). However, both the minimum and maximum temperatures increased about the same amount [0.9-2.2 °F (0.5-1.2 °C) and 0.4-2.1°F (0.2-1.2 °C), respectively].

In the lower elevation portions of the Mountain Counties Area mean temperatures also increased in all three WRCC regions. Mean temperatures increased about 0.5-2.8 °F (0.3-1.6 °C) in the North Central, 1.5-2.4°F (0.8-1.3°C) in the Sacramento-Delta, and 0.9-1.9°F (0.5-1.1 °C) in the San Joaquin Valley regions.

Projections and Impacts

While historic data is a measured indicator of how the climate is changing, it cannot project what future conditions may be like under different GHG emissions scenarios. Current climate science uses modeling methods to simulate and develop future climate projections. A recent study by the Scripps Institution of Oceanography uses the most sophisticated methodology to date, and indicates that by mid-century (2060-2069) temperatures will be 3.4 to 4.9 °F (1.9 to 2.7 °C) higher across the state than they were from 1985 to 1994 (Pierce et al. 2012). For the Mountain Counties Area, the study projects annual temperatures will increase 4.1-4.7 °F (2.3-2.6 °C) with a 3.1-3.4 °F (1.7-1.9 °C) increase in winter temperatures and a 5.2-6.5 °F (2.9-3.6 °C) in summer temperatures. Climate projections for the Mountain Counties Area from Cal-Adapt indicate that the temperatures between 1990 and 2100 will increase by as much as 6-7 °F (3.3-3.9 °C) in the winter and by 10 °F (5.6 °C) in the summer (Cal EMA/CNRA 2012).

Changes in annual precipitation across California, either in timing or total amount, will result in changes to the type of precipitation (rain or snow) in a given area and to the timing and volume of surface runoff. Precipitation projections from climate models for California are not all in agreement, but most anticipate drier conditions in the southern part of California, with heavier and warmer winter precipitation in the north (Pierce, et al. 2012). Because there is less scientific detail on localized precipitation changes, there exists a need to adapt to this uncertainty at the regional level (Qian et al. 2010).

The Sierra Nevada snowpack is expected to continue to decline as warmer temperatures raise the elevation of snow levels, reduce spring snowmelt, and increase winter runoff. Based upon historical data and modeling, researchers at Scripps Institution of Oceanography project that by the end of this century, the Sierra snowpack will experience a 48 to 65 percent loss from its average at the end of the previous century (van Vuuren et al. 2011). In addition, earlier seasonal flows will reduce the flexibility in how the State manages its reservoirs to protect communities from flooding while ensuring a reliable water supply.

A recent study that explores future climate change and flood risk in the Sierra Nevada using downscaled simulations (refined computer projections to a scale smaller than global models) from three global climate models (GCMs) under an accelerating GHG emissions scenario that is more reflective of current trends, indicates a tendency toward increased three-day flood magnitude. By the end of the 21st Century, all three projections yield larger floods for both the moderate elevation northern Sierra Nevada watershed and for the high elevation southern Sierra Nevada watershed, even for GCM simulations with eight to15 percent declines in overall precipitation. The increases in flood magnitude are statistically significant for all three GCMs for the period 2051 to 2099. By the end of the 21st Century, the magnitudes of the largest floods increase to 110 to 150 percent of historical magnitudes. These increases appear to derive from increases in heavy precipitation amount, storm frequencies, and days with more precipitation falling as rain and less as snow (Das et. al 2011).

These hydrologic changes would not only affect upstream ecosystems, local water supplies, and hydropower generation, but also have dramatic effects on the operation of the major multi-purpose dams and on downstream water supplies.

A combination of rising temperatures, a smaller snowpack, and more frequent and potentially longer droughts reduce both surface and groundwater storage, as more water runs off or evaporates and less infiltrates into the ground. Warmer temperatures also increase the vulnerability of forests to pests and disease. These types of changes contribute to more frequent and larger wildfires throughout the region, increasing the risk to communities from both direct losses associated with the fire, and indirect impacts from economic losses in the timber and tourism industries. Following a fire, intense rainstorms can also result in flash flooding, landslides, or large erosion events which damage communities, infrastructure, and reduce water quality in the area.

Tourism, an important component of the region’s economic base, could be significantly affected by the anticipated changes in climate. Changes in hydrology could significantly impact ski resort operations and other water-related recreational activities, such as boating, fishing, and rafting. This will have an indirect effect on the other economic sectors that rely on tourism such as hotels, restaurants, and second-home development.

Adaptation

Climate change has the potential to impact a region, which the state depends upon for its economic and environmental benefits. These changes will increase the vulnerability of natural and built systems in the region. Impacts to natural systems will challenge aquatic and terrestrial species with diminished water quantity, quality, and shifting ecosystems. Built systems will be impacted by changing hydrology, runoff timing, and loss of natural snowpack storage, making the region more dependent on surface storage in reservoirs and groundwater sources. Increased future water demand for both natural and built systems may be particularly challenging with less natural storage and less overall supply.

Water managers and local agencies must work together determine the appropriate planning approach for their operations and communities. While climate change adds another layer of uncertainty to water planning, it does not fundamentally alter the way water managers already address uncertainty (EPA and DWR, 2011). However, stationarity (the idea that natural systems fluctuate within an unchanging envelope of variability) can no longer be assumed, so new approaches will likely be required (Milly et.al 2008).

IRWM planning is a framework that allows water managers to address climate change on a smaller, more regional scale. Climate change is now a required component of all IRWM plans (DWR 2010). IRWM regions must identify and prioritize their specific vulnerabilities, and identify adaptation strategies that are most appropriate for subregions. Planning strategies to address vulnerabilities and adaptation to climate change should be both proactive and flexible, starting with proven strategies that address the region today, and adding new strategies that will be resilient to the uncertainty of climate change.

Local agencies, as well as federal and State agencies, have the challenge of interpreting climate change data and determining which methods and approaches are appropriate for their planning needs. The *Climate Change Handbook for Regional Water Planning* (EPA and DWR 2011) provides an analytical framework for incorporating climate change impacts into a regional and watershed planning process and considers adaptation to climate change. This handbook provides guidance for assessing the vulnerabilities of California's watersheds and regions to climate change impacts and prioritizing these vulnerabilities.

There are numerous studies, planning, and restoration efforts currently underway in the Sierra Nevada that will help improve the understanding about potential effects of climate change and provide effective management strategies for mitigating and adapting to those impacts. For example, a Sierra Nevada Vulnerability Assessment and Adaptation Plan is currently being developed by the USFS, EcoAdapt, Geos Institute, and others to assess the potential impacts of climate change on nine ecosystems, 45 species or assemblages, and 11 ecosystem services and develop implementable management responses. The Sierra Nevada Alliance Regional Climate Change Program engages in and supports efforts to update regional plans, such as general plans, IRWM plans, and forest plans, to incorporate climate change adaptation principles and reduce GHG emissions to help ensure the protection and resilience of the Sierra Nevada region. The National Fish and Wildlife Foundation's Sierra Nevada Meadow Restoration program is supporting meadow restoration efforts with a long-term goal of restoring 50,000 to 500,000 af of water storage capacity in the Sierra Nevada, which will not only provide significant wildlife benefits, but will also help capture some of the increasing runoff expected with climate change as more precipitation falls as rain rather than snow.

The State has developed additional tools and resources to assist resource managers and local agencies in adapting to climate change, including:

- *California Climate Adaptation Strategy (2009)* - California Natural Resources Agency (CNRA) at http://www.climatechange.ca.gov/adaptation/strategy/index.html.
- *California Climate Adaptation Planning Guide* (2012) - California Emergency Management Agency (Cal EMA) and CNRA at http://resources.ca.gov/climate_adaptation/local_government/adaptation_policy_guide.html.
- *Cal-Adapt* Web site at http://cal-adapt.org/.
- *California Climate Change Portal* at http://www.climatechange.ca.gov/.

- *DWR Climate Change* Web site at http://www.water.ca.gov/climatechange/resources.cfm.
- *The Governor's Office of Planning and Research (OPR)* Web site at http://www.opr.ca.gov/m_climatechange.php.

Regionally, the Sierra Climate Change Toolkit, developed by the Sierra Nevada Alliance, is a comprehensive resource for resource managers, local governments, planners, and others that are interested in addressing climate change in Sierra watersheds and communities. The toolkit provides frameworks, specific strategies, and case studies for reducing GHG emissions and adapting to climate change impacts and additional resources to help planning processes or project address climate change (SNA 2011). The USFS Pacific Southwest Research Station is another resource for resource managers and decision-makers to find recent research on managing natural resources in the face of a changing climate.

Many of the resource management strategies found in Volume 3, *Resource Management Strategies* not only assist in meeting water management objectives, but also provide benefits for adapting to climate change. These include:

- Chapter 4, "Flood Management."
- Chapter 5, "Conveyance – Regional/local."
- Chapter 7, "System Reoperation."
- Chapter 11, "Precipitation Enhancement."
- Chapter 14, "Surface Storage – Regional/Local."
- Chapter 18, "Pollution Prevention."
- Chapter 22, "Ecosystem Restoration."
- Chapter 23, "Forest Management."
- Chapter 24, "Land Use Planning and Management."
- Chapter 25, "Recharge Area Protection."
- Chapter 27, "Watershed Management."

The myriad of resources and choices available to managers can seem overwhelming. However, managers can implement many proven strategies to prepare for climate change in the region, regardless of the magnitude of future warming. These actions often provide multiple benefits. For example, meadow restoration not only provides habitat for species, but can also help improve water quality, attenuate runoff, and increase groundwater recharge. Other adaptation measures include water and energy conservation, increasing reservoir and groundwater basin storage capacity, timber harvest, and fuel management.

Water managers will need to consider both the natural and engineered environments as they plan for the future. Stewardship of natural areas and protection of biodiversity are critical for maintaining ecosystems, which can benefit humans through carbon sequestration, pollution remediation, and recreational opportunities. Increased collaboration between federal land managers, water managers, land use planners, resource conservation district managers, ecosystem managers, business leaders, tribal leaders, environmental stakeholders, and local residents provides opportunities for identifying common goals and actions needed to achieve resilience to climate change and other stressors. While both adaptation and mitigation are needed to manage risks and are often complementary, unintended consequences may arise if these efforts are not coordinated (CNRA 2009).

Mitigation

Energy intensity in this overlay region is evaluated in the Sacramento River and San Joaquin River regional reports.

Land Use Conversion

Cost-effective water supplies are critical to the viability of existing and future agriculture in the Mountain Counties Area. Loss of such water supply options would act as a deterrent to increasing agricultural lands within the region and result in commensurate ecosystem losses as agricultural lands are converted to other uses that can afford to pay higher water rates, such as municipal uses.

Water agencies need to develop the capacity to provide surface water in the overlay area's agricultural communities. However, sparse population density often precludes water agencies from recovering the installation and maintenance costs, thus affecting the Mountain Counties Area's ability to grow agriculture in the region vital to the regional economic viability and as a food source for the region and the state.

Legacy Issues

Impacts from early development in the Sierra Nevada, sometimes referred to as legacy impacts, still affect the natural resources and communities of the Mountain Counties Area and beyond, as described below.

Abandoned Mines

Thousands of abandoned mines within the Mountain Counties Area contribute hazardous substances to the waterways including mercury, heavy metals such as copper, cadmium, and zinc, and concentrated levels of arsenic. These contaminants are known health hazards. The following three reports provide greater detail on the legacy impacts of historic mining in the Mountain Counties area:

- *Mining's Toxic Legacy, An Initiative to Address Mining Toxins in the Sierra Nevada*. 2008. The Sierra Fund.
- *California's Abandoned Mines – A Report on the Magnitude and Scope of the Issue in the State.* 2000. California Department of Conservation. Office of Mine Reclamation. Abandoned Mine Lands Unit.
- *Mercury Contamination from Historic Gold Mining in California*. 2000. U.S. Department of the Interior, U.S. Geological Survey.

The abandoned mines are also a source of sediment from unreclaimed slopes, tailing piles, and sediment pond failures.

Roads

Roads, trails, skid trails, and landings that are abandoned or in disrepair continue to contribute sediment to the area waterways. Although specific data for the Mountain Counties Area as a whole is not available, there is sufficient data and discussion from locations such as the Tahoe Basin and other national forests to reach the conclusion that the amounts of sediment from these abandoned or poorly maintained sites is significant. Information on sedimentation from roads and disturbed sites is found in *Final Project Report : Improving Road Erosion Modeling for the Lake Tahoe Basin and Evaluating BMP Strategies for*

Fine Sediment Reduction at Watershed Scales" by Chung and Efta and the *Effects of Roads on Hydrology, Geomorphology, and Disturbance Patches in Stream Networks* by Jones et al.

Historic Cattle Grazing

Once gold was discovered in the Sierra foothills, cattle were driven to foothill encampments to feed the miners. As the gold boom waned and people left the gold fields, the pattern continued where ranchers would transfer their cattle to higher-elevation pastures during the summer, when the heat dries lower-elevation forage, and then drive them back down to lower elevations for the winter. When the USFS was established in the early 20th Century, much of this mountain and foothill grazing land was placed under federal management and a permit system was initiated to support the ongoing use of federal lands for grazing. With lower-elevation irrigated pasture acreage declining over time, alternatives to federal land grazing have diminished, making the dynamic working relationship between ranchers and the Mountain Counties landscape a critical component to the economic sustainability and culture of the region. (Sulak et al. 2002)

Certain historic grazing practices, however, have impacted streams, meadows, and riparian zones. Headcutting and channelization in certain streams are a direct result of previous cattle watering and grazing activities, which can add heavy loads of sedimentation to streams and contribute to the dewatering of wet meadows.

Abandoned Railroad Beds

In many locations, streams were rerouted and beds were raised to accommodate the construction of the railroad lines that served the historic communities, timber operators, and mines. The relocation and channeling of the streams in order to provide dry passage for the trains has contributed to the dewatering of wet meadows. Wet meadows are groundwater-dependent ecosystems that require a shallow water table during the dry summer months to sustain the vegetation. Streams provide water recharge to the groundwater table. However, relocated or channeled streams no longer feed the groundwater table needed to support the historic wet meadow system.

Septic System Failure

Rural residential development on large acreage parcels and in many communities still depends on old individual and community septic systems for wastewater disposal. Failure of the systems from age, complications from environmental factors such as level of groundwater/soil saturation, or improper maintenance is not uncommon. When a failure occurs, untreated sewage water is released into the environment affecting the waterways.

Aging Infrastructure

The aging infrastructure problem within the Mountain Counties continues to increase in size and scope each year. Mountain Counties water systems developed along gravity-fed historic conveyance systems. As growth occurred in the county, pipes and treatment plants were added. Many of these old and unimproved conveyance systems, including ditches, flumes, and pipes, have been in use for more than 100 years (see Box MC-5). The open ditches and flumes are prone to seepage and to damage from forest fires and subsequent sedimentation and debris flows. Historically, rural county water purveyors have been unable to repair and replace their aging infrastructure. State and federal mandated programs, loss of local property tax revenue, population density (miles of pipe per connection), topography (requiring pump stations and pressure reduction stations), and limited finances of disadvantaged communities make it difficult to adjust water rates to fund aging infrastructure. The major issue is population density. There simply are not enough people available to pay for needed services that must be maintained at levels required by law. As a result, some communities dependent on these conveyance systems have been left without water for various periods of time. Mountainous terrain, spatially distant small population centers, and linear systems add to the cost and complexity of maintaining existing systems and providing necessary services. Some of these areas are within U.S. Small Business Administration- designated Historically Underutilized Business Zones (SBA HUBZones), which include areas located within one or more qualified census tracts, qualified non-metropolitan counties, lands within the external boundaries of a Native American reservation, qualified military base closure area, or a redesignated area, and are typically areas with low median household incomes or high unemployment or both. At the same time, there are community groups and landowners who have opposed proposed enclosure or repairs on the ditch systems due to concerns about the loss of an important and historic community asset, including the aesthetics of the flowing canal and loss of vegetation, wildlife, and groundwater recharge created by leakage and percolation. Others have expressed concern that securing additional water through repair or enclosure might be used to induce unplanned growth.

Generating revenue through water rates is a primary tool for repairing and replacing aging infrastructure. Proposition 218 has significantly changed local government finance and water rate adjustments. Proposition 218 was established to ensure that water-related charges on property owners are subject to voter approval. Lack of direct knowledge about what it takes to operate a water district/agency, voter sentiment and general dissatisfaction with government at the highest level can trickle down to local government such that some water purveyors have been unable to adjust charges appropriately to fund, not only facility repair and replacement, but even daily operations. The Proposition 218 process, alone, has increased agency/district costs to implement rate adjustments. Other opportunities for funding capital improvements and operating revenues need to be developed. Most grant funding requires matching funds that many rural agencies in the Mountain Counties Area find difficult to finance. The IRWM process is patterned in such a manner that a high percentage of needed projects do not score high enough to be successful and the money available for IRWM projects is very limited. The region needs to lay the foundation for defining resource sustainability and regional reliability so that there is statewide support to ensure the existing public trust resources and values are maintained to reliable public health and safety standards. Responsible entities in the region need to expand efforts significantly to repair or replace infrastructure within their boundaries to ensure a reliable and sustainable water supply to meet their customers' needs.

There are opportunities to finance the replacement of aging infrastructure by integrating smaller scale inline hydroelectric generation and pumped storage in existing water conveyance systems. The State's goals to increase peak period energy generation, find ways to use surplus off-peak energy, and expand distributed energy to reduce electricity losses over power lines could be achieved by incorporating energy generation, storage, and pumping with the replacement infrastructure. The revenues from the energy generation and storage could finance a substantial portion of the costs for rebuilding the aging water conveyance and treatment systems. Such integration would also help offset the high costs of energy to operate the water treatment and conveyance systems.

PLACEHOLDER Box MC-5 Amador, El Dorado, and Tuolumne Ditch Systems

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Regional Needs and Opportunities

The Mountain Counties Area's primary need is for decision-makers and stakeholders inside and outside the region to 1) better understand and acknowledge the unique roles and the ecosystem services the Mountain Counties provides to the state and 2) better understand current conditions in the region. This baseline understanding is necessary for decision-makers to agree on the need for and to support substantial investment in the Sierra Nevada watershed and its resources so the region can continue providing benefits and services to the rest of the state.

Water is an essential element of the economic, social, and environmental well-being of the Mountain Counties Area. Changes in the allocation of water could have devastating impacts to this largely rural region and its communities, many of which are already disadvantaged or underserved. Water used in this region provides many benefits to the rest of the state, such as timber production, agriculture and food production, heritage and agricultural tourism, outdoor recreation, environmental/ecological services, wildlife habitat, hydropower, and more.

One of the key vehicles for developing and implementing successful long-term management strategies for the region is multi-stakeholder collaborative groups such as watershed councils, fire safe councils, forest management collaboratives, water purveyors, and integrated regional watershed management groups whose members work across interests to achieve results. Stakeholder groups can increase statewide understanding of the region's importance and support efforts to find viable financial and political solutions that address issues such as the lack of funding for projects to tackle localized resource issues critical to the entire state.

Mechanisms to Account for Actual Cost of Water

When Californians turn on the tap, they expect to receive clean, plentiful water. However, rarely do they fully consider the true cost of getting that water to the tap. The typical penny-per-gallon price paid for water by the end user may or may not account for all the costs and processes associated with storing, moving, and treating water from where it falls as rain or snow to where it is used for growing food and meeting domestic, municipal, and industrial uses.

There have been significant initial investments of time and funds expended for the construction of the current infrastructure system of dams, flumes, pipes, canals, treatment plants, and other facilities that extract, impound, convey, treat, and deliver water and wastewater from the Mountain Counties. In addition, the California Energy Commission has reported that 20 percent of the electricity used in California is devoted to water-related uses (California Energy Commission 2005). In some cases, these construction and energy costs have been subsidized at least partially by federal or State funds.

There is a growing need for additional financial investments for the upkeep and maintenance, repairs, replacements, and potential expansion of existing infrastructure and increased energy demands to meet anticipated additional infrastructure needs to convey and delivery adequate water quantities and quality from this region.

While the cost of delivering water to the tap may have increased recently due to regulatory and treatment expenses, aging infrastructure, and rising energy costs, water is still one of the best deals around when compared to other commodities and public utility services (See Figure MC-8). To guarantee there is still water in the future, interests must come together to support protection and enhancement of California's primary water source — the Mountain Counties.

PLACEHOLDER Figure MC-8 Water — A Bargain for the Money

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Metrics

The continued development and use of watershed monitoring systems and enhanced analysis of resulting data sets are important to the proper future management of water resources originating within the Mountain Counties Area. Sierra Nevada System Indicators have been developed that deal specifically with water quality, air quality, air temperature, precipitation, and snowpack. There are many interrelationships between these indicators, especially between temperature and snowpack that are important to all of California. Technological advances have been made in recent years with data sets now available in GIS (Geographic Information System) format that allow enhanced analysis and enable comprehensive editing of data pertaining to water resources within the delineated Mountain County Area boundaries. These expanded GIS compatibilities make it possible to monitor impairments to the water system and clearly track changes in the Sierra Nevada in future years. The development and use of sophisticated modeling techniques to develop a comprehensive spatial picture of measurement data will be specifically useful to the Sierra Nevada to assess and manage long-term ecosystem conditions.

Potential Expansion of Mountain Counties Overlay Area

A concept to expand the Mountain Counties Area is currently being considered for *California Water Plan Update 2018*. The purpose of a prospective expanded overlay area is to incorporate larger interregional planning efforts that have common characteristics and water issues as those existing in the Mountain Counties Area, which will provide greater emphasis on resource planning and water management considerations.

Support of Area of Origin Rights

The Mountain Counties Area historically has been made up of hundreds of small communities scattered across a large, challenging landscape. To develop regional self-reliance, these communities perfected water rights and invested in and built their own water, wastewater, and hydropower agencies. Individually these protections are contained in what is commonly called the County of Origin statutes (CWC Section10505) and the Watershed Protection Act (CWC Sections11460 - 11463). Despite being enacted at different times "...these statutes have a common purpose i.e. to reserve for the areas where the water originates some sort of right to such water for future needs which is preferential or paramount to the right of outside areas, even though the outside areas may be the areas of greatest need" (Brown 1955).

The Area of Origin protections emerged initially when the Legislature adopted the Fiegenbaum Act in 1927, which authorized the State to file for unappropriated water to enable the State to develop the SWP (CWC Sections 10500-10507). The SWP, when operational, would divert water for export at the Delta for use elsewhere. Upstream areas became concerned about the potential loss of water, and in 1931 the Legislature amended the Feigenbaum Act to protect the rights of those sources or Counties of Origin (CWC Sections 10504-10506). California law now provides that no water rights appropriation or assignment may be granted by the SWRCB that will deprive the county in which the water originates for any such water as may be needed for the development of the county (CWC Section 10505).

Areas of Origin are also protected by the federal Central Valley Project Improvement Act (later incorporated by reference into the Burns - Porter Act of 1959 Section12931) that provides that the watershed of origin areas shall not be deprived of the prior right to all of the water reasonably required to adequately supply the beneficial needs of the watershed, area, or any of the inhabitants or property owners (CWC Section11460).

As the region and state continues to grow, land use authorities must be mindful of the limited natural resources and prudently plan to ensure they do not redirect undue consequences on the Mountain Counties Area or its watersheds. In order for the Mountain Counties Area communities to provide adequate water supplies for current and future needs for both local and downstream interests, a more equitable distribution of benefits derived from existing and future water resource development in these counties must be achieved. In order to ensure the ongoing viability of Mountain Counties communities and the natural resources this area and the rest of the state rely on, the region needs to obtain necessary water supplies for present and future needs by exercising Area of Origin rights, while continuing to implement water efficiency measures to ensure all water has beneficial use. This should be part of the State's multi-dimensional comprehensive water supply strategy to ensure there are adequate supplies for multiple uses and benefits for future generations.

Any proposed solution to California's long-term water supply and water quality problems must be designed and carried out within the context of existing protections to the upstream source areas, referred to as Areas of Origin. Recognition by the Legislature and State administration of these key statutory protections is not discretionary, but rather a necessary, foundational element to consider within the context of any proposed Sacramento-San Joaquin Bay Delta solution. The right to use water beneficially by a watershed of origin or Area of Origin within that watershed is unqualified, and is equal to the amount of water that can be used to the capacity for beneficial use in the Area of Origin, as determined through county general plans and other planning processes.

Development of a Comprehensive Long-Term Watershed Protection Program

The future reliability of California's statewide water supply system begins with protection at the source in the Sierra Nevada watershed, the largest natural reservoir and primary source of water for the state.

Forest management practices have dramatically changed the Sierra Nevada landscape since the 1850s. Wildland fires are becoming more frequent and severe, leaving Sierra forests susceptible to erosion and reducing the cover for snowpack, which result in degrading water quality and altering the predictability of the water supply.

The 2009 legislation SBX7 1 (Delta Reform Act), one of several bills related to water supply reliability, ecosystem health, and the Delta, directed the Delta Stewardship Council to achieve the State-mandated coequal goals for the Delta. Coequal goals means there are two goals — providing more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem.

The State must manage its entire water system from the highest Sierra Nevada peak to the Pacific Ocean and develop and implement a comprehensive long-term watershed protection program to protect and enhance the high quality source of drinking water and the overall environment of the Sierra Nevada watershed.

Funding of projects that enhance and restore the upper watershed forests and meadow systems improve water quality and water supply reliability for the state, and protects the habitat essential to achieving the coequal goals.

The solutions must provide tangible benefits to rural areas that also have statewide benefit. The solutions should:

- Identify potential funding programs, incentives, and actions needed to achieve objectives.
- Provide grants and low-cost loans for new water development projects and programs to offset the financial obstacles summarized elsewhere in this report.
- Establish and levy an export fee upon water and/or electrical energy, which originates within a county but is exported and used in areas outside the county of origin.
- Establish a statewide beneficiary pays county tax fee, based on the county's population and demand to sustain a healthy watershed.
- Establish a county tax credit adjustment to those counties in the Area of Origin for watershed stewardship and infrastructure that has statewide benefit.
- Establish a stewardship fee for San Joaquin River-Sacramento River watershed exporters.

Increased Support of Rural IRWM Groups

For purposes of IRWM grants, the Mountain Counties Area is divided into DWR-approved regions. Regions that are partially or totally in the Mountain Counties Area are shown in Figure MC-9 include:

- Upper Feather River watershed.
- North Sacramento Valley Group.
- Yuba County.
- American River Basin.
- Cosumnes American Bear Yuba (CABY).
- Mokelumne/Amador/Calaveras (MAC).
- Tuolumne-Stanislaus.
- Yosemite-Mariposa.
- Madera.
- Southern Sierra.

PLACEHOLDER Figure MC-9 Map of IRWMs in Mountain Counties Area

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

All of these regions have obtained some funding to create an IRWM Plan. Additional planning funding may be needed to ensure that the Mountain Counties DWR regions meet current requirements for IRWM implementation funding. Reducing the technical difficulty of the application, providing additional technical assistance to these regions, and further reducing or waiving match requirements for Disadvantaged Communities (DACs) could help create more of an equitable distribution of the benefits from this bond-funded program.

The IRWM grants are not the only source of water-related grant funding, but the IRWM program encourages long-term planning and inventorying of projects within a region that assists with other sources of water-oriented grant funding. Regional water management groups (RWMGs) will play an increasingly important role in identifying future funding priorities for the region. Developing functional RWMGs with access to technical and planning resources is a pre-requisite to obtaining funding for water projects, including water quality, water supply reliability, and watershed health.

Improved Access to Funding

The funding needs of the Mountain Counties are often overlooked in favor of projects in the more populated areas of the state. These needs include protection of existing natural infrastructure and improvements to basic human-made infrastructure, as well as the research, plans, and studies that are prerequisites of such projects. In addition to the needs of the Mountain Counties residents, the land has critical needs and provides important ecosystem benefits to the entire state. However, the State's beneficiaries do not entirely recognize the value of helping defray the costs of maintaining and restoring the critical watersheds from which the benefits flow.

The public's lack of understanding and lack of appreciation for the value of the region's ecosystems creates a funding imbalance that is difficult to overcome. State infrastructure funding is targeted most often toward urban and suburban areas, while the basic water infrastructure for the whole state is ignored. Public land ownership in the region is primarily federal, and while these agencies recognize the need to increase the pace and scale of restoration, they are also struggling with diminishing budgets and staffing. Local communities often lack the expertise to compete for discretionary funding. Even when these communities work collaboratively with public land managers and regional agencies to seek more resources, the research and metrics that could convincingly demonstrate the value of natural infrastructure improvements to the downstream beneficiaries are not available.

More Equitable Funding Distribution

Several State agencies provide competitive grant programs that provide funding for water-related needs. Mountain Counties entities often experience difficulties obtaining funding from these programs. Some of these challenges have to do with local issues, such as the capacity and expertise needed to create competitive applications and access to matching funds. However, even without these obstacles, many of the State's funding programs are structured in a way, which precludes communities in the region from successful participation. Such structural issues include:

- The region has few cities or towns, so stormwater, urban stream, and urban water use efficiency grants are generally inapplicable.
- Flood control grants are almost exclusively confined to infrastructure that is within the State's Plan of Flood Control project area, which, with minor exceptions, is confined to the Central Valley.

- Seawater intrusion and clean beaches programs are not relevant.
- The region is outside of the CALFED Solution Area, so funding available related to that program is inapplicable for the most part.
- Groundwater management grants can be useful for the region by funding studies to assess groundwater quality and quantity issues, but grant applications for these programs have required groundwater management plans consisting of basic groundwater information (AB 3030 plans) in order to be competitive. Most of the region do not have groundwater basins so there are no prepared groundwater plans. Without these plans, the region's communities are ineligible for groundwater grants.

Another of the major challenges faced by the region's communities is the typical need for matching funds. These matching funds can either be a mandatory requirement of a grant program or they can indirectly influence the ability to obtain funding by providing additional ranking points in the application's review. The Mountain Counties region's communities are particularly challenged in securing matching grant funds because all of these match sources are comparatively scarce in the Mountain Counties Area. Due to the area's lower density population and fewer industrial and commercial developments, there are low tax revenues and a scarcity of discretionary funding in local government budgets. The well-funded irrigation and water districts that serve urbanized populations and concentrated agricultural areas are not commonly found in the region. Federal entitlement programs are focused on low-income areas, but these require a concentration of population that is not found in the Mountain Counties.

Faced with this challenge, regional entities have tried various creative strategies. One of the most successful is to engage a wide range of agencies in partnerships to address problems and issues. If the work of a partnering agency can be shown to impact the problem directly which the grant is seeking to address, it may be able to be counted as in-kind services match. This is particularly helpful in seeking State funds for ecosystem restoration for natural infrastructure maintenance and improvement Federal funding for public lands planning and restoration can be an appropriate match for related State funding activities. In lieu of financial resources, Mountain Counties communities often rely on partnerships and collaborations to accomplish project goals.

Some State and federal granting agencies, including DWR, recognize the obstacles that disadvantaged communities have in obtaining funding and have implemented policies to help overcome these obstacles and, in most cases, this includes a potential reduction in match requirements or by allowing in-kind services as well as cash to satisfy some or all of the match requirements. It has been suggested that if a disadvantaged community can show that it is making an effort to address problems and issues actively, match requirements should be waived altogether.

Capacity issues facing the Mountain Counties communities fall into two categories: the capacity to complete preliminary work (studies, engineering analysis, work plans, and budgets) needed for successful grant applications and the capacity to complete competitive grant applications.

Many funding opportunities, particularly for project implementation, require that the applicant already have a high level of preparatory work in place. This work can range from detailed budgets and work plans to economic feasibility studies, preliminary engineering, and completion of environmental documentation (CEQA and NEPA). The lack of these prerequisites results in an inability to take advantage of many funding opportunities. A notable example of this was the American Recovery and Reinvestment Act of 2009 (ARRA) funding which became available for a short time in 2008 and 2009. These economic stimulus funds were targeted toward shovel-ready projects that would create jobs to help turn around an ailing economy. Very few mountain communities had plans, studies, and permits in place to allow them to take advantage of this funding opportunity.

High profile programs like the ARRA funding have reason to require grantees to "hit the ground running" so that their impact can be seen as immediately as possible. However, even regularly programmed funding opportunities include requirements that can be difficult for small, low-income communities to fulfill. Mountain Counties often lack professional staff resources to complete the plans, studies, and permits that are required by many grant programs. For example, completion of California Environmental Quality Act (CEQA) documentation is frequently required to obtain State grants. This requirement can be difficult to fulfill, both because such documentation requires professional staff or expensive consultants and because it can be difficult to find appropriate lead agencies.

Grant applications range in difficulty from simple to very complex. A few programs require little more than a basic budget and a few paragraphs justifying the project need. These applications are within the capability of local government or agency staff to complete successfully. However, many more programs are requiring increasing professional expertise, both in grant writing and in technical areas, to be competitive for funding. In recent DWR IRWM implementation grant rounds, it was estimated that each of the multiple projects submitted in the regional applications cost an average of $15,000 to prepare. A large water district requesting millions of dollars in infrastructure funding, spending such an amount to apply for a grant is not unreasonable, but this can be a major obstacle for poor rural counties seeking smaller amounts of funding..

Well-funded agencies with large funding requests can justify paying a consulting firm and devoting staff time to create a competitive application for more complex programs. However, local NGOs and county staff can obtain only very small funding needs with current capabilities or with limited capacity-building. Rural agencies without many resources that seek moderate amounts of funding cannot complete such applications on their own and cannot justify the expenditure of funds on consultants to create a successful application. Such entities rarely have grant writing expertise available in-house, and may even be challenged to devote staff time to the technical issues involved in the application. If multiple projects could be bundled in one application the potential gain might justify the expense. However this is discouraged in most grant programs. The result is that smaller projects, which may address critical community needs in a very cost-effective way, are not funded often.

Some State agencies have recognized this problem and have explored various strategies to address it. These include:

- Grants for grant writers: During Round 1 of the Proposition 84 IRWM Planning Grants, the Sierra Nevada Conservancy (SNC) became concerned about the capacity of Mountain Counties region to compete successfully for these grant funds. Without the IRWM planning grant these regions would be unable to complete IRWM Plans, and without such a plan the regions would be ineligible to apply for future water funding. The SNC targeted these regions for $50,000 IRWMP launch grants, which allowed the areas to hire the consultants necessary to convene stakeholders and submit planning grant applications.

- Agency technical assistance: In lieu of providing financial assistance for grant writers, some agencies have provided staff or consultant assistance. In addition to grant writing assistance, such staff and consultants have provided facilitation and technical services to poor communities. Examples of this include the SNC's grant writing and facilitation assistance to regional entities, and the DWR Facilitation and Technical Support Services programs.
- Capacity building grants: Some entities provide small grants, which assist local organizations and collaboratives to build their own capacity to implement programs and obtain grants. Past examples are the DWR Local Groundwater Assistance Capacity Building grants and the National Forest Foundation Community Assistance grant program. Unfortunately, both of these programs have been discontinued.
- Capacity building programs: Regional organizations, such as the Sierra Business Council, have provided training programs for community leaders to build their capacity in a variety of areas, including funding development.

Each of these programs has been helpful to some degree, but building sustainable community capacity is a difficult challenge. Recent experience indicates that two components are particularly effective in successfully meeting this challenge:

1. The existence of a high-functioning local organization that can obtain grants, manage projects, and convene partnerships and collaboratives is a critical factor to local funding and project development. This organization can be an NGO, a local conservation district, or an agency, which has the flexible mission and discretionary resources to respond to various local needs. Building the capacity of such organizations is a good investment that can effectively leverage other resources.
2. If an agency has resources to assist local communities, it is particularly effective to assign specific staff to assist communities on an ongoing basis. Continuity of these relationships can help the staff build trust, target resources, and provide services in a way that helps the community help itself.

Better Communication with State/Federal Agencies

Water management in California is highly decentralized, with a variety of individual, local, State, and federal players involved. In rural areas like the Mountain Counties, many individuals control their own water and wastewater through personal wells and septic systems, which are governed by county zoning ordinances and other local land use regulations. Residential communities that are near to population centers may have local or regional water and wastewater districts that handle their water and wastewater treatment needs. These agencies are typically governed by State and federal regulations. Requirements under one law may contradict requirements under another law and solutions that fix a problem in one location may have negative or unintended consequences on resources in another location. Without a single responsible entity, agreed-upon data protocols, or a widely accessible funding source, planning and implementation of different land and water management programs can be spotty and uncoordinated.

Because the Mountain Counties Area covers multiple jurisdictions with myriad regulatory programs, mandates, and needs, the area would benefit from closer communication among agencies on existing or proposed funding programs, management proposals, regulatory programs, and pending legislation.

Restoration of the Bay Delta is a prime example. The Mountain Counties Area's unique role as the state's primary watershed makes it a critical part of any long-term statewide solution to help protect and enhance the state's ecosystem and provide water supply reliability for all of California. However, the statewide importance of protecting and enhancing the Sierra Nevada ecosystem and the function of its watersheds must not be forgotten in the process. For example, the SWRCB is establishing flow requirements for water coming out of the rivers that feed into the Delta to help meet the Delta's restoration and water supply goals. Many of these river systems have their headwaters in the Mountain Counties Area. If more water is required for flow into the Delta, most of that will have to come from the upstream areas of origin, which have separate needs related to local community sustainability and services already being provided for downstream interests. To be successful, Delta efforts and other State and federal water policies must recognize and not pre-empt the authority and responsibility of cities, counties, and other local jurisdictions whose citizens continue to invest precious local resources in protecting the health and safety of local communities and providing stewardship to the environmental resources of the Mountain Counties.

The majority of Californians have never heard of the Sacramento-San Joaquin Delta.. This was according to poll results released by California public opinion research firm Probolsky Research at the Southern California Water Committee's January 27, 2012, Quarterly Meeting. While the Delta is the core of California's water delivery system, as well as a key environmental resource, 78 percent of respondents in the statewide survey said they do not know what the Delta is. The survey results underscore the significant need to educate Californians throughout the state about where their water comes from. Since public policy is largely driven by the urban coastal areas, the region and State must do a better job in educating public and public officials of the significance of the watershed to create funding sources to enhance and protect this state water source.

Investment above the Low Elevation Rim Dams

The importance of the 13 major river watershed areas within the Mountain Counties Area to the state's overall water picture cannot be overstated. This upper watershed area is critical to the region's economy by providing a reliable water source for renewable hydropower generation for homes and businesses, and high quality and reliable water sources that sustain food crops, the environment, wildlife, aquatic life, recreation, and drinking water to residents throughout California. The watershed in the Mountain Counties Area is the lifeblood to the state, and substantial statewide investment is critical to ensuring a sustainable water supply for the state.

Investment in the upper watershed pales in comparison to extensive infrastructure projects downstream (see Figure MC-10). Such downstream projects typically only improve water supply and water quality in a specific region. While these projects often reduce dependence on the Delta, investment that restores or improves environmental function in the upper watersheds can provide multiple statewide benefits. For example, biomass programs on public lands realize the economic value of renewable energy and air emission benefits in support of community protection from fires, promote healthy forests, and boost local employment. Meadow restoration programs can improve water quality through the earth's natural filtration system, sequester water by acting as a sponge to hold and release water later during the season, increase natural water storage capacity, improve habitat, and create local jobs.

PLACEHOLDER Figure MC-10 Expenditures as Percent of State's Overall Investment

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Investment of time, money, resources, and attention above rim dams is critical for a healthy watershed and long-term water sustainability, not only for those who live in the region, but also for everyone in California who depends on the state's largest reservoir, the Sierra Nevada watershed.

The Sierra Nevada watershed, while not a pipe, dam, or tank, is the state's major natural infrastructure component that requires on-going maintenance that must adapt to the changing environment. Programs need to be developed to protect the ecology of these valuable pieces of natural infrastructure.

Additionally, climate change will alter precipitation patterns and long-term droughts will dramatically change the watershed landscape. The State should develop an adaptive strategy to ensure that this infrastructure is protected and enhanced to provide a sustainable environment and economy for this region and the state. The following programs for an adaptive integrated ecosystem restoration effort can provide water quality and water supply benefits, renewable energy, and create jobs.

- Meadow restoration programs.
- Stream management programs including developing more fish-friendly passage projects, such as Nevada Irrigation District's project on the Auburn Ravine in Placer County.
- Wetlands protection programs.
- Watershed/forest restoration programs.
- Renewable bioenergy programs.
- Watershed open space legacy programs.

Additionally, investments and incentives could have similar results:

- Investment in repairing leaks in small, disadvantaged water distribution systems and raw water canal systems.
- Provide funding for feasibility study, project design, and project construction monies for the mini-raises of small reservoirs where appropriate
- Invest in stormwater catchment basins where feasible
- Remove reservoir sediment to increase the water storage capacity of existing reservoirs
- Incentivize more reclaimed water projects where feasible

Maintaining high water quality standards in the watersheds presents a tremendous challenge that requires millions of dollars each year. Water agencies in the upper reaches of the watershed have been investing in advanced tertiary treatment for many years as compared to others that have enjoyed the dilution provided by valley rivers. This has placed a disproportionate financial burden on Mountain County rate payers. Especially in the face of increasing development pressures in the watershed, the region and the State need to undertake numerous capital watershed projects designed to preserve and improve water quality for downstream uses including:

- Wastewater treatment plant upgrades.
- Septic system rehabilitation and replacement programs.
- Stormwater retrofit programs.
- Sewer extension programs.
- Agricultural pollution prevention plans.
- Public outreach and education.

The Mountain Counties have two valuable attributes — abundant water and significant changes in elevation. This makes the Mountain Counties well suited for hydroelectric energy generation. One seventh of the energy in the state is created by hydroelectric generation. This is a clean, reliable carbon-free source of energy. The State has mandated that 33 percent of the energy used in California come from renewable sources by 2020. Thus far, the State has focused its investment on wind and photovoltaic generation. The problem with wind generation and solar generation is that these are extremely variable. The critically valuable aspect of hydroelectric generation is that it can be turned on or off as the electricity grid requires, and therefore, provides a balance of energy generation derived from wind and the sun. In-conduit hydroelectric projects along could add 1,000 MW or more of new renewable energy. These projects include replacing existing pressure reduction valves with small hydroturbine generators, converting open water canals and ditches to pressurized pipelines for hydroelectric generation, and adding strategically placed storage tanks for energy and fire protection benefits. In-conduit hydroelectric projects not only contribute to statewide renewable energy and reduced GHG emissions goals, but also could generate a significant local revenue stream for infrastructure replacement. There are also many existing reservoirs in the upper watersheds that were not built with hydroelectric generation facilities that could be generating clean renewable energy without the construction of new dams. The challenge facing many of these projects is the distance to transmission facilities. Grant funding for electric transmission capacity would make installing hydroelectric facilities at these reservoirs feasible.

As the need for additional storage is recognized, the added hydroelectric generation benefit possible at new high elevation storage cannot be ignored when the State considers where it will invest taxpayer's dollars. The following programs can expand clean renewable energy to support the State's renewable energy and GHG emissions goals and provide a local revenue source for the replacement of aging infrastructure:

- In-conduit hydroelectric programs.
- Existing dam hydroelectric retrofit/transmission program.
- Possible additional storage reservoirs.

DWR is currently taking action to develop renewable energy to reduce its GHG emissions and achieve AB 32 goals. In addition to executing power contracts for the output from wind and solar projects constructed by others, DWR is exploring ways it can develop solar on its own property. The feasibility of adding new small hydropower generation at two locations to the existing SWP is also being explored by DWR (see www.water.ca.gov/news/newsreleases/2011/021111energy.pdf). A partnership between DWR and Mountain Counties water agencies to develop small hydroelectric energy generation in the Mountain Counties Area would assist DWR in meeting its own renewable energy requirements.

Desired Future Conditions

Desired future conditions for the Mountain Counties include recognition of and investment in the restoration of the ecological health and resilience of forested watersheds and the economic viability of the region. Ecosystem benefits of statewide value including a sustainable supply of high quality water, enhanced energy production, improved biomass management and utilization, reduced threat from catastrophic wildfire, and opportunities to sequester carbon, among others, can be achieved through watershed management.

Regional Water Resource Management Objectives

- Describe baseline conditions better to promote understanding of upper watershed conditions and needs throughout the rest of the state.

- Increase regional and statewide water supplies and reliability by focusing efforts in upper watersheds.
- Maintain and upgrade infrastructure facilities, both constructed and natural.
- Increase off-stream storage.
- Raise existing reservoirs.
- Dredge local reservoirs.
- Reduce layers of bureaucracy, streamline regulatory processes, and expedite timelines.
- Balance regulatory assurances to link investment with returns assuring local monetary investment in upgraded facilities results in economic and environmental benefits.
- Enhance and restore the upper watershed forests and meadow systems.
- Restore ecosystem and watershed health and resiliency.
- Reduce potential for catastrophic fires by reducing vegetation densities and fuel loads.
- Expand meadow restoration efforts.
- Map ecosystem services and explain value of ecosystem services.
- Discuss avoided costs achieved through investing in watershed management versus costs incurred due to suppression of catastrophic fires and the resulting damage.
- Coordinate agencies and resources better regarding resource management and planning approaches.
- Promote regional self-reliance throughout the state by increasing awareness to reduce demands on upper watersheds.
- Explain water pricing in terms of cost per gallon, rather than cost per maf, to allow a better understanding of supply and treatment options.
- Streamline water transfer requirements to respond better to opportunities. The processing time often exceeds the window of opportunity for executing the transfer.
- Improve conditions associated with septic systems.
- Allow flexibility for meeting SBX7-7 water use efficiency (WUE) targets.
- Ability to receive credit for WUE targets from water savings beyond pipe system, e.g., lining of ditches, reduced losses at connection points, etc.
- Understand tradeoffs associated with eliminating water loss from the larger system.

Strategies to Meet Needs and Achieve Desired Future Conditions

Strategies

A set of specific strategies is necessary to ensure that a focus on the watersheds that are a source of California's water, such as the Mountain Counties Area, are included as a priority in any long-term water solutions considered for the state.

1. Increase investments of State funds in the form of State water bonds or other funding mechanisms to provide for ecosystem conservation and repair and improve infrastructure within the Mountain Counties Area. Increased investment should maintain the vitality of the water source and the infrastructure necessary to for supply adequate, timely water supply and quality while ensuring the on-going provision of ecosystem services with far-reaching positive effects throughout the state.
    A. Garner support and funding to enhance watershed and stewardship activities that result in increased statewide benefits.
    B. Increase awareness of the potential for beneficial results from increased SWRCB bond funding.

2. Educate key State and federal decision-makers, land and natural resource managers, urban planners, downstream users, and others about the value of and need for source water protection to facilitate investment, maintenance, and improvement of conditions in the upper watersheds. This will require collaborative efforts.
   A. Elevate State and federal awareness of the origins of water resources within California.
   B. Increase understanding of the Mountain Counties Area's overall importance to the state as a main source of vital natural resources.
   C. Identify specific regional water projects with resulting statewide benefits.
   D. Develop new partnerships and enhance cooperative resource management working relationships for improved long-term statewide benefits.
3. Support the implementation of sustainable IRWM plan resource management strategies, including forest management and watershed protection practices that enhance efficiencies throughout the entire water system from where it falls in the forested headwaters and as it flows through improved/maintainable water impoundment, conveyance, delivery, and flood control systems infrastructure. Enhance water conservation efforts and promoting efficient use/reuse of water as it flows through the system.
   A. Utilize IRWM planning to identify priorities and obtain project funding
   B. Encourage reduced consumptive use of water allowing water to be reused further through the water system.
   C. Identify and address misused, redundant, or outdated regulations that impede implementation of projects that will increase water supply reliability or improve water quality
4. Establish a specific definition of the boundaries of the Sierra Nevada and identify the watersheds included in the boundary to create agreement among all State and federal agencies. Support a comprehensive, long-term statewide solution to ecosystem restoration and water reliability for all of California that takes multiple needs into account.
   A. Identify boundaries and seek legal designation of the Sierra Nevada range.
   B. Strengthen State and federal working relationships for overall California source watersheds management.
5. Develop a climate change adaptation plan, starting with a vulnerability assessment of the region's water resources to direct statewide conservation efforts to achieve the long-term sustainability of California's vital water resources. The Mountain Counties' existing water systems and forests represent enormous potential for hydroelectric and biomass energy production. These resources can help meet statewide renewable energy goals, serve as GHG mitigation mechanisms through renewable energy generation, carbon sequestration, water efficiency and conservation, and may provide a revenue source for local infrastructure replacement and other needs.
   A. Develop a climate change vulnerability assessment and implement adaptation efforts.
   B. Support local biomass utilization and energy production projects to reduce fuel hazards.
   C. Promote, fund, and install small-scale alternative energy production projects including in-line small hydroelectric production and community-scale biomass energy facilities.
   D. Support forest remediation projects and meadow restoration projects to reduce risk of catastrophic fire and increase water yields.
6. Encourage increased resource self-reliance in other regions and explore creating a system of payment for ecosystem services provided that initiates progress towards equalizing water system economics throughout California. Increase efforts for educating downstream users about the source of water, other regions' dependency on water resources originating from within the

Mountain Counties Area, and the costs incurred providing them would aid efforts to acquire funding for necessary water system maintenance and improvements.

A. Establish rate structures for water services based on measured volumes utilized and actual overall costs incurred to deliver from point of origin to point of use.
B. Increase effort to convey to other regions of the state what the interacting relationships between regions are, the overall statewide dependency on Mountain Counties water, and the role of all California residents in Mountain Counties water resource stewardship

Conclusion

As stated throughout, the Mountain Counties Area Regional Report is intended to assist decision-makers in understanding the complexity and value of the natural and cultural resources within the overlay area so that good decisions can be made to protect, manage, and ensure water supply and quality for the state. The natural resources, people, organizations, and agencies rooted in source watersheds are critical to developing solutions for a sustainable water future for California. The state's water future must be considered holistically. California can no longer afford to separate the state into regions and focus attention only in one area or another. All regions of the state — from the upper watersheds, through the Delta, to end water users in agricultural, urban, and coastal areas — must work together to achieve regional and statewide goals, including coordination and implementation of policies and management strategies set forth elsewhere in the CWP.

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Table MC-1 Mountain Counties Water Balance Summary, 2001-2010

Table MC-X Mountain Counties Hydrologic Region water balance for 2001-2010 (in TAF)

Mountain Counties (TAF)	Water Year (Percent of Normal Precipitation)									
	2001 (65%)	2002 (86%)	2003 (88%)	2004 (80%)	2005 (129%)	2006 (140%)	2007 (65%)	2008 (69%)	2009 (88%)	2010 (98%)
Water Entering the Region										
Precipitation	23,445	31,886	32,462	29,605	47,543	51,682	23,983	25,636	32,508	36,042
Inflow from Oregon/Mexico	0	0	0	0	0	0	0	0	0	0
Inflow from Colorado River	0	0	0	0	0	0	0	0	0	0
Imports from Other Regions	9	40	35	15	11	33	35	27	15	26
Total	**23,454**	**31,926**	**32,497**	**29,620**	**47,554**	**51,715**	**24,018**	**25,663**	**32,523**	**36,068**
Water Leaving the Region										
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	264	311	275	333	275	284	290	305	307	273
Outflow to Oregon/Nevada/Mexico	0	0	0	0	0	0	0	0	0	0
Exports to Other Regions	7,376	7,148	8,747	8,946	11,675	1,325	638	699	859	1,285
Statutory Required Outflow to Salt Sink	654	1,565	1,555	1,882	3,466	3,298	951	1,131	1,543	1,816
Additional Outflow to Salt Sink	180	0	0	0	0	0	0	0	0	0
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	17,781	22,405	20,060	20,272	28,120	46,452	25,498	25,546	28,332	31,353
Total	**26,255**	**31,429**	**30,637**	**31,433**	**43,536**	**51,359**	**27,377**	**27,681**	**31,041**	**34,726**
Change in Supply										
[+] Water added to storage [-] Water removed from storage										
Surface Reservoirs	-2721	422	1811	-1859	3,983	351	-3360	-2013	1493	1356
Groundwater **	-80	75	49	46	35	5	1	-5	-11	-14
Total	**-2801**	**497**	**1860**	**-1813**	**4,018**	**356**	**-3359**	**-2018**	**1482**	**1342**
Applied Water * (Ag, Urban, Wetlands) (compare with Consumptive Use)	452	546	506	563	483	527	526	530	531	490

* Definition: Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

** Definition: Change in Supply: Groundwater – The difference between water extracted from and water recharged into groundwater basins in a region. All regions and years were calculated using the following equation:

change in supply: groundwater = intentional recharge + deep percolation of applied water + conveyance deep percolation and seepage - withdrawals

This equation does not include unknown factors such as natural recharge and subsurface inflow and outflow. For further details, refer to Volume 4, Reference Guide – *California's Groundwater Update 2013* and Volume 5 Technical Guide.

n/a = not applicable

Table MC-2 Summary of Small, Medium, and Large Community Drinking Water Systems in the Mountain Counties Area that Rely on One or More Contaminated Groundwater Well(s)

	Small Systems ≤ 3,300	**Medium Systems 3,301 – 10,000**	**Large Systems > 10,000**	**Total**
No. of affected community drinking water **systems**	42	0	0	42
No. of affected community drinking water **wells**	75	0	0	75

Source: State Water Resource Control Board 2013 report to the Legislature, *Communities that Rely on a Contaminated Groundwater Source or Drinking Water.*

Note: Affected wells exceeded a primary maximum contaminant level (MCL) prior to treatment at least twice from 2002 to 2010. Gross alpha levels were used as a screening assessment only and did not consider uranium correction.

Table MC-3 Summary of Contaminants Affecting Community Drinking Water Systems in the Mountain Counties Area

Principal Contaminant (PC)	Community Drinking Water Systems where PC exceeds the Primary Maximum Contaminant Level (MCL)	Community Drinking Water Wells where PC exceeds the Primary Maximum Contaminant Level (MCL)
Gross alpha particle activity	26	44
Arsenic	22	40
Uranium	18	27
Nitrate	2	2
Tetrachloroethylene (PCE)	1	1

Source: State Water Resource Control Board 2013 report to the Legislature, *Communities that Rely on a Contaminated Groundwater Source or Drinking Water.*

Note: Affected wells exceeded a primary maximum contaminant level (MCL) prior to treatment at least twice from 2002 to 2010. Gross alpha levels were used as a screening assessment only and did not consider uranium correction.

Table MC-4 Population Estimates for Mountain Counties Area

County	Population 2000	Population 2010	Change	Percent Change
Alpine	260	218	-42	-16.2%
Amador	29,673	31,004	1,331	4.5%
Butte	33,097	35,851	2,754	8.3%
Calaveras	32,788	36,257	3,469	10.6%
El Dorado	121,726	149,350	27,624	22.7%
Fresno	8,415	8,933	518	6.2%
Lassen	2,228	2,804	576	25.9%
Madera	25,814	28,588	2,774	10.7%
Mariposa	17,130	18,246	1,116	6.5%
Nevada	77,780	82,144	4,364	5.6%
Placer	113,230	123,825	10,595	9.4%
Plumas	20,820	20,007	-813	-3.9%
Sacramento	1,931	2,995	1,064	55.1%
Sierra	3,333	3,053	-280	-8.4%
Tuolumne	54,483	55,365	882	1.6%
Yuba	14,885	13,029	-1,856	-12.5%

Table MC-5 Population Acre Size Percentage

Population Percent	Parcel Size Class					
County	**0-2 acres**	**2-5 acres**	**5-10 acres**	**10-20 acres**	**20-40 acres**	**40-160 acres**	**>160 acres**
ALPINE	42.14%	7.01%	3.45%	6.72%	11.92%	1.41%	27.34%
AMADOR	29.52%	13.85%	12.14%	7.31%	7.82%	18.77%	10.58%
BUTTE	34.29%	13.24%	15.12%	11.73%	6.93%	10.39%	8.30%
CALAVERAS	34.53%	11.14%	8.64%	7.47%	11.81%	15.80%	10.60%
EL DORADO	36.98%	13.00%	13.57%	10.57%	7.71%	13.95%	4.21%
FRESNO	4.72%	12.31%	13.32%	11.4%	11.42%	24.68%	22.07%
LASSEN	66.08%	2.35%	1.30%	1.35%	5.54%	3.58%	19.80%
MADERA	19.77%	14.84%	10.69%	9.05%	8.61%	16.96%	20.08%
MARIPOSA	8.69%	10.69%	10.85%	9.19%	9.29%	20.29%	30.98%
NEVADA	38.48%	16.88%	15.45%	9.99%	7.14%	8.56%	3.50%
PLACER	40.26%	19.89%	12.31%	8.97%	6.27%	9.45%	2.84%
PLUMAS	37.36%	13.03%	9.28%	4.36%	4.93%	11.12%	19.92%
SACRAMENTO	37.38%	4.19%	0.98%	6.24%	4.76%	32.84%	13.20%
SIERRA	38.38%	5.80%	10.26%	4.08%	5.75%	9.58%	26.16%
TUOLUMNE	33.33%	13.95%	10.22%	6.81%	7.50%	14.17%	14.01%
YUBA	4.12%	10.75%	17.26%	12.95%	10.87%	18.56%	25.49%
Grand Total	34.10%	14.80%	12.58%	9.19%	7.63%	13.00%	8.70%

PLACEHOLDER Table MC-6 Water Governance and Planning in the Mountain Counties Area

[table to come]

Table MC-7 Reservoirs in the Mountain Counties Area

Reservoir (Dam)	Stream	Operator	Capacity (taf)
Antelope Lake	Upper Indian Creek	California Department of Water Resources	22.6
Beardsley Lake	Middle Fork Stanislaus River	Oakdale & South San Joaquin Irrigation District	70.6
Belden (Caribou Afterbay)	North Fork Feather River	Pacific Gas & Electric Co.	2.4
Bowman Lake	Canyon Creek	Nevada Irrigation District	64.0
Buchanan (Eastman Lake)	Chowchilla River	U.S. Army Corps of Engineers	150.0
Butt Valley	Butt Creek	Pacific Gas & Electric Co.	49.9
Camanche	Mokelumne River	East Bay Municipal Utility District	417.1
Camino	Silver Creek	Sacramento Municipal Utility District	0.8
Camp Far West	Bear River	South Sutter Water District	104.5
Caples Lake	Trib Silver Fork	El Dorado Irrigation District	21.6
Cascade Lake (Lower Peak)	Trib South Fork Yuba River	Pacific Gas & Electric Co.	0.5
Cherry Lake (Lake Lloyd)	Cherry Creek	City and County of San Francisco	273.5
Concow	Concow Creek	Thermalito Irrigation District	6.4
Crane Valley (Bass Lake)	North Fork Willow Creek	Pacific Gas & Electric Co.	45.4
Don Pedro	Tuolumne River	Turlock Irrigation District	2,030.0
Donnells Reservoir	Middle Fork Stanislaus River	Oakdale & South San Joaquin Irrigation District	56.9
Englebright	Yuba River	U.S. Army Corps of Engineers	70.0
Faucherie	Canyon Creek	Nevada Irrigation District	5.5
Florence Lake	South Fork San Joaquin River	Southern California Edison Company	64.6
Folsom Lake	American River	U.S. Army Corps of Engineers	975.0
French Lake	Canyon Creek	Nevada Irrigation District	12.5
French Meadows Reservoir	Middle Fork American River	Placer County Water Agency	111.3
Frenchman	Little Last Chance Creek	California Department of Water Resources	55.5
Gerle	Gerle Creek	Sacramento Municipal Utility District	1.2
Grizzly Forebay	Grizzle Creek	Pacific Gas & Electric Co.	1.1
Hensley Lake (Hidden)	Fresno River	U.S. Army Corps of Engineers	90.0
Hetch Hetchy Reservoir	Tuolumne River	City and County of San Francisco	360.0
Huntington Lake	Big Creek	Southern California Edison Company	89.2
Ice House	South Fork Silver Creek	Sacramento Municipal Utility District	37.1
Jackson Lake	Jackson Creek	Nevada Irrigation District	1.0
Jackson Meadows	Middle Fork Yuba River	Nevada Irrigation District	52.5
Junction	Silver Creek	Sacramento Municipal Utility District	3.2
Kelly Lake	Trib North Fork American River	Pacific Gas & Electric Co.	0.3
Kerckhoff	San Joaquin River	Pacific Gas & Electric Co.	4.2
Kidd Lake	Trib South Fork Yuba River	Pacific Gas & Electric Co.	1.9
Kunkle	Trib W Br Feather River	Pacific Gas & Electric Co.	0.3
Lake Almanor	North Fork Feather River	Pacific Gas & Electric Co.	1,308.0

Reservoir (Dam)	Stream	Operator	Capacity (taf)
Lake Davis (Grizzly Valley)	Big Grizzly Creek	California Department of Water Resources	83.0
Lake Eleanor	Eleanor Creek	San Francisco Public Utility Commission	28.6
Lake Fordyce	Fordyce Creek	Pacific Gas & Electric Co.	48.9
Lake McClure	Merced River	Merced Irrigation District	1,032.0
Lake Spaulding	South Fork Yuba River	Pacific Gas & Electric Co.	74.8
Lake Thomas A. Edison/Vermilion Valley	Mono Creek	Southern California Edison Company	125.0
Lake Valley	Trib North Fork American River	Pacific Gas & Electric Co.	8.1
Little Grass Valley	South Fork Feather River	Oroville-Wyandotte Irrigation District	93.0
Loon Lake	Gerle Creek	Sacramento Municipal Utility District	76.5
Lost Creek	Lost Creek	South Feather Water and Power Agency	5.7
Lower Bear River	Lower Bear River	Pacific Gas & Electric Co.	48.8
Lower Hell Hole	Rubicon River	Placer County Water Agency	208.4
Lyons	South Fork Stanislaus River	Pacific Gas & Electric Co.	6.2
Main Strawberry	South Fork Stanislaus River	Pacific Gas & Electric Co.	18.3
Mammoth Pool	San Joaquin River	Southern California Edison Company	123.0
Millerton Lake (Friant)	San Joaquin River	U.S. Bureau of Reclamation	520.5
Miners Ranch	Trib North Honcut Creek	South Feather Water and Power Agency	0.9
Mountain Meadows (Indian Ole)	Hamilton Creek	Pacific Gas & Electric Co.	24.8
New Bullards Bar Reservoir	North Fork Yuba River	Yuba County Water Agency	969.6
New Hogan	Calaveras River	U.S. Army Corps of Engineers	317.1
New Melones	Stanislaus River	U.S. Bureau of Reclamation	2,400.0
New Spicer Meadow Reservoir	Highland Creek	Calaveras County Water District	189.0
Oroville	Feather River	California Department of Water Resources	3,537.6
Pardee	Mokelumne River	East Bay Municipal Utility District	180.0
Philbrook	Philbrook Creek	Pacific Gas & Electric Co.	5.2
Ponderosa Divide.	South Fork Stanislaus River	South Feather Water and Power Agency	4.8
Relief	Summit Creek	Pacific Gas & Electric Co.	15.1
Rock Creek	North Fork Feather River	Pacific Gas & Electric Co.	4.7
Rollins Reservoir	Bear River	Nevada Irrigation District	66.0
Round Valley	West Branch Feather River	Pacific Gas & Electric Co.	1.1
Salt Springs Reservoir	North Fork Mokelumne River	Pacific Gas & Electric Co.	141.9
Sawmill Lake	Canyon Creek	Nevada Irrigation District	3.0
Scotts Flat	Deer Creek	Nevada Irrigation District	49.0
Slab Creek	South Fork American River	Sacramento Municipal Utility District	16.6
Sly Creek	Sly Park Creek	Oroville-Wyandotte Irrigation District	65.1

Reservoir (Dam)	Stream	Operator	Capacity (taf)
Tulloch	Stanislaus River	Oakdale & South San Joaquin Irrigation District	68.4
Union	North Fork Stanislaus River	Northern California Power Agency	2.0
Union Valley Reservoir	Silver Creek	Sacramento Municipal Utility District	230.0
Utica	North Fork Stanislaus River	Northern California Power Agency	2.4

Note: Reservoirs listed in table represent 95% of the total storage in the Mountain Counties Area.

Table MC-8 Gross Crop Value

County	Gross Crop Value
El Dorado/Alpine Counties	$36 million
Amador County	$30 million
Calaveras County	$24 million
Tuolumne County	$29 million
Placer County [a]	$68 million *
Total for the 5 counties:	$187 million

Note: [a] Not all of Placer County is included in the Mountain Counties Area.

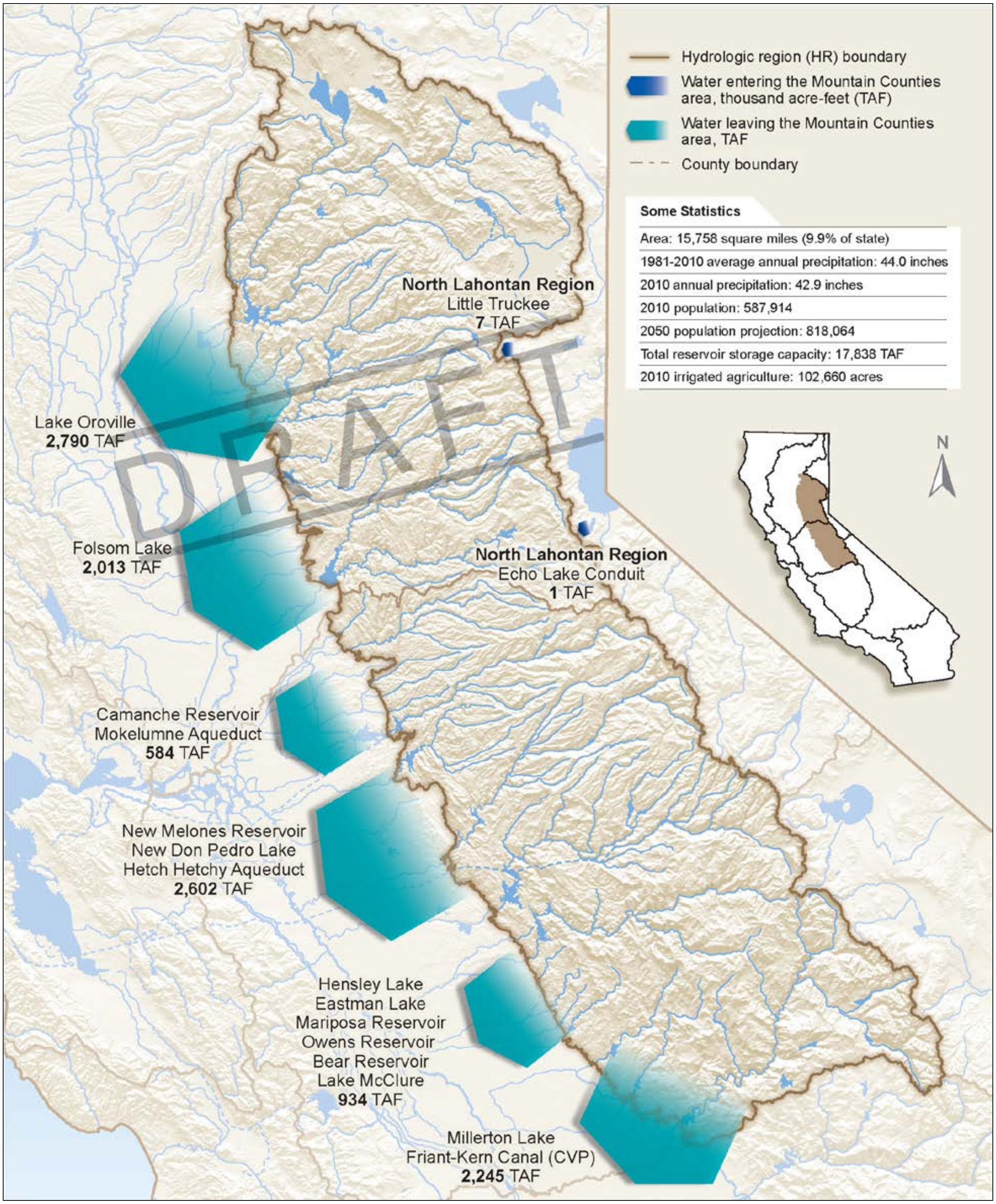
Source: 2011 County crop reports from the County Ag Commissioner.

Figure MC-1 Mountain Counties Area

PLACEHOLDER Photo MC-1 Picture of Sutter's Mill
[photo to come]

Figure MC-2 Context of Mountain Counties Area with Respect to the State

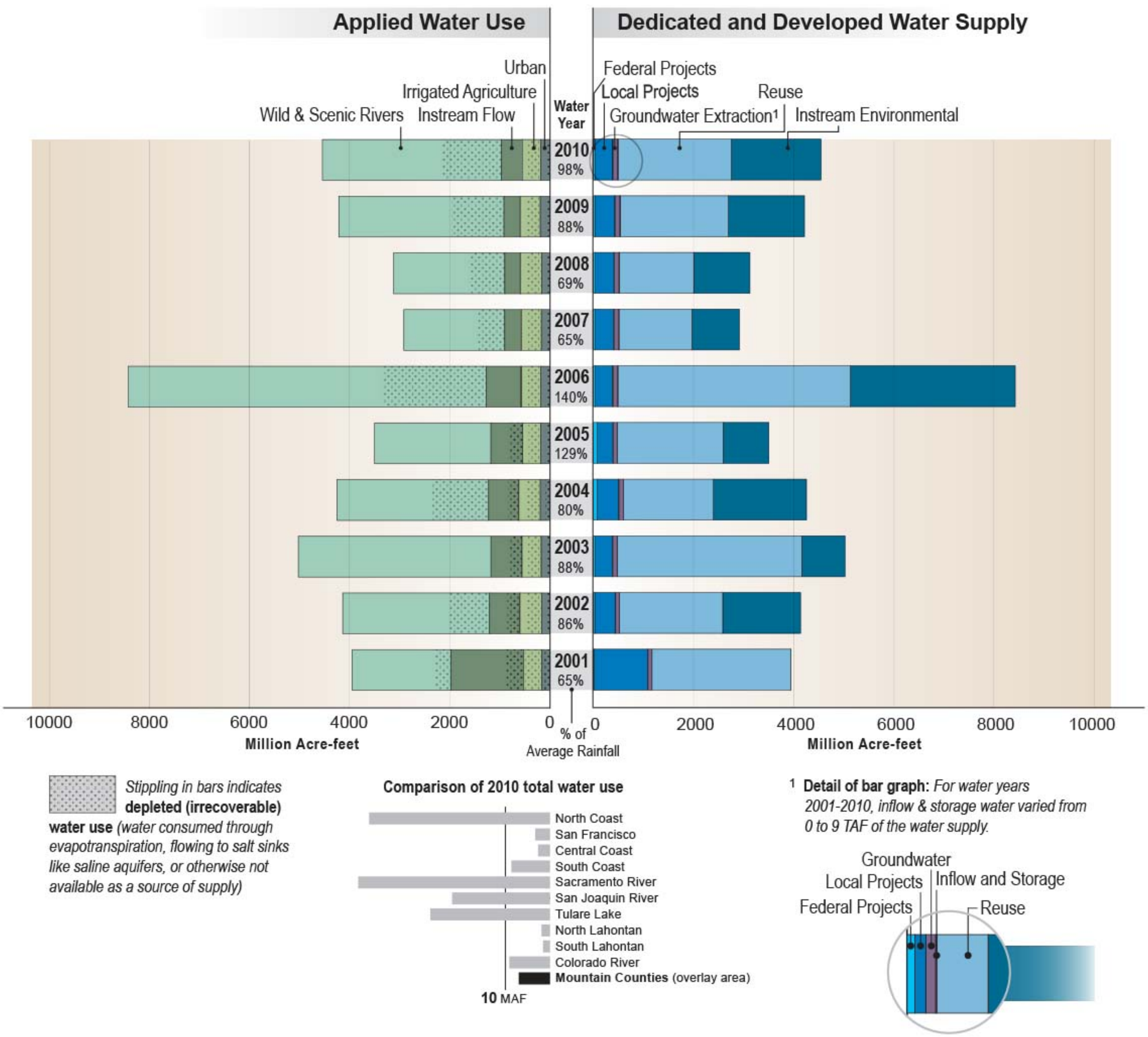
Figure MC-3 Mountain Counties Area Inflows and Outflows in 2010



Source: Department of Water Resources

Figure MC-4 Mountain Counties Water Balance by Water Year, 2001-2010

California's water resources vary significantly from year to year. Ten recent years show this variability for water use and water supply. Applied Water Use shows how water is applied to urban and agricultural sectors and dedicated to the environment and the Dedicated and Developed Water Supply shows where the water came from each year to meet those uses. Dedicated and Developed Water Supply does not include the approximately 125 million acre-feet (MAF) of statewide precipitation and inflow in an average year that either evaporates, are used by native vegetation, provides rainfall for agriculture and managed wetlands, or flow out of the state or to salt sinks like saline aquifers. Groundwater extraction includes annually about 2 MAF more groundwater used statewide than what naturally recharges – called groundwater overdraft. Overdraft is characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years.



Key Water Supply and Water Use Definitions

Applied water. The total amount of water that is diverted from any source to meet the demands of water users without adjusting for water that is depleted, returned to the developed supply or considered irrecoverable (see water balance figure).

Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.

Instream environmental. Instream flows used only for environmental purposes.

Instream flow. The use of water within its natural watercourse as specified in an agreement, water rights permit, court order, FERC license, etc.

Groundwater Extraction. An annual estimate of water withdrawn from banked, adjudicated, and unadjudicated groundwater basins.

Recycled water. Municipal water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.

Reused water. The application of previously used water to meet a beneficial use, whether treated or not prior to the subsequent use.

Urban water use. The use of water for urban purposes, including residential, commercial, industrial, recreation, energy production, military, and institutional classes. The term is applied in the sense that it is a kind of use rather than a place of use.

Water balance. An analysis of the total developed/dedicated supplies, uses, and operational characteristics for a region. It shows what water was applied to actual uses so that use equals supply.

Mountain Counties Water Balance by Water Year Data Table (MAF)

	2001 (65%)	2002 (86%)	2003 (88%)	2004 (80%)	2005 (129%)	2006 (140%)	2007 (65%)	2008 (69%)	2009 (88%)	2010 (98%)
Applied Water Use										
Urban	165	170	174	194	186	189	172	167	193	182
Irrigated Agriculture	365	429	384	427	358	379	401	424	401	368
Managed Wetlands	0	5	3	1	2	16	17	3	2	2
Req Delta Outflow	0	0	0	0	0	0	0	0	0	0
Instream Flow	1451	603	618	604	634	687	314	309	323	414
Wild & Scenic R.	1969	2933	3847	3031	2324	7155	2015	2224	3299	3580
Total Uses	**3949**	**4140**	**5026**	**4257**	**3505**	**8425**	**2918**	**3127**	**4219**	**4547**
Depleted Water Use (stippling)										
Urban	143	60	59	91	80	61	57	59	78	65
Irrigated Agriculture	339	283	260	287	242	249	262	287	278	251
Managed Wetlands	0	3	3	1	1	7	8	2	1	1
Req Delta Outflow	0	0	0	0	0	0	0	0	0	0
Instream Flow	341	248	233	218	249	0	0	0	0	0
Wild & Scenic R.	313	797	0	1,123	0	2,077	532	708	1,044	1,184
Total Uses	**1,136**	**1,390**	**555**	**1,719**	**572**	**2,395**	**859**	**1,055**	**1,401**	**1,500**
Dedicated and Developed Water Supply										
Instream	0	1555	862	1858	911	3291	945	1122	1519	1788
Local Projects	1,064	406	344	419	309	342	363	371	392	351
Local Imported Deliveries	9	11	8	11	6	17	18	9	10	8
Colorado Project	0	0	0	0	0	0	0	0	0	0
Federal Projects	20	30	37	82	81	38	37	40	34	33
State Project	0	0	0	0	0	0	0	0	0	0
Groundwater Extraction	79	73	88	88	80	89	89	92	95	95
Inflow & Storage	0	0	0	0	0	8	8	9	9	9
Reuse & Seepage	2,776	2,065	3,689	1,800	2,117	4,642	1,457	1,485	2,159	2,263
Recycled Water	1	0	0	0	0	0	0	0	0	0
Total Supplies	**3,949**	**4,140**	**5,026**	**4,257**	**3,505**	**8,425**	**2,918**	**3,127**	**4,219**	**4,547**

Figure MC-5 Wildfire Hazard Map of the Mountain Counties Region

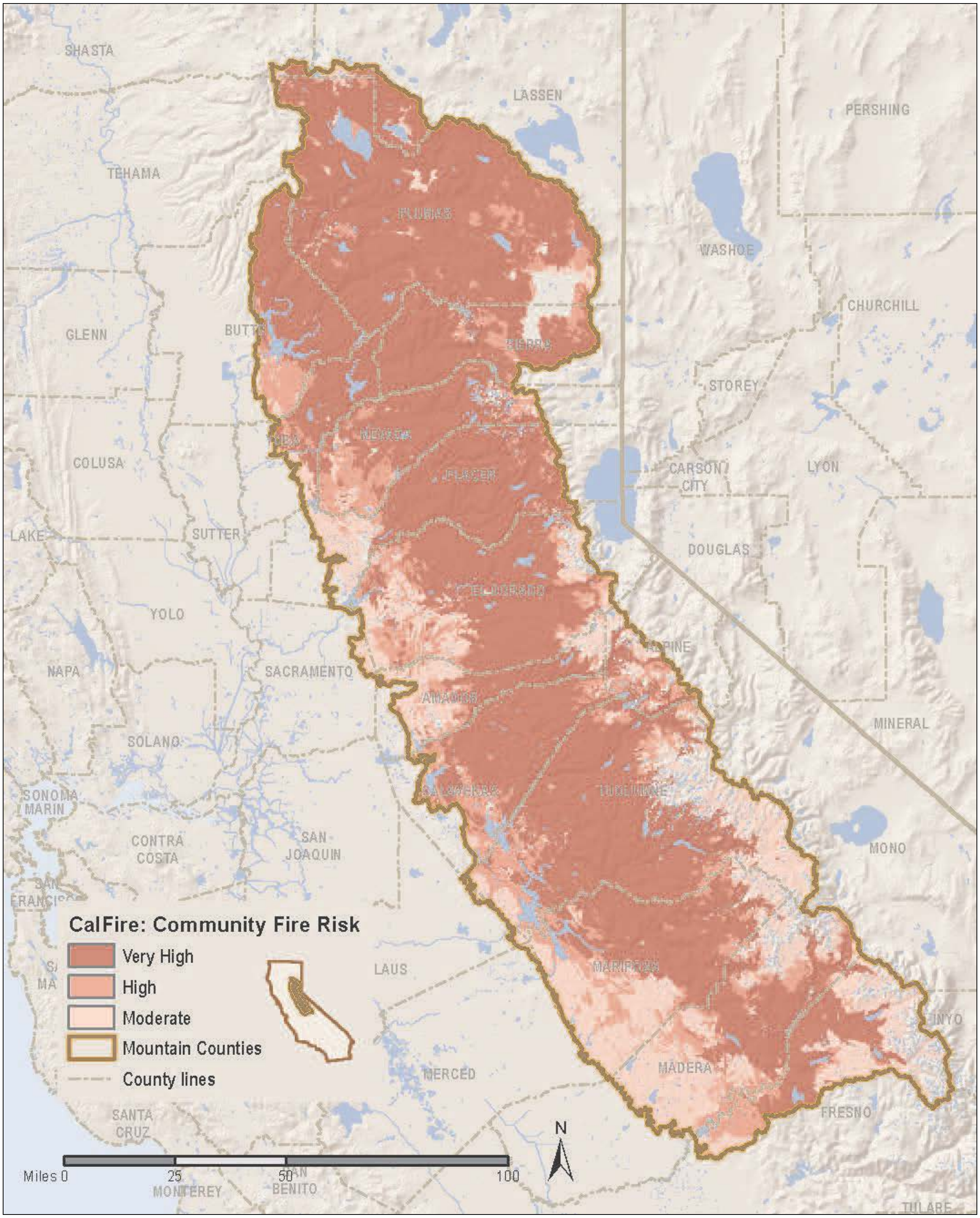


Figure MC-6 Mountain Counties Area Parcel Size Map

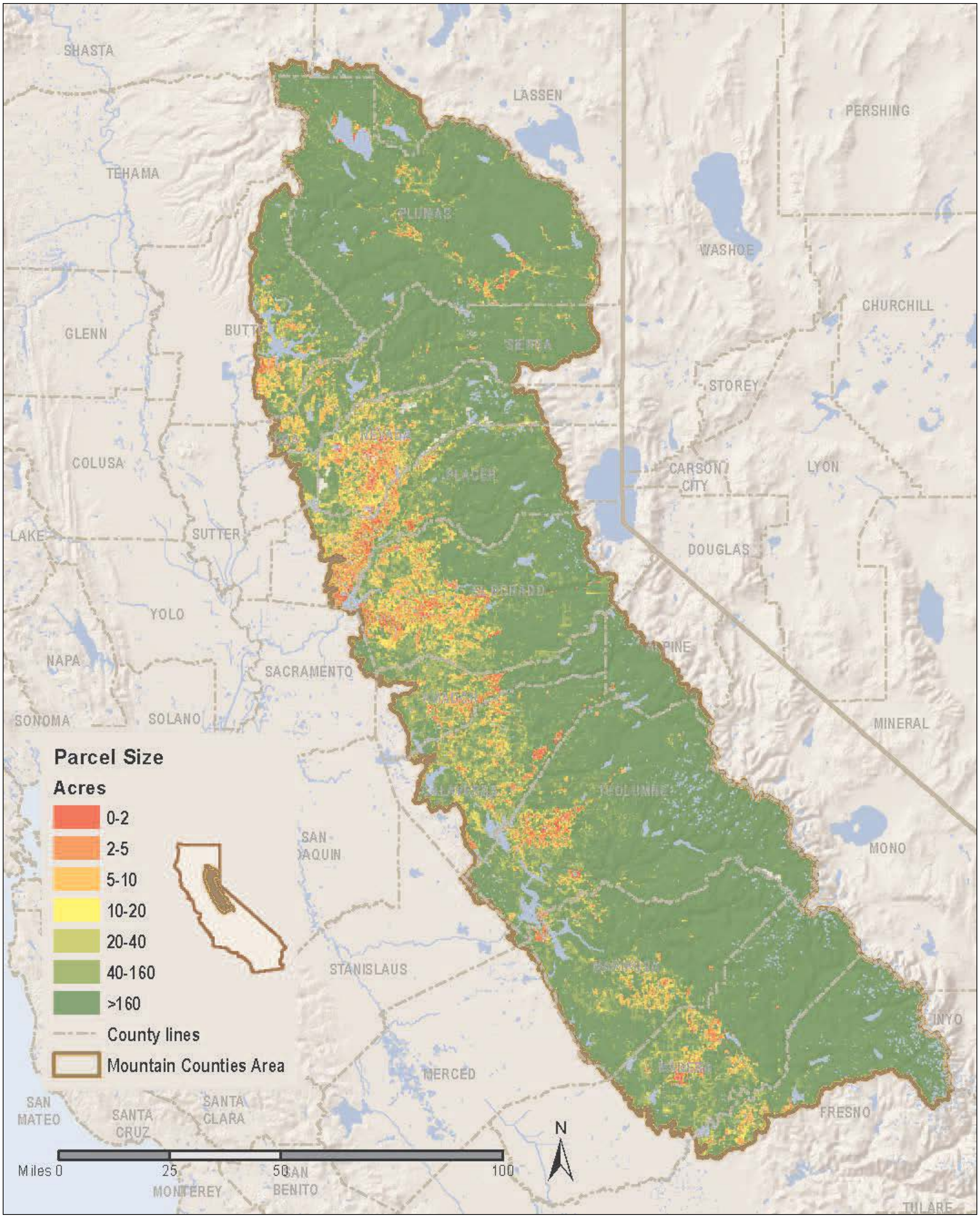
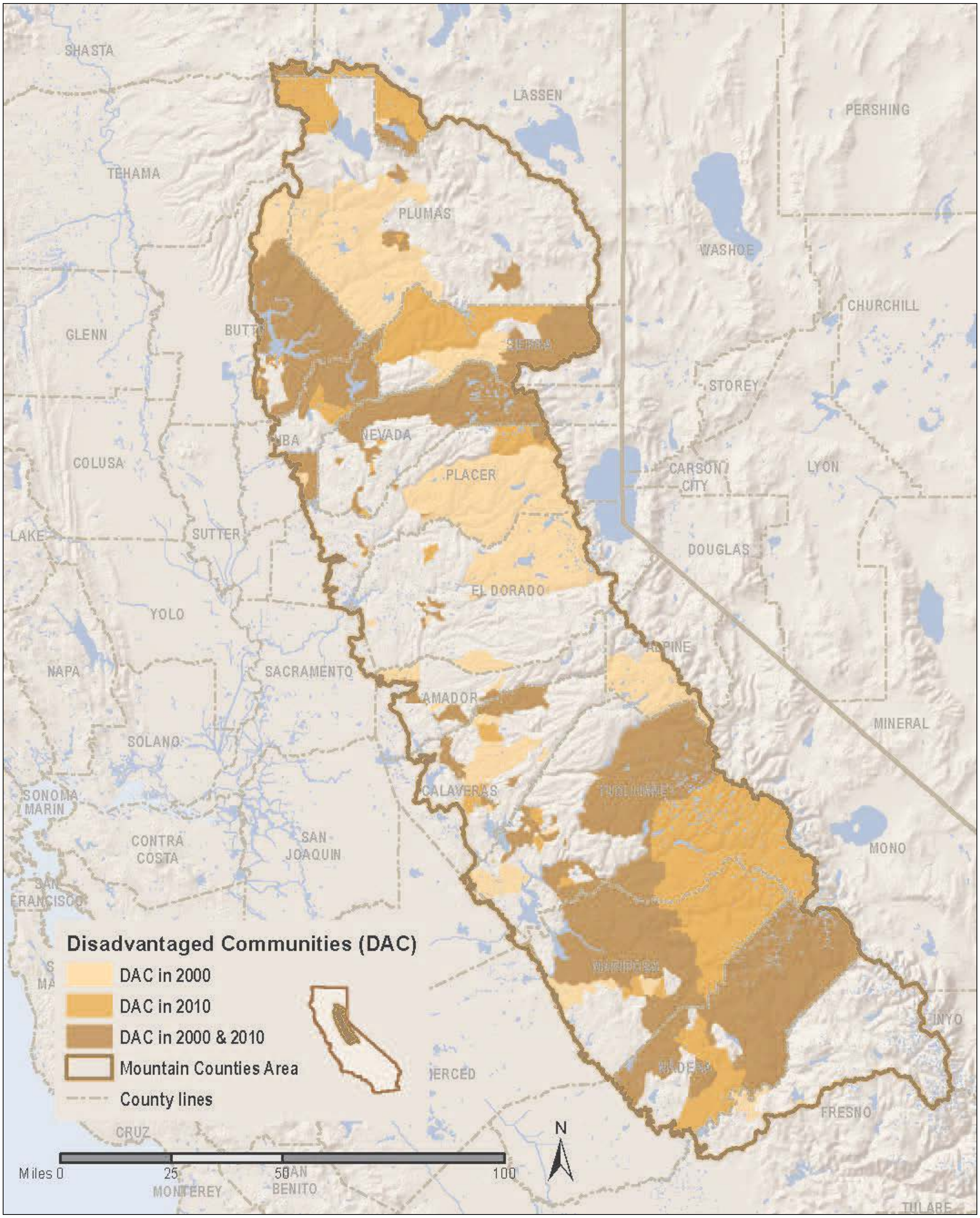


Figure MC-7 Mountain Counties Area Disadvantaged Communities



PLACEHOLDER Photo MC-2 Photo of Rafting in the Mountain Counties Area

[photo to come]

PLACEHOLDER Photo MC-3 Meadow Restoration Photo – Before and After

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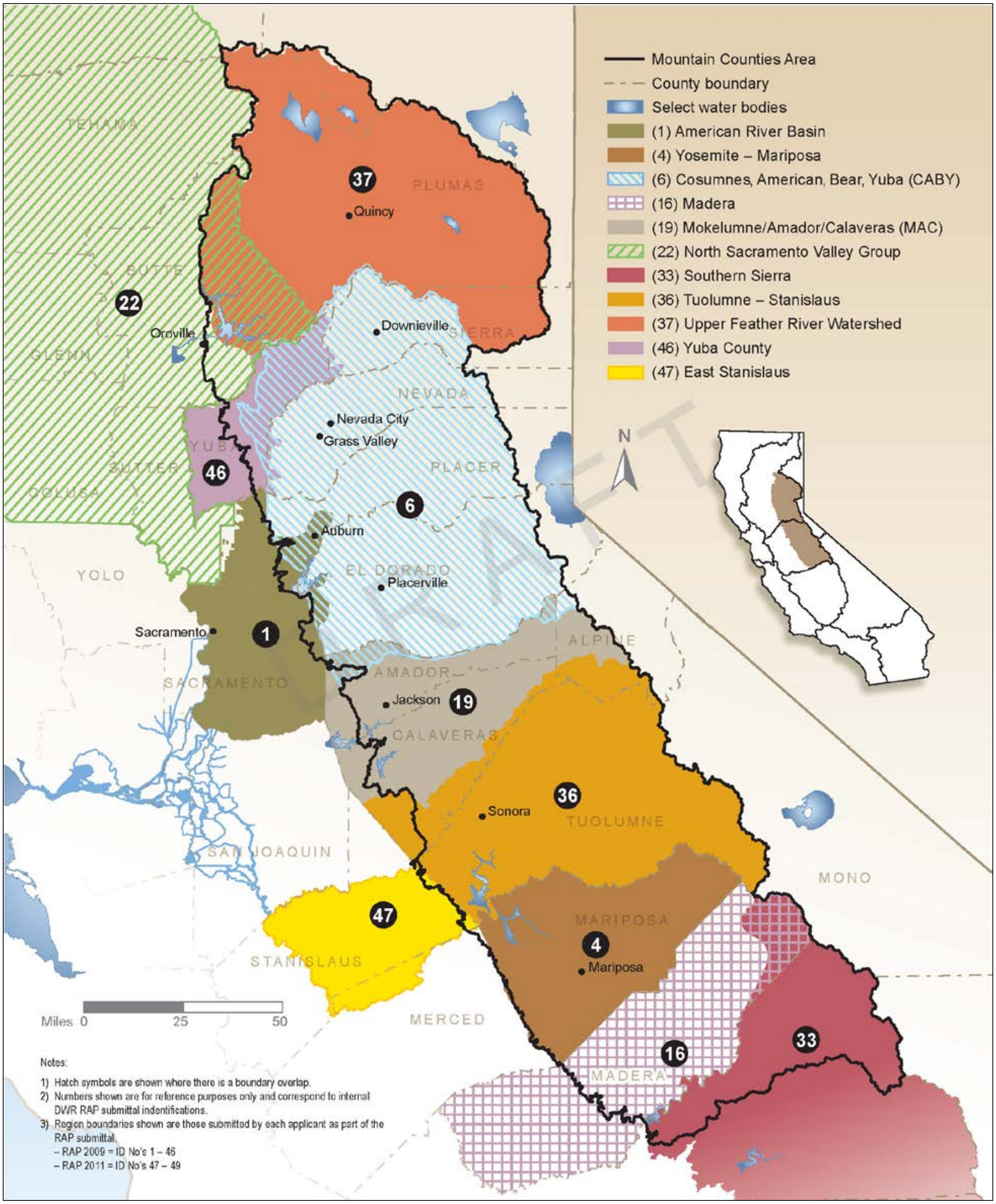
Figure MC-8 Water – A Bargain for the Money

Figure MC-9 Map of IRWMs in the Mountain Counties Area



PLACEHOLDER Figure MC-10 Expenditures as Percent of State's Overall Investment

[figure to come]

Box MC-1 Recycled Water Use

In 2011, El Dorado Irrigation District reported using 2,247 af of recycled water for landscape irrigation, meeting 8 percent of its overall demands.

Calaveras County Water District uses 404 af of recycled water on golf courses each year.

In 2011, Tuolumne Utilities District reported using 1,739 af of recycled water for agricultural irrigation, meeting 42 percent of the overall agricultural demands.

The City of Roseville's recycled water program has reported using 2,400 af of recycled water for golf courses and green belt areas, and is planning to increase its use of reclaimed water up to 4,000 af per year.

The City of Lincoln, has a state-of-the-art wastewater treatment plant, and is working with the County of Placer to construct a regional water pipeline to receive wastewater from the unincorporated areas north of Auburn. Lincoln's wastewater treatment plant will then be able to supply recycled, highly treated wastewater for nearby agricultural customers.

Box MC-2 Forest, Water, and Fire Management in the Mokelumne River Watershed

The Mokelumne River provides several environmental and economic benefits that are typical of watersheds with headwaters in the Sierra Nevada. It supplies water to the East Bay Municipal Utility District and its 1.4 million customers, and to more than 800,000 acres of vineyards, orchards, and other crops. The river provides recreational uses, such as whitewater rafting and trout fishing, as well as hydropower generation. The watershed supports forestry and biomass energy plants. At the same time, the watershed is habitat for many species of fish and wildlife, including Chinook salmon and steelhead.

The Mokelumne Watershed Environmental Benefits Program is a collaborative effort designed to protect and restore nature and its benefits including forests, water, fish, wildlife, and recreation. It also aims to support local economies and rural communities from the headwaters of the Mokelumne River in the Sierra Nevada to the Sacramento-San Joaquin Delta. The program will measure and track both expenditures in watershed restoration and their environmental results with the aim of increasing both the amount and effectiveness of restoration activities.

The project is based on a recognition that downstream communities depend upon the watershed services provided by upstream landowners in the region. As of now, upstream land managers generally have no incentive to invest in stewardship practices that explicitly provide public benefits. There is no clear obligation to downstream users to contribute financially to the management practices needed to ensure the continued provision of the services. No mechanism for this exists as well.

The vision of the project is to provide private and public land managers in the watershed with resources and incentives to carry out certain conservation treatments and thereby ensure the viability of the environmental benefits. The project intends to develop payment mechanisms that allow private utilities, government agencies, communities, foundations, and nonprofits to pay landowners and managers to enhance and manage their lands in ways that benefit people and nature — fish, wildlife and habitat.

Conservation goals of the project include preventing catastrophic wildfire, less soil erosion, reduce sedimentation of streams and reservoirs, and increase mixed-age stands of forest trees. Proposed watershed restoration treatments include fuel load reduction via thinning of stands of small trees and brush, a halt to the practice of piling and burning woody debris, converting wood scraps into valuable products, such as fence posts, stove pellets and other biofuels, re-vegetating abandoned roads to prevent their erosion,; and making meadow improvements (see Box MC-3), among others.

Fire suppression since the late 19th century has allowed the proliferation of unusually dense stands of small trees that are much more susceptible to combustion during wildfires than larger old-growth trees. These allow fire to spread quickly. The result is that when wildfires eventually occur, they are uncharacteristically large and severe. In turn, the bare soil on burned-over hill slopes quickly erodes in rainstorms and sends large pulses of sediment into streams and reservoirs. Landslides also become more frequent with the same result.

Expected results of application of the management practices include a more natural water cycle, which means more water storage in the snowpack and less wintertime water runoff from hill slopes, because they have been re-vegetated, less soil erosion and siltation of waterways; forest restoration that provides shade to reduce stream temperatures; less need to remove silt from reservoirs, and more space in reservoirs for water supply storage and hydropower generation. Thinning of even-aged, single-species stands of trees should also allow more species of trees to grow in an area and increase the variety of animals living there.

The proposed management actions should save money otherwise spent on removal of sediment and debris from reservoirs and on water treatment to remove suspended particles. Intact forest land should provide shade that maintains the snowpack longer into the spring, thus freeing up storage space in reservoirs. The program has begun to evaluate the financial costs and benefits of actions that could reduce soil erosion and sedimentation of water reservoirs.

Downstream reaches of the river support salmon and steelhead, which are cold-water fish in a hot summer climate. The program is starting to re-forest the riverbank on agricultural property, partly for its habitat value and partly aiming to cool the river with shade. A successful effort could reduce the need for releases of cold water from reservoirs and thereby provide more flexibility in water operations.

The program has a collaborative process and structure. Sustainable Conservation, Environmental Defense Fund, Sierra Nevada Conservancy, and The Nature Conservancy, with grant funds from National Resource Conservation Service have convened a group of local and regional stakeholders to develop and carry out the necessary ecological restoration work. The group meets regularly and includes representatives from watershed groups, the USDA Forest Service, local government, East Bay Municipal Utilities District, Pacific Gas and Electric, Sierra Pacific Industries, other private landowners, and the San Joaquin County Resource Conservation District.

Box MC-3 Meadow Improvements in the Sierra

In a natural condition, mountain meadows have deep soils, dense vegetation, and a drainage pattern where water flows across the flat meadow and infiltrates into the soil. Meadows typically remain saturated with water for most of the year and store groundwater in their soils, which act as natural reservoirs. Slow release of water from the sediments to downstream drainages provides flow long after surface runoff has stopped for the season. In addition, the water storage capacity of meadows can reduce the rate of runoff during spring snowmelt and reduce peak flows that cause floods downstream. The net result is higher summer flows and lower winter/spring flood flows compared to degraded meadows.

In meadows exposed to practices such as over-grazing by livestock, road building, and deliberate draining the streams typically erode into gullies. Water then enters into the meadow drains quickly into stream channels rather than across the land surface. Rapid drainage extends and deepens streambank and streambed erosion, further lowering the water table and drying out the meadow. This conversion is permanent — channel incision does not repair itself for reverse damage done to it.

Drying of meadow soils allows invasion by drought-tolerant shrubs and trees that contribute to fuel loads and add to the risk of large wildfires. Loss of wet meadow vegetation eliminates habitat for numerous riparian animals, several of which are now at risk of extinction in the Sierra Nevada. Channel erosion adds to stream sediment loads. Additionally, dry meadows have little forage value for livestock.

Most meadows in the Sierra Nevada had already experienced gully erosion before 1940. Those effects remain on the landscape and will heal only with active intervention. Meadow restoration commonly involves filling or plugging gullies, routing surface flows over the meadow surface, and raising the water table. The Sierra Nevada has more than 12,000 meadows, comprising about 300,000 acres. Since about two-thirds of them might be degraded, to return all of them to well-watered conditions is a huge task.

Mountain meadows are biodiversity hotspots, especially for birds and amphibians. The large variety of plant and animal species in meadows is mostly different from that in nearby forests. Thus, intact meadows add a great deal to the overall biological richness of California's mountains. Recent initiatives aim to rehabilitate and conserve wet meadows in the Sierra Nevada, both for their great biological value and to understand the role of restoration in improving water management better. The impetus lies in a better water supply for people and wildlife.

The largest initiative, begun in 2010, is led by the National Fish and Wildlife Foundation (NFWF). The NFWF program intends to restore and enhance habitat on a large geographic scale, validate the benefits of restoration, and build regional capacity to carry out projects. The first five years of the initiative focus on building the economic and scientific rationale for meadow improvements and carrying out projects to restore at least 20,000 acres. Contingent upon success in the first phase, the second phase will seek to ensure restoration and management of most of the degraded meadows in the Sierra Nevada.

The program addresses three outstanding issues: uncertainty about the magnitude of benefits, maintenance of benefits after restoration, and incomplete support from ranchers. Resolution of the first issue hinges on a demonstration that water outcomes are real and cost-effective. This requires clarification of the relation between water table elevations and base flow increases and the reasons for their variability. To do so, the program is studying a range of meadows from north to south and high to low elevation and across soil and vegetation types. The aim is to quantify groundwater storage and streamflow regulation. Alongside this is an economic analysis of the ecosystem services provided by restoration, including flow regulation, flood attenuation, water supply reliability, and water quality.

Maintenance of desired conditions after restoration is an issue because several pervasive land uses in the Sierra Nevada can undo the work and reduce the value of restored meadows. Development, infrastructure, and road-building threaten many of the largest meadow complexes on private land, while recreational use, fire, and unplanned livestock grazing pose further risks on both public and private land. One solution is to establish written agreements that define the terms of post-project maintenance and site management. Easements to protect the ecosystem services of meadows from future threats are another option.

The great majority of meadows, whether on national forests or private land, are grazed by livestock. Some have more than a 100-year history of cattle grazing. It may not always be clear to ranchers that voluntary limits on grazing intensity to allow or maintain wet-meadow vegetation would either be compensated or be offset by higher forage value. Hence, the program seeks to quantify grazing benefits, to show ideally that meadows with intact hydrology can offer reliable, increased forage for local ranches.

One of the first projects to this end is a joint venture between the Environmental Defense Fund, Tuolumne County Resource Conservation District, American Rivers, and the Cosumnes American Bear Yuba (CABY) Integrated Regional Water Management Group called "Sierra-wide Solutions — Working mMeadows on Private Lands in the Sierra Nevada." The project aims to measure and articulate the costs and benefits of meadow improvements and establish a dialogue on meadow enhancements among the various stakeholders.

The project set up a series of focus groups to engage ranchers and other private landowners and identify their concerns and priorities. Landowners expressed concerns about the effects of enhancement activities on the profitability of their operations and regulatory interference arising from creation of wetlands and habitat for listed species.

The project conducted a study of the economics of meadow improvements. It found that the increase in forage value for livestock is real, but generally, it is not enough to cover the cost of restoration. Thus, it concluded that ranchers are unlikely to pay for meadow improvements on their own.

The study also reviewed the literature on the hydrology of restored meadows and their effect on dry-season flow downstream. It concluded that current knowledge is inadequate and results vary greatly, from showing increases to decreases in downstream flow levels.

In a related initiative, DWR is funding the USDA Forest Service to investigate the hydrology of restored wet meadows and their contribution to improved water supply reliability. Prior to the study, the USDA Forest Service estimated that meadow rehabilitation on national forests in the Sierra Nevada might increase dry-season stream flow by 5000 to 50,000 af in the Sacramento-San Joaquin watershed. See the Chapter 23, “Forest Management Strategy” in Volume 3 for details.

The current study is sampling 100 meadows with areas between 10 and 500 acres in national forests in the Sierra Nevada. It compares water budgets in natural, degraded, and restored meadows to evaluate regulation of groundwater discharge. The aim is to develop more accurate estimates of changes in seasonal groundwater storage and streamflow following restoration. Results to date are, compared to eroded meadows, restored meadows support higher flows in early to mid-summer in most cases and a longer duration of flows in summer. This issue is contentious because irrigators downstream of some meadow restoration projects have asserted a clear decline in late summer flows.

PLACEHOLDER Figure A
[figure and title to come]

Box MC-4 Early Consultation and Cooperation with Tribal Interests

The goal of the Combie Reservoir Sediment and Mercury Removal project — a model project for multiple sites within the region — was to remove and treat mercury-laden sediment trapped behind the dam without contributing large amounts of mercury downstream. The purpose for the sediment removal is to increase the capacity of the lake and improve water quality enough for residential consumptive use. The Nevada Irrigation District worked with multiple partners to develop the project including the Tsi-Akim Maidu Tribe. Working together on the project in the planning stages enabled the partners to resolve a common problem — how to find a balance in the protection of sensitive Native American artifacts located on the site (public space) without increasing public attention and risk of damage.

The Calaveras Healthy Impact Product Solutions (CHIPS) project was formed to address the problems associated with the closing of local lumber mills and the resulting loss of jobs in the timber industry and the increasing risk of devastating wildfires. The focus of the CHIPS project is to build on existing skills from within the local communities to increase fire resiliency and utilize the materials removed from the forest. The outcome is an all-embracing improvement to the social, economic, and environmental well-being of the area. This project was community-driven and now has numerous partners and supporters. An important aspect of the project includes working with the Mountain Miwok and California Indian Manpower Consortium to complete fuel treatments in culturally sensitive areas that are otherwise untreatable due to a policy of avoidance, and to use tribal knowledge to inform treatments.

The Sierra Nevada Conservancy's collaboration with the North Fork Mono Tribe on a number of projects and activities under the auspices of the Sustainable Forests and Communities Collaborative (SFCC) have resulted in:

- The Willow Creek Planning Collaborative, which supported the National Environmental Policy Act process in the Sierra National Forest by providing community input to inform and develop the Addendum to the 1995 Willow Creek Landscape Analysis: Community Values, Desired Conditions and Suggested Strategies from the Willow Creek Planning Collaborative Process.
- Forest- and meadow-based field trips based on mutual education between the Forest Service and concerned participants, to support the NEPA process for the Whisky Ridge Project in the Sierra National Forest.
- An upcoming annual SFCC education symposium whose theme this year will be "Promoting Volunteerism in Our Forests."

Box MC-5 Amador, El Dorado, and Tuolumne Ditch Systems

After years of studies, in 2006 the Amador Water Agency committed to replacing its old Amador Canal with a new Amador Transmission Pipeline. The old canal lost 40 to 50 percent of the water along the 23-mile canal through leakage and seepage. It also faced serious water quality degradation along its route and was susceptible to outages and landslides. The agency built an 8-mile pipeline and will eventually abandon the canal. The project has been operational for two years and has met or exceeded its objectives of increased water delivery efficiency, conservation, water quality preservation, and improved reliability.

Similarly, in its 2010 Urban Water Management Plan Update, El Dorado Irrigation District (EID) identified the conversion of earthen, raw water ditches to piped segments as an important component of its plan to reduce its urban water use in accordance with SB X7-7 (the 20x2020 water conversation, legislation of 2009). Piping EID's Main Ditch alone, approximately 3 miles in length, could save as much as 1,300 af of water per year that is currently lost through seepage and evaporation and improve water quality.

On the other hand, the Tuolumne Utilities District has embarked on a Tuolumne County Ditch System Sustainability Study and a Phoenix Lake Restoration Study with support from the Sierra Nevada Conservancy. These studies address the reservoir and ditch systems' role in municipal storage and delivery as well as other beneficial uses such property values, recreation, fire protection, riparian habitat, livable communities, and biological connectivity throughout the county. A historical evaluation of the 13 canals that make up the ditch system determined they are eligible for addition to the National Register of Historic Places. Ensuing studies will focus on wildlife habitat and aquatic and terrestrial species dependency. The study developed a white paper that identifies "loss" as non-consumptive benefits. The project is intended to be a model for other communities facing similar issues.

These examples show the complexities of maintaining, operating, and improving legacy water systems in the Mountain Counties. Each system is unique and presents local agencies with both challenges and opportunities to comply with constantly evolving federal and State legal obligations while balancing the needs and values of their communities.

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