

3. Region Description

3.1 Introduction

This section of the Upper Sacramento, McCloud, and Lower Pit Region (USR) IRWM plan constitutes the region description for that plan. The description provides an introduction to water-related resources, infrastructure, management programs, and many issues concerning water resources in this IRWM region. This is done with the intent of helping to establish the context of issues and community needs, many of which will be addressed in various ways by projects to be proposed by local agencies and concerned property owners and organizations. This region description is not intended to be a comprehensive assessment of those resources and issues. It is acknowledged that many specialized studies have been and will need to be prepared to provide a more complete evaluation of many of the topics introduced in this section.

Drafting of this region description has relied upon a variety of informative documents including watershed assessments and analyses that have been prepared for specific areas within this region. In fact, this region description would do well to incorporate by reference many of the studies that have been prepared. With that point in mind, it is appropriate to begin this region description with recognition and acknowledgement of some of the key assessments that have been prepared for this region.

Following is a list of watershed analyses or basically equivalent “ecosystem analyses” that have been prepared by the Shasta-Trinity National Forest covering areas that are located completely or partially within the USR. Nearly all of these analyses are available on the website maintained by the Shasta-Trinity National Forest (<http://www.fs.usda.gov/main/stnf/landmanagement/planning>). A more complete explanation of the watershed analysis process will be included in this region description:

1. Mount Shasta Watershed Analysis
2. Lower McCloud Watershed Analysis
3. Squaw Valley Creek Watershed Analysis
4. Edson Watershed Analysis
5. Pit Arm Shasta Lake Watershed Analysis
6. Porcupine Watershed Analysis
7. Headwaters Sacramento River Ecosystem Analysis
8. Shasta Lake West Watershed Analysis
9. Squaw Creek Watershed Analysis
10. McCloud Arm Watershed Analysis
11. Bartle Watershed Analysis
12. Shotgun-Slate Watershed Analysis
13. Iron Canyon Watershed Analysis
14. McCloud Flats Ecosystem Analysis
15. Upper Sacramento River (Castle/Soda Creek area – not on website)

The Modoc National Forest also prepared a watershed analysis for the ‘Medicine Lake Highlands’ in 1999 (available as of 11/2013 at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5380154.pdf).

In addition to the watershed analyses that have been prepared by the Forest Service, there are a couple of watershed assessments that have been prepared by non-federal sources. As noted throughout this section of the IRWM plan, this Region Description draws heavily upon information in the *Upper Sacramento River Watershed Assessment and Management Strategy*. The watershed study area was the watershed of the Upper Sacramento River from the headwaters of the river to Shasta Lake Reservoir. The watersheds

of the McCloud and Pit Rivers, which flow into the Sacramento River at the reservoir and are part of the larger Sacramento River Watershed, were not included in the Upper Sacramento River watershed boundary for the purposes of that assessment. However, much of the regional information from that assessment can be applied to describe the character of many resources in the greater region.

That assessment was funded by the State of California through a Proposition 50 grant, via the CALFED Watershed Program. The River Exchange in partnership with California Trout, the U.S. Forest Service, Shasta Valley Resource Conservation District, Western Shasta Resource Conservation District, and the U.S. Fish and Wildlife Service obtained the grant funds. The Department of Water Resources was the state agency responsible for administering the grant funds, and the River Exchange was responsible for managing the project.

Another watershed analysis, the *Lake Siskiyou Watershed Assessment* (2004), was prepared under the direction of the Siskiyou County Planning Department. The area considered as the Lake Siskiyou watershed is generally the watershed of the Upper Sacramento River above Box Canyon Dam in southern Siskiyou County. The area is bounded by Mt. Shasta to the north, Mt. Eddy on the west, Lake Siskiyou on the south/southeast, and the City of Mt. Shasta to the northeast.

The Mount Shasta Springs 2009 Summary Report, published in 2010 by California Trout, reported findings of a study on general water quality and geochemical parameters, recharge area, age, and vulnerability of springs that originate on and below the slopes of Mount Shasta. The study was conducted and evaluated by a collaboration of California Trout, AquaTerra Consulting, the UC Davis Center for Watershed Sciences, and other project partners. The spring waters study was conducted from 2007-2009, and the report was published in 2010. A related vulnerability rating report concerning the springs was published in 2011 as an addendum to the study.

[In addition, the Mount Shasta Bioregional Ecology Center \(MSBEC\) commissioned a 2014 study of the Medicine Lake Highlands by Dr. Robert Curry, Emeritus Professor of geology at UC Santa Cruz and adjunct professor of earth systems science at CSU Monterey Bay. That report, *California's Water Future – Hydrological Risks to the Medicine Lake Volcano Aquifers Associated with Geothermal Development* \(Curry 2014\), describes the importance of the Medicine Lake Highlands to California water supplies.](#)

3.2 Regional and Internal Boundaries

3.2.1 Regional Boundaries and General Description

The Upper Sacramento-McCloud-Pit River IRWM Region, referred to in this document as USR, includes the entire watersheds of the Upper Sacramento River and the McCloud River from the headwaters of these watersheds to where the rivers flow into Shasta Lake Reservoir (see figure 3.1). This planning region also includes the watershed area that flows directly into the Lower Pit River, which is the portion of the Pit River below Lake Britton to the surface of the reservoir; but does not include the watershed above and draining into Lake Britton. The USR also includes the area commonly known as the Medicine Lake Highlands. Surface waters of the Medicine Lake Highlands flow into the USR via the Lower Pit River, and the groundwater resources represent a significant recharge area via springs into Fall River, which is a tributary to the Upper Pit River and, ultimately, to the Lower Pit. The region was identified by the three main watersheds due to their unity as tributaries to Shasta Lake Reservoir, as well as the common challenges and opportunities faced throughout these three watersheds. The Medicine Lake Highlands were identified as an important source water area and spiritual and cultural region for both the USR and the Upper Pit IRWM Plan. It was included in the USR boundaries because of the surface water flow contributions to the McCloud River (ground water flows contribute to Fall River, which is a tributary to the Upper Pit River).

Below Shasta Dam and Keswick Dam, the waters that originated from the USR subsequently contribute in part to the greater Sacramento River.

The USR is located within southern Siskiyou County and northern Shasta County.

3.2.2 Physical Boundaries and Significant Water Resource Features

As noted above, the USR consists of the watersheds of the Upper Sacramento River and the McCloud River, includes the Lower Pit River area, and includes the area known as the Medicine Lake Highlands. Each of these watersheds and subareas, including their physical boundaries and significant water resource features, are described in more detail below.

The Upper Sacramento River Watershed

The watershed for the Upper Sacramento River itself (as a distinct watershed within the USR) is approximately 600 square miles in size. It has a northern boundary that is dominated by Mount Shasta (the highest mountain in California at 14,179 feet), Black Butte, and Mount Eddy, and a southern boundary that terminates at the waters of Shasta Lake Reservoir. On the west the watershed is bounded by the Sacramento/Trinity River watershed divide, which includes the Eddy and Trinity Mountains. To the east, it is separated from the McCloud River watershed by physical features including Everitt Hill, Snowman's Hill, Girard Ridge, Tombstone Mountain, High Mountain, Hanland Peak and O'Brien Mountain.

Many small natural alpine lakes are scattered along the crest of the Upper Sacramento and Trinity River watershed divide, including Castle Lake, Grey Rock Lake, Cliff Lake, Toad Lake, and others.

The most significant reservoir in this watershed is Lake Siskiyou, which lies behind Box Canyon Dam. This reservoir, with a surface area of approximately 430 acres, represents the only impoundment on the Upper Sacramento River between the headwaters and Shasta Lake Reservoir.

The annual monthly mean flow of the Upper Sacramento River at its Delta above Shasta Lake reservoir is 1,198 cfs.

The McCloud River Watershed

The McCloud River watershed covers approximately 800 square miles. The headwaters of the McCloud River include Colby Meadows, from which the river flows approximately 50 miles southwesterly to Shasta Lake Reservoir. However, the McCloud River is also fed by springs along its run, such as McCloud Big Springs with an average discharge of 600 cubic feet per second. The McCloud Basin drains the eastern and northeastern ridges of Mount Shasta, and in the north is bounded by Military Pass (just south of Whaleback Mountain), Ash Creek Butte, Dry Creek Peak, Rainbow Mountain, and Stephens Butte. This watershed is bounded on the west by the ridges that divide it from the Upper Sacramento River watershed, as described above. The eastern boundary includes Buck Mountain, Dead Horse Summit, Bartle Gap, Mushroom Rock, Grizzly Peak, Dutchman Peak, Shoinhorse Mountain, McKenzie Mountain, North Fork Mountain, Signal Butte, Curl Ridge, Salt Creek Mountain, Minnesota Mountain, Town Mountain and Horse Mountain. To the south the McCloud River and the watershed terminate at Shasta Lake Reservoir.

The McCloud reservoir, formed by the impoundment of water behind McCloud Dam, has a surface area of approximately 520 acres, and is the most significant surface water body in the McCloud watershed.

The McCloud River is often described as consisting of the Upper McCloud River above McCloud Dam and the Lower McCloud River below the dam to Shasta Lake Reservoir. As part of the PG&E McCloud-

Pit Hydropower Project (under license from the Federal Energy Regulatory Commission, or FERC), the McCloud River is partially diverted at the McCloud Dam into the Pit River via the McCloud-Iron Canyon diversion tunnel. As much as 90% of water flowing in the Upper McCloud River has been diverted to the Lower Pit River watershed in this manner. Tributaries below the dam, such as Squaw Valley Creek, supply more than three times as much runoff to the Lower McCloud River than is supplied by the Upper McCloud River watershed.

The annual monthly mean flow of the McCloud River above McCloud Reservoir is 919 cfs. The monthly mean of water diverted in the McCloud tunnel to Iron Canyon Reservoir and ultimately to the Pit River is 833 cfs. The McCloud River, as it enters Shasta Lake reservoir (after the diversion, but also after additional tributaries), has an annual monthly mean of 791 cfs.

The Lower Pit River Watershed

To describe the watershed of the Lower Pit River, it must again be noted that the watershed of the Pit River above and including Lake Britton (regarded as the Upper Pit River) is not included in the Upper Sacramento IRWM region. That is, Lake Britton is not included in the Lower Pit River area, nor are the streams and watersheds that flow into Lake Britton or into the Pit River above the lake. To the west and north, the McCloud River watershed described above borders this area. Major boundary features to the east include the dam at Lake Britton, Hatchet Mountain and Hatchet Mountain Pass. It is noted that the Lower Pit River area also includes the watershed of Squaw Creek that flows directly into Shasta Lake Reservoir between the outlet of the Pit River and the McCloud River arm of the lake.

From Lake Britton, the Lower Pit River flows approximately 40 miles to the confluence with Shasta Lake Reservoir. The estimated size of the watershed is 700 square miles. As noted in the description of the McCloud River watershed, a considerable amount of water is diverted from the McCloud River to the Pit River via the McCloud-Iron Canyon diversion tunnel. The most significant surface water body in the Lower Pit River watershed is the Iron Canyon Reservoir, approximately 500 acres in size, which receives water from the McCloud River via the diversion tunnel. It can also be noted that the series of PG&E diversion dams on the Lower Pit River form several reservoirs along the river. These features are described in Section 5, Water-Related Infrastructure.

The Squaw Creek watershed between the McCloud River and the Pit River flows into the Pit River arm of Shasta Lake Reservoir and can be considered part of the Lower Pit River watershed.

The annual monthly mean of the Pit River as it enters the Upper Sac Region at Lake Britton is 2,944 cfs. The Lower Pit River before entering Shasta Lake reservoir, which includes the diversion received from the McCloud River, has an annual monthly mean of 4,847 cfs. As described above, the Lower Pit River includes several diversions of various reaches as part of PG&E's hydroelectric network.

These diversions are returned back into the river after being channeled through powerhouses.

Medicine Lake Highlands

The Medicine Lake Highlands, which is the northeastern-most area of the Upper Sacramento IRWM region, comprise the upper portion of the Medicine Lake Volcano (Donnelly-Nolan, 2008)¹, a broad

¹ This researcher has done the mapping for the USGS and identifies the Medicine Lake Highlands as the area above the 6680-foot elevation of Medicine Lake. However, in other instances the USGS refers to the entire volcano as the Medicine Lake Highlands. It is useful to make this distinction for hydrological purposes, since the higher elevations receive most of the precipitation and snowpack.

shield volcano that covers about 850 square miles and is the largest volcano by volume (approximately 600 cubic km) in the Cascade Range. The volcano stretches some 30 miles east to west and 50 miles north and south. The Medicine Lake Highlands consist of the Medicine Lake Caldera and its surrounding rim of mountains that include Mt. Hoffman, Glass Mountain, Lyons Peak, and Medicine Mountain. The Highlands receive the voluminous snowpack whose waters are a major source of the Fall River Springs, the largest spring system in California. While not recognized as a typical watershed due to the lack of streams, much of the area of the Medicine Lake Highlands is a significant recharge area, via subsurface flows, to springs outside the region including the springs that feed the Fall River. Fall River is a tributary to the Upper Pit River. The area of the Medicine Lake Highlands that is in the USR includes the caldera in which Medicine Lake itself is located, and the south and southwesterly slopes of the highlands to where it abuts the McCloud River watershed. Significant boundary features include Stevens Butte, Pumice Stone Mountain, Glass Mountain, Round Mountain, and Hambone Butte.

Medicine Lake, from which this area derives its name, lies in a caldera near the top of the highlands at an elevation of approximately 6,680 feet. Medicine Lake has a surface area of approximately 430 acres at full pool. Very small lakes in the vicinity include Little Medicine Lake, Bullseye Lake, and Blanche Lake.

3.2.3 Jurisdictional Boundaries

This section identifies the notable jurisdictional boundaries and over-lapping areas in the region (see Figure 3.1, on the next page). Also included in this subsection is a succinct general history of the land management and ownership experiences of the Native American Tribes in the USR. This provides both an important backdrop from which to understand current land management patterns and structure as well as information to better appreciate the perspective from which these tribes contribute.

Upper Sacramento, McCloud, and Lower Pit Watersheds
Integrated Regional Water Management Plan

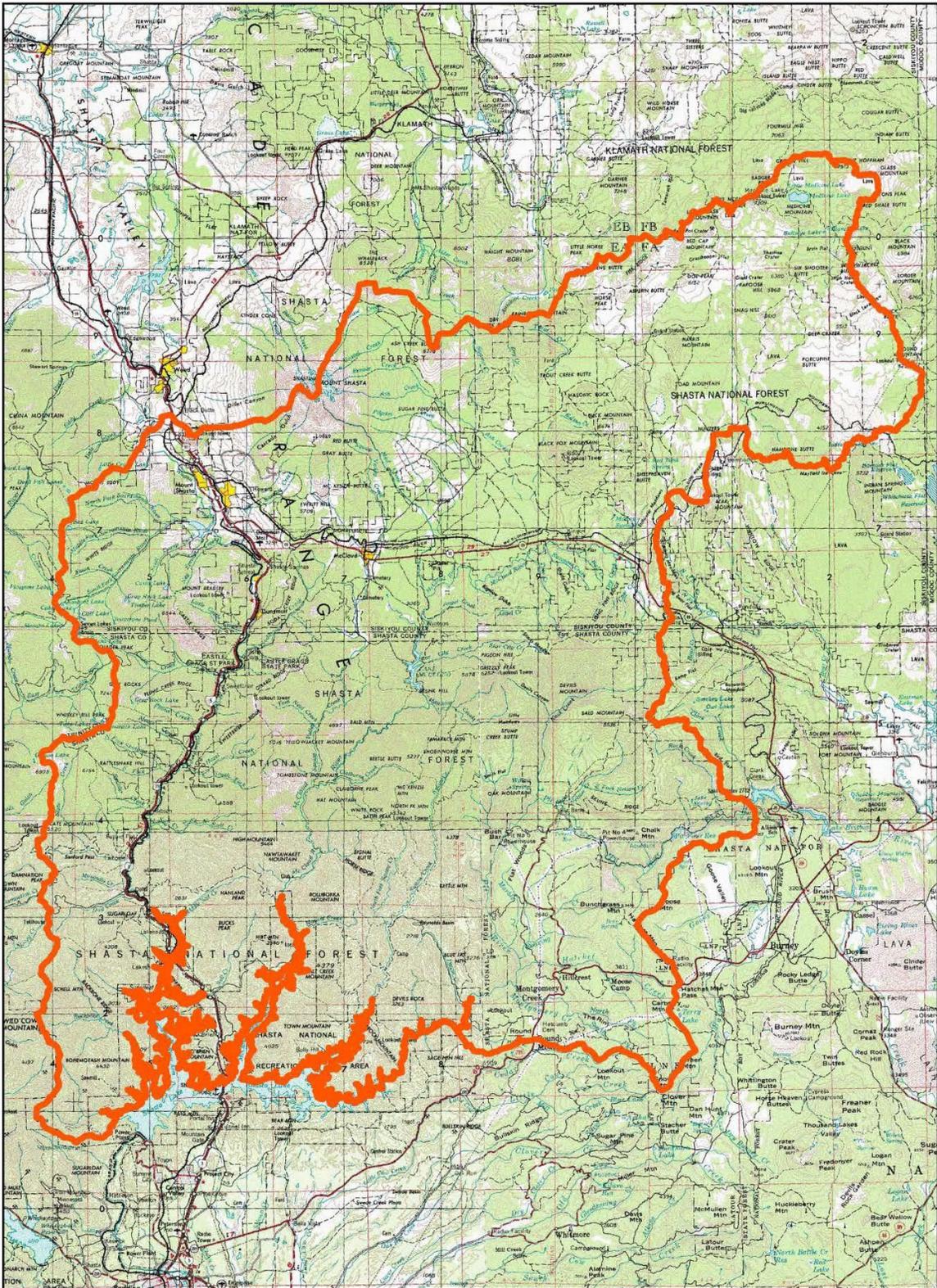


Figure 3.1: Upper Sacramento, McCloud, and Lower Pit Rivers Integrated Regional Water Management Planning Area

3.2.3.1 Aboriginal Experience with Land Ownership and Management

There are four tribes active in the USR IRWM process: the Pit River Tribe, the Winnemum Wintu, the Modoc Nation, and two bands of the Shasta Tribe. The Pit River Tribe is a federally recognized tribe that maintains three rancherias in the region: Big Bend, Montgomery Creek, and Roaring Creek. The Pit River Tribe is comprised of 11 autonomous bands, which are: Atwamsini; Atsugewi; Astarawi; Aporige; Ajumawi; Hewisedawi; Illmawi; Itsatawi; Kosealekte; Hammawi; and Madesi. While not federally recognized, there are three other tribes maintaining historic sovereignty in this region, including the Winnemum Wintu, the Modoc Nation, and the Shasta Tribe, which is represented by two groups: the Shasta Nation and the Shasta Indian Nation.

Pre-history and European Contact:

Native American Tribes are sovereign nations, as they were pre-contact and will be in perpetuity. Historically and to this day within their traditional aboriginal boundaries, they protected, tended, utilized, revered, and named the land and resources. Natural systems continue to be respectfully cared for by many of these tribes, with the recognition of mutual interdependence between people and the environment, and between the physical and the spiritual world.

Americans of European decent entered into the USR in the 1800s and brought with them a social system based on the economic and legal imperative of land ownership.

The opposing worldviews demonstrated by the indigenous people and the European Americans manifested themselves in what historians, anthropologists, and aboriginal peoples of California describe as genocide. Hydrologic modification and commoditization of natural resources greatly impacted California Native Americans historically, and these issues continue to impact the people to this day.

Indigenous Experiences with Land Ownership and Title²:

The history of legal land ownership and title in California begins with the occupation and removal of indigenous peoples from their aboriginal lands. The following laws, legal precedents, and bureaucratic culture that were established after taking control of the land favored the state and the federal governments and European Americans in general. These legal and bureaucratic constructs became the template for natural resource management, which is largely followed to this day.

Initially claimed by Spain, California soon passed into the ownership of Mexico and then the United States in the early and mid-1800s, respectively. With the Treaty of Guadalupe Hidalgo on May 30, 1848, the United States government assumed control of all of present day California along with much of the western U.S. The Treaty also called for the United States to recognize existing land titles and accept all people living in the ceded territory as citizens. William Carey Jones was appointed Confidential Agent of the United States government and was to examine the land titles and determine what rights the native peoples held during the Spanish and Mexican regimes (Robinson 1948 and Starr 2005). Jones' report was clear and direct: it confirmed that the aboriginal peoples did indeed have secure title and right to their lands under the Treaty.

Though the Treaty of Guadalupe Hidalgo had promised continuous ownership of existing land grants, it conflicted with the view held by newly arriving settlers that California should be open to Americans (Robinson 1948). In 1851 Congress passed the first legislation implementing the property protection

² Much of this section is taken from McTavish 2010; references are included so that the reader may find more information

provisions of the Treaty: “An Act to Ascertain and Settle the Private Land Claims in the State of California,” which passed on March 3, 1851, Statute 631. The Act required that existing land titles had to be registered and affirmed by the Land Commission within a five-year period. If a claim was not filed with the Land Commission, the land was considered abandoned. Land from abandoned and rejected claims went back into the public domain to be surveyed and made open to settlement (Robinson 1948 and Sanchez 2003). Very few claims were presented on behalf of the Tribes. Many Spanish and Mexican land grants were not presented either. These public lands were to be later offered to public and private entities as mining claims, homestead claims, grants to the railroads, PG&E, and other utilities, and the National Forest system.

In 1851, President Fillmore appointed three commissioners to conduct treaties with Native American Tribes in California. Between March 19, 1851 and January 7, 1852 at various central meeting places throughout California, they met with 402 tribal heads — representing 139 tribes or bands of aboriginal people, and entered into eighteen treaties (Ellison 1974, Heizer 1972, and Robinson 1948). As described in these treaties, the designated reservations would have added up to 7,488,000 square acres of land, or 7.5 percent of the total area of the state.

The 18 treaties were sent to the United States Senate on June 1, 1852. Most Californians were opposed to having the government sign treaties with the native people. United States citizens in California believed the reservations included valuable land that should be reserved for mining and farming instead of for the tribes. Despite President Fillmore’s recommendation that the treaties be confirmed, Congress ordered them sealed in a secret file, where they remained for 53 years. The injunction of secrecy was not removed until January 18th, 1905 (Goodrich 1925, Heizer 1972, Hoveman 2002, and Sanchez 2003).

Eventually some temporary reservations were set up, some of which were later given permanent status by executive order (Ellison 1974, Theodoratus Cultural Research 1981).

Of the Native American Tribes in the USR, only the Pit River Tribe is federally recognized and has federally-designated land. The other three tribes are not recognized by the United States government and continue to wait for the federal treaties, as well as many following agreements and contracts, to be ratified.

3.2.3.2 Internal Jurisdictional Boundaries

The USR is located within southern Siskiyou County and northern Shasta County. Two incorporated cities in Siskiyou County are located less than seven miles apart within the region. The City of Dunsmuir is located along the banks of the Upper Sacramento River, and the City of Mt. Shasta is located just to the north. Both cities are located along Interstate 5 and the Union Pacific Railroad. The McCloud Community Services District (CSD) serves the unincorporated community of McCloud in Siskiyou County, located off of State Highway 89.

Siskiyou County maintains a countywide Flood Control and Water Conservation District. Siskiyou County also owns and manages water resource and flood management facilities in the region, including Box Canyon Dam and Lake Siskiyou on the Upper Sacramento River.

The Shasta County Water Agency was established in 1957 to develop water resources for the beneficial use of the people of Shasta County. The Water Agency’s governing body is the Shasta County Board of Supervisors. Shasta County also maintains three county service areas (CSAs) in the region, including: Sugarloaf (CSA No. 2); Castella (CSA No. 3); and Crag View (CSA No. 23). All three of these CSAs are located in the Upper Sacramento River watershed portion of the region.

Approximately half of the land in the region consists of federal land managed by the U.S. Forest Service. This land is mostly within the Shasta-Trinity National Forest with a small area in the northeast corner of the region near Medicine Lake that is managed by the Modoc National Forest. Land managed by the Forest Service includes the Castle Crags Wilderness (10,500 acres) and a large part of the Mt. Shasta Wilderness (30,200 acres, not all of which are in the planning region). In the vicinity of Shasta Lake Reservoir, much of the federal land is managed as the Shasta Unit of the Whiskeytown-Shasta-Trinity National Recreation Area. The Bureau of Land Management also has some management areas within this IRWM region.

State lands within this region include Castle Crags State Park, which is 4,350 acres in size, and several tracts of land acquired by the California Department of Fish and Wildlife along the Upper Sacramento River in the aftermath of the Cantara Loop spill in 1991.

The majority of the remaining land in the region is privately owned, including land owned or otherwise managed by private corporations including Roseburg Resources Company, Sierra Pacific Industries, Hancock Timber Resource Group, Campbell Group, Union Pacific Railroad, the Hearst Corporation, Pacific PG&E, and Westlands Water District (which owns land but does not provide water services within the region). Several non-corporate entities own and manage large tracts of land in the region, including The Nature Conservancy.

The entire Upper Sacramento IRWM region is located within the jurisdiction of the Central Valley Regional Water Quality Control Board, which is Region 5 of the State Water Resources Control Board. The Central Valley RWQCB office is located in Redding, California.

3.2.4 Neighboring IRWM Regions

Adjacent to the north and west of the USR is the North Coast IRWM Region, which includes the watersheds of the Klamath and Trinity Rivers, among others. Adjacent to the east of the USR is the Upper Pit IRWM Region. The Upper Pit River watershed is divided from the Lower Pit River at the Lake Britton dam. The Upper Sacramento River flows into Shasta Lake Reservoir, which flows via Shasta Dam to Keswick Reservoir. At that point the river is within the Northern Sacramento Valley IRWM Region, the adjacent IRWM region to the south of the USR. There are no overlapping boundaries for the USR.

Staff working with the USR Regional Water Management Group (RWAG) has consulted with representatives from the three adjoining regions on common issues and coordination is good. No joint inter-regional projects have been proposed as of this writing, though similar issues have been identified, such as the need for investment in source water areas.

The interregional ties of stakeholders in the USR are strengthened by the organizations and entities whose property, ancestral lands, and/or area of interest extends into other regions. For example, the Pit River Tribe is split into three different IRWM planning regions, California Trout is active throughout much of the headwaters in California, and participating counties usually are split between at least two, if not more, IRWM regions.

3.3 Communities and Land Use

3.3.1 Communities

Communities in this region range in size and character from: the two incorporated cities, Dunsmuir and Mt. Shasta; small unincorporated towns such as McCloud and Lakehead; communities that are very small and “village-like” having some combination of homes, post office, a store or two, and/or an elementary school (e.g., Castella, Montgomery Creek, Big Bend); and sparsely populated rural residential areas

which, although extremely small in size or dispersed in development, have specific place names. In addition to these communities, there are many privately owned residential parcels located in isolated parts of the region. These also include independently owned Native American allotments.

The region historically contained many small communities and towns built in support of mines, lumber mills, transportation hubs, and recreational locales. These communities often contained little more than a few cabins for housing located near the main economic focus of the area, be it a sawmill, railroad yard, stage stop, or mine.

Following is a list of the more distinct communities in the IRWM Plan region. Additional information, such as population, is provided for some of these communities in the Demographic section of this Region Description.

<i>Shasta County</i>	<i>Siskiyou County</i>
Big Bend	City of Dunsmuir (incorporated)
Castella	City of Mt. Shasta (incorporated)
Crag View	McCloud
Delta	Bartle
Gibson	
Lakehead	
Montgomery Creek	
O'Brien	
Pollard Flat	
Sugarloaf (Shasta Lake Subdivision)	
Vollmers	

Three Rancherias are managed by the Pit River Tribe in this IRWM region, all in Shasta County. These consist of the Big Bend Rancheria, the Montgomery Creek Rancheria, and the Roaring Creek Rancheria.

It is also noted that there is a small community of cabins and homes, mainly for summer use, at the south end of Medicine Lake. In addition, the Mount Shasta Forest Community is located west of Pilgrim Creek Road, an access point to Medicine Lake; a number of homes there are inhabited year-round.

3.3.2 Land Use

3.3.2.1 Transportation

Before discussing particular community and resource-based land uses in the region, it is first appropriate to acknowledge transportation facilities in the region as both a type of land use and as influential factors concerning other land uses.

Truck and Auto Travel

Interstate 5, which was developed with mostly four traffic lanes as an upgrade to the old two-lane Highway 99, is the primary interstate highway running north-south through California. In addition to its function as a major transportation corridor, Interstate 5 provides opportunities for people living and/or doing business in the region to commute to or otherwise access or ship products to urban areas outside the region, such as the Redding metropolitan area to the south and the Ashland/Medford area to the north. Two state highways, State Routes 89 and 299, pass through portions of the region and connect to Interstate 5. There are also a number of county roads as well as forest service roads that provide access to areas within the region, including some of the more remote locations.

Railway Travel

The Union Pacific Railroad is also a significant transportation feature, particularly along the Upper Sacramento River. The railroad generally runs parallel to both Interstate 5 and the river, and both the railroad and the highway cross the river at various locations within the region. The founding and development of the City of Dunsmuir was largely due to the community's relation with the railroad industry, the servicing of trains traveling through the Upper Sacramento River canyon, and as a resort area promoted, in part, by the Southern Pacific Railroad.

The McCloud Railway has also operated a short line railroad that was developed years ago by the McCloud River Railroad between the Union Pacific tracks (formerly Southern Pacific) in the City of Mt. Shasta to McCloud and eastward to Burney, where it connected to the Burlington Northern Railway lines. A dinner excursion train was operated on the McCloud-Mt. Shasta portion of this line for several years. It was proposed that portions of the line east of McCloud were abandoned.

However, a coalition of nonprofit organizations including Shasta Land Trust, McCloud Local First Network, Save Burney Falls, and the Volcanic Legacy Community Partnership is leading efforts to establish an 80-mile-long public recreation trail on the alignment under rail banking provisions of the National Trails System Act. The trail project has been named the Great Shasta Rail Trail.

Cultural and Environmental Effects of Transportation Corridors and Travel

While these transportation options offer USR inhabitants excellent economic, social, and recreational opportunities, they have also degraded the environment and have had an inarguable effect on indigenous — and even modern — cultures and land use. The actions were devastating to indigenous cultures (McTavish 2010).

The land grants made to the railroad determined ownership of much of the land in California's upper watersheds, setting the template for land use today. In the United States as a whole, 9.5% of the public domain was patented to railroads (Robinson 1948). In California alone, between 1850 and 1880 over 16 million acres were patented to different railroad companies, and by 1880, railroads possessed 16% of the land in California (Sanchez 2003; Short 2001; and White 1983).

The Railroad Act of July 25, 1866, authorized construction of a railroad and telegraph line through the Sacramento and Shasta valleys to Portland. With a 400-foot-wide right-of-way, plus patents for 20 alternate sections per mile, the railroad was granted up to 12,800-acres-per-mile of completed line.

The United States extinguished the Native American Tribes' titles that conflicted with railroad titles, plunging many families and whole tribes into poverty, with no opportunity for self-sufficiency. The government did not extinguish homestead or mineral claims (Robinson 1948).

The arrival of the railroad affected sites of indigenous cultural value, destroying transportation corridors, sacred sites, and historic villages. For example, an 1876 map shows Dog Creek as a major salmon gathering site for the Wintu; building the railroad destroyed this site (Hoveman 2002).

Building the railroad fouled the water so badly that, in 1883, salmon egg production was reduced to the point that the run was almost non-existent for several years.

With the intensity of use of the Interstate 5 and railroad transportation corridor, especially along the Upper Sacramento River, the waters of the region are susceptible to contamination from accidents involving the transport of hazardous materials. For example, on July 14, 1991, just upstream from the city of Dunsmuir, a train derailed along a section of track known as the Cantara Loop. A chemical tank car containing the herbicide metam sodium fell into the Sacramento River and released 19,000 gallons of the

chemical into the river. As the metam sodium mixed with the water, highly toxic compounds were created. Aquatic life in the Sacramento River between the Cantara Loop and Shasta Lake Reservoir was destroyed. As a result of a lawsuit filed against Southern Pacific, the Cantara Trustee Council (CTC) was established to address the effects of the spill on the upper Sacramento River. Fortunately, the health of the river was restored in the following years.

3.3.2.2 Community Land Uses

In recognizing the communities within the region, we can also describe in this context the major land uses that are components of established communities. This includes residential, commercial, industrial, and other land uses that exist in relation to larger communities. The cities of Dunsmuir and Mt. Shasta and the towns of McCloud and Lakehead are the primary population and service centers within the region. Within and adjacent to these communities are not only the most intense residential development and land use in the region, but also the principle commercial areas. Cities, being incorporated communities, have specific boundaries (i.e., city limits) with related service areas for municipal infrastructure. In the case of McCloud, which is not an incorporated city, the McCloud Community Service District (CSD) still has specific district and service area boundaries that function much like city limits.

In some cases, as in areas around the City of Mt. Shasta, residential and other community development has evolved near and sometimes adjacent to the city limits and district service areas. For example, west of the City of Mt. Shasta is the Mount Shasta Golf Course and Resort, as well as substantial residential development. Other areas east of and around the city on unincorporated land also have substantial amounts of development. With special agreements, municipal services may be extended outside the city limits to provide water or wastewater services to neighboring development. In the case of Mt. Shasta, the wastewater treatment plant is designated as a regional facility in that it was intended to serve development both within the city and in specific nearby areas outside the city limits.

Aside from areas that are provided with some form of community services, land use in areas outside cities and service districts in the region is mostly served by individual septic tanks and wells and is served by county services or by special districts (e.g., county sheriff, fire protection district). As discussed in this Region Description under water-related infrastructure, there are several special districts, county service areas (CSAs), and private utility companies that provide water or waste water service to specific communities. Again, using the area west of the City of Mt. Shasta as an example, the Lake Siskiyou Mutual Water Company provides water service to an area, mostly residential in land use, which is connected to the regional wastewater treatment plant operated by the city. A mutual water company also supports community land uses in Lakehead and Shasta County maintains three CSAs with water service for small, primarily residential communities including Castella, Crag View, and the Sugarloaf area near Lakehead.

Industrial and manufacturing uses may occur within or outside communities. For example, the water bottling plant that was developed originally by Dannon near the City of Mt. Shasta is actually located outside the city limits, although the plant has had agreements for limited services (e.g., wastewater) from the city. Also, the old mill site in McCloud has never been annexed into the district boundaries of the community services district.

As noted above, there are several small communities that are primarily residential in character, although they may also have one or two commercial uses such as small stores or gas stations, and/or community facilities such as a post office, school or firehouse. With different degrees of development and mixture of land use, communities such as Bartle, Big Bend, Montgomery Creek and Pollard Flat can be included in this category. There are also three Rancherias in the Big Bend/Montgomery Creek area that provide

residential land use under the management of the Pit River Tribe, which has offices outside the region in Burney.

Residential land use, sometimes with home occupations, is also dispersed in much of the region in areas that may or may have particular place names. For example, homes in varying densities may be found in such areas as along Squaw Valley Road south of McCloud, along Gibson Road and Gilman Road from Interstate 5, and in other various locations in both Shasta and Siskiyou counties.

3.3.2.3 Forestry Land Uses

On the basis of land area, forest management and timber production by private companies or on National Forest lands is a predominant land use. Major timber companies with land holdings and/or resource management roles in the area include Sierra Pacific Industries, Hearst Forest, Roseburg Resources Company, Campbell Timberland Management, and Hancock National Resources Group.

As the mining industry grew in the mid-1800s, large amounts of lumber were required to build and maintain infrastructure for mining operations. Milled lumber was used for housing, water flumes, support structures, and other constructs, and fuel wood was necessary to keep steam-powered equipment running. This spurred the development of the timber industry in the 19th century, which has remained an integral part of regional land use. By the 1890s, mines and communities of various sizes dotted the region, primarily in its southern and northern ends. It was around this time that a number of lumber mills began operating in the watershed near the present-day communities of Castella and Lamoine. This coincides with the advent of railway access between Redding and the Mount Shasta area via the Sacramento River canyon in 1887. The presence of the railroad allowed for easier transport of logs and wood products out of the area, thereby encouraging some lumber companies to expand their timber harvest operations further into the watershed. By 1896, the railroad had opened up large areas in the region to timber harvest. By the late 1870s, logging had become a major industry in the region. The timber industry has continued in varying degrees to be a significant land use and economic catalyst in the region. McCloud Flats, east of the town of McCloud, is an example of a particularly valuable timber production area in this region.

As an aside, the community of McCloud itself is noted as having originated as a lumber company town in 1897 with the formation of the McCloud River Lumber Company, which was supported by the development of the related McCloud River Railroad Company. The lumber company owned, developed, and maintained the town as company property. In 1963, U.S. Plywood Company (which soon thereafter merged with Champion International Corporation) purchased the mill, railroad and the town and began the process of dividing off and selling homes and other property. The McCloud Community Services District was formed to manage the utilities that were once operated by the McCloud River Lumber Company. In 1980, P&M Cedar Products, Inc. (which later became California Cedar Products) bought and reopened portions of the mill. This mill closed in 2002, bringing an end to industrial land use on that site in McCloud. The City of Mt. Shasta also once had large mills adjacent to the city.

Although the Shasta and the Trinity National Forests had been established as forest reserves in 1905, the Shasta-Trinity National Forest, as a unit, was not established until 1954. The years following World War II mark a turning point in the federal government's management of forestlands in northwestern California. Increased demand for lumber and dwindling timber supplies on private lands made logging on federal lands more economically attractive. Technological advances such as lighter weight chainsaws and yarding systems and construction of an extensive network of forest roads made logging possible in areas that were once considered unprofitable or inaccessible.

The importance of, and continuing support for, the timber industry is acknowledged in the general plans of both Shasta County and Siskiyou County. The Shasta County Timberlands Element (Section 6.2) in the

County's General Plan is a combination of planning requirements from the mandated land use, conservation, and open space general plan elements. The Timberlands Element notes:

Land dedicated to commercial forest management provides not only building materials, energy for industrial processes, firewood, County revenue for roads and schools, and employment opportunities, but also wildlife habitat, recreational opportunities, aesthetic enjoyment, and watershed. Maintaining timber operations and preservation of valuable timberlands are important to the economic base and the natural resource values of Shasta County. The Timberlands Element, therefore, relates present and future uses of timberlands to the natural resource, economic, and community development plans for Shasta County. (Shasta County 2004)

Shasta County's General Plan recognizes timberland as one of the county's most valuable resources. The General Plan notes that, of the County's total area, 50.7% is dedicated to commercial forest uses. In 2002, 613,495 acres of non-federally-owned timberlands were designated in timber production zones (TPZs) pursuant to section 6.2.02 of California's Forest Taxation Reform Act of 1976. These lands represented nearly half of all County timberlands and approximately 87% of privately owned timberlands.

Much of the private timberland in the region is within a form of timber production zone pursuant to county zoning. In Shasta County, the Timber Production (TP) district is defined in the Chapter 17.08 of the Shasta County Zoning Code. The purpose of the TP zoning district is to preserve lands devoted to and used for growing and harvesting timber and to provide for uses compatible with the growing and harvesting of timber. The TP district is equivalent to the timberland production zone (TPZ) referred to in the California Timberland Productivity Act of 1982. Land within a TP district is subject to all conditions and restrictions applicable to a TPZ under the act.

In Siskiyou County, the general plan as well as on-going policy developed by the Board of Supervisors supports timber production as an important and significant land use and economic engine. A substantial amount of private timberland in the region is zoned TPZ to encourage the production of timber. The TPZ district focuses the uses of timberland to the production of timber products with compatible uses consistent with the requirements of the Forest Taxation Reform Act of 1976. The TPZ district is directed to those areas dedicated to the growing, conserving and production of timber in areas of sufficient size to be economically feasible. The TPZ district is designated to protect such areas from intrusion by incompatible uses.

Even with the economic and cultural importance of the timber industry in the USR, many communities, private landowners, non-profit organizations, and California Indian Tribes continue to express their concerns regarding commercial timber industry practices and their impact on cultural and environmental resources, wildlife habitat, water quality, species biodiversity, and old growth habitat and dependent species. The practice of clear-cutting is particular problematic for many individuals and organizations who see it as having a negative impact on watershed and cultural resources. This will be an ongoing challenge for the USR and participating stakeholders: to balance the environmental, aesthetic, and cultural needs of regional stakeholders and resources while maintaining this cornerstone economic industry within the region.

3.3.2.4 Recreation

Recreation is another important land use category in this region. Recreational activities encompass a variety of winter and summer sports, including mountaineering, skiing, hiking, camping, fishing, hunting, boating, golf, pleasure driving and other outdoor activities.

The area has a rich history of recreation and related tourism. The rivers, lakes, and mountainous terrain create venues and opportunities for outdoor recreation, featuring such activities as camping, hiking, fishing, hunting, and boating. The beauty of the area, mineral springs, and recreational opportunities in this area have been promoted by both private and public organizations since the late 19th century. In addition to the many publicly owned recreation facilities, there are many privately owned facilities including boat ramps, boat rentals, RV parks, and campgrounds.

In the 1880s, the developing railroad was extended north into what is now the Upper Sacramento IRWM region and this link soon created and supported a tourism industry by making the area more accessible to people from cities and faraway places. More and more residents from the San Francisco Bay Area and Sacramento would take the train to enjoy the sights and recreation opportunities of the Sacramento River canyon and surrounding region. To accommodate these travelers, innkeepers constructed larger and more elaborate resorts to replace the smaller, more rudimentary facilities. The Southern Pacific Railroad played an important role in promoting the resorts and the beauty of the area. The company published brochures and offered excursion rates throughout the area.

Water sports became increasingly popular in this area with the creation of Shasta Lake Reservoir, which continues to be one of the most visited recreation destinations in the area. (The Lake Shasta National Recreation Area is described below.) Today people enjoy boating, house-boating, and waterskiing, in addition to fishing and camping at the reservoir. In 1968, Lake Siskiyou reservoir was created by the construction of Box Canyon Dam. This reservoir is unique in that the primary purpose for which it was created was for recreation and fisheries enhancement, although flood protection and hydroelectric production are also important functions. Like Shasta, Lake Siskiyou continues to be a popular recreation destination. Boat launches, campsites, RV parks, hiking trails, and a golf course were all constructed in the immediate vicinity of Lake Siskiyou. Lake McCloud reservoir is another popular recreation resource for boating and fishing.

In addition to general fishing opportunities, the three rivers and some of the major creeks in the region are renowned as fly-fishing waters. The Upper Sacramento River has nearly 40 miles available for fishing and is noted for its Shasta Rainbow Trout. The Lower Pit River below Lake Britton runs for approximately 30 miles with boulder pocket water and pools, divided into three separate reaches by dams and powerhouses. The McCloud River is famous with anglers for its special resources. The Nature Conservancy operates a reserve with over two miles of trails accessing the Lower McCloud but limits the number of anglers per day. The McCloud River opens to fishing on the last Saturday in April and remains open through November 15. The Lower McCloud is controlled by dam releases from McCloud Reservoir, which generally maintains consistent flows throughout the season.

Private land use along the McCloud River includes private clubs such as the McCloud River Club. This club was established as a private fishing club in 1904 and owns land along approximately seven miles of the river.

Interest in preserving the natural beauty and areas where outdoor recreation could be enjoyed has been an important objective in the region. In 1928, voters in California approved bond money to begin buying lands for the creation of state parks. The newly established State Parks Commission completed a statewide survey for potential state park lands, and Castle Crags was considered for acquisition. The Castle Crags Wilderness Association, created in 1930, raised money needed to purchase Castle Crags and assist the state in establishing the park. In 1933, the State Park Commission authorized the purchase of 925 acres to establish Castle Crags Wilderness State Park. The California State Parks agency manages Castle Crags State Park, which includes 4,350 acres of land. This land is protected from development and is managed for resource preservation and non-motorized outdoor recreation. The park features 76 campsites, 28 miles of hiking trails, as well as fishing and swimming areas.

Related to recreation and tourism is the unique geological attraction known as the Lake Shasta Caverns, which features a network of limestone caverns and calcite formations. The caverns are located on the east side of the McCloud arm of Shasta Lake Reservoir and are only accessible by boat and, for most visitors, by a bus ride up the steep access road. A small related office and commercial visitor center has been developed near the Holiday Harbor Marina on the west side of the lake crossing.

A concern that has been expressed by some owners of private forested land in the region is that recreationalists may not appreciate, and end up disregarding, the fact that much of the forest is not public land. Similarly, tribes in the region have stated a variety of challenges associated with aboriginal lands now managed by the federal government in the public interest; these lands often host a number of sites of great cultural and/or spiritual value, and these values are seldom shared and often not respected by those visitors not sharing those values. It is assumed by many people in the public that, since much of the forested land in this area is within a National Forest, all forested lands are available for public recreation use of all types. Such disregard and, at times, outright trespass has resulted in misuse of and damage to private property and important cultural sites. [Increasing application of publicly-funded conservation easements has created concern among some RWAG members regarding recreation access to those lands.](#)

3.3.2.5 Mining

While mining played an important role in the development of the area and will be discussed in more detail below, it currently has a minimal presence as an active land use in the region. The history of mining will be briefly described below, in part because of the relation of historic mining to on-going water quality issues. The Upper Sacramento River Watershed Assessment, from which much of the following information was extracted, provides a good overview of the evolution of mining in the area.

Historically, mineral exploration and subsequent mining operations were conducted throughout the Upper Sacramento River watershed and the USR. Mining activities began upon the arrival of the Euro-American settlers during the California Gold Rush (circa 1850) and were typically small- to medium-scale operations. Gold mining activities in the watershed were sporadic and ended shortly after they began. Despite the small scale and short time period, the mining activity dislocated and destroyed indigenous people and tribes, as well as negatively affected the habitat and environment in watersheds where mining occurred. The environmental effects from these activities are persistent in terms of water quality and river geomorphology and have negatively affected the capacity of USR watersheds to provide cool, clean water of amounts historically provided.

In general, the easily accessible gold was taken quickly from riverbeds and exposed bedrock. The gold that remained was more difficult and costlier to access and produce. The more ecologically destructive methods of mining — namely hydraulic mining — were stopped by a court case in 1884³. It is worth noting that a significant portion of the gold extracted from the watershed was later mined primarily from 1880 through 1920 as a byproduct of copper processing operations.

Mining activity went through boom and bust periods as the focus shifted to other minerals, including copper, chromite, zinc, silver, limestone, and asbestos, which were mined extensively during the turn of the century era (circa 1890 – 1920). The bulk of the mining activity in the watershed subsided by 1920. Activity picked up during the Great Depression and again during World War II, but the mining era that

³ Farmers sued a hydraulic mining operation in the landmark case of *Edwards Woodruff v. North Bloomfield Mining and Gravel Company* made its way to the United States District Court in San Francisco where Judge Lorenzo Sawyer decided in favor of the farmers in 1884, declaring that hydraulic mining was “a public and private nuisance” and enjoining its operation in areas tributary to navigable streams and rivers.

defined the area was over. In the late 1890s to 1920s, copper and chromite replaced gold as the primary minerals produced in the area. The copper extraction and processing occurred in and around the area that is now the Sacramento arm of Shasta Lake Reservoir. Most of the chromite mining took place on the west side of the Sacramento River between Pollard Flat and Castella.

Copper was discovered in the area in the 1850s and was mined at Copper City (which is now under the reservoir) in 1862. At that time, the copper was found in small quantities by miners who were exploring underground for gold and silver. Where previously there had been several attempts to mine for gold and silver, a copper industry quickly developed. Instead of shipping the ore out of town for processing, the mining companies built and operated large copper smelting plants in the mountains. The copper ore also contained valuable deposits of gold and silver. Even though the amount of gold and silver was not large compared to the amount of copper, the profit from these metals was significant.

The first copper smelter in this area was built south of the IRWM Plan region in Keswick. The area in and adjacent to the region became home to numerous large smelters. The Iron Mountain District, which covered areas in and around the Sacramento arm of Shasta Lake Reservoir, eventually became the most important copper district in Shasta County. Copper production in the area was effectively ended by a court order in 1919 mandating the closure of smelting plants, which were producing toxic fumes detrimental to livestock and crops. Extensive damage to the watershed occurred as a direct result of these toxic fumes. The smelter fumes killed much of the vegetation around what is now Shasta Lake Reservoir, and the loss of vegetation caused large scale erosion and gulying, particularly in the western tributaries to Shasta Lake.

Another example of copper mining and smelting in the region was the Bully Hill Mine. The Bully Hill Copper Mining & Smelter Company built a huge smelter on the banks of Squaw Creek in 1901. In addition to processing ore from the Bully Hill Mine, copper ore from the Afterthought Mine at Ingot was transported by way of an 8.5-mile-long aerial tramway to the Bully Hill smelter. The mine and smelter closed in 1910 because of a decreasing copper supply and litigation over the poisonous fumes released from the chimney of the smelter.

Local mining of chromite was limited. The decline of the copper and chromite industries in California occurred shortly after World War I, but these minerals were mined sporadically during the Great Depression and World War II. Another mineral sometimes mined in conjunction with chromite was olivine. The Lucky Strike Mine near Castella produced both minerals.

Asbestos was another mineral that was discovered in large quantities throughout the watershed. Several asbestos claims were developed during the early 1900s near Castella and Mears Creek. The Trinity Asbestos Mining Company was responsible for planning the road between Castella and Carville, which is located to the east in the Trinity River watershed.

Although not a mineral, sand and gravel have been extracted from local rivers and their tributaries for many uses throughout the years. For example, the river rock from Sims was mined by the state for several years and was used to build Highway 99. The river rock from this source was sufficient to meet strict engineering properties required for freeway construction.

Existing mining activity in the watershed is limited to few permitted commercial operations and small-scale recreational gold mining. For example, the Spring Hill Mine, owned by Sousa Ready Mix, is located in the City of Mt. Shasta. This aggregate operation is located on private land in the Spring Hill area adjacent to Interstate 5. Stone and cinder are excavated and used for aggregate and concrete production. Another example is an underground gold mine that is permitted to operate on the Shasta-Trinity National Forest near Pollard Flat, adjacent to the Sacramento River. This tunnel claim is worked intermittently.

Despite the spotty nature of the mineral resources remaining in the watershed, mining claims cover the majority of the Sacramento River and its tributaries, including several claims above Lake Siskiyou. In recent years, speculators claimed much of the river and sold the claims to hobby miners via the Internet. These claims were intermittently worked with suction dredges in the summer months until a court order required CDFW to suspend all suction dredge-mining permits in 2009. The moratorium on instream dredge mining is in effect until CDFW completes environmental review of the permitting program and updates applicable regulations accordingly.

The historic Balakala, Keystone, and Mammoth Complex mines of the West Shasta Copper-Zinc Mining District and the Bully Hill Mine of the East Shasta Copper-Zinc Mining District are undergoing active remediation.

3.3.2.6 Agriculture

Agriculture and ranching occupy much of the valley and foothill areas of Siskiyou and Shasta counties; however, these activities are limited in this IRWM Plan region because of the steep mountainous terrain. Agricultural and grazing activities have been limited and scattered.

Various ranch and farming operations sprang up to support early mining activity. As gold mining diminished, many prospectors turned to small-scale ranching and timber operations. Nineteenth century land grants drew more settlers to the area. Between 1899 and 1920, several families and individuals homesteaded the valley that later was turned into the Iron Canyon reservoir.

For example, a ranch operation was recorded near Pollard Flat. Historic records note how the Baker Ranch, located west of Pollard Flat, used a ditch originally constructed for hydraulic mining to serve as irrigation for cattle. Cattle grazing was also prevalent at this time on the grasslands west of the present-day City of Mt. Shasta. The conversion of mining ditches to agricultural ditches was a common transition in these areas. By the early 1900s, the area around Mount Shasta hosted many small farms and orchards. Apple, cherry, plum, and pear trees were planted throughout the Mount Shasta area as early as 1887. Historic records note that the young orchards and vegetable patches would thrive without much rain. This was because the area had plentiful water, including several wet and dry meadows. As a result, there was moisture enough in some areas to grow fruits and vegetables without irrigation. Areas with wet meadows were partially drained to irrigate dry meadow gardens and orchards. Produce, orchards, and animals were also raised south and west of the city and in the Dunsmuir area, as well as in the vicinity of McCloud.

While agricultural and ranching practices of the early settlers contributed to the current conditions of local watersheds, much of the land that was used for such purposes was later abandoned or developed for other purposes. Agricultural and ranching practices along the old Highway 99 soon gave way to forestlands or housing developments once Interstate 5 was constructed. Farms and ranches around Castella, Dunsmuir, and Mt. Shasta began to disappear in conjunction with the construction of Highway 99 and later Interstate 5. In the modern era, vehicular traffic grew, refrigeration and packaged foods became more prevalent, and most small family farms and garden plots that once served the area gave way to residential and other forms of development.

3.3.2.7 Power Development

The topography of the area lent itself to the development of hydroelectric power facilities beginning in the last decade of the nineteenth century. The first recorded use of hydroelectric power in Shasta County occurred at the Gladstone Mine in 1894. The Northern California Power Company, which had originally been established as the Keswick Electric Company to supply power to the Keswick Smelter, took over electrical operations of the Gladstone Mine sometime around 1900. PG&E purchased the water rights of

the Mount Shasta Power Company in 1917 and in 1919 purchased the Northern California Power Company. The construction of the Pit River hydroelectric facilities spanned from 1921 to 1966 and has been said by PG&E to be the single largest construction project in PG&E's history. More discussion of PG&E's hydroelectric system involving the McCloud River and the Lower Pit River is included in Section 3.5, Water Supply and Demand.

The Hatchet Ridge Wind Project, developed by Renewable Energy Systems on private land owned by Sierra Pacific Industries and the Fruit Growers Supply Company, has been developed along the southeastern boundaries of this region approximately six miles east of Burney. The total project consists of 44 wind energy turbines on 77 acres with a total generating capacity of approximately 100 megawatts. While this project was and continues to be controversial among some stakeholder groups, it does represent part of the region's potential for renewable energy production⁴.

The power production generated in the USR is largely hydropower. Thus, these activities contribute greatly towards California's AB 32 goals for renewable power generation. However, these developments came with an environmental price in terms of blocking anadromous fish passage, disrupting a natural sediment regime, and decimating indigenous populations and cultures through land acquisition and the destruction of food sources. While stakeholders remain interested in pursuing renewable power sources, the qualifications today of a power project likely will look much different than they did in the mid-1900s. These projects, when discussed, often include land already affected by development or infrastructure, or even power production in current water transmission lines. The planning of these projects will usually include all affected stakeholders rather than only those benefiting from the production of power.

Information on in-region interest in geothermal energy development can be found in this document in Section 7.4 Geothermal Waters.

3.3.2.8 Federal Land Management

Recognizing that a large portion of land in this IRWM Plan region is federal land managed by US Forest Services, the following section provides an overview of related land use and resource planning and management for federal lands. Most of this discussion is focused on lands managed by the Shasta- Trinity National Forest, but it is noted that the Modoc National Forest manages a small portion of the region in the vicinity of Medicine Lake.

The National Forest Management Act (NFMA) of 1976 was formulated to balance interests in providing a steady supply of harvestable timber with interests focused on other public uses, including recreation, and a stronger emphasis on conservation. Under the NFMA, the USFS must develop Land and Resource Management Plans, or LRMPs in cooperation with state, local, and federal agencies, tribal governments, and the public to guide the management of forests within its jurisdiction. The plans divide each forest into management areas and outline how the forest will be managed over a 10- to 15-year period. NFMA prohibits harvesting under LRMPs where harvesting may cause extensive or irreparable harm to resources, biological diversity, or watersheds. The act also restricts the use of clear cutting (frequently referred to as "green-tree retention" in USFS terminology) and limits the volume of trees that can be removed to the number that can be harvested annually on a sustained- yield basis. LRMPs must also be

⁴ Project concerns include: energy transport out of the region and lack of benefit to local communities; impact of this project on the viewshed; impact to migrating bird species (such as endangered Bald Eagles); the position of the installation along the Pacific Flyway, and; the potential negative impacts of low frequency emittance on human health.

consistent with the Multiple-Use Sustained-Yield Act and be compliant with the National Environmental Policy Act. The Shasta-Trinity National Forest completed its LRMP, or Forest Plan, in 1995.

Another fundamental federal land management document, the Northwest Forest Plan (NWFP), adopted in 1994, consists of a series of federal policies and guidelines governing land use on federal lands in the Pacific Northwest region of the United States. It covers areas ranging from northern California to western Washington and includes national forest lands in this IRWM region. The NWFP was originally drafted with the intent of protecting critical habitat for the northern spotted owl and the marbled murrelet, but the plan came to include much broader habitat protection goals.

The NWFP takes an ecosystem approach to forest management, while adhering to the requirements of applicable laws and regulations. The dual intent of management on affected federal lands is: (1) to maintain a sustainable supply of timber and other forest products that will help maintain the stability of local and regional economies on a predictable and long-term basis to meet the need for forest habitat and forest products; and (2) to maintain a healthy forest ecosystem with habitat that will support populations of native species (particularly those associated with late-successional and old-growth forests), including protection for riparian areas and waters.

The Shasta-Trinity National Forest Land and Resource Management Plan (Forest Plan) was prepared to guide the management of the Shasta and Trinity National Forests. The primary goals of that plan are to integrate a mix of management activities that allow use and protection of forest resources, meet the needs of guiding legislation, and address local, regional, and national issues. The Forest Plan provides four general levels of direction: (1) general Forest-wide management direction; (2) Land allocations and Standards and Guidelines from the Record of Decision (which adopted the plan); (3) direction specific to each management prescription (or type of land allocation); and (4) specific (or supplemental) direction for each management area within the Forests. The following table provides a generalized description of basic land use designations pursuant to the Land and Resource Management Plan.

<i>Land Use Designation</i>	<i>Description of Land Use</i>
Matrix	Mixed use. Most timber harvest would occur on these lands. Standards and guidelines are in place to ensure appropriate conservation of ecosystems as well as provide habitat for rare and lesser-known species.
Late-Successional Reserves	Established to protect and enhance conditions of late-successional and old growth forest ecosystems and to ensure the support of related species, including the northern spotted owl.
Administratively Withdrawn Areas	Recreation and visual areas, backcountry, and other areas where management emphasis precludes scheduled timber harvesting.
Riparian Reserves	Provide an area along streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis.
Congressionally Withdrawn	Wilderness areas where management emphasis is on enhancing the natural conditions for wildlife habitat and non-motorized recreation. Timber harvest is precluded

The implementation process for the Forest Plan provides the framework for translating management direction into actual projects or activities that will be consistent with the environmental and administrative objectives of the plan. A responsibility of the Forest Supervisor is to ensure that, subject to valid existing rights, all outstanding and future permits, contracts, cooperative agreements, and other instruments for occupancy and use of affected lands will conform to the plan. The implementation strategy of the plan

establishes the framework for translating management direction into goals, objectives, and standards for on-the-ground projects. The Forest Plan is implemented on each of the various Ranger Districts in the forest. Projects will continue to be planned and evaluated through an interdisciplinary process. District and STNF staff conduct environmental analyses for projects and document them in appropriate environmental documents that are tiered to the Forest Plan.

The Whiskeytown-Shasta Trinity National Recreation Area (NRA) was established in conjunction with the development of Shasta Lake Reservoir. The U.S. Forest Service manages the NRA. Land use designations are consistent with the Forest Plan for the Shasta Unit. Riparian Reserves, the largest land use designation in the NRA, are located in areas along rivers, streams, lakes, and wetlands, including the area inundated by Shasta Lake Reservoir. Approximately 25% of the land in the NRA is designated Matrix and Adaptive Management; these areas generally emphasize recreation and visual quality. Late Successional Reserves (LSR) and Administratively Withdrawn Areas each account for 20% of the land use designations in the NRA. LSRs are characterized by large blocks of land reserved for northern spotted owl and other species that are dependent on late successional old-growth forest. Lands with this designation are scattered throughout the NRA; these lands have a natural appearance, with much of the land area covered with late successional forest vegetation. The Shasta Unit of the NRA is not managed for timber harvest.

Recreational use in the NRA is extensive and is estimated to exceed two million visitor days annually. Water-oriented activities, such as boating, fishing, waterskiing, and house-boating, are the main attractions. Currently operating marinas include Antlers, Sugarloaf, Shasta, Lakeview, Holiday Harbor, Packers Bay, Bridge Bay, Silverthorn, Jones Valley, and Digger Bay. Other recreational land uses include hiking, camping, picnicking, and off-highway vehicle activities.

It is noted that the Bureau of Land Management (BLM) manages a small portion of the region near Shasta Lake Reservoir west of Backbone Ridge. These lands, located in the far southwest corner of the region, consist of several sections (i.e., 640-acre tracts) located in a patchwork of private, National Forest, and BLM ownership. This area is managed in accordance with the Interlakes Special Recreation Management Area. Land in this area is managed for multiple uses including motorized recreation, timber harvest, wildlife habitat, scenic viewshed, and mineral development.

Each of these federal agencies has a mandate to work in cooperation for the interest of the local indigenous tribes, however, when recreational development was first pursued, local indigenous tribes were not part of the planning or implementation process and there were no laws at this time for the protection of historic and prehistoric sites. Many of the developed recreation locations today — campgrounds, boat launches, hiking opportunities, and more — are located on sacred sites to one or more of the tribes indigenous to the region. These tribes still have difficulty accessing these sites for traditional uses and, because of the status of several of the tribes as federal unrecognized, the federal entities responsible for land management in and around these areas cannot provide the access and protection to the tribes in holding their traditional religious observances.

Federal Agencies and the Indian Trust Responsibility

Federal agencies have a unique and particular responsibility to federally recognized tribes when it comes to federally managed land and other natural resources. “There is a government-to-government relationship between the United States and each Indian tribe; the United States has a legal trust responsibility to each tribal government that includes the protection of the sovereignty of each tribal government (25 U.S.C. Sec. 3601)”. This charge includes a responsibility to make decision based on tribes’ best interests, encouraging self-government and economic opportunity. This responsibility has been interpreted as a fiduciary duty, or relationship, which imposes the highest degree of responsibility

the law recognizes, similar to the relationship between a guardian and a ward. Agency officials must advocate for the tribe, act in good faith towards the tribe, and seek to make tribal resources under the agency's control productive and profitable. This includes a requirement to consult with affected tribes with regard to the development and/or best uses of resources.

3.4 Demographic, Economic, Social and Cultural Characteristics

3.4.1 Demographic and Economic Characteristics

The population of the USR is estimated at approximately 12,000. Native American Tribes active in the USR maintain that the area formerly sustained a much larger population without significant inputs of energy or materials from outside the region.

Many communities have actually lost population over the last several decades due to economic factors such as loss of employment opportunities and other demographic trends. Following are population numbers for various communities within the region, in order of size, recognizing that part of the population of the region is dispersed and not affixed to any particular community. Also listed is information about the estimated median household incomes in these communities. It will be noted for comparison that the California statewide median household income (MHI) in the term 2007-2011 was \$61,632. Based on the formula for disadvantaged communities (i.e., a community with an annual median household income that is less than 80% of the statewide annual median household income), the relative threshold for recognition as a disadvantaged community (DAC) would be \$48,706. A severely disadvantaged Community is identified as having 60% of the state's MHI, or about \$36,979.

City of Mt. Shasta:

The City of Mt. Shasta had a population of 3,416 as recorded in the 2010 census. The City's population dropped since 2000 by about 6.3%. Estimated MHI for the City was \$38,504, identifying the City of Mt. Shasta as a disadvantaged community.

City of Dunsmuir:

The City of Dunsmuir hosted a population of 1,782 in 2010, dropping since 2000 by about 14.2%. The estimated median household income in 2010 was \$35,283, making the City of Dunsmuir a disadvantaged community.

McCloud:

The population of the unincorporated area of McCloud in 2010 was 1,210, lowering since 2000 by about 18.0%. The estimated 2010 median household income was \$28,750, identifying the community as severely disadvantaged.

Lakehead/Lakeshore:

While not in the DWR DAC mapping tool, information for Lakehead and Lakeshore was gathered from the ACS data available on the census information page. Population for the area in 2007 was 723, with an estimated median household income in 2009 of \$64,429. This area is not economically disadvantaged per the information gathered here.

Castella:

While not in the DWR DAC mapping tool, information for the community of Castella was gathered from the ACS data available on the census information page. The estimated population of the Castella area (based on zip code 96017) in 2010 was 322, growing by 45% since 2000. The estimated median

household income in Castella for 2010 was \$36,955, making Castella a severely disadvantaged community.

Montgomery Creek:

The population identified for the Montgomery Creek Census Designated Area in 2010 was 75, with a growth of 69.8% since 2000. The estimated MHI was \$11,346, making Montgomery Creek a severely disadvantaged area.

Big Bend:

The population of the Big Bend census-designated-place in 2010 was 91, with 55 households. Population has gone down since 2000 by about 31.5%. The estimated median household income in 2010 was \$38,125, identifying Big Bend as a disadvantaged community.

Indigenous Populations:

Pit River Tribe in this IRWM region manages three Rancherias in Shasta County. These consist of Big Bend Rancheria (estimated population of 10); the Montgomery Creek Rancheria (estimated population of 15), and the Roaring Creek Rancheria (estimated population of 14).

The Winnemem Wintu number 127. Thirty-seven of their together with their Chief reside at the traditional Winnemem village site of Tuimyali near Shasta Lake Reservoir.

Members of the Modoc Nation live primarily in the northeastern portion of the USR.

The Shasta Tribe is made up of the Shasta Nation and the Shasta Indian Nation. Members of the Shasta Nation currently live throughout the region, though not specifically in the USR. Members of the Shasta Indian Nation are scattered throughout northern California and southern Oregon.

The areas that comprise the Upper Sac IRWM Plan region are fairly small portions of the two counties in which they are located — Shasta County and Siskiyou County. Also, since much of the population is very rural, and the communities in the region are very small, county-wide numbers are not very applicable to the actual character of this region. Nevertheless, some comments on county statistics are appropriate.

Shasta County:

According to the 2010 census, the total Shasta county population was 177,223, which was a growth of 8.56% since 2000. As of 2010, the median household income in the county was \$43,944, which had grown by 27.99% since 2000.

Siskiyou County:

The population of Siskiyou County, according to the census, in 2010 was 44,900, up 1.4% from the 2000 population of 44,301. The estimate for 2012 was 44,639. Siskiyou County median household income was \$36,981 in 2010, which had grown by 25.23% since 2000.

3.4.2 Other Economic Characteristics

According to the California Employment Development Department, at the end of December 2012, the unemployment rate in Siskiyou County was 15.9% and 12.0% in Shasta County, compared to the state rate of 9.7% (California EDD 2013).

The communities in the areas of the Upper Sac, McCloud and Lower Pit have been economically depressed since the downturn in the forest products industry in Northern California in the 1980s. One of

the biggest economic issues affecting communities in this region and their ability to maintain and upgrade water-related infrastructure has to do with the economy of scale. The communities are small in population and tax base. For example, the City of Dunsmuir, an incorporated city with a fully-functioning water and wastewater system, has a population of less than 1,650. Nevertheless, the city needs to finance maintenance of its aging infrastructure and upgrade systems as necessary. This includes making improvements to comply with regulations and requirements such as those applicable to operating the wastewater treatment plant to ensure protection of water quality in the Upper Sacramento River.

Also relevant in these small communities, which have such low median household incomes, is the challenge and equity of levying necessary monthly household fees to finance operation of and fund improvements to local water and wastewater systems.

As noted above, many communities in the region are experiencing population losses. Again, using the City of Dunsmuir as an example, between 1990 and 2000 the city experienced a 9.7% decline in population. For comparison, during this same time period, Siskiyou County experienced a 1.8% increase in population. The decline in the city's population has primarily been the result of the loss of timber and railroad-related jobs and the relocation of many family wage earners who were employed in those industries. There has also been an increase in the number of dwellings that are being used primarily as seasonal homes rather than year-round residences. Statistics for McCloud and Big Bend also indicate population losses in those communities.

The City of Mt. Shasta has also experienced relatively slow residential growth within the city limits in recent years. The average annual growth rate of the population within the city since 1995 has been less than 1%. Residential growth in the area has predominately taken place in the unincorporated area outside the Mt. Shasta city limits. The 1993 Mt. Shasta General Plan projected that, between 1990 to 2010, the population of the planning area would increase to a population of between 6,500 and 8,500 persons, depending on whether the Plan's higher growth rate of 2.25% per year or the 1.5% per year historic growth pattern took place. The 1993 General Plan intended to provide land area and densities to accommodate a population of 10,201 persons in the planning area.

3.4.3 Disadvantaged Communities

According to DWR, as indicated in its Disadvantaged Communities Mapping Tool (DWR 2013), the following areas in the USR (listed with their MHI and population as quoted by DWR) are specifically recognized as disadvantaged communities:

Big Bend (*MHI: \$38,125; Population: 91*)
City of Dunsmuir (*MHI: \$35,283; Population: 1,782*)
City of Mt. Shasta (*MHI: \$38,504; Population: 3,416*)
McCloud (*MHI: \$28,750; Population: 1,210*)
Montgomery Creek (*MHI: \$11,346; Population: 75*)

For the unincorporated communities above, the designation is applicable to the census designated place, (CDP), in which the communities are located. As described on the DWR website:

The maps and GIS files are derived from the US Census Bureau's American Community Survey (ACS) and are compiled for the 5-year period 2006–2010. DWR has included, in the maps, a calculated field entitled DAC (y/n), which indicates the DAC status for different census geographies (Place, Tract, and Block Group). DAC status is determined based on the DAC definition provided in DWR's Proposition 84 and 1E IRWM [Guidelines](#), dated August 2010. A MHI of less than \$48,706 is the DAC threshold (80% of the Statewide MHI).

As noted above, a disadvantaged community (DAC) is defined as a community with an annual median household income that is less than 80% of the statewide annual median household income. Based on the formula for disadvantaged communities, if the statewide annual median household income is accepted to be \$61,632 (based on 2011), the relative threshold for recognition as a disadvantaged community would be \$48,706. Reviewing the numbers given above for the various communities in the region, it is evident that virtually all of the communities with the exception of the Lakehead area have median household incomes below the DAC threshold. Some communities such as Dunsmuir, Big Bend and Montgomery Creek, may even be considered to be severely disadvantaged (i.e., median household income less than 60% of statewide median).

The majority of the population of the region resides in Siskiyou County. According to the 2010 Census, Siskiyou County had a median household income of \$36,981. Compared to a DAC threshold of \$48,706, the county median income is below the qualification for Disadvantaged Community (DAC) status.

As described in the regional acceptance process proposal for recognition of the Upper Sac IRWM Plan region, it is not much of a stretch to say that the entire proposed region is a disadvantaged community. The majority of the communities in the region have median incomes below 80% of the state average, which places them in the Targeted Income Group for most federal grant programs. For this reason, any groups that represent general community interests can be said to be representing disadvantaged communities as well.

In Shasta County, based on 2010 census data, 18.5% of the county population and 14.35% of families were rated as being in poverty. This can be compared to the state rate of 13.71% of the population in California (10.21% of families), and the federal rate of 13.82% of the population (10.08% of families). However, the poverty rates for Shasta County as a whole are not representative of the very rural population in the USR. For example, for the community of Big Bend, 46.15% of the population and 36.84% of families were rated in poverty. For Montgomery Creek, 37.33% of the population and 53.33% of families were rated as in poverty.

In Siskiyou County, the 2010 county-wide poverty rates are reported to be 17.13% of the population and 12.99% of families. The poverty rates within the IRWM region vary. The poverty rate in Dunsmuir is reported to be 22.5% of the population and 12.87% of families, McCloud is 21.82% of the population and 18.07% of families, and Mt. Shasta is 9.91% of the population and 8.75% of families.

Indigenous tribes throughout the USR, while not separately identified as DACs through the census process, could be considered disadvantaged because of the history they have survived as a people.

Pre-contact population numbered in the tens of thousands. After European contact, Native Americans were prohibited from owning or leasing land, selling timber, mining, or pursuing other income-generating activities. By 1853, Indians were starving and begging for food. Congress appointed Edward Beale as the first Indian superintendent for California (Hurtado 1988). The administrations of Beale and his successor, Col. Thomas J. Henley, lasted over a decade and were rife with corruption and incompetency. Cattle for starving Indians wound up with subagents; reservation boundaries were changed, land was lost to squatters; vouchers were irregular; and the books were incomplete (Hoveman 2002; Sanchez 2003). It was not until the 1870s and 1880s that the efforts of humanitarians advocating reform of the living conditions and treatment of Indians began to make a difference.

The late 1800s brought the first allotments to local tribes. Given the poor condition of the land, shortage of water, and lack of start-up farm equipment, animals, or seed, most tribes could not make a subsistence living from agriculture on the allotments. Because so much land had already been patented to the railroads, the allotments were discontinuous, which fragmented the tribes and made it difficult to maintain

a tribal relationship with the BIA agents. Agent efforts to secure replacement land were often half-hearted, underfunded, or blocked by private owners. Agents frequently supported the efforts of interested buyers to purchase allotment land because they believed the land was useless to the Indians. In 1906 C. E. Kelsey, a special agent for Indian Affairs, reported that 2,058 allotments had been made in California with 261 canceled, leaving 1,797 outstanding. The majority of these outstanding allotments were in Lassen, Modoc, Plumas, Shasta, and Siskiyou counties (Robinson 1948; Theodoratus Cultural Research 1981).

This history indicates the disadvantaged and disenfranchised status of the tribes from a societal and cultural perspective (as well as with regard to economic status and condition). While not identified as disadvantaged through the census calculations used by the state for formal identification and calculation, it is important for the USR RWAG members and all participating State and federal agencies to remember the difficult history each and every one of these tribes has experienced as part of the members' relatively recent past. The continued existence of these tribes is a testament to the strength of their cultures, the cohesion of their families, and their belief in traditions. Participation in any resource management process is a survival technique that is undertaken with few resources for some of the tribes involved in this IRWM planning effort.

3.4.4 Social and Cultural Values

Regional cultural values must be approached cautiously, as generalizations are difficult to apply in a region where background and values vary widely. Thus, following this introduction are sections relating to the variety of cultural and societal values held by groups living in and passing through the region. These qualities make the USR a challenging region to consider in this regard, but they also add to the attraction of the region by a diverse group of people, and the real investment in time, energy, money, and emotion by a vast number of individuals and groups.

Landscape

A fairly common regional personal and social value is appreciation, if not profound affection, for the scenic landscape and abundance of environmental resources in this area. Whether local residents were drawn to this area because of the beauty of the forested, mountainous region (with Mount Shasta as a premier icon) and the abundance of natural resources, or they simply enjoy those resources as incidental amenities in their lives, it is a common personal and social value to have a strong sense of admiration for the scenic quality of the area and the wealth of natural resources.

The indigenous people living in the Upper Sacramento, McCloud, and Lower Pit watersheds value some portions of the landscape so greatly that ancestral tradition forbids entry. This can be seen in the designation of Mt. Shasta, above treeline, as a Cosmological District by the National Registry of Historic Places (NRHP). Likewise, a number of sites throughout the USR have been identified as sacred to single or multiple tribes active in the region. The designation of a place, piece of infrastructure, or landscape by the NRHP will usually bring with it a variety of use protocols and rules. Sites identified as Traditional Cultural Properties cannot, by law, be identified to the public but must still be considered in any land use planning. Other sites may not have been identified as "National Register eligible", but when considered in any federal undertaking will need to be evaluated as eligible. It is important for stakeholders in the region to be aware of these designations when planning projects and/or programs by consulting the Native American Heritage Commission (NAHC) and tribes who may be impacted. **Table 3.2**, below, shows the variety of NRHP designations found in the USR.

<i>Place</i>	<i>Designation</i>	<i>Reason</i>
Mount Shasta (above treeline)	Cosmological District	Historic indigenous values and clarity of the sky
Medicine Lake Highlands	Traditional Cultural District	Indigenous cultural values
Dunsmuir Historic Commercial District	Historic District	Historic events and architecture
McCloud Historic District	Historic District	Historic events and architecture

Small Towns and Rural Character

Local values in many parts of the USR reflect appreciation for the rural or small-town character of communities in this region. There is much value for and, frequently, conviction to protect what is valued as the local quality of life. For example, the mission statement included in the Mt. Shasta Community Action Plan reflects this concern. That statement reads, “The mission of the Mt. Shasta Community Action Plan is to maintain the character and resources of our ‘small town’ community while striking an appropriate balance between economic development and preservation of our quality of life.” (City of Mt. Shasta 2002) This statement acknowledges the value that, while community development and economic growth is understood to be necessary for a variety of important social reasons, local communities are also aware that growth needs to be managed carefully to avoid or minimize disturbance to existing resources and community characteristics that are highly valued.

Natural Resources

It is a common social value that communities in the region are proud of their relationship with the environment and resources. In the City of Dunsmuir, there is the motto, ‘Home of the Best Water on Earth’. The Dunsmuir Chamber of Commerce proudly states in its website that visitors can walk from their hotel to one of the best sport fishing streams in the country. The City of Mt. Shasta is also proud to report on its website that the city has won several state and national awards for its pure, unfiltered and untreated water.

Certainly, a large number of residents would agree that natural resources in this area are major elements for their personal and social recreation. Local residents and families value the abundance and quality of recreation opportunities and the convenient access to such resources provided by living in such an area. Some people would also add that natural resources are an important factor in their spiritual values. A variety of social groups and non-profit organizations have been formed to address concerns regarding various aspects of the natural environment and particular environmental issues.

These groups include organizations that advocate the development of hiking and multi-use trails; protection and enhancement of fishing-related resources and wildlife habitat; support for backcountry skiing and other snow sports; and support for a variety of other environmental and recreational resources and activities. In some cases, certain groups have and will actively challenge development proposals (e.g., large water bottling facilities and geothermal development) that they feel will jeopardize valued resources, and some organizations will engage in litigation when they feel it is necessary.

For many people and businesses in the region, values relating to natural resources are intensively focused on concern for the success and viability of their businesses, employment opportunities, and related economic factors. Many of the local communities first evolved due to resource-related industries such as mining and timber extraction, production, and processing. Even though there are no longer any major mills located within the region itself, timber management, production and transporting of material to mills and biomass generators in outside communities (such as Anderson, Burney, and Weed) are still

significant components of the local economy and job market. Forest material is produced from both large holdings of private land as well as from National Forest land.

The community of McCloud, once an actual “company town” developed and owned by a lumber corporation, still largely reflects the heritage of its origin as a mill town, as do other communities in the region.

It can be said that support for resource-related businesses and timber production is still a strong social value in this region. Both Shasta County and Siskiyou County continue to strongly support the timber industry and the goals of private companies to manage their lands as productive business operations. These counties and other local governments recognize the important contributions that private industry provides to local economies including the creation of jobs. With this recognition are the values that local governments continue to embrace for private property rights and resistance to what is regarded as “unnecessary” regulatory constraints to land management practices on timberland, agricultural land, and other private lands.

Indigenous cultures historically active in the region hold the land and the resources as sacred to their people and to all life. These people report a deep sense of loss for the many dramatic changes that have been forced upon indigenous cultures and their homelands in this region over time. These losses and historic struggles have not dampened the interest with which local tribes pursue justice for the restoration and protection of natural and cultural resources, however. Some policy and planning issues on which some local tribes are active include:

- Government-to-government consultation with BLM, Shasta-Trinity, and Modoc National Forests, in addition to other entities involved in implementing regional projects that have the potential to impact cultural and environmental resources;
- Efforts to protect sacred tribal sites from inundation that would result from proposals to raise Shasta Dam;
- Promoting greater understanding and respect for the Medicine Lake area as a cultural area, and protection of this site from impacts related to land uses such as geothermal development;
- The desire for more attention to be given to indigenous resource management principles and practices that are sometimes referred to as traditional ecological or environmental knowledge (e.g., indigenous uses of fire as a land management tool, understanding of forest composition of native plants and biodiversity of species, etc.);
- Protection and restoration of sacred sites and traditional cultural properties that are publicized tourist attractions;
- Safeguarding traditional plant gathering areas from destruction and contamination, including efforts to restore what has been lost; and
- Support for the reintroduction of salmon — both as a food source and as a highly valued cultural element — to the McCloud River and other streams in the region as existed prior to the installation of Shasta Dam.

In addition to these policy issues, tribes are also active in advocating for the protection of source water areas and tribal water rights.

Tourism

Tourism is also a major and growing element of the economy in the region and influences social perspectives and values. The promotion of tourism is closely tied to values concerning conservation of resources, including protection of scenic resources, as well as proposals to improve facilities that support tourism. An example is the promotion of the Volcanic Legacy Scenic Byway along State Highway 89. Tourists share an appreciation and enjoyment of many of the same resources that local residents enjoy for family and social recreation. This includes natural resources such as trout streams, mountain lakes, and hiking areas as well as developed facilities such as local reservoirs, the Mt. Shasta Ski Park, and golf courses. Consequently, there are many common values shared by recreation and tourism interests concerning protection and conservation of related resources. However, it should be noted that, at times, there are also conflicting values when tribes and local residents become concerned that resources may be over-developed and over-used by development proposals to promote and accommodate tourism.

Cultural and spiritual tourism is relatively popular within the USR, even, or perhaps especially, by those living within the region. Ancestral sites of the indigenous people of the region are especially popular locations due to the pre-history values and/or exceptional natural beauty. Generally, indigenous peoples have learned to be guarded about the location of sacred sites because of the appeal those sites have to a variety of non-native groups. The Winnemem Wintu and the Pit River Tribes are no exception, but when Panther Meadows on Mt. Shasta was identified as a potential ski resort, the Wintu became active in the effort to stop it due to its sacred status within the tribe. This \$21 million project was to accommodate 5,000 skiers a day with seven lifts and three lodges (Beggs, et al. 2003). The US Forest Service completed the EIS in 1990 and found it to be in compliance with the multiple-use classification of the mountain, and approved the project. Opposition to the ski resort united diverse groups such as Save Mount Shasta, the Native Coalition for Cultural Restoration of Mount Shasta, two nonprofit Native American tribes and various other organizations. Using the 1966 National Historic Preservation Act, they succeeded in getting the US Forest Service to reverse the decision in 1998 (Huntsinger, et al. 2000). The Pit River Tribe continues to participate in quarterly government-to-government consultations with Shasta Trinity USFS over recreational impacts and management activities occurring in Panther Meadows.

Cultural conflict concerning Panther Meadows has continued in various forms, even after the US Forest Service withdrew the permit for the ski resort. Panther Meadows is an alpine wildflower meadow that attracts environmentalists, hikers, rock climbers, and New Age spiritual pilgrims. Heavy use in the area has caused damage to the meadow and spring in the past. To provide visual and physical separation from the path and to protect the spring, the US Forest Service built a U-shaped rock wall that now surrounds it on three sides and they continue to improve signage and trails.

3.4.5 Native American Tribes: Approach to Resource Management and Water Issues

Four ethnographic essays have been prepared and incorporated into the USR IRWM Plan as part of the Region Description. The intention of this work is to help identify and summarize issues and concerns relating to water resources from the perspectives of the indigenous peoples of this region. The following ethnographic essays, listed in alphabetical order, address the perspectives of the Modoc Nation, the Pit River Tribe, the Shasta indigenous culture (with reference to both the Shasta Nation and the Shasta Indian Nation), and the Winnemem Wintu Tribe.

Two ethnographers were obtained by the River Exchange to author these sections in cooperation with the various tribes that have participated in the USR planning program. Shelly Davis-King (Davis-King & Associates) prepared the two sections that feature the cultural perspectives of the Winnemem Wintu Tribe and the Modoc Nation. Shelly Tiley prepared the sections that feature the cultural perspectives of the Pit

River Tribe and the Shasta Tribe. These sections are specific to the tribes identified and were not opened for comments or editorial changes from other stakeholders.

3.4.5.1 The Modoc Nation

Background and Introduction

The Modoc people (Mowatocknie Maklaksûm), speakers of a Penutian family language, have their geographical heritage in northern California and southern Oregon (e.g., James 2008; Scruggs 2013; Stern 1998), with cultural affinities to California, the Great Basin, and the Plateau. Their prehistoric territory was in the drainages and lakes of Tule Lake and the Lower Klamath River, Little or Lower Klamath Lake, Clear Lake, the Lost River in Oregon and California, and over to the shores of Goose Lake (Curtin 1912; Stern 1998). Much of Modoc country in California is part of the volcanic plateau, some which is held in national reserve as Lava Beds National Monument. The Lost River watershed drains the northern part of the plateau flowing into Tule Lake, while most of the more southerly watershed flows into Big Sage and other reservoirs. The southern territory extended to the north and northeast slopes of Mount Shasta and included Medicine Lake. The portion of Modoc country applicable to the IRWM Plan is in southern Modoc territory, in the area of Medicine Lake and the Medicine Lake Highlands. This area includes the Medicine Lake volcano and various peaks of the Cascade Range that receive massive snowpack each year. Much of the snow then melts, becoming subsurface recharge that ultimately feeds the Pit River. This area is considered part of sacred Modoc territory, and indeed, the earliest ethnographic and historical work with the Modoc acknowledges that the Modoc lands are sacred and the water, especially, was protected and revered (e.g., Curtin 1912; Stern 1998). As Modoc author Cheewa James (2008:19) has written, “The Modocs were water people, much of their livelihood and culture stemming from waterways.”

Kumush created the Modoc world by first making the lakes, rivers, and mountains; naming them; and the first people who became the animals, plants, fish, stones, earthquakes, and all things that are known followed. At about this time the Modoc people were also created and given their territory as noted above — land given by the creator was then considered sacred. Curtin (1912:vi) noted, “...into this country that Kumush gave to the Modocs came white settlers,...” and by 1863 a military fort was established. The Modoc were restricted from practicing their traditional subsistence activities, and according to stories shared, were forced to sign a treaty with the federal government before they were given food and other supplies. The treaty outlined where the 2000 Modoc people could live, what they could do, and provided that they should get some land. Insufficient supplies, a lack of treaty ratification for five years, and other factors meant that by autumn 1872, the Modoc were starving and without access to their traditional subsistence areas. In November of that year, federal troops moved in and fired their weapons on women and children — an act to which the Modocs responded by killing a group of settlers. In April and May 1873, skirmishes between the soldiers and the Modocs continued and the now-famous story of Keintpoos (Captain Jack) and his stronghold occurred. Still the soldiers ultimately prevailed, and the surviving Modoc Tribe was split in two. One group became the federally-recognized Modoc Tribe of Oklahoma, and includes descendants of Captain Jack’s band of Modoc, while the other Modocs were sent to live with their traditional enemies, the Klamath.

Today, there is a Modoc presence in the federally-recognized Klamath Indian Tribes (formerly known as the Klamath, Modoc, and Yahooskin Band of Snakes), but Modoc interests are not addressed at the tribal level. Consequently, the Modoc have formed a new governmental group, The Modoc Nation, which ultimately will seek recognition as a California tribe. The Modoc Nation has participated in the IRWM Plan process specifically because of their concern about the Medicine Lake Highlands.

Ethnohistoric Modoc Water-Related Information

Chief Greywolf (Jeff Kelley) of The Modoc Nation provided much of the background ethnographic information or directed the author to various publications with which he felt his people would agree. Similarly, publications that have presented a viewpoint not shared by The Modoc Nation have not been included in the following discussion (e.g., publications by Joaquin Miller). Chief Greywolf (in an email of 10 June 2013) said that for the sake of this specific IRWM Plan, the key factor to understand

“is that the Medicine Lake Highlands are very important to the Modoc... who have been occupying it since time immemorial and can prove the last 15,000 years. That we had a permanent encampment there and hunted, fished, gathered food, herbs, obsidian, and more. That we had Crisis Quest there, used the water for healing, bathing & cleansing ceremonies. That our Creator made this area specifically for our people, that there was no mistake that our people were put here to protect and preserve the lands, animals, water! That even though our numbers are few, we are still strong and will be victorious as Kumush our Creator had stated.”

One of the principal chroniclers for the Modoc, Verne Ray (1963), wrote that there were three major divisions of the Modoc historically. Each of these divisions was based on the winter village structure whereby the people would gather in large communal villages after the harvest season. The Gumbatwas (literally “people of the west”) had some eight winter villages in an area at the time that he wrote, west of a line that included much of Tule Lake, Lower Klamath Lake, and the western part of Lost River Valley; the pasganwa-s (river people) or Lower Lost River division, had numerous winter villages on Lost River near the mouth of Tule Lake; and the Kokiwas (gogewa-s) or Eastern division, had at least 12 winter villages on the Lower Lost Lake drainages into parts of Tule and Clear lakes, extending as far as Goose Lake. There was a summer village in the Kokiwas area on Medicine Lake, near Mt. Hoffman. The village, called Lani’shwi, was a base camp for obsidian quarrying at Glass Mountain, and a hunting base camp (Ray 1963:208).

Like most California native groups, the life of the Modoc was subject to a seasonal round, based on their subsistence needs. Their traditional area, largely in the Klamath Basin, included thousands of acres of marshland, areas of volcanic rocks, and to the east, areas mimicking Great Basin environments. Seasonal fish runs, especially suckers (e.g., the Lost River Sucker [*Deltistes luxatus*] or the Modoc Sucker [*Catostomus microps*]), seasonal water plants, such as water lily seeds (*Nuphar polysepala*), and waterfowl were all important for food, medicine, or utilitarian objects, but hunting game and seed gathering were equally significant. Stern (1998) mentioned that the Modoc would submerge their tule boats to preserve and prevent them from rotting, and in March would take them to Lost River to fish for suckers. When the sucker population was waning, later in the spring, the women, especially, would go in search of biscuitroot (*Lomatium canbyi*; Coville 1897), and then for ipos (*Carum oregonum*), while others searched for waterfowl eggs (Stern 1998). In early summer rich blue flowers in the meadows would signal emerging camas (*Camassia quamash*), harvested and prized for their bulbs. Ray (1963) documented that the Modoc also harvested white-blooming meadow “death camas” (*Toxicoscordion venenosum*). In July, the aforementioned water lilies (wokas) were ready to harvest (Coville 1904). Throughout this part of the year, the dependence of the Modoc on clean, fresh water was crucial, and this is part of the reason that water remains so important today. While hunting, berry gathering, and nut harvesting remained a subsistence focus through the rest of summer, a second run of suckers brought some Modoc back to Lost River while others went to the Mount Shasta or Tule Lake uplands to gather huckleberries and hunt. Hunting involved purification, usually via sweat lodges, and then rinsing in spiritual lakes or streams to rid the hunter of human scent. In the autumn, people returned to their winter villages to reassemble the large houses, build storage pits for food, gather firewood to use against the upcoming cold wind and snow, repair tools, and hunt pronghorn (*Antilocapra americana*; Barrett 1910).

The activities listed here have varied some in the prehistoric past, but are relatively the same as noted by Howe (1979) and Sampson (1985) as existing for thousands of years.

An important aspect of Modoc life was the quest an individual took when there was a crisis of some sort in their life. These times of crisis were often times rites of passage such as birth, death, marriage, illness, or loss, and the Crisis Quest would involve “fasting, isolation, strenuous artificial activities, and ritual bathing” (Ray 1963:77). With the exception of the puberty crisis quest, the basic ritual pattern was the same, and “preparation for the dream required swimming in pools or streams significant because of their mythological associations” (Ray 1963:77). As noted by one Modoc, the quest included,

“One [that] was a male coming of age ceremony on Mt. Shasta. Adults would also do the quest if they need wisdom or guidance. Some quests were in other sacred places too. Part of the quest involved the physicality, the physical exertion of stacking up rocks. The stacking of the rocks had to do with fasting. One of our stories has to do with Isis, the son of Kumush.

And when he died, he laid down on the top of Mt. Shasta and that is why it is white and snow-capped today.”

According to Ray (1963), all full-scale quests involved ritual bathing, as noted, in places where some important event had occurred, and while such places would not be recognizable to those unfamiliar with the associated stories, the place and the necessary rituals there were well known to the person on the quest.

Another aspect of Modoc life was summed up in Ray (1963: Chapter 15), where he noted that the Modoc did not often battle, but when they did, the battles were bloody. The Shasta and Pit River people were traditional enemies, and the Paiutes to the east were added to this list once the horse was introduced. There were also raiding parties for horses and women, and the Klamath and Modoc might team together in a battle with the Shasta. Today, the Modoc assert that the Klamath were also their traditional enemies, and it was a terrible event when they were forced together on the reservation after the Modoc War. The Modoc War itself has been documented in several books and studies, including the Modoc versions in James (2008) and Riddle (1914). Newspaper accounts of the war have been recently compiled into an independent volume (Woodhead 2012). Of major importance is that the Tribe was split asunder, with one group forced on the “terrible 2000-mile winter ride in railroad cars intended for hauling cattle” to Kansas and the others forced north onto the Klamath Reservation (Scruggs 2013). Some Modoc chose not to go to either place.

The Modoc were among the first California Indians beyond those taken to the Missions to have contact, albeit indirect, with western introductions, the horse being the principal item, followed by various firearms. By 1826, fur trapper Peter Ogden (Elliott 1910:210; Layton 1981), in traveling through Modoc area, noted that the “Klamath” (sic, Modoc) had one horse that he observed. If one horse had been seen, there were bound to be others. It has also been documented (e.g., Heizer 1942; Sapir 1909) that Columbia River Indians went to the Sutter’s Fort area near Sacramento, and had been doing so for some time, at least back to 1800. More information on this topic can be found in Layton (1981), but the important point is that the Modoc had acquired and become accustomed to the horse and weapons long before the Modoc War.

Germane to the present study, the Medicine Lake Highlands are a volcanic region that consists of the caldera, hills and, lakes. Water there is sacred to Native American tribes, as it has been for at least 10,000 years, according to archaeological studies and some tribal oral histories. For the last 30 years or so, Native American groups have been arguing against development of the Medicine Lake Highlands for geothermal or other industrial uses because such development at the sacred lake is considered offensive to the Modoc

Nation and other tribes. The lands are sacred grounds and it would be “like building a power line in a Catholic cathedral or something.”

In terms of the Native American battle against the power development companies who wish to harness geothermal power, to date, the Modoc Nation has aligned themselves with the Pit River Tribe who has been arguing against development since the early 1980s. The Tribes promoted a study of cultural uses of the Medicine Lake Highlands, provided information that indicates prime cultural significance of the Medicine Lake Highlands. By 1995, although geothermal exploration projects had been approved by the US Forest Service and the Bureau of Land Management, there had been no proper consultation with tribes. Although some consultation ~~with~~ occurred the following year, the Pit River Tribal Council passed a resolution expressing opposition to geothermal development in the Medicine Lake Highlands and requesting a Cultural Management Plan for the Highlands. An ethnographic study resulted in the July 1999 designation of the Medicine Lake caldera as a Traditional Cultural Property (TCP). [The designation was expanded in 2005 to an area of 73,000 acres \(113 square miles\), including the entire Medicine Lake Caldera and most of the uplift of the Medicine Lake Highlands above 6,000 feet \(Middleton-Manning et al. 2018\).](#) The Modoc were included in this TCP designation, and the Modoc Tribe ~~agrees~~ [agreed](#) with the findings [for the 2013 IRWM Plan](#).

The Advisory Council on Historic Preservation (ACHP) which advises Congress and the President on matters related to historical (cultural) resources, stated the following with regards to the highlands:

“The Medicine Lake Highlands contains an interrelated series of locations and natural features associated with the spiritual beliefs and traditional cultural practices of the Pit River and Klamath/Modoc Indian tribes. For centuries, the area has been vitally important to the culture of these two tribes as a place for physical healing, prayer, spirit quests and other traditional activities. These cultural values and practices by the tribes depend entirely on maintaining within the district the environmental qualities that now exist, including natural land forms, heavy forested cover, scenic vistas, and a natural quiet that reinforces a sense of solitude and contemplation. The Pit River Tribal Chairman, in a recent letter to the Council, emphasized the natural qualities needed for continued use of the traditional cultural places within the Medicine Lake district. [ACHP 2002]”

The Keeper of the National Register of Historic Places, in her determination of eligibility, said the unique nature of the area in relationship to important traditional spiritual activities and practices, was supported by “...multiple lines of evidence substantiate the historic and continuing value of the Medicine Lake area and the volcanic caldera it rests in to Native Americans in maintaining their traditional cultural identity” (ACHP 2002).

The Modoc believe the waters of Medicine Lake have power to heal and to renew, and consequently they return to the lake annually when possible. The Pit River Tribe and the Modoc Tribe (Nation) have annual ceremonies they hold jointly at Medicine Lake, simply called “Medicine Lake Gathering of the Modoc and Pit River People.” There, for four days, a sacred fire is lit, people gather to share stories, reminisce, honor elders, dance traditionally, drum, sing, conduct ceremony at Schonchin Springs, visit sacred sites, and of course, heal. The healing powers of the water are important and are involved in the training of medicine practitioners. This is one reason why the tribes, including the Modoc, are fearful that groundwater removal and fracking might alter the metaphysical healing powers. Those who argue against the Native American position say that the Medicine Lake Highlands are no longer pure because of the tens of thousands of people who use the area; the number of vacation homes on land adjacent to Medicine Lake; and other nearby activities that occur throughout the year (e.g., snowmobile trails and parks and cross-country skiing). Mining and logging have also altered the landscape. While this may affect the spiritual landscape, the healing powers of the water are not affected, except in as much as recreational

users foul the water quality. This is the main reason that the Modoc desire a groundwater monitoring project, as described below.

A Stanford Law Clinic (Stanford Law School [SLS] 2006) study stated that for at least 10,000 years, the Modoc, members of the Pit River Tribe, and other tribes have used and continue to use Medicine Lake and the Highlands for religious activities such as vision quests, religious prayers and teaching, traditional shaman/doctoring practices, life cycle ceremonies, collection of traditional foods, medicines, and materials, spiritual renewal, and quiet contemplation. These benefits depend on the physical, environmental, and visual integrity of these areas, and their quietude. In that SLS document a tribal member was quoted as saying: “We are only the transient stewards of this land, picking up the sacred thread from our ancestors, and making sure it stays sacred for generations to come.” In the words of a Modoc man,

“The Spirit of Creation, just being there with what I call my relatives—sun, wind, trees, rocks, brush, everything that God has created. I’m part of that when I’m out there at that altar, and it continues when I come away from that altar. That water out there, Medicine Lake, is sacred because it’s the life-blood of Mother Earth. It’s also the life blood of the people.”

Among the Modoc, certain features of the landscape were an important part of prayers. Ray states “parts of the earth were frequently addressed... most often called upon were mountains and bodies of water... for example, a prayer to the mountain where hunting was to be done for luck on that particular venture...” (1963:21). Through dreams and vision quests, shamans acquired power from spirits that were associated with sacred places, such as “former gathering places of mythological beings” (Ray 1963:32). Medicine Lake is one of those places.

Modoc Examples of Caretaking of Water

The Modoc Nation, since its inception, has been concerned about the quality of sacred water in their traditional territory. As such, they have participated in numerous studies and programs, of which a select few are listed here as examples.

1. Legislative Council of The Modoc Nation Resolution 2013-14 states tribal opposition to geothermal or and other industrial development activities in the Sacred Medicine Lake Highlands
2. IRWM Roundtable, April, 2013
3. California Tribal Water Summit, April, 2013
4. Department of Water Resources California Water Plan Update, 2013
5. Upper Sacramento, McCloud, and Lower Pit River IRWM Plan, 2012-13
6. The California Delta Plan H.R. 1837, 2011
7. House Bill (HB) 2873 Protecting Oregon’s fish populations, 2011
8. Native American Heritage Commission, 2011
9. California Department of Fish and Game opposition of Draft Suction Dredge Mining EIR, 2011
10. Tribal resolution to have Medicine Lake Highlands protected from development, geothermal, fracking; Although the move is led by the Pit River Tribe, the Modoc Nation supports this, 2013
11. Legislative Council of The Modoc Nation Resolution 2013-15 states Modoc Nation opposition to removal of Klamath Dams (Klamath Basin Restoration Agreement & Klamath Settlement Agreement) because the Klamath Tribe has signed away all rights to water, fishing, and hunting, gathering, and any other rights, 2010-2013

Modoc Projects

For the Upper Sacramento, McCloud, and Pit River IRWM Plan, the main project the Modoc Nation would like to promote is that of groundwater monitoring in the Medicine Lake and Medicine Lake Highlands area.

3.4.5.2 The Pit River Tribe

Pit River Background Information

Territory:

Pit River Territory encompasses a 100-mile square from Mount Shasta on the northwest to Mount Lassen on the southwest and to Goose Lake on the northeast and Eagle Lake on the southeast. The Territory of the Tribe consists of all ancestral lands recognized by the Indian Claims Commission in its July 29, 1959, (7 Indian Claims Commission, 815-863 Appendices A & B pages 1-49; findings of fact and opinion in Docket No. 347, i.e., the 100-mile square as described in Docket No. 347). The Pit River Indians consist of 11 bands — nine from the northern or Achumawi division and two bands of Atsugewi people (Dixon 1908; Kniffen 1928; Merriam 1926). The IRWM Plan study area includes territories of the northern Achumawi bands.

It is beyond the purview of this study to propose the locations of boundaries either between Pit River bands or between the Pit River people and neighboring tribes. The post-contact period brought significant disruption of native life-ways, and the recorded boundaries may reflect only historic land use accommodations. However, it is abundantly clear that various groups converged on particular areas of the lower Pit River and the McCloud River in the ethnohistoric period (Merriam 1926).

Pit River Bands:

The Pit River bands have always been autonomous, a practice which continues today, where cultural resource management is conducted not only with the Tribe but also with cultural representatives of the bands. From east to west, the bands involved in the lower Pit River watershed include the Ilmawi, whose major habitation and resource area included the vicinity of the confluence of the Pit River and Hat Creek, much of which is now inundated by Lake Britton, the Itsatawi, who occupied the next stretch of river down and territory to the south adjacent to Goose Valley, and the Madesi, the westernmost Pit River band, occupying the area from Big Bend to Montgomery Creek (Kniffen 1928).

The river was divided into sections, not just in terms of band territories, but sections under the control of individuals, often people of authority who directed community activities for as many as four adjacent settlements. Even finer breakdowns of territory, recorded for the Madesi but probably common practice, occurred: the banks of the river in Madesi territory alone were broken into 21 sections owned by individuals.

Subsistence and Settlement:

As hunter-gatherer-fishers, Pit River people used the various life zones in their territories on a seasonal basis. Waterfowl hunting in the swamps was important in the spring, when tules, grasses, and roots were also available. They moved to the river's edge for summer salmon fishing, dispersed in the fall for hunting and the procurement of nut crops, and wintered in sheltered valleys near the river in wintertime. Winter was the best time for sucker fishing. Major winter settlements, therefore, were mostly strung along the river.

Very dense populations were noted in ethnographic and historic accounts along the river, particularly near the Hat/Pit confluence and at Big Bend. In the westernmost part of the territory, the steepness of the adjacent banks precluded riverside habitation, but salmon fishing was undertaken, and the north shore of the Pit River was a popular hunting retreat. Since Pit Rivers are a riverine people, a large range of activities took place along the riverbanks, including residential placement, fishing, gathering, cemeteries, and social and sacred uses.

The land is as rich in ritual as it is in resources. With a worldview revolving around nature where everything is sentient, potentially powerful, and deserving of respect, a large number of places figure into myths or are the home of nature spirits. Thus, the landscape itself reflects the mythical past, and recalls moral teachings.

Religion:

De Angulo stated that, for Pit River people, life is “a continuous religious experience” (de Angulo 1926). He further describes “The spirit of wonder, the recognition of life as power, as a mysterious, ubiquitous, concentrated form of non-material energy, of something loose in the world and contained in a more or less condensed degree in every object” (de Angulo 1926:354).

Religious history was taught during the long nights between December 20 and March 20 (Merriam 1928). Stories such as An-nik-a-del, the Coyote stories, and others were meant to give people a sense of their place on earth and to explain the genesis of various landmarks and customs. Since Merriam’s recording of the account of the beginning of the universe was taken from Madesi man, Istet Woiche, many of the referents in the story are local places, plants, and animals.

Ethnohistoric Pit River Water-Related Information:

Historic events have alienated large portions of the Pit River, but the Pit River Tribe has consistently attempted to maintain their relationship with this life-giving resource. The Pit River became a conduit for early Euro-American exploration and immigration, exposing the river-dwelling Pit River Indians to outside trade, diseases, and violence from the early 19th century. Peter Skene Ogden travelled down the Pit River on his 1826–1827 Snake Expedition. Later, one of the major trails of the Hudson Bay Company between Sacramento and Klamath Falls, Oregon ran along the Pit River, partially retracing Ogden’s route. The route was established by Alexander R. McLeod. Ogden’s route was subsequently followed by Michael Framboise and John Work between 1829 and 1833, and John C. Fremont in 1846 (Neasham 1957). In the 1840s, it guided Euro-American emigrants, settlers, and then military personnel into Pit River lands (Wheeler-Voegelin 1974).

Only a few conflicts took place between the early explorers and trappers and the Pit River people, but the John Work expedition was the vector for a massive epidemic that spread through California and Oregon in 1832–1833 (Cook 1955). There is no debate about the severity of local effects; the impacts were catastrophic for the Pit River people, with casualty estimated at or above 40% of the population (Wheeler-Voegelin 1974). Other waves of Euro-American diseases continued into the twentieth century, including smallpox, diphtheria, measles, and tuberculosis (Gillihan and Shaffer 1921).

The Pit River portion of the trail west for the settlers passed through the high-density residential areas around the Pit River/Hat Creek confluence. Pit River people acted immediately to protect their territory. As the two groups competed for resources, conflict escalated quickly, and by 1857, a number of vigilante groups formed to attack the Indian residents. Described as “armed, drunk, and dangerous” even by some in the local Euro-American community, they quickly became the cause of and not the solution to ongoing hostilities between the groups. Fort Crook was established five months after this conflict began, and the

military alternated between punishing attacks on villages and providing shelter and protection from marauding vigilantes (Tiley and Pierce 2004).

Two years later, the Pit River people were rounded-up and forced to march to Round Valley in Mendocino County. They were then taken out to sea in a boat, which was meant to disorient them so that they could not return to their territory. One family's horrifying account of this journey is provided by Wilson (1997). Conditions were so wretched on the reservation that most people escaped en masse after men on a hunting trip spotted Mount Shasta and, subsequently, the way home.

After their return, Indian people found many of the old village sites already occupied by Euro- American ranches along the Pit River and its confluences with Hat, Burney, Kosk, and Clark Creeks. They were forced into some sort of accommodation of these new circumstances. Initially, most labored for Euro-Americans as ranch hands or domestic help, setting up camps close to their employers. After seasonal work such as haying or fruit picking was over, families returned to the more traditional pursuits of hunting, fishing, and acorn and pine nut collecting.

The Dawes Act of 1887 was meant to transform Native American social organization, replacing group-based strategies with a life-way centered upon independent family farms. Indian families were allowed to file for parcels of land which would pass into their ownership after 25 years, at which time they would be owned and taxed like any other land. To an extent, the allotment system was used successfully by Pit River people in protecting some of their important ancestral areas, and in re- forming communities along the river. In the area now beneath Lake Britton, small Indian towns locally referred to as districts, formed at Fishing Creek, Carbon, Albion, Indian Springs, and the Peck's Bridge areas. Though the land released for allotments was often poor, waterless, and steep, some families were quite successful in establishing small ranches or orchards. As was true elsewhere, however, many allotments were lost when taxes became due, or when the immediate economic needs of the families became too critical and the land was sold.

By far, power companies bought out the largest number of allotments. In 1920, James Fitzpatrick and a Dr. Archer visited the Pit River to set the prices for the Pacific Gas and Electric purchase of the land adjacent to the river. Some of the arrangements made are still controversial. Many Indian people could not read at the time, and thought they were leasing, not selling, their land. Evictions regularly occurred, with the entire story documented in the documentary films prepared in the early 70's: *47 Cents/Acre* and *The Dispossessed*. As Lake Britton filled and families were again displaced, indigenous communities remained, particularly at Big Bend and Roaring Creek.

The subsequent building of the Pit 1, 2, 3, 4, 5, 6, and 7 Hydroelectric Plants drowned the little settlements and their pre-contact precursors, halting the salmon runs, and restricting access to large and culturally important stretches of the river. Dispossessed again, and economically and socially crippled by the loss of their major resource, the Pit River people continued the struggle to remain stewards of their ancestral lands.

The Madesi area also underwent of impacts not common for the region as a whole. At Big Bend, the hot springs had drawn Yana, Wintu, and Pit River people to their waters. In the historic era, they were purchased by a Mr. Henderson, who turned the area into a resort. Access to this once-shared place of healing now was dependent upon the whim of the current landowner. Other sacred sites as well fell just out of reach on private lands.

The Madesi area was also somewhat unique in the amount of impacts on lands remote from settlements. Government timberland went on sale in 1878 and allowed the purchase of up to 160 acres at \$2.50 an acre. Outlying areas were victim to a speculative boom as a result, and large acreages passed into private

hands. The area was subsequently heavily logged. Timber harvesting in Big Bend remains a concern today. Clear-cutting large patches of land erodes the topsoil, which flows into the river. The Pit River Tribe remains very active and in ongoing consultation with the USFS and other private entities that continue to conduct heavy logging activities. The Pit River Tribe continues to express concerns over current watershed activities that impact cultural resources such as water quality, water quantity, loss of botanical biodiversity of forest ecosystems, wildlife and fisheries.

Land claims in the Pit River region continue to be disputed by the Pit River Tribe. In 1928, various tribes were allowed to sue the government for compensation for the loss of their lands since they had never been compensated. Stewart's documentation of Pit River claims for the Land Claims Commission received a favorable preliminary judgment (Olmsted and Stewart 1978). However, attorneys advised the Pit Rivers to join in the larger Indians of California case. The community was split with many people opposed to — and who continue to be opposed to — the settlement.

Pit River Caretaking of Water:

A continuing reverence for the land and water has been noted by virtually every researcher in Pit River territory. In the 1870s, Powers states that “they are not content with designating the river as a whole, but every reach, every cataract, every bend, has a name to itself” (Powers 1976). de Angulo remarked upon the “extremely intimate contact” with nature characteristic of the Pit River people in the 1920s. In the 1970s, Olmsted wrote that “Pride in the knowledge of the extent and resources of their aboriginal home territory is matched only by Achumawi self-esteem for successful survival in their homeland...” In spite of the many disruptions over the last 150 years, band-specific ties to the land and its waters remain. It is important to note that Pit River people draw no distinction between prehistoric, historic, and current use, stressing rather their continuous association with the land.

Beginning in the 1960s, a group of educated, activist tribal members have sought recognition of the Pit River's rights to their ancestral territories. This led to several well-documented protests, one of which took place at The Cove. In 1974, three tribal elders were interviewed as a part of the Oral History Program at California State University, Chico. In what was meant to be an address to the public at large, they stated that the Pit River people needed land for not only economic reasons but for spiritual fulfillment as well (Lego, et al. 1974). In an argument used today, they pointed out that each group was created on a specific piece of land (and often a specific stretch of river) and was responsible for its stewardship. Therefore, Pit River people alienated from their land base are spiritually “lost.” These views have not changed in forty years and the new generation continues to assert and act upon their beliefs.

The Pit River Tribe and individual members have worked tirelessly with various state and federal agencies to continue their stewardship of the land and the water. They have provided patrols and site protection programs for State Parks, assisted the Forest Service with plant restoration projects, participated in land management planning with licensee, Caltrans, Pacific Gas and Electric, and other entities, and actively stood for their cultural and spiritual interests at Medicine Lake and Mount Shasta. Among their greatest achievements of stewardship were the designations of three Cultural Districts eligible for the National Register of Historic Places, including the Mount Shasta Cosmological District, Medicine Lake Highlands Traditional Cultural District, and Pit River Aboriginal Cultural District. All of these districts recognize the importance of the lands and waterways not only to current tribal members, but to future generations.

Current projects include: the Pit River Tribe Native Greenhouse, aims to provide for the propagation of native plants for enhancing regional restoration projects; the Hat Creek Riparian Restoration, Cultural Protection, and Recreation Improvement Project in coordination with California Trout and the Parkway Conservancy serves to protect and restore riverfront lands near the Hat Creek/Pit River confluence; The

Pit River Tribe Tribal Workforce Training Program in tandem with Lomakatsi Restoration will encourage forest jobs in ecological restoration, and; the Pit River Tribal Forest Enterprise will focus on best management practices, and traditional environmental knowledge application to produce sustainable yields. The Pit River Environmental Department supports the development of these activities under the direction of Tribal Council, Cultural Representatives and tribal community. Tribal departments continue to coordinate with Federal and State and local entities to monitor regional projects, protect cultural and environmental resources, and identify and create employment opportunities for Pit River Tribal membership.

The Pit River Tribe's Environmental Department and Tribal Historic Preservation Office are responsive to numerous projects that involve cultural resource management, and individuals from the tribe have actively participated as archaeological monitors and as ethnographic tribal interviewees.

They also actively review regional land use planning in order to keep them aligned with tribal planning documents. Their dedication to the protection of their ancestral resources goes far beyond words alone.

The tribe believes that federal Consultation between the tribe and federal agencies is not taking place to an adequate degree, and that the State of California should be in formal Consultation with the Tribe over natural resource issues, water quality, and allocation issues that affect Tribal rights and interests.

In addition to being a part of the Upper Sacramento and Upper Pit River IRWM; the Pit River Tribe is part of the North Coast IRWM. The Pit River Tribe is currently coordinating with North Coast Tribes; building needed partnerships to address IRWM planning issues impacting California Indian Tribes to identify solutions for future IRWM regional planning. The Pit River Tribe continues to advocate for adding a Beneficial Use Designation protection for "Cultural Use" of waters" in the Upper Sacramento and Upper Pit River IRWM Regions; as modeled in the North Coast Region.

Proposed Pit River IRWM Plan Projects:

The Pit River Tribe is unable to propose projects for this IRWM Plan because of the lack of funds to cover the work prior to reimbursement. Needs are expressed below in order to alert agencies of their needs and concerns and in the hope that some of these needs will be met under other programs.

Some general concerns were expressed including the need for the restoration of salmon to the river through the building of fish dams (promised since the 1920s but never completed); the need to restore biodiversity (particularly along stretches of formerly-flowing water) and management of invasive species; the need for access to the river for economic and cultural activities (large stretches of shoreline are held by Pacific Gas and Electric); continuing recognition and maintenance of tribal water rights; and the need for water quality monitoring, roads decommissioning, and ecological restoration to restore the many rivers and tributaries, in Big Bend, Burney Creek and particularly around Lake Britton and the stagnant waters associated with the Pit 6 and 7 hydroelectric projects, where swimmers have been catching impetigo and algae blooms have killed off mussel populations. There was a request for the protection of pools, falls, and seeps along the river course — which are often sacred locations. The sucker fishery has been closed down; one project desired by the tribe would be the establishment of a native species hatchery.

Concerns about natural and atmospheric mercury contamination were expressed by Native American stakeholders during public outreach. The state has just completed environmental scoping for a statewide Total Maximum Daily Load (TMDL) for mercury in reservoirs. Discussions with RWQCB staff confirm that elevated levels of mercury have been documented in some species of fish in Lake Britton. Of importance to tribal interests is the posting of advisories for water bodies known by the RWQCB to show evidence of elevated mercury.

Low flow events in the Pit River are a concern as they impact aquatic and wetland-dependent species important to traditional and recreational uses such as redband trout. Tribal interests wish to assure water reliability for “cultural beneficial uses,” including habitat restoration and to support sustained fisheries for redband trout.

Clear-cutting of timber around Big Bend continues, creating heavy loads of silt in the river. The lack of management of fuel loads on neighboring forested areas have contributed to several large, destructive fires in the area in the last decade, further impacting water purity. The old PG&E tunnels north of the river are still leaking potentially toxic materials. Neighboring Kosk Creek is observed to be warmer than it was, previously. There are also concerns that people drink and eat fish from these contaminated water sources. For those that abstain, the loss of salmon, sucker fish, crawdads, and mussels has meant a processed diet and the proliferation of health problems. The tribe does have water-monitoring stations and would like to be more involved in regional water quality and quantity testing and restoration.

Many Pit Rivers are still without access to safe drinking water and wastewater treatment systems. Many Pit River communities have undeveloped drinking water sources and community members rely on untreated surface waters; a lack of wells and water systems exists to supply water to households on tribal lands and allotments. A project to provide safe drinking water to the rural allotments and rancherias would constitute a major improvement. Water and wastewater infrastructure continue to be a major issue affecting the tribe.

Tribal members expressed significant concerns about PG&E’s current cloud-seeding projects as well as proposals mentioned in the State Water Plan Update 2009 to potentially conduct cloud seeding in the watershed as it has pursued in other watersheds in California. They cite the lack of scientific data regarding impacts from the process of injecting substances into clouds (primarily silver iodide, but also liquid propane and dry ice) that causes raindrops to form and the unknown effects of how cloud seeding affects weather and precipitation over neighboring regions. Public disclosure of these activities was also desired.

Access to waterways for traditional subsistence foods and fisheries remains of great cultural and economic importance to the Pit River Tribe.

3.4.5.3 The Shasta Indigenous Culture (including both the Shasta Nation and the Shasta Indian Nation)

Shasta Background Information

Territory:

Shasta territory extended from the forks of the Salmon River on the south to the Rogue River in Oregon, encompassing most of current Siskiyou County.

Bands:

The three main divisions included in the Ikiruka’tsu group are Oregon’s Jackson and Klamath Counties along the Rogue River and Jenny Creek and the Klamath River near Bogus Tom; the Iruaitso in Scott Valley; and the Katiru or Wiruwitsu downriver along the Klamath River near Seiad Valley. Three smaller groups included the New River Shasta along the North and East Fork of the Salmon River; the neighboring Konomiho on the Salmon River’s North Fork; and the Okwanuchu on the upper reaches of the Sacramento River and Squaw Valley Creek. The Okwanuchu and Shasta Valley groups were located adjacent to Mount Shasta and are of the most relevance to this overview. Heizer and Hester (1970) synthesized various sources in order to detail 156 known villages and discuss boundaries between groups.

The Okwanuchu, most closely associated with the Sacramento and McCloud Rivers, were described by Dixon (1905) as a small tribe occupying the head of the Sacramento River to Salt Creek and the upper McCloud as far as Squaw Creek and Squaw Creek Valley. Merriam also associates them with the upper McCloud (Merriam 1926). Wheeler-Voegelin thinks that Okwanuchu, Pit River, and Wintu people shared Squaw Valley (Wheeler-Voegelin 1974) based upon an historical account (Anonymous 1873). Silver (1978) accepts Dixon's location and adds that Voegelin (1942) suggests that they were inter-married with the Ajumawi Pit River band. A recent master's thesis (O'Donnell 1994) provides more detail, but the resolution of exact boundaries is beyond the scope of the current effort.

Subsistence and Settlement:

Shasta territory abounded in resources, from the rivers with salmon, trout, and other fishes and mussels to rich valleys with a wide variety of vegetal foods including acorns (a staple), roots, bulbs, greens, and berries, to forested uplands with deer, elk, and bear. Such natural bounty in all seasons facilitated high-density populations and complex cultures (Silver 1978:216).

Permanent settlements were made close to waterways, particularly the Klamath, Scott, and Shasta Rivers (Theodoratus, et al. 1989:17). Substantial rectangular winter homes (umma), a sweathouse and, if the village was large, an assembly house were the dominant features of settlements (Holt 1946:305-306). People moved to brush shelters along the river in the summer and to the hills for acorns in the fall.

The subsistence economy was focused upon riverine resources, particularly the bi-annual salmon runs, which provided both immediate food and dried winter stores. Salmon were obtained using nets, basket traps, weirs, hook and line, and spears. Specific rules and ritual practices surrounded fishing. Fishing platforms were built each season in April at the onset of the summer salmon run, with the first use blessed with a prayer. The winter salmon run occurred in the late fall. Steelhead also made a run in the fall. The first fish of the run was allowed to pass, since it brought "salmon medicine" from the Yurok First Salmon ceremony downstream. First Salmon ceremonies were also held in Shasta territory at Hamburg on the Klamath River and at Big Bend on the Shasta River. The first fish caught after that was hung to dry. Only when this first fish was dried and a portion eaten by all the fishermen, could people consume the salmon (Dixon 1907:430-431). Fish were also caught in artificial pools formed by piling rocks. These locations were owned and named, and the owner sprinkled tobacco and herbs in the water and prayed. Such pools were fished at night and on the last day a feast was held for friends and relatives (Holt 1946:310). Dixon (1907:428) also noted two large dams located at the mouth of the Shasta River and the Scott River which were individually owned, but at which anyone was welcome to fish. Women and children also collected mussels in spring and fall. In very dry years, water was diverted from rivers to the smaller streams so that salmon could ascend. It is believed that the salmon must return for the Shasta to prosper.

Religion:

The Shasta respect the spiritual/supernatural power existing throughout the environment and believe an individual has intimate day-to-day contact with such power (Renfro 1992:25). Each area has special places especially imbued with this force, such as pools, rock outcroppings, and secluded places that can be visited for special powers (Theodoratus, et al. 1989:4). Spirits (axe'ki) with mysterious powers occupy rocks, cliffs, lake, mountain summits, and rapids and eddies in streams (Dixon 1907:470). Prayers and offerings accompanied many daily activities as well.

Ethnohistoric Shasta Water-related Information:

Earliest contacts with Euro-Americans were fur traders in the 1820s and 1830s — many of whom were associated with the Hudson Bay Company. Scott's Valley, known to them as Beaver Valley, was rich in beavers; Thomas McKay collected 1,800 beaver pelts there in one month in the winter of 1836 (Silver

1978:212). The Shasta used the beads and mirrors they acquired in weaving, basketry, and on clothing. As has been recorded elsewhere, however, the amicable contacts had deadly consequences. Measles, malaria, and smallpox decimated native populations (Cook 1955).

The Shastan peoples acutely felt the Gold Rush; miners quickly crowded them from their fisheries and hunting grounds (Silver 1978:212). They were driven away from the river. Cook noted, “all along the Sierra foothill belt, and on the tributaries of the Klamath, the miners followed the watercourses and in doing so, drove out the heavy Indian populations” (1976:281).

But most of the impact was more direct. Gibbs (1853:162) reports that “many of their villages were burned and their people shot... [The Whites] had determined to wage a war of extermination against the Indians on the upper Klamath and its tributaries...” Hunted by individual citizens, “vigilantes” funded by the State of California, and the U.S. Military, with their children kidnapped as slaves, the Shasta were nearly wiped out (Renfro 1992:92-93). Those that survived did so in a “great state of destitution” (Gibbs [1853] 1972:59). Some of this poignant history has been recounted in Hall and Hall (2004).

Individual Shasta bands signed the treaty of November 1851, which was then never ratified by Congress. Shasta lands were taken at-will by settlers, though no agreement had been completed.

The Oregon bands of the Shasta joined the Klamath, Takelma, and Tututni in the Rogue River Wars of 1850-1857. When they were vanquished, they were sent to the Grand Ronde and Siletz Reservations on the Oregon coast. Some of the remaining Shasta found refuge with sympathetic white ranchers.

Shasta people took hope in this dark time by participating in three different waves of the 1870 Ghost Dance movement. It was hoped that dances, lasting for days in specially-constructed long houses, would allow people to consult the dead on how to make their way in a changed world (DuBois 1946).

All of these forces tended to scatter the surviving Shastan peoples. In 1907, Dixon spoke to individuals at Siletz, Yakima, and the Grand Ronde Reservation in Oregon, Yreka, Scotts Valley, and along the Klamath River (Dixon 1907:390). Their survival of the genocidal forces mounted against them in the historic era is remarkable.

In 1910, the federal Forest Allotment Act allowed Indians to legally homestead lands on the Forest Reserve (Winthrop 1986:52). Since no ratified treaty existed, the Shasta never were provided a reservation and these small landholdings quickly became population centers for groups of landless people (Renfro 1992:99). Working through the legal system for reparations for the lands they lost, they were awarded \$600 (or about 58 cents per acre) per person by the Indian Land Claims Commission in 1973 after consolidating their claims with other California Indians in Dockets 31 and 37 (Winthrop 1986:66). The 1934 Indian Reorganization Act allowed Shasta people to form the Quartz Valley Rancheria comprising 600 acres in 1940. As federal policies changed, the Rancheria was terminated in 1958, but then reinstated in the early 1980s.

Shasta Caretaking of Water:

Visits to culturally important springs to which access was possible, probably never stopped. Carraway George recalled attending Shasta ceremonies in the 1930s located at the Sacramento headwaters at the Mt. Shasta City Park. Many people would travel some distance to attend these ceremonies. Others camped at various other springs with mineral water, particularly for healing. Springs continued to be sacred as well as having healing values (Winthrop 1986:59).

In the 1970s, the Shasta became politically organized in order to gain federal recognition, fight desecration of their traditional lands, and maintain traditional life-ways (Renfro 1992:21). Formal and

informal gatherings allow people to sing, dance, pray, and pass on their culture. Traditional healing methods also continue. Winthrop (1986:45) notes that many long-term continuities in both beliefs and practices persist.

The Shasta have actively expressed their concerns at the federal, state and county levels regarding resources in their ancestral territory and have advocated the incorporation of Native American perspectives in the decision-making process (Theodoratus, et al. 1989; Winthrop 1986). Their opposition to land development in Graveyard Gulch in Scott's Valley meant frequent intervention with the Siskiyou County Planning Commission. They have collaborated with the Klamath National Forest in land use planning and the protection of cultural resources (Winthrop 1986). Their opposition to the Salt Caves Dam proposed for the Klamath Canyon in 1986, for which California Indian Legal Services filed their comments "exemplifies their concern with the sacred landscape that remains a focus of Shasta religion" (Winthrop 1986:58).

Theodoratus, et al. (1989:33) note that traditional uses of the area are ongoing, though only the participants might know these activities. They also caution that information on such places might not be given unless they are in danger of imminent destruction.

Proposed Shasta IRWM Plan Projects:

At present, the Shasta people are represented by two groups: the Shasta Indian Nation and the Shasta Nation, both of whom are stakeholders in the IRWM Plan process.

The Shasta Nation (Shasta Tribe, Inc.), in letter dated April 3, 2013, stated in their Tribal Ordinance #432013 that all regional governmental agencies and contracting agencies are in violation of the Shasta Nation's Inherent Sovereign Authority. This is based upon the un-extinguished title the Shasta lands. This was also strongly stated at the June 5, 2013 IRWM Plan meeting. Their position is that the price is too high for sovereignty to be relinquished for development dollars — that is, anyone taking the money will relinquish their water rights.

An addendum to the Shasta Nation Tribal Sovereignty document dated February 2, 2013 also stated "The Shasta nation declares it's sovereign and exclusive authority over the air, water, Indian lands, mineral, wildlife, and other natural resources within our boundaries to the exclusion of competing tribes."

In a brief meeting, members of the Shasta Nation pointed out that they have a different view regarding the lowering of Shasta Dam because they still have burials beneath the water that would be exposed. They are concerned about burials in other places as well.

The Shasta Indian Nation has a different view, stressing that they want their concerns about water heard. It was stated that, because of the importance of fish and fish runs both economically and ceremonially, fish are a cultural resource for the tribe — that water itself is sacred. In the past, they have worked for the restoration of the watershed, through cooperative actions with the US Forest Service, including plantings and cleanups.

3.4.5.4 The Winnemem Wintu Tribe

Winnemem Wintu spiritual leader Charlie Keluche said:

"The first Indians appeared near where the hatchery on the McCloud River now is. NomLestowa [supreme being] looked down and said: 'What kind of people are we going to bring up? They need water.' So he drew his finger down from Mount Shasta, forming the McCloud River. Then he

made fish and deer and all kinds of food. In four or five days all the McCloud Valley was full of people. [Du Bois 1935:74, quoting Charlie Keluche about 1934]”

Background and Introduction

The indigenous Wintun people of northern California are divided into roughly nine regions, with the most populous of those regions being along the McCloud River, a place called *winnemem*, or “middle water” in the Wintu language. The indigenous people of the McCloud, now politically formed into the Winnemem Wintu Tribe, have occupied this drainage, portions of the lower Pit River, and the meeting of the two rivers at the Sacramento River since the beginning of time. The Winnemem Wintu Tribe, recognized by the State of California and the California Native American Heritage Commission as an existing and historic California Native American Tribe, has traditional tribal lands within the Upper Sacramento River Watershed that includes the Upper Sacramento River, the McCloud River, the Pit River, and Squaw Creek. Far up the slopes of *Bullyum Pui Yuk*, or Mt. Shasta, the McCloud River begins as a series of springs and seeps, ultimately becoming the 50-mile-long river the Winnemem consider their central homeland. The origin of the Winnemem Wintu at Mount Shasta makes them, in the words of former spiritual leader Florence Jones (Jones and Sisk 2002),

“... people of nature. It also is the foundation of our religion, provides us our place of worship, and makes us responsible for the care of the mountain, which we do through prayers, songs, and dances. We have other places, too... made by the great Creator for the [Winnemem] Wintu Tribe to take care of. In return, the mountains and sacred places take care of the people by sending the healing spirits, herbs and medicines, and by teaching the doctoring ways. Our trails once formed a spider web on our sacred mountain and the many sacred places that must hear us sing and listen to our prayers. Unfortunately, today many huge areas have been lost due to clear-cut logging methods and strip-mining techniques, and land developers who support the non-Indian life styles and economy.”

Numerous books have been written about and for the Winnemem Wintu and their neighbors, including Cora Du Bois’ 1934 *Wintu Ethnography*, Christopher Chase-Dunn and Kelly Mann’s 1998 *The Wintu and Their Neighbors*, and Alice Hoveman’s 2002 museum exhibition catalog entitled *Journey to Justice: The Wintu People and the Salmon*. While a number of other books and articles have been published, there are also many unpublished investigations by Jeremiah Curtin, John P. Harrington, and Margaret Guildford-Kardell that documented the cultural richness and population density of the Winnemem Wintu along the McCloud River, especially prior to the construction of the Shasta Dam. It is a testament to their cultural persistence, despite all odds, tremendous roadblocks, and near annihilation, that their ceremonies and focus on water continue to uplift and energize the Winnemem people today. These are a people who struggle to protect their sacred places in landscapes of unusual power. The central principal on which the United States of America was founded — that of religious freedom — is a fundament where the indigenous Winnemem Wintu are still losing ground — sacred ground. The Winnemem Wintu Tribe are a proud, spiritual people who “have survived the settlement of America, the extermination and termination policies of the United States and the sicknesses brought to us by those who came to ‘civilize’ us” (Jones and Sisk 2002). Chief Caleen Sisk notes that “now we find that U.S. Government, after killing our people and taking our land, can’t remember who we are so we must prove that we are a tribe in order to regain federal acknowledgment so we can protect our religious practices and sacred places.”

The section that follows summarizes some of this story, especially with respect to the Winnemem relationship to water, salmon, and the health of the earth.

Ethnohistoric Winnemem Wintu Water-related Information

Until non-Indians came to California, the Winnemem Wintu lived a relatively peaceful spiritual life along the McCloud River. Soon after 1492 though, explorers and adventurers began their encroachment into what became California. Space does not permit a full discussion of the intrusions, but in less than 100 years after Columbus landed on the eastern coast of America, men like Hernando de Alarcón and Francis Drake were exploring the Pacific coast. This was soon followed by Spanish explorers, Mission fathers, French and Russian trappers, and American adventurers in the 1700s and early 1800s. Each of these groups brought their own form of destruction upon the native people, disrupting trade patterns, ceremony, and basic lifestyle. By the early 1800s, disease had affected most native populations of California. The influenza epidemics of the late 1700s and early 1800s wiped out whole villages, followed by the major Sacramento River Valley epidemic of the 1830s. J. J. Warner, a member of a trapping party observed:

In the fall of 1832... The banks of the Sacramento River, in its whole course through the valley, were studded with Indian villages... Upon our return, late in the summer of 1833 we found the valleys de-populated. From the head of the Sacramento to the great bend and slough of the San Joaquin, we did not see more than six or eight Indians; while large numbers of their skulls and dead bodies were to be seen under almost every shade-tree near water, where the uninhabited and deserted villages had been converted into graveyards. (Cook 1955a:318)

Although there is some conjecture among physicians as to what caused this sudden illness, most think that some form of malaria caused the 1833 epidemic. Cook (1955a:322) noted that some specialists estimated the death toll to be between 40–100% of the villages and that he personally thought it was about 75% for the Central Valley. From Cook:

“This is a startling and disturbing result. It means that fully 20,000 natives of the great Central Valley died in 1833; my own opinion is that this figure is too small. It means that three-quarters of the Indians who had resisted 70 years of Spanish and Mexican domination were wiped out in one summer. It also means that the red race in the heart of California was so crippled that it could offer but a shadow of opposition to the gold-mining flood that swept over it in 1849. It means that the ethnography of the Sacramento and San Joaquin valleys should be restudied from the standpoint of a far greater population than has ever been conceived as occupying the area.”

With this catastrophic population decrease, the Americans and others who arrived in the 1840s and 1850s to explore for gold, till the land, and settle in California, had less resistance from California natives than they might have had just 30 years prior. The native people were living modified and reduced lifestyles vastly different from their prehistoric past.

It can be argued that based on the geographic remoteness of Winnemem villages from the goldfields and major settlement areas, the people were not subject to the same annihilation as the rest of native California. Yet throughout native America, economy and livelihood were based, in part, on vast and proscribed trade networks where each group was affected by the groups with which they traded and, as such, a group exposed to non-native disease, tools, destruction would transfer that pathogen, technology or stories to the next group and they to the next, and so it went. That people were relatively mobile and were able to visit/trade with a number of groups meant the advancement of disease in particular could be frighteningly rapid. If the encroachments along the coast were not sufficient to intrude, the introduction of the horse on the eastern portion of the IRWM area made for vast changes in the region (see The Modoc Nation section). This was soon followed by the American advance of the Gold Rush and, in the years following statehood, the Winnemem Wintu have seen their land taken for resource extraction, especially by utility companies, federal land managing agencies, and by private property owners. No longer do the Winnemem own land where they hold sacred ceremonies.

Perhaps the most important point to convey about the Winnemem Wintu is that they are a spiritual people whose spiritual world includes the heavens, the earth, and the water. The sanctity of the water is of critical importance and each incremental reduction of purity makes it increasingly difficult to maintain cultural continuity. As Nompipom-Tunai Wintu Frank LaPena (2002:15) wrote, “with the loss and destruction of each sanctuary on the land, a little more of our heritage as Wintu and our cultural legacy was hidden away from each succeeding generation...” With the impounding of the Sacramento River there came the inability of the Chinook salmon to get past Shasta Dam — a disastrous event for a people who relied principally on salmon for their sustenance. Homelands were inundated and subsistence base removed so the Winnemem had no choice but to leave the McCloud. With this eviction came the additional “eviction” of those Winnemem who had already passed on and had been interred in their homeland. When the 1941 Central Valley Project [CVP] Indian Land Acquisition Act was signed into law, the creation of a trust land cemetery in Central Valley was one of three stipulations to compensate the Winnemem Wintu for the loss of their land. None of these stipulations were ever completely fulfilled. Florence Jones was called upon by the Bureau of Indian Affairs to pinpoint cemetery locations along the river so that the bodies could be removed to this new cemetery. The piece of border land that became the Black Canyon Cemetery was never placed into federal trust for the tribe or the families of those buried in the new cemetery. For this reason and since the government did not honor their promises, the Winnemem Wintu Tribe feel that they have not relinquished ownership of the allotment lands under the Shasta Reservoir — these lands still belong to the tribe. The end result is that both Winnemem ancestors, the people who had passed and the salmon who could no longer return home, were casualties of the CVP construction.

Until one has seen a Chinook salmon (*Oncorhynchus tshawytscha*), it is difficult to believe just how enormous in size they can be. Adult specimens of more than 120 pounds have been caught and they might have been even larger in aboriginal times. Since the construction of Shasta Dam, the winter run of Chinook has decreased so dramatically that it was thought there were only 100 or so individuals remaining in the early 1990s (National Marine Fisheries Service 1997 and 59 FR 440). In 1994, the winter-run salmon were listed in the Federal Register as endangered under the Endangered Species Act. Central Valley spring-run Chinook were subsequently listed as a threatened species on September 16, 1999 (Good, et al. 2005). In his report to the U.S. Fish and Fisheries Commission in Washington D.C., Livingston Stone (1874) noted:

“... the McCloud Indians... [are] so singularly connected with the abundance of the salmon in the Sacramento River. Had white men come here and required salmon for food, this main artery of the supply system of the river would have been stopped; or, had white men come and engaged in mining — as they have done on the Yuba and on the Feather and American Rivers — the spawning beds would have been covered with mud and ruined, as in those rivers and in less than three years the salmon supply of the Sacramento would have shown a vast decrease. The presence of the Indians, therefore, as far as it implies the absence of the whites, is the great protection of the supply of the Sacramento salmon.”

Even though the salmon have been removed from the Winnemem Wintu daily diet, these are a hearty people who continue because of their commitment to honoring the sacred spirits/places, laying down prayers, and acknowledgment of the intimate connection of the people to Mount Shasta and its waters via a network of sacred sites. Even upon death, a soul may go to Mount Shasta and then on to the Milky Way (Milky Way in Winnemem is *LesyemerL*, meaning spirit or soul trail; Du Bois 1935:78- 79). Secondly, the soul may go to a certain spring to drink water until the stomach is filled, and then rise like a balloon (Du Bois 1935:78).

Du Bois (1935:88) observed that the Wintu generally were a deeply spiritual people and that shamanism (or spiritual doctoring in this case) “must have been their chief preoccupation with the supernatural.” She (1935:118) continued:

“From a description of various phases of Wintu religion and from a discussion of shamanism itself, it becomes evident that the supernatural experiences were had by most of the tribe. The custom of praying and fasting at sacred places, the care of sacred objects,... the contacts with souls and spirits, were all common experiences of lay persons [in the tribe].”

That the spirituality continues today is part of the motivation for environmental and political activism evidenced by the Winnemem Wintu Tribe. These are the people responsible for the salmon, responsible for the water, responsible for the sacred fires, and, overall, responsible for the health of the earth. Despite the broken promises of the federal government with treaties, allotments, and rancheria land, the Winnemem Wintu have survived, they persisted in the face of ongoing opposition. Their caretaking of the water throughout their recorded history is well documented (e.g., Chase-Dunn and Mann 1998; Du Bois 1935; Hogue 1995; Hoveman 2002; Knudtson 1977; LaPena 1978; Masson 1998; and Stone 1874, 1876, and 1880). A few examples follow to indicate that participation in the IRWM Plan process is only one activity among numerous others that occupy the tribe’s time and efforts.

Winnemem Wintu Caretaking of Water

Following are examples of the generations of civil and spiritual action by the Winnemem Wintu to protect and preserve the waters of the McCloud River.

1. The Winnemem Wintu have always held that water is essential to their well-being and survival as a people. Chief Caleen Sisk notes that the first of many major protests by the Winnemem regarding their water rights was related to the establishment of the first federal fish hatchery in California, soon to be known as Baird Fish Hatchery. In 1872, Livingston Stone was appointed Deputy Fish Commissioner with the specific task of establishing a salmon hatchery to provide salmon eggs to replenish the depleted Atlantic salmon population on the east coast (Heizer 1973 records excerpts from Stone’s annual reports). Although Stone studied many locales, he chose the McCloud River as the best site (Hedgpeth 1941:129). In writing to Washington, DC, he provided detailed information about the Winnemem he found there because their presence was especially germane to the abundance of salmon. The Winnemem supported that stance in that “they evidently entertained the belief that they should continue, like their ancestors before them, to keep the McCloud River from being desecrated by the presence of the white man... Individuals frequently said... that I was stealing their salmon and occupying their land” (Stone 1875:408).

The Baird hatchery was built across the river from the sacred salmon heart rock where the “arteries of the heart are distinguishable. Near it a streak of black earth was identified with the blood vessels lying along the salmon’s backbone” (Du Bois 1935:80). When the leaders of that time saw what the white men were doing, in 1873, they held a war dance at this rock to protect tribal rights to the salmon. Stone said the Winnemem “assembled in force, with their bows and arrows, on the opposite bank of the river, and spent the whole day in resentful demonstrations” (Heizer 1973:7). In 1887, the Winnemem Wintu held what was to be their last public war dance, at the Baird Fish Hatchery. However, since that time, the Winnemem have held war dances at Shasta Dam, at the State Capitol, and elsewhere in the state to gain recognition of their position: the Winnemem then and now believe that their salmon and land have been illegally taken.

2. In 1851, a treaty (known as the Cottonwood Treaty) was made and signed between the United States Indian Agents and Chiefs of various tribes, including the Winnemem (Heizer 1972). The Winnemem

Wintu were represented by Num-te-re-man. The treaty, as with all 18 treaties made between the Indian Agents and California Tribes, was never ratified by Congress; the ratification would have provided a 35-square-mile reservation for the Wintu. Four decades later, in 1889, Norelputis, a Winnemem leader, sent a letter (often called the Wintu-Yana Petition) to President Benjamin Harrison, pleading with the United States Government for clarification and rectification of the conditions heft on the Winnemem due the incursion of non-Indians onto Winnemem land. He was also concerned about of the duplicity of the un- ratified Cottonwood Treaty. The letter pleads for better treatment of the Winnemem, other Wintu bands, and the Yana — all of whom had suffered horribly at the hands of the non- Indian. The letter concludes by asking for justice for the Wintu. The President sent A. M. Tinker to investigate the claims made in the Wintu-Yana Petition. In 1890, Tinker wrote a letter to the President describing the condition of the Baird Indians, and recommended providing allotments on the McCloud River to rectify the problems. Some allotments were provided, but then, in 1937, they were taken away to begin removal of Winnemem from the McCloud River, in anticipation of the Shasta Dam. In 1938 construction on the dam began, ultimately inundating Winnemem territory on the lower McCloud River. Five years later, the Winnemem were removed from their McCloud River homelands as Shasta Lake water would soon inundate their villages and sacred sites.

3. In the 20th Century, the Winnemem Wintu continue historic traditional ceremonies and practices along McCloud River at known historic places, all of which might be determined eligible for the National Register of Historic Places. Florence Jones successfully argued for religious freedom, using the American Indian Religious Freedom Act (AIRFA) to obtain a US Forest Service Special Use Permit in 1979 for an ancient doctoring and prayer site on the McCloud River where traditional ceremonials are held every year. Annually, ceremonies are held at a National Register site on Mount Shasta that include a ritual where tribal members and guests dive into the water and participate as salmon swimming upriver, completing different tasks at the three different falls on the McCloud River. Numerous sacred sites on the McCloud River and up to and including Panther Meadow on Mount Shasta are still used for prayers, sacred fires, fasting, visions, swimming for spiritual tasks/healing, and ceremonial runs among other actions. In 2006 the Winnemem Wintu brought back their puberty ceremonies on the McCloud River, dancing and taking care of sacred sites all along the river, although the tribe has had great difficulty holding this ceremony in peace and dignity on their traditional site. The tribe has received three cultural easements within this IRWM region, including access to a sacred spring from a private timber company. There are also two spring ceremonies conducted by the tribe on the McCloud River each year that include climbing a sacred mountain and rock and a seven-mile run.
4. The Winnemem hold an annual medicine gathering and prayer journey throughout Winnemem Wintu territory. The ceremony, known as “Round the World” involves visiting and praying at sacred springs, at historic sites along creeks, streams and the McCloud River and gathering certain plants necessary for spiritual and physical healing. Traditional activities along the McCloud and the Sacramento rivers and tributaries include the cultivation and harvesting of plants for traditional uses: medicine, food (berries, acorns, fruit, roots, bulbs, leaves), arrow shafts, ceremonial fires, gathering bark for ceremonial huts, and more.
5. In June 2002, Winnemem Wintu Chief Caleen Sisk testified before Congress on sacred sites protection, particularly in light of the proposed raising of Shasta Dam and the catastrophic effect it will have on remaining sacred sites and ceremonial grounds still in use after all of the years of cultural genocide.

6. In 2004, the Winnemem Wintu Tribe held the Hu'pChona (a war dance, the words of which mean "dance in the old way") at Shasta Dam to oppose the raising of the dam and the proposed flooding of tribal cultural properties. It was also held at the state capitol in 2009 and at BalasChonas (puberty ceremony) in 2012.
7. The Winnemem Wintu say that when they first bubbled out of the sacred spring on Mount Shasta at the time of creation, humans were helpless and unable to speak. It was salmon, the Nur, who took pity on the humans and gave them their voice. In return, the Winnemem have promised to speak for them always. The Winnemem Wintu Tribe has never given up on the possibility of reintroducing McCloud salmon to the McCloud River. Perhaps the only positive thing to come of the Baird Fish Hatchery for the Winnemem was the taking of McCloud salmon eggs to the Rakaia River in New Zealand. The McCloud River salmon have survived only in New Zealand. Tribal members journeyed to visit and apologize to the salmon in 2010 and the story has been captured in an award-winning documentary film, *Dancing Salmon Home*. The tribe continues to speak and dance for the salmon, in ceremony (such as at Glen Cove; Carquinez Strait where the salmon return to the fresh water from the ocean; the Salmon Dance at the Coleman Fish Hatchery; and again in New Zealand) and through ongoing planning and discussions with the National Oceanic and Atmospheric Administration (NOAA) and the Bureau of Reclamation (USBR) for the reintroduction of McCloud River salmon to the McCloud River.
8. The Winnemem Wintu Tribe has had active involvement in California and federal water issues, a few of which are listed here:
 - Participation in California Water Plan Updates and representation on the Tribal Advisory Committee
 - Tribal Water Summits from 2009-2013
 - The only participating tribe in the Upper Sacramento Watershed Assessment with a two-year involvement and significant input in the final document
 - One of the founding members of the Upper Sacramento/McCloud/Lower Pit IRWM Plan; tribal members participated in writing the planning grant, and over a three-year period have attended every general meeting; they have had significant participation in special meetings/committees relating to governance, projects, and future funding, including meeting with John Laird, California Secretary for Natural Resources on the important issue of Tribal Sovereignty; the Tribe is a cosponsor of a ground water monitoring project that will be in the IRWM Plan
 - Member of the Delta Visions Stakeholders Advisory Committee from 2007-08
 - Continues to oppose the raising of Shasta Dam and has objected directly to USBR as well as commenting on the Draft Feasibility Study and now Draft Environmental Impact Statement (EIS); the Tribe has fought raising of the dam since 2002 and will continue as long as needed; on this issue, the tribe is involved with ongoing meetings with representatives from the Governor's office and California departmental heads
 - The tribe is in coalition with other environmental and fisheries organizations to protect the Sacramento/San Joaquin River Delta and is currently a plaintiff in a lawsuit against USBR regarding alleged illegal water contracts
 - Tribal members spoke at Mt. Shasta City Council meetings, Siskiyou County Board of Supervisors meetings, and Mt Shasta community meetings against Pacific Gas & Electric (PG&E) Cloud Seeding Towers, and the threat of polluting nearby pristine water and sacred sites

with silver iodide; they are also vocal opponents of chem trails and the use of geo-engineering chemicals that pollute the land, air, and water with toxins

- The Tribe has been a staunch active opponent of water bottling plants such as the proposed Nestlé plant in the town of McCloud and had been actively involved in the local movement to prevent the construction of this facility; the tribe contends that such large international corporations extract large amounts of water and reap huge profits that do not benefit local disadvantaged communities or the environment
9. As a traditional spiritual tribe, the Winnemem Wintu have always protected their sacred sites. The tribe received international recognition because of their stance, along with other allies, to stop development of a destination ski resort on Mount Shasta. The proposed ski area would have been located directly over the National Register-eligible Panther Meadow, one of the tribe’s more sacred sites. They actively monitor sacred and historic sites throughout Shasta Trinity National Forest and have voiced opposition to the Federal Energy Regulatory Commission Relicensing (and proposed raising) of McCloud Dam. Actively involved in a lawsuit against the National Forest, the tribe asks that the Forest Service repair and/or mitigate damages to Winnemem sacred sites caused by Forest Service projects. One action asks the Forest Service to prevent pollution of a traditional Winnemem stream. The tribe is actively seeking National Register of Historic Places listings for their Traditional Cultural Properties that include sacred sites, ceremonial areas, and traditional cultural landscapes. The tribe is working with the Forest Service to document these places. The landscape of Wintu sites along the McCloud River is said to be one of the richer landscapes — next to only Yosemite or the Grand Canyon.

Proposed Winnemem IRWM Plan Projects:

More complete information on the conceptual projects can be found in Chapter 10. What follows here is a Winnemem Wintu story about the importance of beaver in the watershed and a summary list of some projects the Winnemem Wintu promote.

The Story of Besus as told by Chief Caleen Sisk:

“Bring back the beaver to the side streams of the McCloud River. We call beaver by the name Besus, and he is the sacred center. He brings in the life by creating the central place that the birds can come, the plants can grow, the fish can spawn, and all of the animals and plants can live and revive. What beaver does is beneficial for the watershed. Every year they build their dams and little huts, and every year the water flows down and breaks through the dam so the water can flow freely again. Beaver are vital to the health of our water statewide. We want to bring back the beaver in earnest to the high mountain pools that feed the river McCloud at Trout Creek. These natural reservoirs create sponge-like meadows that allow a natural seepage. Without the beaver, the water in the creeks all flows too fast. The US Forest Service has a model of this. We need a study of the beaver — what is their population now on the McCloud? Zero? We get them down on the creeks near here [Bear Mountain] but how many are still in the McCloud? The ancient rainbow, like the red band trout (*Oncorhynchus mykissstonei*) that we used to see on the McCloud would especially be helped by the return of the beaver because the trout need calmer pools during the spawning season to lay their eggs and there are no pools anymore because the river flows through without any place to rest. It needs to be understood that a study of the beaver should not be just a study of the beaver, but a study of the whole center that the beaver bring to the creeks and river. That is why we call Besus the sacred center.”

1. Pilot project to bring the beaver back to the watershed

- a. The tribe advocates for more education about how the beaver historically improved the entire watershed. This project would be an educational opportunity to learn about the benefits of returning the beaver to its historic territory. Advantages of returning the beaver could include increased water retention, creation of cold-water pools, and improving and expanding habitat for other beneficial species. The project would include mitigation for possible economic loss to private landowners in the study area.
2. Protect, rehabilitate, and restore Mount Shasta high alpine meadows
3. Restore and enhance native fisheries; remove invasive species from riparian ecosystems; work with landowners to bring back anadromous species such as the McCloud River salmon
4. Monitor chemical composition of precipitation in high mountain meadows
5. Restore historic conditions in the meadow, the Ash Creek Sink, and at Coonrod
6. Groundwater monitoring and spring study throughout the region

Conclusion

Given the diversity of interests concerning natural resources in this region, it can be expected that, at times, there will be conflicting values and objectives. The RWAG for the USR is interested in helping avert and resolve adversity whenever it can by encouraging greater understanding of diverse interests and values. Such efforts can include support for education, opportunities for dialog and exchange of ideas among various stakeholders, and increased appreciation for the different social and cultural values related to water and related natural resources.

3.5 Water Supply and Management

This section includes an overview of water supply and management in the USR. Looking at a 20-year planning horizon, the year 2035 is the general horizon year for this planning process.

One of the challenges in a largely rural planning area is that there are few, if any, urban water providers as defined by DWR's definition (3,000 or more connections, or delivering at least 3,000 acre-feet annually). The USR has no purveyors qualifying as an urban water supplier. As such, they do not complete urban water management plans nor are these agencies required to implement best management practices for water use efficiency. In addition, there has never been a development of the size that would trigger a water supply assessment (at least 500 units, an industrial development using at least that amount of water, or any development that will increase water demand within a single system by at least 10%) by the water agency, land use planning entity, or developer. It is possible that an industrial development such as the proposed water bottling facilities throughout the region would trigger an assessment, but as yet none has been completed. While operators and Boards of Directors are aware of service area issues and needs, these conditions are often not represented in a formal water supply assessment for small purveyors.

In response to these circumstances, this section is arranged to address water supply on a general level first, then getting at greater specifics as supply and demand relate to individual water agencies. It will then go into more detail with municipal water supply and management infrastructure, including topics of recycling, transfers (including inter-basin), and water infrastructure.

This section also identifies the major components of infrastructure related to water resources in the USR. It recognizes the primary community service systems as well as major impoundments and conveyance infrastructure. Also recognized in this section are special water-related infrastructure components such as Box Canyon Dam, the hydroelectric system operated by Pacific Gas and Electric Company, and Shasta Dam that, while located outside the region, has substantial impacts to and implications on the rivers and watersheds of the Upper Sac IRWM Plan region.

Importantly, the DWR Guidelines request that regions respond to how this planning process may reduce reliance on the Sacramento-San Joaquin Delta. Since the USR is not dependent upon the delta for water, this question is not applicable. However, decisions made by state and federal entities in support of delta health and statewide water reliability could affect the quantity and timing of water availability within the USR. The outcomes of these negotiations are yet to be seen and stakeholders will rely further on increasing in-region flexibility and self-reliance to the extent that they are not already there.

3.5.1 General Water Supply Sources

The USR includes the complete watersheds of the Upper Sacramento River and the McCloud River and, therefore, these watersheds do not receive water from outside areas. The Medicine Lake Highlands surface flow contributes to the USR, but that area is also a significant recharge area for the Fall River Springs, which have an estimated output of approximately 869,000 acre-feet per year (USGS, 1998). The Fall River Springs feed Fall River, which is a tributary to the Upper Pit River.

With the exception of the Lower Pit River watershed, whose source originates in the Upper Pit IRWM Region, it may be said that virtually no water enters the region from other than natural precipitation within the region. The Lower Pit River receives water from both the Upper Pit River watershed and from the diversion of water by PG&E from the McCloud River (which is within the same IRWM region but a different watershed).

As described in Section 3.5.5, the only conventional transfer of water out of the Sacramento River Basin to another basin (in this case to the Klamath River Basin) results from a small diversion from the North Fork of the upper Sacramento River to the watershed of the upper Shasta River. Some stakeholders consider the bottling and export of spring and ground waters throughout the region to be a water transfer.

3.5.2 Environmental Water Demands

DWR's 2012 IRWM Plan Guidelines ask for consideration of important ecological processes and environmental resources within the region and the associated water demands to support environmental needs. This is a complex and highly-specific subject, fairly localized relative to where particular impacts of a project may occur. For example, much more could be said in this chapter about the impacts that construction of Shasta Dam, McCloud Dam, and PG&E's hydroelectric facilities on the Pit River have had on ecological processes as a result of disrupting natural stream flows in specific areas. The operational protocols of particular facilities relative to ecological processes are important, as well, in the health and continuity of many downstream ecosystems. Operations policies and practices also have effects on recreational resources.

Along with the issue of the quantity of water supplies, water quality, including variations of water temperature, can significantly impact ecological processes. This has been noted, for example, in evaluations of how the changes of water temperature in the Lower McCloud River caused by McCloud Dam have affected aquatic resources such as the variety and distribution of particular species of fish.

Another example of a localized ecological concern was when the Nestle Corporation proposed a water bottling facility adjacent to the community of McCloud. Prior to the project being abandoned, various studies were conducted as part of the environmental review process to evaluate the potential impacts that water diversion and consumption might have on Squaw Valley Creek and related aquatic species and ecological processes.

This IRWM Plan will not affect water supplies or quality in any way, however, stakeholders have indicated a goal of increased coordination and communication throughout the region in order to

implement projects that protect and/or improve the water supply and/or water quality conditions for in-region uses. It is important to note that the IRWM process in this region relies upon the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) when applicable and as administered by various state and federal agencies to evaluate projects that may affect water supplies and related environmental resources. There is wide concern from tribes, community organizations, local governments, and other stakeholders that political pressures and regional water demand from state population centers may impact (negatively) available regional water supply. Commodification of water resources has promulgated many discussions and will likely be an ongoing topic for RWAG consideration.

3.5.3 Future Supplies and Demands

Given the upper watershed nature of this region, a typical regional water balance is irrelevant and not available to the region. Compared with the total outflow, there is no substantial diversion of water for consumptive use. The various agencies and communities in the region have a variety of master plans and other planning documents to project their future water supplies and consider needs in terms of expected future demand. With those analyses, they have identified improvements needed to accommodate future demand as well as to alleviate their current system deficiencies. Agencies adopt planning horizons for their master plans based on their resources, projections and needs.

Groundwater supply is an area where stakeholders acknowledge significant gaps in knowledge. While in-region resident experiences suggest that extensive groundwater withdrawals — as seen with water bottling facilities — negatively affect residential wells, there are no formal studies to back up this finding. The unknown nature of the resource has resulted in a lack of public protections. It is imperative for all stakeholders to gain a better understanding of this resource and there are in-region efforts to work with local, state, and federal agencies to better determine supply, potential yield, quality and connectivity, and other impacts.

Based on conversations with water system managers in the region and review of the applicable master plans and planning documents, it appears that the current sources of water for water suppliers in the region are, in most cases, adequate to meet the use demands that are expected by the year 2035. That expectation assumes: 1) that recent (slow or negative) growth trends continue; 2) that storage capacity and water distribution systems are maintained; 3) that regulatory activity remains as it currently stands with regard to withdrawal rates, and; 4) that the region isn't subjected to prolonged droughts in that period.

There are systems that rely on sources of water that are particularly vulnerable to droughts, or which are not adequate to serve the extent of development that those sources are now expected to serve.

Some of these systems, such as the County Service Areas in Shasta County, have been upgraded as needed. Some systems within the region will not realize the connectivity between surface infiltration and groundwater/spring sources until a prolonged drought occurs. Those communities reliant upon a single source of water — spring-, ground-, or surface water — acknowledge this weakness and are assessing alternatives to address it.

It should be noted that, in addition to water supply systems, a major constraint to communities in effectively meeting demands for community services is likely to be the lack of capacity of wastewater infrastructure to meet evolving standards and regulations for discharging treated wastewater. The City of Mt. Shasta, which partially discharges water into the Upper Sacramento River, is an example of a community facing that challenge and needing to upgrade its wastewater collection and treatment system.

Because of various physical and economic constraints to municipal development in the region, and considering recent growth trends, there are few indicators to suggest that there will be substantial growth of population and related water use in the region by 2035. Substantial increases in water use, if any, are likely to be related to water bottling and beverage production, and/or to development and operation of recreational uses such as new golf courses. Such uses will need to either develop their own water sources or enter into agreements with purveyors (e.g., cities, CSDs) for service, provided the purveyors have the capacity to accommodate the demand. For example, the City of Mt. Shasta's General Plan recognizes the prospects for residential and other development on the north side of town in what is known as the Spring Hill area, but developers will need to work with the city to extend the municipal water system with adequate storage to that area.

There are no known projects or changes in conditions (aside from potential impacts related to climate change) in the USR that can be expected to substantially decrease the amount of water that currently leaves the region. The in-region reservoirs are so small in relation to Shasta Lake reservoir that any flow criteria developed by the State Water Resources Control Board to address delta and other downstream needs will likely be insignificant for these upper reservoirs. Due to the rugged topographic character of this upland region and lack of land suitable for large-scale agricultural production, an appreciable increase in the use of water for agriculture is not expected.

What may be significant for the region are possible (and potential) unexercised water rights by Native American tribes. While currently unknown and un-quantified, federally recognized tribes do hold federal — and therefore correlative state — rights to water resources (DWR, 2009). As climate change alters regional hydrology, and more pressure is put on regional resources by interests south of the region, it will be important for the region — and for the state — to get a better understanding of these unexercised aboriginal water rights that may be called upon in the future.

Understandably, since the water that flows from or through the Upper Sacramento, McCloud, and Lower Pit IRWM region is an important resource for the Central Valley Project (CVP), the U.S. Bureau of Reclamation and the users who are dependent upon that project have their own concerns about the impacts of climate change and other issues in the region that may impact the demands on resources. The same may be said for PG&E in regard to water used for hydroelectric production.

There are no substantial diversions in this region from the rivers that feed the CVP that would result in a net loss to the inflow of Shasta Lake Reservoir. Issues related to the water supplies of the CVP that are discussed in the IRWM plan include local concerns about the impacts of cloud seeding and weather modification and the proposal to raise Shasta Dam and the level of the reservoir (see Chapter 6, Issues and Interests). The potential impacts of geothermal development in the Medicine Lake area on the recharge and water quality of Fall River, which eventually flows into Shasta Reservoir via the Pit River, is also discussed. Also, concerns with the capacity of the cities of Mt. Shasta and Dunsmuir to treat wastewater that is discharged into the Upper Sacramento River (which flows into Shasta Lake Reservoir and supplies the CVP) in compliance with water quality regulations is an important concern in the plan (see Chapter 6).

In some ways, this region is insulated from many of the larger water resource concerns of California due to the fact that most of the water from this region flows into Shasta Lake Reservoir, which is managed by the Bureau of Reclamation for the CVP (the Bureau has not participated in this IRWM planning effort). In other respects, however, this region needs to be regarded as one of the primary resource areas for the entire Sacramento River system and the State of California. As climate change alters the hydrologic regime, it will be important that the state look to source water areas and invest in healthy ecosystems, fire-safe landscapes, and the communities relying on these resources.

3.5.4 Municipal Water Supply and Management Infrastructure

Much of the information presented below is shown in the measurement convention used by the water purveyor and/or city. There are two conditions under which water is measured—water at rest and water in motion. Water at rest is measured in units of volume. Water in motion is measured in units of flow—unit of volume for a convenient time unit. For easy conversion, the list below provides some common conversion metrics:

Volume:

1 cubic foot (cf) = 7.41 gallons

1 acre foot (af) = 326,000 gallons = 43,560 cf

Flow:

1 cubic foot/second (cfs) = 450 gallons per minute (GPM) = 0.646 million gallons/day (MGD) 1 GPM = 1/450 cfs = 0.00144 MGD

1 MGD = 1.547 cfs = 694.4 GPM

Dunsmuir

As one of the two incorporated cities in the region, the City of Dunsmuir maintains a municipal water system and a municipal wastewater system.

The Master Water Plan for the City of Dunsmuir was completed in 1994 and includes a summary of the existing water system, future water demands, recommended improvements, and estimates of cost. The Master Water Plan estimated raw water usage (metered and unmetered water consumption) in the year 1994 at approximately 0.45 million gallons per day (MGD) and estimated water usage for the year 2014 at approximately 0.62 MGD. Based on “ultimate development” conditions, which includes expanding the water system to serve unincorporated areas of the county, future water demand in the city is estimated to be 1.03 MGD.

The City of Dunsmuir is supplied water through the diversion of four of 16 springs known collectively as Mossbrae Springs. These four springs have an effective capacity of approximately 1.5 MGD and are located near the northern extent of existing development in the city. Based on a 1957 license for the diversion and use of water issued by the State Water Resources Control Board, the city has rights to 1.97 cubic feet per second (CFS), or approximately 1.27 MGD.

Water from the four springs is collected and discharged to a concrete weir box, where most of the water is discharged into an 18-inch steel water supply main. The remainder overflows the weir box and is allowed to flow down the hillside along with the remaining spring waters to form Mossbrae Falls, which flows into the Sacramento River. The entire Mossbrae Springs system (i.e., all 16 springs) is estimated to have a total yield of approximately 15 CFS, or about 9.6 MGD.

Water from Mossbrae Springs is of excellent quality and requires no treatment or chlorination at this time. However, existing chlorination facilities are available adjacent to the head-works. These facilities were constructed in the late 1970s when the water system began to show evidence of bacterial contamination from up-gradient sewage disposal systems. However, soon after the completion of the treatment facilities, the up-gradient development responsible for the problem was connected to the city’s wastewater collection system and the contamination ceased.

The city also operates the Airport Well, which was established in the 1970s in order to provide potable water to Dunsmuir’s Mott Airport in the northernmost area of the city. Given that the well was never

designed to serve development beyond limited airport operations, the well has very limited production capacity, delivering only about four gallons per minute.

The city has two water storage reservoirs: North Dunsmuir, which was completed in 2007, and Woodridge, which dates back to 1905. Together these reservoirs provide approximately 1.0 million gallons (MG) of storage. The city's water distribution system consists of approximately 18.4 miles of 1- to 18-inch diameter pipeline of varying construction and ages. With a theoretical useful life of 55 to 75 years, depending upon the type of lining and coating used, most of the existing steel pipelines are very near the end of their useful life. According to city staff, a number of water main sections require frequent repair and are in need of replacement as soon as possible.

The City of Dunsmuir has applied to various state and federal agencies for grant monies to complete approximately \$9,613,000 worth of improvements to the municipal water system as recommended by the Master Water Plan. While some of the recommended improvements have been made, such as the addition of a 600,000-gallon water storage reservoir in 2007, the city is still in the process of determining the best funding strategy for the remaining improvements. In the meantime, the city has adopted a water rate increase that will be phased-in over the next several years, which will cover some of the highest priority water projects.

The City of Dunsmuir Wastewater Treatment Plant (WWTP) is located approximately 1.3 miles south of the city limits in Shasta County, adjacent to the Sacramento River. The 2007 Master Sewer Plan for the City of Dunsmuir was prepared by PACE Engineering, Inc. and includes a summary of the existing sewer system, future sewer demands, recommended improvements, and estimates of cost.

The sewer system was originally constructed in the downtown area in the early 1900s, with the majority being replaced in 1975. The north Dunsmuir area was sewered in 1968. Some sewers in the downtown area experience a significant amount of infiltration and inflow (I&I), which is groundwater and stormwater that seeps into the sewer system during extremely wet weather. This I&I component increases the wastewater flows at the WWTP from an average dry weather flow (ADWF) of about 0.25 MGD during the summer to a peak wet weather flow (PWWF) in excess of 2.1 MGD during the winter.

The WWTP was completed in 1975 and has an ADWF design capacity of 0.41 MGD and a theoretical PWWF capacity of 2.0 MGD. Treated effluent is discharged directly into the Sacramento River during the winter (from September 16 to June 14). During the summer (June 15 to September 15) all effluent is discharged to the percolation ponds. The existing WWTP facility has capacity limitations in the secondary clarification process, which becomes ineffective at flows above about 0.6 MGD. During higher flows, solids are not removed in the clarifier and effluent is severely degraded, which prevents discharge to the river. During these conditions, effluent is discharged to the ponds, which consumes storage volume for summertime flows and violates effluent discharge requirements set by the Regional Water Quality Control Board.

The City received a Cease and Desist Order from the Regional Water Quality Control Board (RWQCB) on December 8, 2006, wherein it was charged that effluent copper, zinc, and dichloroboromethane (DCBM) concentrations at the treatment plant exceed permissible limits under the National Toxics Rule, the California Toxics Rule, and the Basin Plan (CDO No. R5-2006-0136, RWQCB). Some improvements have been completed at the WWTP to improve effluent water quality since 2006, though there is not adequate capacity to treat wet weather flows above about 0.6 MGD, resulting in poor effluent quality during wet weather conditions. This limitation prevents the city from being able to meet effluent discharge requirements, affects the city's ability to discharge to the river during high wintertime flows, and impacts the available effluent storage volume onsite for summertime use. Aside from the current need

to enlarge the secondary clarifier, the treatment plant has been continually upgraded to meet state requirements and the needs of the city and is in good condition.

Mt. Shasta

The City of Mt. Shasta operates the municipal wastewater collection system, and the city-owned wastewater treatment facility has three means to dispose of treated effluent. The city releases treated water into the Upper Sacramento River in the canyon just below Box Canyon Dam during the winter. During the summer, reclaimed water can be used at the Mt. Shasta Resort Golf Course. The city can also pump treated effluent to a leachfield located on a U.S. Forest Service tree plantation near Highway 89 when the other two discharge methods cannot be utilized.

The City of Mt. Shasta also owns and operates the municipal water system. The city captures water from Cold Spring (also known as Howard Spring) and delivers it to city residents. It also uses two groundwater wells to supplement demand in the summer if needed. The City of Mt. Shasta monitors the flow and usage rates of this spring. The average spring production fluctuates from month-to-month and year-to-year, with its lowest monthly production of 2.9 cfs (1,317 gpm) having been recorded in March 1992. It was also noted that maximum spring production generally occurs in the summer months; however, this varies from year to year, where in 2006 production peaked in June (with usage peaking in July).

The city has owned and operated its own water system since 1912, when it was purchased from the Sisson Development Company. Through the years, Cold Springs has been the primary source of water for the water system. The city's current water right is 100% of the Cold Springs yield, which is about 3.2 MGD based on a 20-year average annual production. The city also has two wells that can produce approximately 1.7 MGD to supplement the spring water resources in the summer and fall. In 2009, the city had 1,695 water service connections with an average day demand (ADD) of 1.7 MGD, and a MMD of 3.2 MGD.

The total estimated water production needed to serve build-out of the city's current water service boundary by the year 2030 is approximately 4.3 MGD. In addition, the city's General Plan planning boundary encompasses property that is outside the current water rights service boundary. Therefore, if the city wishes to achieve full build-out of its current water rights service area boundary or to serve areas outside of that service area boundary, then it will need to develop supplemental water supply sources. Interest in obtaining additional supply from Big Springs has been expressed by the city.

Although multiple parties have rights and/or claims to Big Springs, and the acquisition of water rights for Big Springs would involve a lengthy and expensive process, the city's Master Water Plan suggests that the city may want to consider pursuing water rights in order to acquire additional cost-effective water supplies to meet future demands.

~~Because the city does not meter water usage, the city's current annual average water usage per household equivalent (HE), based on the current consumption rate of 1,026 gallons per day per HE, is very high; about 3.5 times that of Dunsmuir. A recommendation in the 2010 Master Water Plan is that the city may need to employ aggressive water conservation policies in order to postpone the need for future capital improvements needed to expand its water system.~~

The City of Mt. Shasta provides sewer service to a population of approximately 3,500. The regional sewage treatment plant, which serves the city and some unincorporated development in the vicinity, was completed in 1976 and is located approximately two miles south of the city limits. A gravity collection system connects the city infrastructure with the wastewater treatment plant. The collection system consists of approximately 30 miles of gravity sewer line. During the winter, as noted above, the wastewater treatment facility releases treated wastewater into the Upper Sacramento River at Box

Canyon, just below the dam. During the summer, reclaimed water can be applied on the Mt. Shasta Resort Golf Course (the only occurrence of water reuse in the USR) and, as noted above, the city also periodically pumps effluent to a leachfield located on a U.S. Forest Service tree plantation when it cannot utilize the other two discharge points.

The wastewater treatment plant has increased its capacity from 0.75 to 0.80 MGD, which is sufficient to handle an additional 434 household equivalents. The average daily demand is 230 gallons per day per person. The City of Mt. Shasta, like Dunsmuir, also experiences significant I & I during wet weather. This I & I component increases the wastewater flows at the WWTP from an average dry weather flow of about 0.65 MGD during the summer to a peak wet weather flow in excess of 3 MGD. In conjunction with the climactic conditions during the winter months, this makes it very difficult to treat wastewater effluent to the required levels.

The City of Mt. Shasta 1992 Master Sewer Plan for the Sewage Collection and Treatment Facilities contains the results of an investigation of the sewage collection system and treatment facilities. The plan includes conceptual plans, staging, and cost estimates for the major capital improvements that were thought would be necessary for the time period of 1992–2012. The city also completed a Wastewater Treatment Plant Capacity Evaluation report in 2003. The report concluded that the plant was currently operating at 80% capacity. For the treatment plant to reach its existing design capacity, improvements would need to be made, some of which include upgrading of wastewater collector and interceptor lines.

The City of Mt. Shasta is currently under interim effluent limitations for operation of its wastewater treatment facility and is pursuing an upgrade of its current aerated pond wastewater treatment system to provide treatment levels equivalent to Title 22 Standards for reclaimed water prior to discharging to the Upper Sacramento River below Box Canyon Dam. In addition, the City has to reduce effluent concentrations of zinc, copper, and ammonia to meet new final limitations. These enhanced treatment requirements are considered necessary by the Regional Water Quality Control Board to preserve that stretch of the Upper Sacramento River as a pristine white water rafting and fishing area.

McCloud CSD

In addition to other community services, the McCloud Community Services District (CSD) maintains both a water system and a wastewater treatment system for the unincorporated community of McCloud.

The water supply capacity of the district comes from three springs — Upper Elk, Lower Elk, and Intake Spring — which provide approximately 13.4 cfs, or about 6,000 gallons/minute. The district is currently using approximately 25% of this capacity. The current residential water usage during summer is 4,500 gallons per day per connection, while winter use is 900 gallons per day per connection. (It is important to note that the McCloud Community Service District, like most other communities in the region, does not currently meter water usage, which contributes to the high estimates of water usage). Based on a usage of 4,500 gallons per unit per day, it is estimated that approximately 2,085 residential units could be built before reaching capacity.

The two Elk Springs used by the McCloud community have been identified as slightly vulnerable to contamination and potential over-use (CalTrout 2010). This is largely due to short residence time and age of the water, high usage, and the local nature of land uses in the recharge area.

The capacity of the McCloud CSD's wastewater system is 300,000 gallons per day, and the district is currently operating at 50% of capacity. With the current capacity and water supply availability, the district projects that a total of 500 residential units can be built (Siskiyou County 2010). McCloud's treated wastewater is discharged into Squaw Valley Creek.

Shasta County Water Agency

The Shasta County Water Agency was established in 1957 to develop water resources for the beneficial use of the people of Shasta County. The Water Agency's governing body is the Shasta County Board of Supervisors. On June 30, 1967, the Water Agency negotiated and entered into a contract with the Bureau of Reclamation for the delivery of up to 5,000 acre-feet of Central Valley Project (CVP) water annually for agricultural, municipal and industrial uses. Much of this amount was eventually assigned to cities, community service districts, and water districts in Shasta County. The Water Agency currently administers 1,022 acre-feet of Central Valley Project water that is subcontracted to private parties and other water purveyors in Shasta County. The Water Agency supplies portions of its CVP allocation to two county service areas located within this IRWM region (i.e., 77 acre-feet to CSA No. 3 – Castella, and 119 acre-feet to CSA No. 23 – Crag View). These CSAs are described below.

The Water Agency also serves as staff to the Redding Area Water Council, which was formed as a response, in part, to the drought period of 1987–92. The Water Council is dedicated to preserving the quantity and quality of water available in the Redding Basin. In May 2007, Shasta County adopted an AB 3030 Groundwater Management Plan for the Redding Groundwater Basin. In June 2007, Shasta County approved the Redding Basin Water Resources Management Plan to help ensure water supply reliability in the Redding basin during drought conditions. Shasta County is also a member of the Northern California Water Association (NCWA).

In 2010, Shasta County joined as a participating agency in partnership with Butte, Colusa, Glenn, Sutter and Tehama Counties for preparation of the Northern Sacramento Valley Integrated Regional Water Management (NSVIRWM) Plan. It was noted by the county in considering participation in the IRWM planning process that failure to participate could result in local water purveyors in Shasta County being disqualified from pursuing various types of state grants (Shasta County 2010). Shasta County maintains that its role is that of a “purveyor” of water as well as a jurisdictional agency due to its resources and functions as the Shasta County Water Agency.

County Service Areas

The County of Shasta has established eight county service areas (CSAs) that provide water service to rural unincorporated communities in the county. Three of these CSAs are located in this IRWM Plan region: CSA No. 2 – Sugarloaf; CSA No. 3 – Castella; and CSA No. 23 – Crag View. These CSAs, which are all located in the Upper Sacramento River watershed portion of the region, are described below.

The governing board of county service areas is the County Board of Supervisors. Some CSAs in Shasta County have an advisory committee to facilitate communication with the county concerning management of the particular district. Members of each community advisory board (CAB) are landowners and/or residents in the district who are informally elected by the landowners and residents of the district and formally appointed by the Board of Supervisors to two-year terms. Currently, none of the CSAs in the USR have an operating CAB.

The Shasta County Public Works Department is assigned responsibility for operation and administration of county service areas. CSA operations are under the Deputy Public Works Director for Operations with the Development Services Division retaining CSA administration duties including billing and collection and budget development and administration. CSAs are not supported by general funds of the county. Each CSA operates as an enterprise fund with water usage charges and related fees used as the basis for financing delivery and system operation and maintenance. A budget for CSA operations is presented annually to the County Board of Supervisors.

As reported in the Shasta County LAFCo *Municipal Services Reviews, Volume 1, County of Shasta and County Service Areas* (May 2003), all of the water CSAs in the county, including the three that are located within this IRWM region as described below, have sufficient water supply and access to water supply to meet the essential needs of its customers within its existing service area in the foreseeable future. It is recognized that the source and supply of water to all CSAs could be adversely impacted by severe drought conditions. Under such conditions, the county would take appropriate demand management actions necessary to ensure that any rationing or reductions would not impose a health and safety risk in affected communities.

CSA No. 2 – Sugarloaf: County Service Area No. 2 is located approximately 20 miles north of Redding at the upper reach of the Sacramento River arm of Shasta Lake Reservoir across from the Salt Creek inlet. The community, which is comprised of the Shasta Lake Subdivision, is located on the shore of the reservoir and is accessed from Interstate 5 at Lakehead via Lakeshore Drive. CSA No. 2 was formed in 1976 to establish an entity to secure financing, construct, operate, and maintain a new water system to serve the Shasta Lake Subdivision, which is the only development served by this CSA. The estimated population living primarily within the 86-parcel subdivision is 150 (Shasta LAFCo 2003). The population fluctuates seasonally. Residents are comprised of a mix of seasonal summer users, retired or semi-retired residents, and year-round owners who commute to nearby areas of employment.

Prior to 1976, residents in the area obtained water from a small spring-fed creek west of the subdivision. A small rock dam was constructed in the creek and water was diverted by gravity into a steel pipe to a concrete tank. In the summer, however, the spring would go dry and water would need to be hauled in. A loosely organized water company operated the system. The system was found to be unreliable and, when residents petitioned the county to assume responsibility, the county initiated proceedings to form a county service area. The CSA was formed in 1976 and construction of the water distribution, storage, and treatment facilities was completed in November 1978 (Shasta LAFCo 2003). Funding for initial construction was obtained through a grant and loan from Farmers Home Administration. An annual parcel charge was levied to collect funds to pay the annual debt service on the original loan. Three subsequent expansions of the distribution system were completed by late 1982. The expansions were financed entirely by the developers of the parcels to be served by the expansions.

CSA No. 2 obtains water from two sources. The primary source, and most of the total water available, is from an appropriative water right to an unnamed spring-fed stream located on a hillside in the northeast sector of the CSA. The water available through the diversion structure at the stream source is largely dependent upon the amount of rainfall in a given year and varies annually. A backup source, which is a well that pumps water from a mountain aquifer, was developed for when low rainfall results in inadequate supply from the stream.

As currently constructed, the system has a designed capacity of 86 services (Shasta LAFCo 2003). When LAFCo prepared the municipal services review in 2003, it found that there were 58 active services and 28 standby accounts (service available, but not connected). Therefore, the system was found to be operating at 64% capacity and, if the standby accounts were converted to consumer status, the system would be operating at full capacity. This CSA has not expanded its boundary by annexation since it was formed. In 1984, Shasta LAFCo adopted a sphere of influence for the CSA that provided for three expansion areas. The sphere of influence study noted that, should there be proposals to add more development within the CSA, the current water system would need substantial modification. An additional source of water would need to be developed and storage, treatment, and distribution facilities would need to be expanded (Shasta LAFCo 2003).

CSA No. 3 – Castella: County Service Area No. 3, which serves the community of Castella, is located in Shasta County approximately 50 miles north of Redding near the Siskiyou County line. The CSA is

located on the west bank of the Sacramento River south of Castle Crags State Park and north of the community of Sweetbrier. Castle Creek flows west to east and into the Sacramento River through the community. Interstate 5, the Union Pacific Railroad, and two major power transmission lines traverse the area (Shasta LAFCo 2003). Land use consists generally of a mix of retired and semi-retired or unemployed residents, summer users, and year-round residents who mostly commute out of the community for employment. Commercial development includes two small grocery stores and a tavern. The community also has an elementary school and a fire station manned by a volunteer fire company.

Prior to 1976, the community's water was diverted by a privately-owned system through an open ditch from Castle Creek. The ditch ran through a pasture to a pit with sand that was intended to serve as a filter before the water was piped to the community. The filter and pipe inlet were not secure and rodents and small animals could get into the system and further diminish the water quality. The distribution system was also antiquated. The water quality problems were very severe and, in times of drought such as in 1976 and 1977, Castle Creek ran so low that surface diversions were difficult.

These issues prompted the residents to petition the county for assistance in securing federal funding for a new water system. The Board of Supervisors requested initiation of proceedings to form a county service area and CSA No. 3 was formed in 1976 to provide and maintain an improved water system to serve the community of Castella.

The CSA obtains its water from an appropriative water right and an allocation from the Shasta County Water Agency. The source of water continues to be Castle Creek. The total water available to the CSA is 157-acre feet per year, based on the appropriative water right, which entitles the CSA to up to 80 acre-feet per year, and the Shasta County Water Agency allocation (derived from a Central Valley Project allocation through the Bureau of Reclamation) that provides for up to 77 acre-feet to the CSA per year (Shasta LAFCo 2003).

Construction of the district's new water storage, treatment and distribution system was completed in November 1980. The water storage tank is located on a Forest Service parcel on a hillside on the east side of the district. Funding for initial construction was obtained by a grant and loan from Farmers Home Administration and a loan from the Shasta County General Fund. An annual parcel charge was levied in the district to pay the annual debt service on the original loan. The developers of the parcels to be served by such expansion finance any expansion of the system.

The water system, as currently constructed, has a designed capacity of 123 services. In 2003 there were a reported 90 active services and 21 standby accounts (service available, not connected) in the community of Castella. The system is approximately 68% capacity. If the standby accounts were all converted to consumer status, the current system would be operating a 90% capacity (Shasta LAFCo 2003). The CSA has not expanded its boundary by annexation since it was formed in 1976. Shasta LAFCo adopted a sphere of influence for the CSA in 1984, recognizing that the district might someday expand south into the community of Sweetbrier. However, there has been no effort on the part of landowners in Sweetbrier to convert from private water sources to water service from CSA No. 3 (Shasta LAFCo 2003).

CSA No. 23 – Crag View: The community of Crag View is located immediately south of the Siskiyou County line along the west bank of the Sacramento River. The river generally bound the area to the east, the Siskiyou County line to the north, and Interstate 5 to the west.

Prior to 1992, the Crag View Community Services District (CSD) provided water service. By that year, the CSD was experiencing financial and organizational difficulties and its board of directors asked the County of Shasta to initiate a re-organization that would dissolve the CSD and create a county service area to assume responsibility for the water system. The Local Agency Formation Commission approved

the re-organization for formation of the CSA in February 1992; the assets and liabilities of the Crag View CSD were transferred to the new CSA; a schedule of fees and charges was established; and CSA No. 23 began operating the water system (Shasta LAFCo, 2003).

The source of water is Castle Creek and the intake facility, storage tank, and treatment equipment is located near the Dunsmuir Railroad Park. The CSA receives an allocation of 119 acre-feet from the Shasta County Water Agency. The estimated population in the CSA is 180 (Shasta LAFCo, 2003). The CSA encompasses 73 parcels, of which 69 are connected to the water system. Therefore, the system is operating at approximately 90% capacity. There have been no annexations to the CSA since it was formed.

Other Infrastructure Systems

There are several systems operated by private companies in the region. These include the Lake Siskiyou Mutual Water Company, serving the community immediately surrounding Siskiyou Reservoir, and the Lakeshore Heights Mutual Water Company, which serves the community of Lakehead. The Lakeshore Heights MWC obtains its water by a diversion from Charlie Creek and has a permit to divert up to 128 acre-feet per year.

Individual domestic wells throughout the region utilize groundwater for human consumption and there are larger wells that supply water to bottling plants in Mt. Shasta and Dunsmuir.

Individual septic tanks are commonly used outside of areas served by community systems.

3.5.5 Inter-Basin Transfers

The only case of a man-made inter-basin transfer in this IRWM region consists of a transfer of water out of the Sacramento River Basin to the Klamath River Basin resulting from a small diversion from the North Fork of the Upper Sacramento River to the watershed of the upper Shasta River. A small diversion dam on the North Fork diverts up to 15 cfs of water in winter and early spring for storage in Hammond Reservoir. The diversion site is on the south side of Mt. Eddy and transfers water northward via what is known as Eight Mile Ditch to the reservoir located southwest of the City of Weed. Water is distributed from Hammond Reservoir to water right holders for summer irrigation in the upper Shasta River Valley during the irrigation season.

A diversion of between 2 and 8 cfs of water from the Upper McCloud River to the community of McCloud and ultimately to Squaw Valley Creek (a tributary to the Lower McCloud River below McCloud Dam) is made possible by Lakin Dam. The McCloud River Lumber Company constructed that small diversion dam in 1925.

As noted in the Resource Management Strategies (Chapter 8), the water bottling and beverage manufacturing that occurs within the USR could be thought of as a transfer, though non-traditional. This “transfer” is un-quantified and the effects of it on local resources (e.g., groundwater that supplies local wells) have not been assessed. This is a knowledge gap that USR stakeholders would like to address.

3.5.6 Dams, Reservoirs, and Hydroelectric Infrastructure

Box Canyon Dam and Lake Siskiyou

In 1969, the first construction phase of Box Canyon Dam was completed, creating Lake Siskiyou reservoir. Lake Siskiyou represents the only impoundment on the Upper Sacramento River between the headwaters and Shasta Lake Reservoir. The dam is 209 feet high with a length of 1,100 feet. Lake

Siskiyou has a storage capacity of 26,000 acre-feet with a normal surface area of approximately 430 acres.

The Flood Control and Water Conservation District manages the flood control and water conservation in Siskiyou County and the county is the main landholder around Lake Siskiyou. These lands were acquired to facilitate construction and operation of the Box Canyon Dam and provide recreational opportunities, including water-based recreation and camping. Of the 2,240 acres owned by Siskiyou County, approximately 550 acres are below the ordinary high-water mark of the reservoir, 1,390 upland acres are adjacent to the lake, and approximately 300 acres have been set aside as deer winter range (SHN 2004).

The reservoir captures water from the North, Middle, and South forks of the Upper Sacramento River and other streams that flow directly into the lake, many of which are spring fed (e.g., Wagon Creek). The hydroelectric plant at the dam has a total rated capacity of 5 megawatts (MW) of electricity.

Siskiyou County owns the dam as part of the Siskiyou County Flood Management District. The County contracts out the operation of the power plant and leases out operation of the campground on the west side of Lake Siskiyou.

McCloud Dam and Related Hydroelectric Infrastructure

The infrastructural system developed and maintained by Pacific Gas and Electric Company (PG&E) to produce hydroelectric power from the waters of the McCloud River and the Pit River are substantial features relating to the hydrologic character of those streams. It is helpful to describe the system as two related systems: 1) the part of the system related directly to McCloud Dam with diversion from the dam to the Pit River, including the components of the system on the Pit River below that outlet, and 2) the part of the system that generates power from the Pit River prior to the point where the Pit River receives waters diverted from the McCloud River. These two systems are consistent with the licensing framework administered by the Federal Energy Regulatory Commission (FERC) for PG&E's operations in the USR.

McCloud dam was constructed in 1965. It is a 241-foot-high, 630-foot-long earth- and rock-filled dam located on the McCloud River that impounds McCloud reservoir. The McCloud reservoir is approximately 5 miles long and has a surface area of 520 acres with a maximum storage capacity of about 35,197 acre-feet.

McCloud dam has been primarily a diversion facility for PG&E, as described below. However, PG&E has proposed to construct a new powerhouse at the base of McCloud dam as a new electrical generation component of its system. The McCloud Dam hydroelectric plant would use water stored in McCloud reservoir and released into the Lower McCloud River to meet instream flow requirements. No new impoundment is proposed. The turbine and generator set would have an installed capacity of about 5 to 8 MW. The Lower McCloud River runs approximately 24 miles from the dam to Shasta Lake Reservoir.

McCloud dam diverts flows from the McCloud River via a 7.2-mile-long tunnel (the McCloud tunnel) and a 563-foot-long pipeline section at the Hawkins Creek crossing that hydraulically links McCloud reservoir with Iron Canyon reservoir.

Iron Canyon Dam is a 214-foot-high and 1,130-foot-long earth-filled dam that impounds diverted water from the McCloud River as well as water from Iron Canyon Creek tributaries to create Iron Canyon reservoir on the ridge between the McCloud and Pit River watersheds. The reservoir has a maximum storage capacity of 24,241 acre-feet and a surface area of about 500 acres. The dam has a slide gate leading to a pipe for instream flow releases to Iron Canyon Creek.

The 2.9-mile-long Iron Canyon tunnel diverts water from Iron Canyon reservoir. An associated 1,194-foot-long pipeline at the Willow Spring Creek crossing and a 5,467-foot-long steel penstock provides water to the James B. Black powerhouse near the Pit River. The powerhouse contains two turbine generator units with a combined maximum capacity of 172 MW. The powerhouse is located about 0.5 miles upstream of the Pit 5 powerhouse described below. Flows discharge from this powerhouse via a tailrace leading directly from the generation units to the Pit River.

It is noted that, at this point on the Pit River, the waters from the two PG&E systems (i.e., the McCloud dam diversion and the facilities operated on the Pit River, described below) basically come together above the Pit 6 reservoir.

Pit 6 dam and reservoir are located on the Pit River downstream of James B. Black powerhouse. The Pit 6 dam is 183-foot-high and 560-foot-long concrete structure, and the Pit 6 reservoir has a maximum storage capacity of about 15,619 acre-feet and a maximum surface area of about 268 acres. The reservoir serves as the forebay for the Pit 6 powerhouse. Two 18-foot-diameter steel penstocks with a total flow capacity of 6,470 cfs extend 602 feet from the dam to the Pit 6 powerhouse turbines located at the base of the dam. The Pit 6 powerhouse is located at the base of the Pit 6 dam. The powerhouse contains two turbines with a maximum generator capacity of 80 MW. Water is discharged from the Pit 6 powerhouse directly into the Pit 7 reservoir.

Pit 7 dam and reservoir are located on the Pit River downstream of the Pit 6 powerhouse. Pit 7 dam is a 228-foot-high and 770-foot-long concrete gravity dam. The Pit 7 reservoir, which is approximately 8 miles long, has a maximum storage capacity of 34,142 acre-feet and a surface area of about 468 acres. Pit 7 reservoir serves as the forebay for Pit 7 powerhouse. Two penstocks extend 572 feet from the dam to the turbines in the powerhouse located at the base of the dam. The Pit 7 powerhouse contains two turbines with a maximum combined capacity of 112 MW. Water is discharged from Pit 7 powerhouse directly into the Pit 7 afterbay.

Pit 7 afterbay has a surface area of about 69 acres at a normal maximum water surface elevation of 1,067 feet msl (which is the maximum water surface of the reservoir). The afterbay dam is a 30-foot-high, steel reinforced, rock-fill structure. The Pit 7 afterbay serves to attenuate changes in the water flow from Pit 7 dam and powerhouse before entering Shasta Lake Reservoir, which abuts and sometimes inundates the afterbay.

PG&E has proposed to add a Pit 7 afterbay powerhouse, which would use water released upstream from the existing Pit 7 powerhouse and dam. No new impoundments are proposed.

The Pit 3, 4, 5 Hydroelectric Project (Pit 3, 4, 5 Project) is an existing combination of related hydroelectric facilities located on the Pit River above the James B. Black powerhouse. The Pit 3, 4, 5 Project consists of hydraulically connected developments with a total of four dams, four reservoirs, three powerhouses, associated tunnels, surge chambers, and penstocks. The powerhouses contain nine generating units with a combined normal operating capacity of about 325 MW. After passing through this network of facilities (including the Pit 6 and 7 facilities described above), the Pit River flows into Shasta Lake Reservoir.

While mention will be made of the Pit 3 reservoir, more popularly known as Lake Britton, it is noted that this reservoir is not actually in the USR. The region may be said to begin at the base of the dam. The Pit 3 development includes the 1,293-acre Pit 3 reservoir (Lake Britton). The reservoir has a gross storage capacity of 41,877 acre-feet. The Pit 3 dam is a concrete gravity structure with a crest length of 494 feet and a maximum height of 130 feet. The facility includes a tunnel and penstocks to deliver water to the

powerhouse. The three generating units in the powerhouse have a total normal operating capacity of 69.9 MW.

The portions of the actual Pit River between hydroelectric facilities are described as reaches. The Pit 3 reach of the river extends approximately 6 miles from the Pit 3 dam to the Pit 4 reservoir. A steep-walled canyon confines the reach.

The Pit 4 development consists of the 105-acre Pit 4 reservoir, with a gross storage capacity of 1,970 acre-feet. The Pit 4 dam directs water through a long tunnel and penstocks to the powerhouse, which contains two generating units with a combined total operating capacity of 95 MW. The Pit 4 reach of the river extends approximately 7.5 miles from the Pit 4 dam to the Pit 5 reservoir. Similar to the Pit 3 reach, it is confined by a steep-walled canyon.

The Pit 5 development consists of the 32-acre Pit 5 reservoir, which has been described as “long, narrow, and riverine in character.” The reservoir has a gross storage capacity of 314 acre-feet. The Pit 5 dam, with a concrete gravity overflow structure 340 feet long and 67 feet high, diverts water via the 5,109-foot-long tunnel No. 1 to Tunnel Reservoir, also known as the Pit 5 open conduit. Tunnel Reservoir has a surface area of approximately 48 acres and a gross storage capacity of 1,044 acre-feet. The Pit 5 Tunnel Reservoir dam is a compacted earth fill embankment structure that is approximately 3,100 feet long and 66 feet high. The outlet of tunnel No. 1 and the inlet for tunnel No. 2 are both located in the bed of the Tunnel Reservoir. Water from the tunnel No. 1 enters the east end of this reservoir/open conduit below the water surface, creating the appearance of a large upwelling spring. At the west end of the reservoir water enters Pit 5 tunnel No. 2, which leads to the Pit 5 powerhouse. Tunnel No. 2 has a total length of 23,149 feet, leading to four penstocks that are 1,380 feet long. The penstocks feed the powerhouse, which contains four generating units having a total combined capacity of 160 MW.

The Pit 5 reach of the river extends approximately 9 miles from the Pit 5 dam to the Pit 6 reservoir. The upper portion has a very high percentage of riffle habitat and very few large pools. The middle portion near Big Bend flows through a more open canyon that narrows somewhat along the lower portion.

The Pit 6 reservoir represents the tailwaters of the Pit 5 powerhouse. Water surface elevations fluctuate in response to peaking flows entering from the Pit 5 powerhouse at the head of the reservoir and from the J. B. Black powerhouse (McCloud-Pit Project), which is on the Pit 5 reach a few hundred yards upstream of the Pit 6 reservoir. The Pit 6 reservoir and PG&E facilities downstream are described above as elements of the McCloud dam and Pit project facilities.

Shasta Dam

While Shasta Dam and its impoundment, Shasta Lake Reservoir, are technically not included in the USR (since the lower portions of the watersheds in the region terminate at the lake), the dam, reservoir, and related features are significant factors concerning water resources in the region and warrant discussion as related to this region.

The Bureau of Reclamation, which manages the facility, completed construction of the dam and reservoir in 1944. Shasta Dam is a curved gravity concrete dam on the Sacramento River about 9 miles north of Redding. The dam is 602 feet high and 3,460 feet long, with a base width or thickness of 543 feet. The dam controls runoff from about 6,420 square miles. The four major tributaries to Shasta Lake Reservoir are the Upper Sacramento River, McCloud River, Pit River, and Squaw Creek, in addition to numerous minor tributary creeks and streams. The dam has a current reservoir capacity, at full pool, of 4.55 million acre-feet (MAF) and a water surface area of 29,500 acres. Seasonal flood control storage space in Shasta Reservoir is about 1.3 MAF. The elevation of the lake, which also represents the approximate lowest elevation of the IRWM Plan region, is 1,070 feet.

Shasta Dam was constructed for flood control, irrigation water supply, municipal and industrial water supply, hydropower generation, and recreation purposes. Shasta Dam was constructed as an integral element of the Central Valley Project. The Central Valley Project (CVP) is the largest surface water storage and delivery system in California. The program supplies water to more than 250 long-term water contractors in the Central Valley, Tulare Lake basin, and San Francisco Bay Area. Shasta Reservoir accounts for approximately 40% of the total storage capacity of the CVP and provides for over half of the total annual water supplies delivered by the CVP. The CVP also provides flood damage reduction, navigation, power, recreation, and water quality benefits. The power plant at Shasta Dam consists of five main generating units and two station service units with a combined capacity of 715,000 kilowatts (kW).

Shasta Lake Reservoir supports extensive water-oriented recreation. Recreation within these lands is largely managed by U.S. Forest Service (USFS) as part of the Whiskeytown-Shasta Trinity National Recreation Area (NRA). There are also some privately owned and managed recreation facilities.

Shasta Dam is operated in conjunction with Keswick Dam, located about 9 miles downstream from Shasta Dam. Keswick dam was completed in 1950. In addition to regulating outflow from Shasta Dam, Keswick Dam controls runoff from 45 square miles of drainage area. Storage capacity of Keswick Reservoir below the top of the spillway gates at full pool is 23,800 acre-feet.

The USBR has initiated environmental compliance documentation for the Shasta Lake Water Resources Investigation. A feasibility study was reinitiated in 2000 to examine the potential of raising the dam and, consequently, the level of the lake. Reclamation and cooperating agencies are analyzing alternative dam raises from 6.5 to 18.5 feet and corresponding increases of reservoir storage. Issues related to raising the dam are discussed in the Hydrology and Water Resources section of this Region Description.

Cultural Effects of Shasta Dam on Aboriginal Lands and People

The site of Shasta Dam was a logical engineering solution to the challenge of delivering adequate water supply to the San Joaquin Valley and southern California, but the location was selected without regard to [the Winnemem Wintu Tribe's](#) ~~tribes~~ location and history. When Shasta Dam was completed, it created the largest man-made lake in North America, covering traditional ancestral villages, homesteads, cemeteries, and sacred sites. It submerged most of the habitable terrain in the region, including the Baird Fish Hatchery, Kennett, Copper City, and the Pit River Railroad and it blocked the salmon run that used to fill the rivers. (Clark 2005; Franco 2007; McTavish, 2010)

Among the many tasks required in order to build Shasta Dam, was a requirement that the USBR acquire the Redding Allotments (previously committed to the ownership and management of indigenous people) and move the graveyards that were below the impoundment level of Shasta Lake Reservoir. Each allotment case was unique. Determining the ownership and probate status, finding all the heirs, and completing the document search was likely time consuming. The acquisition of all of the required allotment titles was far from completed in 1941. Faced with the realization that lack of titles to the allotments might actually hold up progress on the project, the USBR turned to Congress for assistance. The Central Valley Project Indian Lands Acquisition Act (CVPILAA) of July 30, 1941, 55 Stat 612, gave the USBR “all the right, title, and interest of the Indians in and to the tribal and allotted lands within the area embraced by the Central Valley Project.” The funds were to be deposited with “the superintendent of the appropriate Indian Agency.” [The Winnemem Wintu Tribe](#) ~~Given the issues with probate and tribal members the difficulty of finding all the heirs, it is unlikely that all entitlements were never compensated distributed.~~ [The Winnemem Wintu Tribe continues.](#) ~~Many affected tribes continue~~ to consider this an issue of environmental and legal justice, and continues to press the federal government to

fulfill all the CVPILAA provisions and to fulfill promises⁵ and provide payment and/or like lands for the allotments now submerged.

3.5.7 Integration and Coordination of Management Activities

While the water supply systems supplying communities with pressurized water are themselves fairly remote — from each other and from larger urbanized areas — there are opportunities to manage resources together in order to achieve common goals. Many of these are identified in the more specific objectives identified by the USR stakeholders, including quality water for human consumptive use, the environment, and for commercial use. While there may not be the opportunity for integrating infrastructure needs, gaining knowledge and recommendations from each other through regular communication and coordinated project development and implementation could represent a significant resource savings in time and money for all water purveyors involved in the USR planning process.

Throughout the IRWM planning process, stakeholders identified the lack of information as a hurdle for many types of planning activities, including knowledge of glaciation patterns, the connectivity of springs to surface and groundwater, understanding how groundwater connects to other resources throughout the USR, and understanding the probability and potential outcomes of future regulatory activities. All stakeholders agree that additional knowledge, shared by all participants, would go far in helping the USR to move forward with regional resource management. The details of the study development and data gathering can be difficult to establish collaboratively before adequate trust is established, and stakeholders anticipate conversations regarding standard practices and acceptable transparency as the RWAG continues to meet.

3.6 Climate and Geology

3.6.1 Climate

The elevations of the USR range from the lowest points at the lake level of Shasta Lake Reservoir at 1,067 feet above sea level to the highest point on top of Mount Shasta at 14,179 feet mean sea level (msl). Most of the region is located at elevations between 1,100 and 4,000 feet msl.

The region lies within the Mediterranean climatic zone, which extends into the Pacific inland west, from Mexico to south-central Oregon. This zone can generally be characterized as having warm, dry summers and cool, wet winters. Precipitation amounts are highly variable. Elevation and topography in the region vary substantially and exert a large influence on many climatic factors.

At the higher elevations of this IRWM region, approximate annual precipitation averages for the City of Mt. Shasta is 40 inches and for McCloud is 50 inches. Nearly all precipitation falls between October and May and may fall as both rain and snow at the lower elevations below 7,000 feet, while is mostly snow above 7,000 feet. In general, precipitation amounts increase with elevation with more than 70 inches above the 7,000-foot level. Summer rain and thunderstorms occur infrequently but can be intense.

As noted in the Mt. Shasta Watershed Analysis (USFS 2012), each side of Mt. Shasta has a different climate that is largely created by the mountain itself. The south side of the mountain (McCloud area) receives the most rainfall and winds are generally calm. In contrast, the north side of the mountain receives substantially less rainfall, becoming quite arid and is characterized by very windy conditions. The west side (near Mt. Shasta City) also can be quite windy, particularly when north-south winds are

⁵ The CVPILAA created a cemetery in the town of Shasta lake to replace historic burial grounds. Part of the CVPILAA promised to place this property in trust for the Winnemem Wintu and other affected families.

funneled through the Sacramento River Canyon and between the mountain and Mount Eddy. The east side of the mountain may or may not experience a rain-shadow effect, depending upon the approach of individual storm events.

Hot, dry summers and a mild climate characterize the lower elevations of the southern part of the region in the vicinity of Shasta Lake Reservoir during the remainder of the year. Average temperatures range from the mid-40s Fahrenheit in the winter months to near 80 degrees in the summer months, with summer days typically reaching near or above 100 degrees. Annual precipitation, mostly in the form of rain, varies from 45 to 75 inches depending on local topography. Approximately 85% of this precipitation falls from November 1 through April 30. Summer thunderstorms are common and can release significant amounts of localized rain. These storms can also be dry with conditions that encourage fire ignition and spread from lightning strikes. High summer temperatures combined with low humidity and limited rainfall are perhaps the strongest climatic influence on local plant communities.

3.6.2 Projected Impacts of Climate Change on the USR

Given its location in a heavily forested and sparsely populated area of far northern California, as well as its abundant spring sources fed by mountain snowmelt, the USR has unique climate vulnerabilities as well as those it shares with other regions. These climate change-related vulnerabilities are summarized below and are described in greater detail in Chapter 9, Climate Change, and Appendix F, USR Climate Change Vulnerability Assessment.

Water Supply

Because of the USR's abundant water resources, there has been little water storage infrastructure developed in the region ([see Section 3.5.4 for a discussion of municipal water systems and Sec. 3.5.6 for a discussion of reservoirs](#)), as well as little research into the region's volcanic aquifers where so much of the USR's groundwater is found. While reliance on water from spring sources has resulted in excellent water quality and limited drought vulnerability in the past, projected climate change impacts, such as diminishing snowpack, more frequent droughts, earlier snowmelt, and more precipitation falling as rain than snow, could impact groundwater recharge and the resultant supply of water available from the springs.

Water Demand

Projected warming due to climate change is expected to further increase summertime demand associated with landscape irrigation, potentially affecting water supply availability for other uses in the region.

Water Quality

Climate change-driven threats to water quality are largely due to the increased risk of wildfire and related secondary effects, such as erosion, sedimentation, and higher water temperatures. The potential for more frequent, larger fires is associated with projected warming, more frequent and longer periods of drought, greater variability in precipitation, and earlier snowmelt. In addition to potential shifts in water quality due to wildfires, lower instream flows caused by prolonged droughts could diminish the assimilative capacity of the region's streams and impact the ability of wastewater treatment providers to discharge treated effluent into these water bodies.

Flooding

With projected shifts in the timing, quantity, and type of precipitation due to climate change, more frequent flooding is expected in portions of the USR. This could impact communities and transportation

infrastructure along the Upper Sacramento River and adjacent to Squaw Valley Creek in McCloud. In addition, potential flooding due to the loss of vegetation from wildfires is a serious concern.

Ecosystems and Habitat Vulnerability

Erosion and subsequent sedimentation of aquatic habitats are ongoing challenges in the USR due to the region's steep and complex topography, numerous waterways, and active fire regime. Further, as previously noted, erosion and sedimentation are likely to be exacerbated by increased wildfire activity associated with climate change. In addition, climate sensitive species, such as populations of McCloud River redband trout that occur only in isolated portions of the upper watershed, may be vulnerable to the increasingly frequent or prolonged periods of drought expected for the region. While there has been little research on the potential impacts of climate change on vulnerable species in the region, there are several special-status species present in the USR. Projected warming and increasing sedimentation of regional waterways could also affect the proposed reintroduction of anadromous species. Adding to these climate change complications for native species is the fragmented habitat found in some areas of the USR, as well as the region's dams and highways.

Hydropower

While energy needs are expected to increase as the region's temperature warms, future energy demand in the USR is likely to be similar to present demand due to the region's slow rate of growth and anticipated improvements in energy efficiency.

3.6.3 Geology

The USR is located within portions of both the Klamath Mountains geomorphic province and the Cascade geomorphic province.

Rock units of the Klamath Mountains Province underlie large portions of the western and southern areas of the region. The geomorphic expression of these areas is controlled by the bedrock geology as expressed in topographic features, including the type, rate, and magnitude of erosion processes. The topography is rugged with prominent peaks and steep dissected drainages. Eroding hill slopes dominate the geomorphology features within these areas, although mass wasting features are frequent. Naturally occurring erosion, including mass wasting, is relatively high because of the steep terrain, parent materials and climate. The soils developed from the underlying parent material have distinct and characteristic properties that can affect vegetation patterns and disturbance mechanisms at multiple spatial and temporal scales.

Metasedimentary rock units are located in much of the region, including limestone units in the lower parts of the Upper Sacramento River and McCloud River watersheds. Small intrusions of igneous rock can be found throughout these areas and typically iron-rich ultramafics and silica-rich granitics. In the southern portions of the region in the vicinity of Shasta Lake Reservoir, which fall within the southeastern extent of the Klamath Mountains province, geologic features include multiple limestone terranes, including the McCloud Formation and Hosselkus limestone area. In addition to containing numerous limestone caverns, limestone terranes also provide habitat for many cave-adapted invertebrates and limestone-associated biota (USDA 2010). (*Note: A terrane is a section of the earth's crust that is defined by clear fault boundaries with stratigraphic and structural properties that distinguish it from adjacent rocks.*)

The limestone formation in the area around Shasta Lake Reservoir is unique in its development, composition, and contribution to paleontological significance. Because of its diverse fossil faunas, the area immediately north of the reservoir and between its McCloud and Pit Arms is considered to be one of California's most important areas for paleontological research (USDA 2010).

Castle Crags are a unique geologic feature in this region. This formation, with its towering granitic spires, is known as a pluton. Castle Crags are located within the Klamath Mountains' geological province, but large granitic bodies called plutons intruded into many parts of the province during the Jurassic period around 65 million years ago. Castle Crags are located about 10 miles south of Dunsmuir and are readily visible from Interstate 5. The Castle Crags Wilderness was established in 1984. This 10,500-acre addition to the National Wilderness Preservation System, along with lands within Castle Crags State Park, includes portions of this unique and scenic geologic feature and was formed to protect and manage this area.

Areas on the north and eastern sides of the Upper Sacramento IRWM Region are predominately located within the Cascade Range geomorphic province. The Cascades province is characterized by rhyolitic to basaltic volcanic activity. Many of the characteristic volcanic features of this province can be found in the region. Mount Shasta, at 14,179 feet, is at the top of the Upper Sacramento River and McCloud River watersheds. It is regarded as the largest stratovolcano in the Cascade Range. There are seven named glaciers on Mount Shasta. Mount Shasta has erupted, on average, at least once every 800 years during the last 10,000 years and about once every 600 years during the last 4,500 years (River Exchange 2010). The last eruption is believed to have occurred about 200 years ago.

The Medicine Lake Highlands, located in the northeast corner of this IRWM region, consists of a large shield volcano and volcanic area with a variety of volcanic formations including glass (obsidian) flows, lava flows, pumice deposits, lava tubes, cinder cones, and craters. The Medicine Lake Highlands area exceeds 200 square miles in area with the highest elevation at 7,913 feet above sea level. The most recent major volcanic activity in the area occurred about 300 years ago. The Medicine Lake Volcano includes a down-dropped caldera in which Medicine Lake is located. The caldera is now partly filled with ash deposits, glacial deposits, alluvium, and lacustrine deposits.

Geologic features including Mount Hoffman, Glass Mountain, and Medicine Mountain define the rim of the caldera.

Concerning geologic features in this area, the Forest Service recognizes Special Interest Areas (SIAs) to protect areas with unique characteristics including, in some cases, geologic features. SIAs are protected for their educational, scenic, scientific, or recreational values. Special protection policies, such as prohibiting the construction of roads, apply to certain SIAs. For example, the following SIAs have been established in the Medicine Lake Highlands on the basis of unique geologic features.

- Medicine Lake Glass Flow Geologic Area: This 600-acre lava flow is an example of glassy dacite lava and has been nominated by the Modoc National Forest for National Natural Landmark Status. It is located one-half mile north of Medicine Lake.
- Glass Mountain Glass Flow Geologic Area: This large lava flow, with impressive obsidian features, is located approximately 2 miles east of Medicine Lake.
- Fourmile Hill Tree Molds Geologic Area: This area, approximately 10 acres in size, contains cylindrical hollows in the lava flow which were produced when trees were engulfed by lava flows.

West of the Medicine Lake Highlands and on the north side of the McCloud River watershed is the area known as the McCloud Flats. This is an area of level lava flows and low volcanic buttes. The drainage pattern from this area is very sparse. Mud Creek is the only perennial tributary from the volcanic landscape to the north. However, south of the river is the Eastern Klamath Mountain Paleozoic Belt with its steep, metamorphic mountains. The channel of the McCloud River is of relatively low gradient for its entire length except for three distinctive waterfalls. The Upper McCloud River is confined within a

narrow canyon. The Lower McCloud flows to the southeast through the eastern extent of the Klamath Mountains province for its entire length. The gradient is steeper and the river lies in a wide canyon that has a well-defined inner gorge and riparian zone.

Several Quaternary (1.6 million years and younger) fault zones have been identified in the region, though, historically, the area has not experienced major seismic activity. Four earthquakes with a magnitude of five or greater on the Richter scale have had epicenters recorded in the vicinity within the last 100 years. There are many inactive pre-Quaternary faults throughout the area.

The region has periodically experienced smaller earthquakes in the magnitude range of three to five on the Richter scale. Seismic activity is related to volcanic features as well as fault zones. When magma and volcanic gases or fluids move, they may either cause rocks to break or cracks to vibrate. When rocks break, high-frequency earthquakes are triggered. However, when cracks vibrate, either low-frequency earthquakes or a continuous shaking called volcanic tremor is triggered. Over the past 20 years, an average of approximately five earthquakes per year with magnitudes of one or more have occurred beneath Mount Shasta. From time to time earthquake swarms in which many quakes with similar magnitudes have occurred during a short span of time have punctuated this background seismicity. For example, a quake as part of a larger swarm with a magnitude of 2.4 occurred in this area in September 1992. The most seismically active area beneath the mountain lies about 18 kilometers southeast of Mount Shasta City at a depth of 10 to 12 kilometers (Hirt 2001).

Climate, geology, topography and other factors determine soil characteristics. Soil productivity is defined as the capacity of the soil to produce a plant community or sequence of plant communities under natural conditions or a specified system of management. There are a variety of factors that influence the productivity of soil, including soil depth, percent of rock fragments, texture, available water-holding capacity, nutrient status, maintenance of the duff layer, mineral toxicity, and pH. Other environmental factors that influence soil productivity are precipitation, aspect, slope gradient, and elevation. The productivity of the soil types in the region range from very low to high. The most productive soils occur in flat valley bottoms.

While a detailed discussion of soil characteristics is beyond the scope of this IRWM Plan Region Description for planning purposes, it can be noted that much of the region has been mapped for soil characteristics and the information is available. For example, in the Upper Sacramento River Watershed, the Soil Survey of Shasta-Trinity National Forest Area, California, identifies 62 soil map units with the most common soil families being the Marpa, Nuens, Goulding, and Estel. These four families are well drained and are of fine loamy-loamy/skeletal mixed composition. Approximately 25% of the soils within the area are classified as highly to very highly erodible. The greatest threats to the maintenance of soil productivity are sheet and gully erosion. Nearly all bare soil is subject to erosion if a sufficient amount of surface water flow is present. Some soils have a higher propensity to erode than others. Examples of highly erodible soils in the study area are Estel Family, Neuns Family, Goulding Family, and Deadwood Family. Soil conditions following intense, hot-burning fires are especially conducive to erosion.

3.7 Hydrology and Water Resources

3.7.1 General Hydrologic Features

3.7.1.1 Upper Sacramento River Watershed

The watershed for the Upper Sacramento River itself (as a distinct watershed within the USR) is approximately 600 square miles in size. Many small natural alpine lakes are scattered along the crest of the Upper Sacramento and Trinity River watershed divide, including Castle Lake, Grey Rock Lake, Cliff

Lake, Toad Lake and others. Castle Lake is noted for being the site of the Castle Lake Limnology Laboratory of the University of California at Davis, which has been conducting limnology research in the region for decades.

The length of the watershed is approximately 40 miles. The most significant reservoir in this watershed is Lake Siskiyou, which lies behind Box Canyon Dam. This reservoir has a surface area of approximately 430 acres. Average daily flow of the Upper Sacramento River at entry to the reservoir is estimated to be approximately 1,000 cfs with a peak daily flow of 70,000 cfs (recorded in 1974) and an extreme low of 117 cfs (recorded in 1977).

Major tributaries to the Upper Sacramento River watershed include the South Fork, Middle Fork, and North Fork, Wagon Creek, Mossbrae Falls, Soda Creek, Castle Creek, Hazel Creek, Shotgun Creek, and Dog Creek. A more complete list of tributaries is found in the Upper Sacramento Watershed Assessment and Strategy (North State Resources 2010) The only streamflow gage in the system is just above Shasta Lake at Delta. None of the tributary streams have flow gages, so their relative contribution to flow has not been determined.

3.7.1.2 McCloud River Watershed

The McCloud River Watershed covers approximately 800 square miles. The headwaters of the McCloud River are said to be at Colby Meadows, from which the river flows approximately 50 miles southwesterly to Shasta Lake Reservoir. The McCloud River is often described as having an Upper McCloud River section above McCloud Dam and a Lower McCloud River section below the dam.

Major tributaries to the Upper McCloud River include Mud and Tate Creeks, as well as Big Springs. Most of the flow in the upper watershed enters the river system via springs, most notably Big Springs (more than 600 cfs).

The McCloud reservoir, with a surface area of approximately 520 acres, is the only significant surface water body in the McCloud watershed, and is formed by the impoundment of water behind McCloud Dam. As part of the PG&E McCloud-Pit Hydropower Project, McCloud River flows are diverted at the McCloud Dam into the Pit River via the McCloud-Iron Canyon diversion tunnel. The hydroelectric project diverts approximately 75% of the Upper McCloud River's flow through a pipeline to Iron Canyon Reservoir, then conveys it downslope and discharges it into the Pit River at the Pit 6 powerhouse upstream from the Pit River Arm of the reservoir (PG&E 2006). As much as 90% of water flowing in the Upper McCloud River has been diverted at times to the Lower Pit River watershed. The McCloud-Pit Project is currently in the relicensing process administered by the Federal Energy Regulatory Commission (FERC).

The lower McCloud River flows approximately 24 miles from Lake McCloud into Shasta Lake Reservoir. Major-Important tributaries to the McCloud River below the dam include Squaw Valley, Ladybug, Nawtawaket, Hawkins, Claiborne, and Chatterdown Creeks. None of these tributaries have stream gages, so relative contributions of flows are not available. Gages related to operation of the PG&E diversion from McCloud Reservoir to the Pit River are maintained above and below the reservoir. Near McCloud Bridge, a gage monitors inflow to Shasta Lake from the McCloud River system.

3.7.1.3 Lower Pit River Watershed

The Lower Pit River watershed is approximately 700 square miles. This does not include the portion above Lake Britton, as it is not included in the USR. From Lake Britton, the Lower Pit River flows approximately 40 miles to the confluence with Shasta Lake Reservoir. As noted in the description of the

McCloud River watershed, a considerable amount of water is diverted from the McCloud River to the Pit River via the McCloud-Iron Canyon diversion tunnel.

The most significant surface water body in the Lower Pit River watershed is the Iron Canyon Reservoir, approximately 500 acres in size, which receives water from the McCloud River via a diversion tunnel. The infrastructural system developed and maintained by PG&E to produce hydroelectric power from the waters of the McCloud River and the Pit River are substantial features relating to the hydrologic character of those streams. In fact, it is impossible to describe the character of the Lower Pit River in this region without a description of the dams, reservoirs and reaches of river between PG&E's project features. These facilities are described in the Water-Related Infrastructure section of this Region Description.

The Squaw Creek watershed, which is a substantial watershed by itself, is located between the McCloud River and the Lower Pit River. While it may be considered a singular watershed, it flows into the Pit River arm of Shasta Lake Reservoir and, for the purposes of this description, is considered to be within the Lower Pit River watershed. The Squaw Creek watershed is the only large tributary to Shasta Lake that does not contain dams, reservoirs, or diversions.

[Important tributaries to the Pit River between Pit 3 Dam \(Lake Britton\) and Pit 7 Dam \(just above Shasta Lake\) include Rock, Screwdriver, Underground, Canyon, Blackberry, Deep, Nelson, Kosk, Iron Canyon, Roaring, Hatchet, Montgomery, and Hogback Creeks. None of these tributaries have stream gages, so relative contributions of flows are not available. Several flow gages on the Pit River are maintained in connection with the PG&E hydroelectric project. At Pit 7 Dam, a gage monitors inflow to Shasta Lake from the Pit River system.](#)

3.7.1.4 Medicine Lake Highlands

Medicine Lake, from which this area derives its name, lies in a caldera near the top of the highlands at an elevation of approximately 6,680 feet. Medicine Lake has a surface area of approximately 430 acres at full pool. Very small lakes in the vicinity of Medicine Lake include Little Medicine Lake, Bullseye Lake, and Blanche Lake.

Total precipitation in the vicinity of the Medicine Lake Highlands is estimated at approximately 30 inches per year. Much of this precipitation falls in the form of snow. Surface water flow and groundwater recharge occur mainly during snowmelt in the late spring and early summer. There is almost a complete lack of surface runoff in the area. Most streams are intermittent, flowing only during snowmelt or intense rain shower events. One of the only recognized perennial streams in the area is Paynes Creek, which originates at Paynes Springs and flows for less than one mile before returning entirely to subsurface flow. Medicine Lake is fed primarily by emergent springs rather than from surface drainages. Outflow from Medicine Lake is believed to occur via Paynes Springs to the south of the caldera. Isolated springs are located in the area, representing surface outflow of shallow groundwater flow from snowmelt and winter precipitation.

While the springs that feed Fall River are not included in the Upper Pit River IRWM Region, much of the Medicine Lake Highlands area is considered to be a recharge area, via subsurface flows as opposed to surface drainage, to those springs. Fall River is a tributary to the Upper Pit River.

The Medicine Lake Highlands area has significant spiritual meaning and value to all of the tribes having ancestral territory in the USR. Some of these traditions are discussed in the ethnographic descriptions included in Section 3.4.5 of this chapter.

3.7.1.5 Groundwater

As noted in the geology section above, the western and southern portions of the region are largely comprised of geologic characteristics belonging to the Klamath Mountain geomorphic province. Much of that area is underlain by discontinuous sequences of metamorphic rocks and is largely made up of meta-sedimentary and peridotite rock types that are generally impermeable. Fractures and remnant stratigraphic sedimentary features create most void spaces capable of storing groundwater. Overall, the Klamath Mountain bedrock lacks the storage capacity needed to sustain a reliable groundwater aquifer (The River Exchange 2010).

On the northern and eastern sides of the region, typical of the Cascade Range geomorphic province, volcanic deposits underlie the area. These areas are typically a reliable source of clean groundwater.

The region includes two groundwater basins as recognized in DWR Bulletin 118: the McCloud Area Groundwater Basin (Number 5–35) and the Toad Well Area Basin (Number 5–37). The surface area of the McCloud Area basin is 21,320 acres, or 33 square miles. The estimate of groundwater extraction for agricultural use, based on a 1991 DWR survey, is estimated to be 3 acre-feet.

Groundwater extraction for municipal and industrial uses is estimated to be 420 acre-feet. Deep percolation of applied water is estimated to be 280 acre-feet (DWR 2004).

The Toad Well Area Groundwater Basin is 3,360 acres in size. That area is fairly remote and unpopulated and there is, according to Bulletin 118, no known data for projecting a groundwater budget.

While there are numerous private wells and some community wells in the region, there are no other areas in the region that overlay designated groundwater basins. The area in the vicinity of Mt. Shasta City was once designated as a groundwater basin, but it is now considered to be a groundwater source area and groundwater use is not monitored. Competition for groundwater has increasingly become a concern in the vicinity of Mt. Shasta. Residents in the vicinity of a water bottling plant located immediately north of the city limits (formally known as the Coca Cola/Dannon plant) are concerned that the facility has the capacity to extract water in amounts that will adversely impact household wells. ~~The plant has been dormant, but it was announced in the Mount Shasta Herald in October 2013 that the plant was purchased by Crystal Geyser, with an anticipated date of December 2014 to begin operations.~~ [Since Coca Cola's closure of the facility in 2010, the plant has been dormant. In 2013, Crystal Geyser purchased the plant and announced plans to reopen the industrial water-bottling facility. The County of Siskiyou approved an Environmental Impact Report \(EIR\) in 2017. RWAG members WATER and the Winnemem Wintu Tribe subsequently filed litigation against County of Siskiyou and RWAG member City of Mt. Shasta regarding sufficiency of the EIR, and failure to complete AB 52 consultation with the Winnemem Wintu Tribe. As of December 2018, Crystal Geyser has yet to commence bottling operations.](#)

~~A significant data and knowledge gap is a real understanding of how groundwater resources are connected in this area and how industrial-scale water bottling affects surrounding residential wells.~~ [Lack of data on groundwater connectivity inhibits understanding of potential impacts from withdrawal by water bottling facilities.](#) While residents proximal to these facilities have reported a lowering of their water levels and getting sandy or silty water during periods of operation, the connection to industrial activities has not yet been investigated. As the facilities operate using groundwater, which is not regulated, there are no requirements for studies or monitoring when placing a facility like this other than the basic CEQA requirements. [\(Some RWAG members have also noted that SGMA is forcing water and beverage bottling companies into unprotected Watershed Recharge Areas, such as the USR.\)](#) With current groundwater law in California being the correlative use doctrine, the burden of proof lies on adjacent landowners to show that their water is being impacted by a neighboring owner. Thus, any investigation into the effects of

industrial-level groundwater effects on surrounding users will need to be completed by stakeholders or other “outside” interest groups.

The USGS Open File Report 86–65 (Water Resources Data for the Mount Shasta Area Northern California) assessed water quantity and water quality data collected from March 1981 to August 1984 at wells, springs, streams, and lakes in an 800-square mile area in the vicinity of Mount Shasta.

Groundwater levels, discharges, temperatures and chemistry from 1981–84 are documented in the report. Although this is the most detailed study known, the data for continuous groundwater levels, rather than intermittent, is very sparse. [At present there is virtually no available information on groundwater location or quantity in the USR. This is primarily due to the lack of alluvial groundwater basins in this mountainous region. RWAG members often comment that better understanding of groundwater is a primary research need.](#)

Groundwater quality in the Sacramento River Hydrologic Region is generally excellent. The cities of Dunsmuir and Mt. Shasta, and the McCloud Community Services District, obtain most of their water from springs and the water requires no treatment. However, most of the actual groundwater quality data are collected from areas downstream of the upper Sacramento River watershed. There is therefore a lack of groundwater quality, quantity, and residency/replenishment data.

In the rural mountainous areas of the watershed, domestic supplies come almost entirely from groundwater. A few communities are supplied by surface water, but most communities rely on groundwater supplies for public use. In these regions, groundwater supplies are extracted from highly fractured rocks within the subsurface, but these supplies are highly variable in both quantity and quality.

3.7.2 Water Quality

Water quality is important to the regional economy, residents’ health, and is an important spiritual value to indigenous people of the region. Thus, the protection of water quality and preservation of the purity of water used within this region and sent south to other parts of California is a concern of local residents on both an ethical and regulatory compliance level. Though multiple organizations – private, federal, and tribal – monitor water quality on an ongoing basis, some stakeholders believe that more effort could be made to monitor and track local water quality.

3.7.2.1 Regulatory Framework

There is an extensive federal and state regulatory framework in place to protect and improve water quality for beneficial uses. Today, many of these regulations directly influence water management actions in the region. The regulations are designed to support continued, long-term use of water supplies for drinking water, agriculture, and ecosystem benefits. Federal and California law mandates most of the water quality monitoring activities in the watersheds of the region. The primary laws governing water quality in the watershed are the federal Clean Water Act and the Porter-Cologne Water Quality Control Act (Porter-Cologne Act).

The 1972 Federal Clean Water Act (CWA) established strategies for managing water quality including requirements to maintain a minimum level of pollutant management using best available technology and a water quality strategy that relies on evaluating the condition of surface waters and setting limitations on the amount of pollution that the water can be exposed to without adversely affecting the beneficial uses of those waters. Section 303(d) of the CWA bridges these two strategies. Section 303(d) requires that states make a list of waters that are not attaining standards after the technology-based limits are put into place. See the following section for information regarding the USR’s 303(d)-listed waters.

The US Environmental Protection Agency (EPA), State Water Resources Control Board, and Regional Water Quality Control Boards (RWQCBs) have permitting, enforcement, remediation, monitoring, and watershed-based programs to prevent and reduce pollution through both the CWA as well as the Porter-Cologne Act.

Pollution can enter a water body from point sources such as wastewater treatment plants and/or other industries that directly discharge to rivers and from non-point sources (NPS) over a broad area, including run-off from a city and/or agricultural farmland or grazing areas located adjacent to streams. Some NPS contaminants are naturally occurring in local rocks and soils, such as heavy metals (e.g., arsenic, chromium, selenium), but also come from urban runoff and include heavy metals, oils and greases, as well as herbicides, pesticides, and fertilizers. Preventing pollution from most point sources relies on a combination of source control and treatment, while preventing NPS pollution generally involves the use of best management practices (BMPs), efficient water management practices, and source control. In addition to mining, non-point source regulations and related best management practices are applicable to other types of ground-disturbing activities including construction and timber harvest.

Sediment has been identified by the EPA as a primary contaminant over the entire United States. Sedimentation levels and rates are affected by a number of management practices/oversights, including a suppressed fire regime and unmaintained roads. The topic is covered in the Upper Sacramento Watershed Assessment (River Exchange 2010), but an excerpt here provides context: "...fire suppression has changed the fire regime in the watershed from frequent low-intensity surface fires to infrequent stand-replacing fires. Large fires can pose a substantial risk to water quality as a result of causing a cascading sequence of flooding, accelerated erosion, channel scour, and increased sedimentation often related to water repellent soils, which can destroy productive habitats over large areas for years to decades."

NPS pollution is not typically associated with discrete conveyances. Congress originally passed the Federal Safe Drinking Water Act (SDWA) in 1974 to protect public health by regulating the nation's public drinking water supply. SDWA applies to every public water system in the United States. SDWA authorizes the U.S. EPA to set national health standards for drinking water to protect against both naturally occurring and manmade contaminants that may be found in drinking water. Originally, SDWA focused primarily on treatment as the means to provide safe drinking water. Amendments in 1996 enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. Under the SDWA, technical and financial aid is available for certain source water protection activities. The California Department of Public Health (CDPH) is responsible for enforcing the SDWA and drinking water regulations specific to California as defined in Title 22 of the California Code of Regulations.

The rivers of the USR are subject to compliance with the Basin Plan prepared by the Central Valley Regional Water Quality Control Board (Regional Water Board) in 2009. Even though the Basin Plan does not include actual monitoring activity, it is the document that sets the water quality objectives and drives on-going water quality monitoring efforts. The 2009 Basin Plan applies to the entire watersheds of both the Sacramento and San Joaquin Rivers, an area of approximately 27,210 square miles in size.

The recognition of beneficial uses is a critical component to water quality management in California. State law defines beneficial uses of California's waters that may be protected against quality degradation to include (and not be limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Typical categories of beneficial uses (often overlapping) that are applied to rivers in this region are:

- Agricultural Supply (AGR): Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing. For example, this use, specifically irrigation and stock watering, is designated as existing for the Upper Sacramento River from the source to the Box Canyon Reservoir and Box Canyon Dam to Shasta Lake Reservoir.
- Water Contact Recreation (REC-1): This applies to uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, and use of natural hot springs. Canoeing and rafting is a separate subcategory.
- Non-Contact Water Recreation (REC-2): Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water or the likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
- Warm Freshwater Habitat (WARM): Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. This use, for example, is designated as existing for Lake Siskiyou and McCloud Reservoir.
- Cold Freshwater Habitat (COLD): Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
- Spawning, Reproduction, and/or Early Development (SPWN): Uses of water that support high-quality aquatic habitats suitable for reproduction and early development of fish. Two subcategories, warm and cold, are included to further describe spawning habitat type. For example, this use is designated as existing for the Box Canyon Dam down the Upper Sacramento River to Shasta Lake Reservoir and is considered a potential use for Lake Siskiyou.
- Wildlife Habitat (WILD): Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
- Hydropower Generation (POW): Uses of water for hydropower generation. The McCloud River and the Lower Pit River are recognized for hydroelectric uses.

The Basin Plan identifies both numeric and narrative water quality objectives applicable to water draining out of the watershed. The Upper Sacramento River above Shasta Lake Reservoir is not listed as water quality limited under Section 303(d) of the CWA (Central Valley Regional Water Quality Control Board 2006). For the 36.4-mile reach listed in the Basin Plan, all the beneficial uses are listed as threatened, but supporting (U.C. Davis 2010). The threatened status is related to the suspicion that metals from urban runoff and storm sewers are degrading water quality and threatening beneficial uses. Additionally, significant impacts to water quality have occurred within this reach, namely the Cantara spill of herbicides in 1991 and metals contamination from mine drainage near Shasta Lake Reservoir.

The McCloud River is designated in the basin plan for municipal and domestic water supply, contact and non-contact recreation (including fishing, canoeing, and kayaking), power production, cold freshwater habitat, coldwater spawning, and wildlife habitat. The Lower Pit River is designated for all of the

beneficial uses designated for the McCloud River, as well as for water supply for irrigation and stock watering, warm freshwater habitat, and warm water spawning.

The Federal Clean Water Act (CWA) includes provisions for reducing soil erosion relevant to water quality. It makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit was obtained under provisions of the Act. This pertains to construction sites where soil erosion and storm runoff and other pollutant discharges could affect downstream water quality. For free-flowing streams, the turbidity levels are often a function of the suspended sediment.

The National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. NPDES is authorized by the CWA and is administered by the State of California through EPA authorization. Point sources are discrete conveyances such as pipes or ditches. Industrial, municipal, and other facilities must obtain NPDES permits if their discharges go directly to surface waters.

Facilities may also need to obtain a NPDES permit if they discharge pollutants into a storm sewer system. Below is a table listing those permits awarded to entities operating within the USR boundary.

Table 3.3: NPDES Permits awarded within the USR boundary.

<i>County</i>	<i>Holder</i>	<i>NPDES Permit Number</i>	<i>Details</i>
Siskiyou County	California Cedar Products Company	CA0082139	Adopted 30 January 2003
	City of Dunsmuir	CA0078441	Wastewater Treatment Plant Adopted 4 October 2012
	City of Mt. Shasta	CA0078051	Wastewater Treatment Plant Adopted 4 October 2012
	Union Pacific Railroad Company	CA0083178	Dunsmuir Railyard Adopted 27 January 2005
Shasta County	Mining Remedial Recovery Company, Inc	CA0081876	Various mine locations Adopted 6 September 2002

The Sacramento Watershed Coordinated Monitoring Program (SWCMP) is a monitoring effort by the California Department of Water Resources (DWR), Northern Region, and the Regional Water Board. The SWCMP is designed to meet the monitoring needs of the Regional Water Board’s Surface Water Ambient Monitoring Program (SWAMP) and the DWR Northern District. The purpose of the SWAMP is to implement comprehensive statewide water quality monitoring (DWR 2009). The SWCMP program monitors and assesses ambient water quality of the Sacramento River and its larger tributaries at locations from upstream of Shasta Lake Reservoir downstream to the lower ends of all of the larger tributary streams to the Sacramento River.

There are a variety of state laws in California pertaining to local land use planning and consideration of water resources and related impacts. These laws mandate detailed consideration by local agencies of water availability, use, and quality, as well as wastewater and stormwater management. For example, the California Environmental Quality Act (CEQA), codified in the California Public Resources Code (§ 21000 et seq.), requires identification of potential impacts that may result from proposed land use plans and projects. If potential impacts may be significant, detailed analysis, typically with an environmental impact report (EIR), and formulation of mitigation measures to eliminate or reduce those impacts to acceptable levels is required.

[According to the Winnemem Wintu Tribe, all springs and groundwater on and under Mount Shasta are Traditional Cultural Properties \(TCPs\) and Tribal Cultural Resources \(TCRs\) of the Winnemem Wintu Tribe. Therefore, according to the Winnemem Wintu Tribe, projects that affect these waters are subject to review under the National Historic Preservation Act \(NHPA\) and California Environmental Quality Act \(CEQA\) pursuant to AB52 which took effect in 2016.](#)

Counties and cities typically become the lead agencies for projects proposed in their jurisdictions, which means they become responsible for ensuring that review of the proposed project complies with CEQA. State agencies have their own CEQA procedures for projects in which they are the lead agency. Federal agencies have similar environmental review requirements pursuant to the National Environmental Policy Act (NEPA).

Concerning water resources, CEQA requires local agencies to consider hydrology and water quality impacts with specific questions such as whether the project would:

- Substantially deplete groundwater supplies
- Substantially alter existing drainage patterns or the amount of runoff water Substantially degrade water quality
- Place housing within a 100-year flood hazard area

Concerning utilities and service systems, CEQA analysis requires consideration of questions including whether the project would:

- Have sufficient water supplies available to serve the project
- Require or result in the construction of new water or wastewater facilities or expansion of existing facilities
- Exceed the capacity of the wastewater treatment provider
- Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board

3.7.2.2 General Source Water Quality

Much of the water in the USR is derived from snowmelt. As a result, the water in the system is generally very pure and low in dissolved minerals. The quality of surface waters in the region is generally considered good by the Central Valley Regional Water Quality Control Board (CVRWQCB), although some water bodies are affected by nonpoint pollution sources that influence surface water quality: high turbidity from controllable sediment discharge sources (e.g., land development and roads); high concentrations of nitrates and dissolved solids from range and agricultural runoff or septic tank failures; contaminated street and lawn runoff from urban areas, roads, and railroads; acid mine drainage and heavy metal discharges from historic mining and processing operations; and warm-water discharges into coldwater streams. (CVRWQCB 2009)

The quality of water in underground basins and water-bearing soils is also considered generally good throughout most of the region. Potential hazards to groundwater quality involve nitrates and dissolved solids from agricultural and range practices and septic tank failures. The ability of soils to support septic tanks and on-site wastewater treatment systems is generally limited particularly on older valley terrace soils and certain loosely confined volcanic soils in the eastern portions of the region (CVRWQCB 2009).

The surface water quality of streams and lakes draining the Shasta-Trinity National Forest and adjacent private lands generally meets standards for beneficial uses defined by the Basin Plan (CVRWQCB 2009).

However, there are some areas where the water quality does not meet standards during periods of storm runoff; in some places, as a result of drainage from historic mining and processing operations.

While Shasta Lake Reservoir is not technically in the USR, the lake has a direct relationship with the region in several respects. For instance, the lake receives water directly or indirectly from streams and subsurface flows from the region before that water continues flowing downstream as part of the greater Sacramento River basin. The lake, therefore, is the recipient of pollution that may come from lands located in the USR (e.g., from mine sites in the region) or, in the case of the Pit River, pollutants that come from the watershed above the region, but which flow through the region (i.e., the Lower Pit River) before entering the reservoir.

Annually, approximately 6.2 million acre-feet of water flows into Shasta Lake Reservoir from the Sacramento River, McCloud River, and Pit River drainages. A favorable inflow-outflow relationship of 1.4 to 1 contributes to generally good water quality, both in the lake and downstream (USFS 1996).

Nutrient inputs and bacteria are not a major concern in the Upper Sacramento River and McCloud River drainages. However, they have been a concern in the Lower Pit River as a result of runoff from agricultural and range lands in the Upper Pit River watershed. Water quality concerns are influenced largely by the quality of the river coming out of the upper watershed. The main stem of the Pit River (headwaters to McArthur) is listed per CWA Section 303(d) as impaired for temperature, dissolved oxygen, and nutrients. In addition, several tributaries have been listed as impaired for elevated levels of fecal coliform bacteria (*E. coli*). Lake Britton, located on the Pit River immediately above this IRWM region, is subject to nutrient enrichment and algae blooms. In addition, 123 miles of the Pit River from the confluence of the North and South forks to Shasta Lake Reservoir is listed for Nutrients, organic enrichment/low dissolved oxygen, and water temperature. The river is targeted as low priority for the development of total maximum daily load (TMDL) standards, with proposed TMDL scheduled for completion in 2013 (California Water Board 2006).

Waters discharged by stream channels draining the areas disturbed by the mining of sulfide ore deposits are generally acidic and contain high concentrations of dissolved metals including iron, copper, and zinc. The sources of the metals are surface and groundwater discharge from underground mines and waters flowing through open pits, tunnels, mine tailings, waste rock, and tertiary deposits that include modern alluvium along the shoreline. Interaction with sulfide minerals and erosion of metal-rich material commonly result in low (acidic) pH readings and high metal concentrations.

For example, one source of the metals in the region is associated with the Bully Hill/Rising Star mining complex adjacent to the Squaw Creek Arm. Although the mines are no longer operational and remedial action continues, these areas are a documented source of metals and continue to be subject to an abatement order issued by the CVRWQCB. A containment structure constructed sometime during the early 1900s has filled with sediment downstream from the Bully Hill Mine. No information is available on the character of the material stored behind this earth fill dam. In 2006, North State Resources, Inc., conducted a Phase 1 Site Assessment of an area adjacent to, but over a small divide from, the Bully Hill Mine. That assessment documented elevated levels of sulfide minerals in sediment samples and extremely low pH values in surface waters draining the mine. A recent study conducted by the State Water Resources Control Board sampled mercury accumulations in fish at a number of locations throughout Shasta Lake Reservoir. That study documented elevated levels of mercury in some specimens (Davis et al. 2010).

Another study of mercury contamination in fish from Northern California lakes and reservoirs found tissue mercury concentrations in fish from Shasta Lake reservoir (DWR 2007). That DWR report also discussed factors in addition to past mining activity that affect bioaccumulation of mercury in fish (DWR

2007). For example, the report cited that mercury is a natural element with many soils and rocks such as serpentine having low concentrations of mercury. Erosion and leaching carries minute quantities of mercury to downstream water bodies. Atmospheric deposition is also a factor.

Deposition from burning of coal is a known source of mercury; research indicates that California is a receptor of mercury across the Pacific Ocean from Asia where coal combustion is heavily relied upon for fuel. Wildfires can also release significant concentrations of mercury stored in foliage and ground litter to the atmosphere and distant volcanoes can contribute to atmospheric deposition of mercury.

Other tributaries in this IRWM region to the main body of Shasta Lake Reservoir are also a source of metals, along with acid mine drainage from a number of mines in the Dry Creek and Little Backbone watersheds. In addition to runoff from the historic workings (i.e., adits and portals), there are a number of large tailing deposits that are currently leaching various metals into tributaries to the reservoir (CVRWQCB 2003a).

The *Upper Sacramento River Watershed Assessment* included discussion of mines on Little Backbone Creek. The Mammoth, Golinski, and Sutro mines are estimated to contribute, respectively, copper loads of 70.55, 1.1, and 0.11 pounds per day on an annual basis to Shasta Lake Reservoir.

Additionally, it has been reported that a significant portion of the cadmium loads that are present downstream of Shasta Dam may come from the reservoir and its tributaries, depending on the flow regime (The River Exchange 2010).

Sampling has demonstrated low levels of chemical constituents regulated under Title 22 of the California Code of Regulations. Although limited data are available on metals in the McCloud and Pit Rivers, samples collected in 1985 and 1986 indicated generally low metals concentrations near or below laboratory reporting limits. Levels of minerals in samples collected in the project area and surrounding watershed in 2007 did not exceed the applicable maximum contaminant levels.

Federal and state agencies as well as PG&E and The Nature Conservancy have collected water quality monitoring data for the McCloud River. DWR maintains water quality information on the McCloud River in the California Data Exchange Center database. The Nature Conservancy monitors water quality at its McCloud River Preserve. Water quality monitoring of the lower McCloud River includes measures of water temperature, dissolved oxygen, pH, specific conductance, and turbidity, as well as correlated data on weather, air temperature, and debris movement. PG&E monitors water quality in compliance with its FERC licenses.

Natural processes and land use activities influence the water quality of the McCloud River. Turbidity and water temperature are two important factors that influence the water quality of the river and affect aquatic habitat. Turbidity is caused by suspended sediment transported from upstream waters and in surface runoff, particularly from disturbed landscapes. Water temperature is affected by a variety of conditions, such as river flows, solar radiation, and density of vegetation along the river. In the Lower McCloud River, water temperature is influenced by flows released from the McCloud Reservoir.

Mud Creek, a tributary upstream of McCloud dam, adversely affects water clarity in the McCloud River by periodically delivering large amounts of fine volcanic sediment from the Konwakiton glacier on Mount Shasta. The turbidity of the lower McCloud River is influenced by the water quality and water levels of the McCloud Reservoir and runoff from upland areas throughout the basin. Turbidity levels are

generally low during most of the year, ranging from 5–10 nephelometric turbidity units (NTU’s)⁶, but can spike to more than 900 units during periods of intense rainfall and flood flows (FERC 2011). Sediment becomes trapped at McCloud Dam and is released into the lower river during large storm events, temporarily increasing turbidity levels, especially in the upper segments of the lower river. Testing of the McCloud Dam bypass valve can cause high turbidity for a short period when sediment is discharged from the reservoir into the Lower McCloud River.

Although little data exist on anthropogenic pollutants such as oil and grease, pesticides, and herbicides in the region, pesticide screening samples collected upstream of Shasta Lake Reservoir in the Pit and Lower McCloud Rivers in 1999 and 2000, respectively, contained low pesticide levels (FERC 2011).

Concerning water quality on the Medicine Lake Highlands portion of this IRWM region, the quality of water in that area is reported to be good. Water quality of Medicine Lake was monitored by the USGS in 1992, which found the lake to have good clarity, low nutrient levels, and low buffering capacity. Monitoring of oil, grease, and petroleum hydrocarbons in the lake found that all were below detectable levels. Additional sampling of Medicine Lake, as well as of Little Medicine Lake and Bullseye Lake, was conducted in November 1997. The results reported that the water quality of Medicine Lake, Little Medicine Lake, and Bullseye Lake is excellent, and that no sample indicated that an EPA water quality standard was exceeded for any constituent (U.S. Department of Interior 1998).

Clean Water Act Section 303(d) Listing

The State and Regional Water Boards assess water quality data for California's waters every two years to determine if they contain pollutants at levels that exceed protective water quality criteria and standards. This biennial assessment is required under Section 303(d) of the Federal Clean Water Act.

The list is reviewed for approval by the U.S. Environmental Protection Agency. Within the Upper Sacramento IRWM region, the waters listed in **Table 3.4**, below, are included on the 2010 California 303(d) list of water quality limited segments under (California State Water Resources Board 2013).

Table 3.4: 303(d) listings in the USR*

<i>Waterbody:</i>	<i>Listed for:</i>	<i>Area Affected:</i>	<i>Identified Source:</i>
Pit River (from the confluence of the north and south forks to Shasta Lake Reservoir)	Nutrients, organic enrichment/low dissolved oxygen, water temperature	123 miles	Agriculture and grazing
West Squaw Creek (below Balaklala Mine)	Cadmium, copper, lead, and zinc	2 miles	Abandoned mines
Shasta Lake Reservoir (where West Squaw Creek enters)	Cadmium, copper, and zinc	20 acres	Resource extraction
Shasta Lake Reservoir	Mercury	27,335 acres	Resource extraction
* While Shasta Lake Reservoir is technically not recognized as being located in the USR, it is noted as a related concern here.			

⁶ Turbidimeters using the nephelometric principal compare the light scattered due to contamination with the light scattering from a standard reference suspension. The result is a measurement of turbidity in nephelometric turbidity units.

3.7.2.3 State Constituents of Concern

In addition to discussing water quality more generally, IRWM plans are required to document any known contamination of nitrate, arsenic, perchlorate, or hexavalent chromium in the region. Further, if "the IRWM region has areas of nitrate, arsenic, perchlorate, or hexavalent chromium contamination, the Plan must include a description of location, extent, and impacts of the contamination; actions undertaken to address the contamination, and a description of any additional actions needed to address the contamination" (Water Code §10541(e)(14)).

Nitrate

Documented occurrences of nitrate in the USR are generally well below the established maximum contaminant level (MCL) of 10 mg/L and there are no known exceedances of the MCL in the region (see Appendix F for a complete list of detections). With little intensive agriculture, detections of nitrate in the region are most often associated with failed septic systems and/or insufficient separation between septic systems and drinking water sources.

Arsenic

According to DWR Division of Drinking Water, Siskiyou County Environmental Health, and Shasta County Environmental Health, there are no cases of arsenic contamination in the USR. Furthermore, based on a search of the State Water Resources Control Board's (SWRCB) GeoTracker GAMA database, arsenic is not commonly detected in the region's public drinking water systems and when detected, concentrations have generally been low. Indeed, the region has experienced only one documented exceedance of the 10 µg/L MCL for arsenic and it does not appear to have impacted drinking water supplies.

The exceedance was detected in December 2008 at Sugarloaf Marina in the unincorporated community of Lakehead on the Sacramento River arm of Lake Shasta. It was recorded in three of five environmental monitoring wells at the site that were installed between 2001 and 2007 to monitor remediation of a fuel leak that was identified in 1998 during removal of underground storage tanks.

Although it cannot be confirmed, it is anticipated that the high arsenic levels detected at the monitoring wells resulted from the use of In-Situ Chemical Oxidation (ISCO) to attenuate residual hydrocarbons at the site. The ISCO process used at Sugarloaf Marina entailed injecting hydrogen peroxide, ferrous sulfate, and sodium persulfate into the ground, was begun approximately eight months prior to the detected exceedances, and was ultimately successful in bringing closure to the case in 2012 (SWRCB 2018a). Although the practice of injecting ISCO chemicals to remediate sites is common, research conducted by the United States Geological Society indicates that it also has the potential to mobilize naturally occurring arsenic at levels far exceeding the MCL (Cozzarelli et al. 2017).

Whatever the cause may have been, according to SWRCB closure documents, residual chemicals posed little risk to human health because most area homes and businesses are supplied with drinking water by the Lakeshore Heights Mutual Water Company and the few wells located within 2,000 feet of the site are all up gradient. Moreover, there have been no additional exceedances of the MCL for arsenic in the region since that time.

A list of all arsenic detections in the USR is provided in Appendix F, while **Table 3-5** below shows those detections exceeding the MCL of 10 mg/L.

Table 3-5: Detections of Arsenic in the USR Above 10 µg/L

<i>Location Name</i>	<i>Well ID</i>	<i>Well Type</i>	<i>County</i>	<i>µg/L</i>	<i>Date</i>
Sugarloaf Marina	MW-1	Monitoring	Shasta	200	12/18/2008
Sugarloaf Marina	MW-2	Monitoring	Shasta	79	12/18/2008
Sugarloaf Marina	MW-3	Monitoring	Shasta	26	12/18/2008

Perchlorate

Perchlorate (ClO⁻) is an inorganic chemical used in solid rocket propellant, fireworks, explosives, flares, matches, and a variety of industries. To date there are no known detections of perchlorate in the USR, whether above or below the MCL of 6 µg/L.

Hexavalent Chromium

Although trace amounts of hexavalent chromium (Cr VI) have been detected in three small public water systems in the USR, detections have been infrequent and range from 1.4 µg/L to 3.3 µg/L (i.e., well below the now invalidated MCL of 10 µg/L). Detections in environmental monitoring wells have likewise been infrequent and with limited exception have also been well below the now invalidated MCL. The only detections exceeding 10 µg/L were observed in 2008 and 2009 during monitoring of cleanup efforts at two former gas stations in Dunsmuir that had leaking underground fuel tanks removed. Like the detection of arsenic at Sugarloaf Marina in 2008, the Cr VI was detected following the injection of ISCO chemicals at the former gas stations - ozone at one and oxygen release compounds at the other.

Although the use of ISCO chemicals was ultimately successful in removing residual hydrocarbons, with closure of one case in 2010 and closure of the other in 2011, it is anticipated that the spike in hexavalent chromium occurred due to ISCO chemicals oxidizing naturally occurring chromium similar to the 2008 mobilization of arsenic at Sugarloaf Marina. This is supported by the lack of exceedances for Cr VI in the region since that time. Furthermore, because homes and businesses within the City of Dunsmuir receive their drinking water from spring sources that are up gradient and far from either of the former gas stations, it is believed that the temporary spike in Cr VI did not pose a threat to public health.

Table 3-6 shows the concentrations of arsenic detected in the region that exceed the former MCL of 10 µg/L, while all detections of Cr VI in the USR are shown in Appendix F.

Table 3-6: Detections of Hexavalent Chromium in the USR Above 10 µg/L

<i>Location Name</i>	<i>Well ID</i>	<i>Well Type</i>	<i>County</i>	<i>µg/L</i>	<i>Date</i>
Frank's Shell	MW-6A	Monitoring	Siskiyou	86	6/24/2009
Frank's Shell	MW-2B	Monitoring	Siskiyou	30	9/10/2008
Frank's Shell	MW-3	Monitoring	Siskiyou	23	3/27/2008
Frank's Shell	MW-5A	Monitoring	Siskiyou	11	6/24/2009

Conclusion

Due to the relatively low density of development throughout much of the USR, a lack of intensive agriculture, and a large percentage of the population that is served by municipal water and wastewater systems, the region is considered to have low vulnerability to nitrate contamination under current conditions. Perchlorate, which has never been detected in any of the region's wells or water systems that are monitored by the State, is also believed to pose little to no risk to public health in the region. While naturally occurring arsenic may pose some concern due to its presence in the region's volcanic soils, the potential for contamination is considered low because arsenic detections have typically been infrequent and the few exceedances of the MCL established for it are thought to have been caused by the

remediation of fuel spills. This is also true for hexavalent chromium. Although chromium is present in the region's soils, Cr VI detections have been infrequent and the few detected exceedances of the MCL likely resulted from the use of ISCO chemicals during environmental cleanup efforts.

3.7.2.4 Other Water Quality Concerns

Concerns have been expressed in regional stakeholder meetings about the potential for water and ground contamination from weather modification activities. This issue as it relates to precipitation enhancement and geoengineering is discussed further in Section 6.4.2 of Chapter 6, Issues, Interests, and Challenges.

Geoengineering can be practiced for many reasons. It includes activities ranging from encouraging the growth of algae with the goal of taking up carbon dioxide, to spraying chemical elements into the atmosphere with the objective of reducing solar radiation or changing weather patterns all together. The Intergovernmental Panel on Climate Change has noted that these strategies have limited, if any, success. One of the reasons this issue is relevant to the USR is the perceived water quality changes associated with what some residents believe is an increase in spraying. Some residents report an increase in aluminum content of the free-flowing rivers throughout the region. At this time, there are no available agency technical reports or peer-reviewed scientific articles addressing these claims.

Aside from the water quality issues, unintended climatic consequences could be numerous, such as changes to the hydrologic cycle, including droughts or floods, caused by the geoengineering techniques, but possibly not predicted by the models used to plan them. Such effects may be cumulative or chaotic in nature, making prediction and control very difficult.

3.7.3 Spring Water

(Note: Much of the following discussion about springs in this region is credited to the Mount Shasta Springs 2009 Summary Report, published in 2010 by California Trout ([California Trout 2010](#)). That report is discussed below. [\(Some RWAG members dispute the methods and findings of this study. Because of its importance to understanding of a critical regional resource, RWAG may wish to specifically address these issues at a later date.\)](#))

Mount Shasta's glacial meltwater, as well as meltwater from snowfields and rainfall in the higher elevations of the local watersheds and the Medicine Lake Highlands, percolate through the volcanic geology and emerge as hundreds of springs. Springs feed the McCloud River and the Upper Sacramento River and are substantial tributaries to the upper reaches of these streams. Spring-fed rivers have a constant input of cold water, as opposed to rivers fed primarily by surface runoff. The cold, clean spring waters provide ideal habitat for native trout and many other fish and aquatic populations.

Rainfall, snowmelt, and glacial meltwater filter through layers of volcanic rocks. There are few perennial streams flowing off the sides of Mount Shasta or from the Medicine Lake Highlands. Most of the water is absorbed into the ground and eventually flows to the surface as springs, [most notably the Fall River Springs, the largest spring system in California \(Curry 2014\)](#). Springs feed the base flow of stream headwaters and may be pumped by private and municipal water systems.

Springs are fundamental sources of municipal water supplies for local communities such as McCloud and the cities of Dunsmuir and Mt. Shasta.

As summarized in the *Mount Shasta Springs 2009 Summary Report* (California Trout 2010), following are examples of some the most prominent springs in the region:

McCloud Big Springs

The Big Springs on the McCloud River is said to contribute from approximately 600 cubic feet per second (cfs) to 200 cfs, which is a considerable percentage of the total flow of the McCloud River at that location. It discharges directly into the McCloud River, emanating from a deeply eroded escarpment on the Hearst Property.

Muir Falls

Muir Falls also discharges directly into the McCloud River, located at an elevation of approximately 2,983 feet. It is a large spring that discharges along a wide area of riverbank at river surface.

Elk Springs

There are two discharges that are considered to be Elk Springs: Upper Elk and Lower Elk. Both of these springs are utilized by the McCloud Community Services District (CSD) to provide drinking water to the community of McCloud.

Intake Spring

Intake Spring is also a source of drinking water for the McCloud CSD. The springs are located at approximately 4,610 feet, with a calculated recharge elevation of 6,435 feet.

Mt. Shasta Big Springs

Mt. Shasta Big Springs is located in the Mt. Shasta City Park and is frequently publicized as the headwaters of the Upper Sacramento River. It has an average estimated discharge of 20 cfs. It is considered to be a non-thermal spring. The tritium sampling of this spring indicated the water to be greater than 50 years old.

Cold Springs

Cold Springs, also known as Howard Springs, is an important water source for the City of Mt. Shasta. The City of Mt. Shasta monitors the flow and usage rates of this spring. The average yearly spring production fluctuates from year to year, with its lowest monthly production of 1,317 gallons per minute at 2.9 cfs having been recorded in March 1992. It was also noted that maximum spring production generally occurs in the summer months, however, this varies from year to year. In 2006, production peaked in June while usage peaked in July.

Mossbrae Springs

The City of Dunsmuir is supplied water through the diversion of 4 of 16 springs known collectively as Mossbrae Springs. The entire Mossbrae Springs system (i.e., all 16 springs) is estimated to have a total yield of approximately 15 cfs, or about 9.6 MGD. The water from the springs falls into the Upper Sacramento River as the scenic feature known as Mossbrae Falls.

Medicine Lake Highlands' Springs

In the Medicine Lake Highlands, despite an estimated 30 inches per year of precipitation at higher elevations, there is a lack of surface runoff due to the extreme permeability of the volcanic geology and infiltration of precipitation. Isolated springs are located in the area, often representing surface outflow of shallow groundwater flow from snowmelt and winter precipitation. Medicine Lake itself is fed primarily by emergent springs rather than from surface drainages. Outflow from the lake is believed to occur, in part, via Paynes Springs to the south of the caldera. Paynes Springs, which is a pair of springs, is the

source of Paynes Creek. Other springs in the area include Schonchin Spring, Crystal Springs, and Tamarack Spring.

Groundwater elevations in the vicinity of Medicine Lake, including the Giant Crater Lava Field which extends southward from the southern flank of Medicine Lake Volcano, indicate radial flow away from the area and contribute to spring flows outside the area. The headwaters springs for the Fall River, which is a significant tributary to the upper Pit River, are located approximately 35 miles to the south-southeast of Medicine Lake (outside this IRWM Plan region). Those springs, which emerge from the distal end of the Giant Crater Lava Field, provide the Fall River with a high volume, near- constant water source. In fact, the Fall River is said to originate from what is considered California's largest network of cold-water springs. In total, the entire spring system generates approximately 1,200 to 2,000 cfs of water. By some calculations, 85% of the summer base flows in the Pit River actually originate in the Fall River. At approximately one million acre-feet per year, the Fall River is said to be responsible for supplying nearly 22% of the storage capacity of Shasta Lake Reservoir.

Mount Shasta Spring Waters Study

The *Mount Shasta Springs 2009 Summary Report*, published in 2010 by California Trout, reported the findings of an initial baseline study on general water quality and geochemical parameters, recharge area, age, and vulnerability of springs that originate around Mount Shasta mountain. The study focused on springs in three areas: the two watersheds of the McCloud River and the Upper Sacramento River, both of which are in this IRWM Plan region, and the watershed of the Shasta River (a tributary to the Klamath River). The Shasta River watershed is northwest of and outside this IRWM Plan region.

Recognizing that much of the water resources in the area depend on springs that are sourced from glaciers, snow pack, and rainfall that originates on Mount Shasta, the spring and groundwater study was initiated by California Trout to assist local governments in considering policies regarding related water resources of the greater Mount Shasta area. The study was conducted and evaluated by a collaboration of California Trout, AquaTerra Consulting, the UC Davis Center for Watershed Sciences, and other project partners. The spring waters study was conducted from 2007–2009, and the report was published in 2010. A related vulnerability rating report concerning the springs was published in 2011 as an addendum to the study.

The scope of the Mount Shasta Springs study included taking water samples from 22 springs on Mt. Shasta, beginning in fall of 2007. Springs at high, middle, and low elevations in each of the three watersheds were sampled. The water samples were analyzed for a suite of general water quality and geochemical parameters. A subset of the samples was also analyzed for oxygen, hydrogen and deuterium isotopes. The intent of the sampling was to determine where the water originates on the mountain, as well as to consider if certain springs may be related. This information was gathered to assist in determining if and how these springs may be impacted as the result of development and/or climate change. To further support the study, nine springs were monitored for flow to determine if seasonal and yearly fluctuations in flow are occurring.

Five of the spring samples were age-dated based on analysis of the tritium isotope. After the first year the study was refined and the 2009 report summarizes and analyzes the first two years of data. The information collected from the study informed the development of a vulnerability rating for the springs sampled. The rating analysis assumed that Mount Shasta spring waters could be vulnerable to land use (water quality), development (water use), and climate change (variability). The purpose of the vulnerability rating is to assist with water management decisions (California Trout 2010).

The springs that contribute to the McCloud watershed that were sampled as part of this study all seem to have reduced sulfate equivalent, which may be an indication of a shorter travel time. This coincides with the tritium isotope results obtained on Muir Falls on the McCloud River, which has been dated at approximately 14 years. This is a significant spring in the McCloud basin and, coupled with the dating results, data could indicate that the aquifer of this spring (and potentially McCloud Big Springs) is a very large one with limited storage. Some of the other springs do not have year-round flow or appear to fluctuate, indicating more relation to seasonal snow pack melting.

Most of the springs in the McCloud River drainage are considered to be non-thermal springs with low dissolved constituents, limited water-rock interaction, and inferred low residence time. Low residence times are most obvious in Intake, Widow, Bundora, and Esperanza springs, which all have local recharge areas. Due to this factor, the study concluded that they could all be considered more vulnerable to precipitation fluctuations. McCloud Soda Springs shows high dissolved constituents, low discharge rates, longer residence time, and slightly elevated temperatures, making it the only “slightly-thermal mineral spring” in the McCloud basin (California Trout 2010).

The springs that discharge into the Upper Sacramento River watershed are also mostly classified as non-thermal springs with low dissolved mineral constituents and low residence time. There are a few exceptions to this generalization. One exception is Mt. Shasta Big Springs, the water of which has been dated to be older than 50 years, indicating high recharge elevations and longer recharge paths. There are also a few slightly-thermal mineral springs located in the Dunsmuir area, which have slightly elevated temperatures and high dissolved mineral content. The Cities of Mt. Shasta and Dunsmuir depend upon spring water as their potable community water source and some data on spring production and water use in these cities was obtained and included in the study.

3.7.4 Geothermal Water

The Glass Mountain Known Geothermal Resource Area (KGRA) is situated within the Medicine Lake Highlands – a volcanic region consisting of a caldera and surrounding volcanic features. The United States Geological Survey (USGS) began exploring the Glass Mountain region in the 1960s. While there were no known hot springs in the area, when the USGS discovered evidence of geothermal resources, the area was designated as a KGRA. The Bureau of Land Management (BLM) assumed responsibility for subsurface resources and the US Forest Service (Modoc National Forest) manages surface assets in this area. The BLM and USFS conducted environmental assessments for exploratory drilling and offered geothermal leases to private developers beginning in the mid-1980s. To date, exploratory wells have been drilled but no geothermal energy has been produced.

Two geothermal development projects were proposed on federal leases in the Medicine Lake Highlands in 1997. The first of the two, Fourmile Hill, involved a proposed 49.9MW dual-flash geothermal power plant, well field, and 24-mile, 230-kilovolt (kV) transmission line. The Fourmile Hill leaseholds are outside the rim of the caldera and to the northwest. The second project, Telephone Flat, would also produce 49.9MW of power with similar support facilities requiring a 12-mile transmission line. Telephone Flat is located within the caldera, within a mile from Medicine Lake.

The project sites are located within six miles of one another, but the projects were proposed independent of each other. A variety of environmental studies, including combinations of environmental impact statements pursuant to the National Environmental Policy Act and environmental impact reports pursuant to the California Environmental Quality Act, were prepared for both projects. By 2012, the geothermal developer had withdrawn both project approvals in favor of a new larger 480 MW geothermal development proposal. The new proposal is nearly 5 times larger than the two previous 49.9 MW projects.

The geothermal development projects proposed in the vicinity of Medicine Lake have been controversial and the subject of litigation. A lawsuit filed in May 2004 argued that the BLM renewed geothermal leases without taking previous reports into consideration or consulting adequately with affected Native American tribes. The proposed sites are on federal lands that are also the location of sacred grounds according to local Native American nations. The Medicine Lake Highlands have been identified as being sacred to the Pit River, Klamath, Modoc, Shasta, Karuk and Wintu tribes. A coalition of tribes petitioned the National Register of Historic Places to recognize the Medicine Lake Caldera (the oval crater within the highlands) as a Traditional Cultural District in August 1999, which was enlarged in 2005 to include 73,000 acres, covering a large portion of the Medicine Lake Highlands.

Concerning other related water resources, one reason for opposition to geothermal development in this area has been concern that geothermal drilling could have a significant adverse impact on groundwater quality. Hydrologic and geothermal resource assessments have evaluated the potential effects of projects on existing surface water and groundwater resources and the effects associated with geothermal heat extraction. Specific concerns were expressed during public scoping that the use of shallow groundwater for geothermal activities would adversely affect or compete with existing groundwater uses in the Medicine Lake basin; that blasting required during project construction could impact private wells in the area; and that spills or releases of either geothermal fluid or any potentially harmful substances used by the projects could impact surface water or groundwater in the area. On a regional basis, concern was expressed that production or injection of shallow groundwater or geothermal fluids could adversely affect the quality and/or quantity of flow to the Fall River Springs or would adversely impact thermal features in the area.

Geothermal water and hot springs are found within this IRWM region in the Big Bend area along the Lower Pit River. Hot springs have been given names including Indian Hot Springs and Crystal Hot Springs. Temperatures are reported to be as high as 170 to 180 degrees Fahrenheit. Much of the hot water flows from the riverbank into pools or otherwise directly into the Pit River. The Big Bend area has a history of resort operation and other uses of geothermal water.

3.7.5 Flooding

Flooding is generally a natural event and can provide many natural and beneficial functions to natural floodplains. Nonetheless, when human development in areas susceptible to flooding is factored in, flooding can impact the environment and community development in a variety of adverse and costly ways. In many areas as population growth expands, there is increased pressure to develop within floodplains. Such development limits the options available to flood managers and exacerbates flooding potential. Even with new requirements that require flood management to be incorporated in agency general plans, flood managers are sometimes not included in development decision-making.

While most communities in this region are located in topography that is not as conducive to general or major flooding (aside from localized flooding, e.g., blocked culverts) as communities in valley-type settings, there are communities in the region that have experienced and are vulnerable to flooding. For example, the Upper Sacramento River flows through the City of Dunsmuir and has caused flood damage on numerous occasions. Significant floods and damage in the city since 1911 are reported to have occurred in January 1997, January 1974, February 1940, January 1914, December 1964, March 1916, and December 1955 (FEMA 2011). Damage from the 1974 flood in Dunsmuir was estimated to have cost \$4.2 million with 25 homes destroyed. The city has experienced substantial damage from flooding to its wastewater collection and treatment system on several occasions.

Flooding can damage water and sewer systems. Floodwaters can back up drainage systems and cause localized flooding. Culverts can be blocked by debris such as logs from flood events, also causing localized urban flooding. Floodwaters can get into drinking water supplies, causing contamination.

Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, and streams. Transportation systems are also subject to being damaged by flooding. Roads are typically closed due to varying degrees of erosion-related washout. Road shoulders may be compromised due to high levels of runoff and rill erosion from intense precipitation. At the most severe stages, entire roadways may be undercut and eroded due to high discharges where roads parallel flooding waterways.

The most problematic secondary hazard for flooding is bank erosion, which in some cases can be more harmful than actual flooding. This is especially true in the upper courses of rivers with steep gradients where floodwaters may scour the banks, edging properties and infrastructure improvements closer to the floodplain or causing properties to fall into the river. Flooding is also responsible for hazards such as landslides when high flows over-saturate soils on steep slopes, causing them to fail. During the “New Year’s” storm that extended through January 1, 1997, the Union Pacific Railroad main line north of Redding suffered damage from more than 40 slides and washouts, mostly between Lakehead and Castella, and was closed for several weeks.

A floodplain is the area adjacent to a river, creek or lake that becomes inundated during a flood event. Floodplains may be broad, as when a river crosses a flat landscape, or narrow, as when a river is confined in a canyon. The USR is located mostly within mountainous terrain with drainages that course through high-relief, deeply-cut river canyons with narrow floodplains. Large amounts of water move through these river canyons and flooding is predominantly confined within the canyons and riverine valleys. Occasionally, railroad, highway or canal embankments form barriers, resulting in ponding or diversion of flows. Some localized flooding not associated with stream overflow can occur where there are no drainage facilities to control flows, or when runoff volumes exceed the design capacity of culverts and other drainage facilities. In some areas, the lack of broad, floodplain topography reduces flood hazards and the scope of flood impact, yet this channeling of the water into a narrow confinement during peak events does result in significant demand on culverts, bridges and other structures that divert or channel water flows.

Flooding in this IRWM region can be caused by two types of flooding: flash floods and riverine floods. Flash floods occur suddenly after a brief but intense downpour. They move rapidly, terminate suddenly, and can occur in areas not generally associated with flooding. Although the duration of flash flood events is usually brief, the damage they cause can be severe. Riverine floods are typically described in terms of their extent (including the horizontal area affected and the vertical depth of floodwater) and the related probability of occurrence (expressed as the percentage chance that a flood of a specific extent will occur in any given year (e.g., a 100-year flood). The big winter floods of 1997 and 1974 were caused by these much longer duration events (e.g., extended series of large winter frontal storms, or “pineapple express” storms). In these instances, the floods built very gradually over several days before peaking. The most widespread damage recorded to roads, bridges and other infrastructure on the Shasta-Trinity National Forest occurred in response to these types of floods.

Rain-on-snow events are a notable factor that contributes to flood hazards in the region. Rain-on-snow flooding develops when warm rains fall on accumulated snow, causing layers of snow to melt and run off in conjunction with the rain. The ground is often already saturated in such cases. Storm fronts with snow levels above 7,000 feet bring heavy rainfall over large areas where snow may have accumulated from previous storms with snowfall down to 3,000 feet or lower. These flood-producing storms typically occur between October and March.

The unincorporated community of McCloud is located in a small valley at an elevation of about 3,300 feet. Panther and Squaw Valley Creeks flow near and through the community. Panther Creek enters the valley from the northwest side and has formed a small alluvial fan where it exits an otherwise confined channel. This channel decreases in size to a small drainage ditch through the developed portion of the community. Squaw Valley Creek enters the valley and community from the northeast. A significant rain event that occurred between December 29, 1996 and January 1, 1997 resulted in flooding and damage in many places in Northern California, including the community of McCloud.

Over 11 inches of precipitation fell on a deep snow pack in the area, triggering flooding of Panther and Squaw Valley Creeks. Anecdotal accounts, reported in the Flood Insurance Study for Siskiyou County (FEMA 2011), suggest that flooding was the worst to occur in the McCloud area in over 50 years.

It is expected that climate change will affect flood potential. Climate change is projected to cause increases in global temperatures that likely will lead to shifts in the timing and magnitude of precipitation and runoff. Increased temperatures might alter precipitation and runoff patterns, such as higher snowline elevations, earlier snowmelt, and less overall snowpack. The projected shift in the timing of reservoir inflows could pose significant challenges for management of flood storage capacity in major system reservoirs. This would result in potential increases to the number of people, property, and other assets exposed to flooding in the state.

Potential for Dam Failure

The Siskiyou County Flood Control and Water Conservation District Act created the Siskiyou County Flood Control and Water Conservation District in 1957. In the planning region, the primary operation of this district is management of Box Canyon Dam on the Upper Sacramento River, along with management of Lake Siskiyou reservoir behind the dam and the county-owned property surrounding the lake. As described in the water-related infrastructure section of this document, the dam has a height of 209 feet and a length of 1,100 feet. It has a maximum discharge capacity of 42,700 cubic feet per second. Lake Siskiyou has a storage capacity of 26,000 acre-feet with a normal surface area of approximately 430 acres. The facility is used for minor flood control, hydroelectric power and recreation.

While dams such as Box Canyon Dam provide some protection from flooding by impounding and regulating flows, they also present a potential for flooding consequences of their own related to the potential for structural failures. Hazard studies such as those referenced in the Siskiyou County Hazard Mitigation Plan (2012) calculate and evaluate inundation areas that might result from a structural failure of a dam. Box Canyon Dam is considered a high-risk dam for which flood inundation mapping is available.

There is often limited warning time for a dam failure. These events are frequently associated with other natural hazard events such as earthquakes, landslides or severe weather, which limits their predictability and compounds the hazard. The most significant issue associated with dam failure involves the properties and populations in the inundation zones. Flooding as a result of a dam failure would significantly impact these areas, where properties would experience a large, destructive surge of water.

Flood-Related Programs

Through its Flood Hazard Mapping Program, the Federal Emergency Management Agency (FEMA) identifies flood hazards, assesses flood risks, and partners with States and communities to provide flood hazard and risk data to guide mitigation measures and actions.

FEMA prepares Flood Insurance Studies for communities. There are Flood Insurance Studies for both Shasta and Siskiyou counties and selected incorporated areas within these counties. These Studies

investigate the existence and severity of flood hazards in the study areas and aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Local and regional planners can use such studies in their efforts to promote flood plain management.

Existing FEMA maps for the Upper Sacramento basin are Dunsmuir FIRM panel 0603630001B and the FIRM panel that includes Lake Siskiyou (0603621375B). Panel 0603621400B includes the area east of Interstate 5 above the City of Dunsmuir and Panel 0603621600B includes the area east of Interstate 5 below the City of Dunsmuir. The City of Mt. Shasta is listed as an “area not included.”

There is a recently revised FEMA map in the McCloud basin that includes the Mud Creek drainage, which is prone to mud and debris flows primarily from Konwakiton glacier on Mount Shasta.

Existing FEMA maps for the McCloud basin (including the McCloud River, Squaw Creek, Ash Creek, Dry Creek, and Edson Creek) is FIRM panel 0603621425B. There are no known FIRM maps for the Lower Pit River area or the Medicine Lake Highlands.

Counties and cities are also obligated under California planning law to address the potential for flooding in their general plans. They are directed to provide consistent policies concerning the recognition of flood hazards in their general plan safety elements, corresponding with appropriate land use designations and policies in their general plan land use elements. The safety elements of general plans establish standards and policies for the protection of the community from hazards. Flood-related policies in general plans are intended to help reduce the risk associated with flooding and potential dam failure hazards for future development.

In the Shasta County General Plan, for example, Chapter 5.0, Public Safety Group, (which serves as the general plan safety element) addresses flooding in Section 5.2, Flood Protection. This General Plan observes that damages resulting from the development of flood-prone areas can be minimized through floodplain management. This management concept encompasses a comprehensive program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control projects, and floodplain management regulations. Shasta County’s General Plan acknowledges that National Flood Insurance Program information should serve as the basis for land use and zoning designations in floodplain regions during the implementation phase of the planning process.

The Siskiyou County General Plan also addresses the potential for flooding and promotes appropriate development standards in flood hazard areas.

Both Shasta County and Siskiyou County have also adopted Hazard Mitigation Plans, which include consideration of flooding and the potential for inundation from the failure of dams. The Disaster Mitigation Act (DMA) is federal legislation enacted to promote proactive pre-disaster planning as a condition of receiving financial assistance under the Robert T. Stafford Act (1988). The DMA encourages state and local authorities to work together on pre-disaster planning.

Lastly, it is noted that, in addition to FEMA programs, the California Department of Water Resources has a program to identify flood hazard areas through its Awareness Floodplain Mapping program. (Information about this program is available online at <http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/>.) The intent of the Awareness Floodplain Mapping program is to identify all pertinent flood hazard areas by 2015 for areas that are not mapped under the National Flood Insurance Program and to provide communities and residents an additional tool in understanding potential flood hazards currently not mapped as a regulated floodplain. The awareness maps identify the 100-year flood hazard areas using approximate assessment procedures.

New Awareness Floodplain Maps will be added to the program as they become available. As of January 2013, maps were posted for areas of the region within Shasta County but not for Siskiyou County. DWR notes that their maps are not FEMA regulatory floodplain maps but that, at the request of a community, FEMA would include the data on their maps.

3.7.6 Other Water Resource Issues

Following is discussion related to some of the particular issues that have been raised during work on the Upper Sac IRWM plan.

3.7.6.1 Precipitation Enhancement

Note: This issue is also addressed in the Issues and Interests Chapter of this IRWM Plan.

According to the California Water Plan 2005, precipitation enhancement, commonly called cloud seeding, artificially stimulates clouds to produce more rainfall or snowfall than would naturally occur. The Department of Water Resources (DWR) states that precipitation enhancement in the form of cloud seeding has been practiced continuously in several California river basins since the early 1950s (DWR 2005). The projects mostly use silver iodide as the active cloud seeding agent, supplemented by dry ice if aerial seeding is done. The silver iodide can be applied from ground generators or from airplanes. Occasionally other agents such as liquid propane have been used. In recent years, some projects have also applied hygroscopic materials (substances that take up water from the air) as supplemental seeding agents. Operators engaged in cloud seeding have found it beneficial to seed rain bands along the coast and orographic clouds over the mountains. (DWR 2005)

In California, precipitation enhancement projects are intended to increase water supply or hydroelectric power. The amounts of water produced are difficult to determine, but estimates range from 2 to 15% increases in annual precipitation or runoff. DWR makes reference to a National Research Council 2003 report on weather modification, which had limited material on winter orographic cloud seeding such as practiced in California and other western states. However, DWR has found that the report concurs that there is considerable evidence that winter orographic weather modification can result in up to a 10% increase in precipitation.

In a draft section for the California Water Plan Update 2013, DWR reports that the Pacific Gas and Electric Company (PG&E) had planned a new precipitation enhancement project on the Pit and McCloud Rivers in Northern California on the headwaters of Shasta Lake Reservoir, but that this proposal has been suspended. That project was expected to have been one of the more productive in California because of the frequency of storms and being able to take advantage of natural storage by increasing precipitation recharge of the large volcanic aquifers that feed the Pit and McCloud Rivers year round (DWR 2013). The intended result would be increased hydroelectric power production.

Much of the added precipitation would have gone into recharging the large volcanic aquifers that supply the springs in the region. Accepting a PG&E estimate for the formerly proposed Pit River cloud seeding project of 200,000 acre-feet of water for that region, DWR suggests that another 200,000 to 300,000 acre-feet of water per year might be generated by precipitation enhancement in other areas (DWR 2013 Draft).

In California, proposals have been made to the California Energy Commission's Public Interest Energy Research (PIER) program for additional research into cloud seeding to evaluate the effectiveness of existing programs in the state and optimize their effectiveness. Justification was stated as being the potential benefits to hydroelectric energy production. This approach would survey the latest scientific advances in cloud physics, remote sensing, atmospheric science, and seeding technologies, and would

evaluate strategies and recommendations for the best course of action to maximize the contribution of operational cloud seeding programs to the state's water and energy supplies. Study could also include the potential effect of global warming and atmospheric pollution on seeding practices and capabilities. DWR has recommended that the PIER program include and fund research on cloud seeding in their activities.

Questions and controversy about potential unintended impacts from precipitation enhancement have been raised over the years. Common concerns relate to downwind effects (enhancing precipitation in one area at the expense of other areas downwind) and long-term toxic effects of silver iodide. The Bureau of Reclamation has studied these issues, and findings include those reported in its Project Skywater programmatic environmental statement in 1977 and in its Sierra Cooperative Pilot Project EIS in 1981.

According to DWR's summary of preliminary observations for the draft California Water Plan 2013, available studies indicate that silver and silver compounds have a rather low order of toxicity and there is little potential for eventual toxic effects of silver (DWR 2013 Draft). The report states that accumulations in the soil, vegetation and surface runoff have not been large enough to measure above natural background. A 2004 study done for Snowy Hydro Limited in Australia is said to confirm the earlier findings from the Bureau of Reclamation.

Draft material from DWR for the 2013 California Water Plan Update states that findings about silver accumulation testing by PG&E on the Mokelumne River and Lake Almanor watersheds were reported at the 2007 annual meeting of the Weather Modification Association. Both watersheds have been seeded for more than 50 years. Sampling at Upper Blue Lake and Salt Springs Reservoir showed very low to non-detectible concentrations of silver in water and sediment. Similar results were found at Lake Almanor in tested water, sediment and fish samples during the 2000 to 2003 period. Amounts were far below toxic levels and there was little to suggest bio-accumulation. DWR has concluded that continued operations should not result in any significant chronic effect on sensitive aquatic organisms. (DWR 2013 Draft)

State requirements for sponsors of weather modification projects consist of filing a Notice of Intention (NOI) initially and every five years for continuing projects, with record keeping by operators and annual or biennial reports to DWR. Sponsors also need to comply with the California Environmental Quality Act. Annual letter notices should also be sent to the Board of Supervisors of affected counties and to DWR. There are also activity reports to be sent to the National Oceanic and Atmospheric Administration, which give the number of days and hours of operation and the amounts of seeding material applied.

Draft recommendations to increase precipitation enhancement that are being considered by DWR for the California Water Plan Update 2013 (DWR 2013 Draft) include the following:

- The state should support the continuation of current projects as well as the development of new projects and help in seeking research funds for both old and new projects. Operational funding support for new projects may be available in the IWRM program.
- The state should support research on potential new seeding agents, particularly those that would work at higher temperatures. Global warming may limit the effectiveness of silver iodide, the most commonly used agent, which requires cloud temperatures well below freezing, around -5° C, to be effective. The increasing cost of silver is a detriment to some ongoing projects.
- DWR, in partnership with the Bureau of Reclamation, and seeking cooperation with PG&E, should produce an EIR/EIS on a Pit River project similar to the one proposed several years ago, since this is an area with one of the best potential yields which could benefit both the Central Valley Project and the State Water Project (which share in-basin use above and in the Delta) and there would appear to be multiple State benefits from augmenting recharge of the huge northeastern California volcanic aquifer.

The California Water Plan Update 2013 is still in draft form as of this writing and it is not known if and when the draft recommendations will be adopted and pursued.

3.7.6.2 Shasta Dam and Proposals to Raise the Lake Level

As described earlier in this Region Description, Shasta Dam and its impoundment, Shasta Lake Reservoir, are not included in the USR. The watersheds of this region and the region itself terminate at the reservoir's current high-water mark. Nevertheless, the completion of the dam in 1944 has had significant impacts and implications on the lower watersheds of the region, and any dam raise would back the reservoir further into the USR. A description of Shasta Dam is provided in Section 3.4, Water-Related Infrastructure. Issues concerning fish, especially as related to anadromous fish that have been blocked by the dam and related facilities, are discussed in Section 3.7, Biological Characteristics. The following discussion notes the issue of the proposed raising of Shasta Dam as related to the USR.

The USBR has initiated feasibility studies and environmental compliance documentation for the Shasta Lake Water Resources Investigation (SLWRI). A feasibility study was initiated in 2000 to analyze alternatives for raising the dam from 6.5 to 18.5 feet and corresponding increases of reservoir storage. In February 2012, the USBR released a Draft Feasibility Report and Preliminary Draft Environmental Impact Statement (EIS) to examine the potential for enlarging the dam. The primary study area is extensive, due to downstream concerns along the greater Sacramento River and nearly statewide considerations for the use of water stored in Shasta Lake Reservoir. The study area directly includes: Shasta Dam and Lake; land around the lake; lower reaches of primary tributaries flowing into Shasta Lake reservoir (Sacramento, McCloud, and Pit rivers and Squaw Creek); and all smaller tributaries flowing into the lake. The draft EIS documents address the potential impacts, costs and benefits of the No Action alternative and five action alternatives evaluated to date.

[Currently, planning funds have been allocated, preliminary core drilling has begun and USBR has announced that contracts for construction will be signed by end of 2019 \(Record Searchlight 2018; USDI 2018\).](#)

Federal, state and local stakeholders have identified several areas of concern during SLWRI meetings and workshops. Major concerns that have been raised, as identified in the Preliminary Draft EIS for the Shasta Investigation, include the following:

- Impacts to Cultural Resources — Sites of cultural significance exist in and around Shasta Lake reservoir, many related to historic activities and religious beliefs of Native Americans. The Winnemem Wintu Tribe continues to raise concerns about the culturally devastating impacts of enlarging Shasta Dam on their historic and culturally significant sites. The Winnemem Wintu have indicated that at least 118 archeological sites that are still used today for their ceremonies would be destroyed and/or rendered unusable by inundation, in addition to the many sites that were destroyed when Shasta Lake Reservoir was first developed. The USBR has claimed that the effects of the dam raise on Winnemem traditional cultural properties (TCPs) are unavoidable and has not offered any plan for mitigation or avoidance. The Winnemem Wintu Tribe contends that cultural concerns and laws are being deliberately and illegally ignored.
- Impacts to Recreation — Shasta Lake Reservoir is the principal recreation destination in Shasta County. Local interests are concerned about possible adverse effects on recreation at the lake. This ranges from impacts to the lake area concessionaires and their facilities to concerns about potential impacts on the regional economy. Shasta Lake Reservoir is within the Shasta-Trinity National Recreation Area (NRA). Accordingly, impacts to campgrounds and related facilities administered by the USFS under the NRA have been identified as a concern.

- McCloud River — Although the California Department of Water Resources (DWR) is the current non-Federal sponsor for the SLWRI, its participation and that of other state agencies are limited by California Public Resources Code 5093.542(c). (See discussion of special McCloud River legislation below.) The McCloud River CRMP and others have expressed concerns about impacts to the McCloud River resulting from enlarging Shasta Dam.
- Impacts to Reservoir Area Property Owners — Raising Shasta Dam by 18.5 feet would inundate about 2,500 additional acres around Shasta Lake Reservoir. This would affect at least 130 structures and require replacing seven bridges and about 115 segments of existing paved and non-paved roads.
- Impacts to the Environment — Enlarging Shasta Dam or modifying project operations would affect a broad range of environmental resources, some adversely and some beneficially. Significant concern has been expressed about potential impacts to reservoir rim wildlife habitat, fishery habitat on several inflowing creeks and streams, and fishery resources in affected watersheds.
- Reservoir Reoperation — Residents and businesses around Shasta Lake Reservoir have expressed interest in revising the operation of Shasta Dam to reduce the potential for extreme seasonal drawdown for flood control, such as occurred in early 2004.
- No studies have been done regarding alternate ways to meet water supply needs.

3.7.6.3 McCloud River Legislation

Unique provisions have been adopted by the State of California to protect the special qualities of the McCloud River. These provisions, as will be noted, have implications on the proposal to raise Shasta Dam and the lake level.

In 1994, the USFS evaluated the eligibility of the McCloud River for listing as a wild and scenic river under the Federal Wild and Scenic River Act during preparation of the Shasta-Trinity National Forest Land and Resource Management Plan (LRMP) (USDA 1994). Although the LRMP found the McCloud River eligible for listing, the direction was to not formally designate any reach of the river as wild and scenic. Instead, the direction was to manage the lower McCloud River under a Coordinated Resource Management Plan (USDA 1994). The Coordinated Resource Management Plan (CRMP) is a coordinated effort between landowners and stakeholders with a vested interest in the river. The CRMP requires its signatories to protect the values that make the river eligible for federal designation as wild and scenic and contains a provision stating that the USFS reserves the right to pursue designation if the CRMP is terminated or fails to protect these values. (More information about the McCloud River CRMP is included below.)

The California Resources Agency also evaluated the McCloud River in the late 1980s to determine whether the river was eligible for listing as a wild and scenic river under the State Public Resources Code (PRC). The Resources Agency study found it eligible, but the California legislature declined to formally add the river to the California wild and scenic river system. The legislature instead passed an amendment to the California Wild and Scenic Rivers Act in the PRC to protect the river below McCloud Dam. This Act was amended in 1989 to include portions of the McCloud River. Although the McCloud River is not formally designated as a state wild and scenic river, PRC Section 5093.542 specifies that the McCloud River should be maintained in its free-flowing condition, and its wild trout fishery protected. The amendment specifies that no new dams, reservoirs, diversions, or water impoundment facilities are to be constructed on the McCloud River from 0.25 miles downstream from the McCloud Dam to the McCloud River Bridge — a reach length of approximately 24 miles. Section 5093.542(c) states the following:

Except for participation by the Department of Water Resources in studies involving the technical and economic feasibility of enlargement of Shasta Dam, no department or agency of the state shall assist or cooperate with, whether by loan, grant, license, or otherwise, any agency of the federal, state, or local government in the planning or construction of any dam, reservoir, diversion, or other water impoundment facility that could have an adverse effect on the free-flowing condition of the McCloud River, or on its wild trout fishery.

Section 5093.542(d) also states that all state agencies exercising powers under any other provision of law with respect to the protection and restoration of fishery resources shall continue to exercise those powers in a manner to protect and enhance the fishery [of the protected segments of the McCloud River].

As discussed above, raising Shasta Dam and the lake level as proposed in the Shasta Lake Water Resources Investigation (SLWRI) would inundate portions of the lower McCloud River. At gross pool, the existing reservoir can inundate just over a mile of river upstream from the McCloud Bridge. Raising Shasta Dam could extend this area by about 2/3 of a mile. The EIS for the SLWRI evaluates the related potential impacts of this increased length on the trout fishery of the McCloud River and the related legislation. PRC Section 5093.542(c), as noted, may limit participation from state departments or agencies in planning or constructing any water impoundment facility that could adversely affect this area of the McCloud River.

Acknowledging the provisions of the PRC relative to the McCloud River, the Bureau of Reclamation has expressed the intent to continue to coordinate with state and potential non-federal sponsors to develop strategies to support state agency participation in the SLWRI and necessary permitting processes, such as those related to water rights and CEQA.

3.7.6.4 McCloud River CRMP

The McCloud River Coordinated Resource Management Plan (CRMP) was adopted in July 1991 to maintain the values of the McCloud River. The management plan establishes guidelines to coordinate management activities with the principal landowners in the McCloud River drainage area and public agencies that administer programs in the area. The main objective of the plan is to improve management of the area's resources to allow for multiple uses while protecting the natural environment and private property rights. Signatories of the McCloud River Coordinated Resource Management Plan include McCloud River Club, Crane Mills, USFS, McCloud River Co-Tenants, PG&E, California Trout, Sierra Pacific Industries, DFG, Hearst Corporation, and The Nature Conservancy (McCloud River CRMP 1991). The Winnemem Wintu Tribe, with aboriginal claims to this territory, have made several requests to join the CRMP, but have not yet been invited.

The area addressed by the McCloud River CRMP is described as being divided into two segments: the Lower McCloud and Upper McCloud areas, with the area being essentially the area visible from the river and Squaw Valley Creek; that is, ridge top to ridge top. More specifically, the Lower McCloud area covered by the plan is the segment that covers the McCloud River and Squaw Valley Creek drainages above Shasta Lake Reservoir north to Lake McCloud on the river, and up to Cabin Creek on Squaw Valley Creek. The east boundary extends up to approximately one mile on the east side of the river. The west boundary extends up to four miles from the river and Squaw Valley Creek. The Upper McCloud segment generally encompasses the inter-gorge area of the river from Lake McCloud up to Algoma Campground.

The CRMP is supported by an MOU that establishes a McCloud River coordinating group for the plan. As described in the MOU, the mission of the coordinating group is to coordinate, between agencies and

landowner participants, the various land management activities in the plan in such a way as to achieve the following goals (CRMP 1991):

1. To maintain respect for the property rights of the participants;
2. To enhance and improve habitat for wildlife and fish by coordination with other resources and by specific habitat improvement projects;
3. To improve water quality for fisheries and other beneficial uses;
4. To improve and coordinate recreation resource opportunities and interpretation;
5. To maintain soil resources for beneficial uses;
6. To develop the timber resource to its reasonable attainable potential in harmony with other resources.

3.8 Biological Characteristics

3.8.1 General Biological Features

As noted in the Geology section (Section 3.6) of this chapter, the USR straddles two ecological provinces, the Klamath Mountain province and the Cascade province. In the Klamath Mountain province, the complexity of the geology and terrain has a strong influence on the structure, composition, and productivity of vegetation, producing floristic diversity and complexity in vegetative patterns. The diverse patterns of climate, topography, and parent materials in the Klamath Mountains create a mosaic of vegetation patterns that are found to be more complex than patterns typically found in the Cascade Range.

Generally speaking, the western and southern portions of this IRWM region are characterized by biotic communities typical of the Klamath province, while the northern and eastern portions of the region, including the Medicine Lake Highlands, are characterized by biotic communities typical of the California Cascades province. The Klamath Province is dominated by Douglas fir, Douglas fir/mixed hardwood, mixed conifer, mixed conifer/hardwoods, and Ponderosa/Jeffrey pine forests. The California Cascades Province is dominated by mixed conifer and/or ponderosa pine associations on relatively dry sites.

According to the Sacramento River Watershed Program, there are approximately 217 species of wildlife associated with the variety of habitats found in the watersheds of this IRWM region (Sacramento River Watershed Program 2012). For example, concerning the McCloud River watershed, this estimate of 217 species reportedly consists of 132 birds, 55 mammals, 19 reptiles, and 11 amphibians. Within the mixed conifer and oak forests of the region, wildlife includes mammals such as black bear, mountain lion, ringtail cat, gray fox and the rare wolverine. Otters are common along the rivers and major creeks of this region. As many as 17 species of bats inhabit the area.

The steady supply and volume of cold, clean water in the region supports a high quality wild trout fishery. The watershed also provides important habitat for a number of special-status plant and animal species including rough sculpin, Shasta salamander, and northern spotted owl.

3.8.1.1 Biotic Communities

This section describes some of the common biotic communities in the region and, on that basis, provides an overview of the region's wildlife and fishery resources and habitats of special concern. The primary source for this section is the *Upper Sacramento River Watershed Assessment* (June 2010). Much of this section incorporates related material directly from the *Upper Sacramento River Watershed Assessment*. That material has been adapted and expanded as applicable to discussion of the larger planning region, of which the Upper Sacramento River watershed is one of the four watershed areas along with the McCloud River watershed, the Lower Pit River watershed, and the Medicine Lake Highlands. Various watershed analyses prepared by the Shasta-Trinity National Forest have also been used in preparing this section.

Biotic communities are groups of plant, wildlife, and fish populations that interact with one another in the same environment. This region encompasses a wide diversity of biotic communities. This diversity results from the large size of the region in combination with the variety of landforms, soil types, topography, and microclimates. Human use and management have influenced some of these factors. The plant species present in a biotic community are generally a response to abiotic, or non-living, factors such as climate, topography, and soils. The plant assemblages, however, largely determine wildlife species. Therefore, biological communities are commonly defined in terms of their dominant plant species (e.g., oak woodland, mixed chaparral, annual grassland).

The planning region encompasses a wide diversity of biotic communities. This diversity is a result of the large size of the region in combination with the variety of factors including landforms, topography, microclimates, and soil types. Dominant plant species and species composition in these communities vary with dramatic changes occurring in relation to aspect, slope, geologic substrate, or juxtaposition with other communities. For example, it was projected in the *Upper Sacramento River Watershed Assessment* that, in that particular watershed, the Sierran mixed conifer biotic community was by far the most dominant community, covering approximately 46% of the 383,000-acre watershed. Mixed hardwood was the next most abundant community in the watershed (approximately 12%), followed by mixed chaparral, mixed hardwood-conifer, white fir, and lacustrine (primarily portions of Shasta Lake Reservoir). Other biotic communities covered no more than 3% of that watershed.

For the purposes of this region description, the biotic communities in the watershed have been divided into three general categories: aquatic, riparian, and terrestrial. These general communities are discussed below.

Aquatic Communities

The aquatic characteristics of the region include sub-alpine lakes, several man-made reservoirs, rivers and other perennial streams, and a complex of springs, intermittent streams, seasonal floodplains, wetlands, seeps, marshy fens, and wet meadows. These landforms provide habitat for a variety of aquatic species. While not typically covering large areas of land in the region, aquatic ecosystems are a significant type of biotic community. In addition to fish, aquatic environments provide habitat for a variety of other aquatic fauna including invertebrates and amphibians, as well as planktonic organisms.

The discussion of aquatic communities and their key species was sequenced hierarchically in the *Upper Sacramento Watershed Assessment*, beginning at the base of the food-web and progressing up to higher level consumers (i.e., microbes and planktonic organisms, invertebrates, amphibians and aquatic reptiles, and fish and fisheries). Of the special-status species present in the watershed, seven are aquatic. Of these seven, three are fish species (rough sculpin (*Cottus asperimus*), hardhead (*Mylopharodon conocephalus*), and rainbow trout (*Oncorhynchus mykiss*)), three are amphibians (Cascades frog, foothill yellow-legged frog, and tailed frog), and one is an aquatic reptile (northwestern pond turtle). In addition to these, several other species are considered species of interest. This inclusion is generally based on the species' unique history in the region, importance as game species, or relationship to a specific habitat type of interest.

Aquatic macro-invertebrate species and communities, which include insects, snails, clams, crayfish, worms, and other invertebrates living in the aquatic environment, are a critical component of aquatic ecosystems and resources. Aquatic insects generally feed on algae, terrestrial and aquatic organic debris, and other macroinvertebrates. They provide a critical food source for fish and amphibian species, and certain aquatic insects with a terrestrial life phase have been shown to provide an important food source for riparian and upland reptile, bird, and bat species. In the upper headwater areas of the watersheds, Odonata (dragonflies and damselflies), caddisflies, mayflies, and Diptera (true flies) appear as the

dominant taxa in most of the streams. In the central and lower portions of watersheds, mayfly, stonefly, caddisfly assemblage represents species groups that indicate high- quality aquatic conditions

Mollusks serve as primary herbivores and detritivores in benthic stream communities and are major food items for fish and other stream-dwelling or stream-related animals. The freshwater mollusk fauna of rivers and tributaries in the area has long been considered exceptionally diverse, including snails such as *Physella* as well as cold water-specific genera such as *Fluminicola* (pebble snails) and *Vorticifex*.

Non-native signal crayfish are present in the main river watersheds and appear anecdotally to be expanding because they are widely distributed in locations where they were not in the late 1970s when the streams were last surveyed.

Concerning amphibians and aquatic reptiles, in some areas of the planning region there is a high diversity of herpetofauna, which include 12 aquatic amphibian species and one aquatic reptile species. In 2002, surveys for terrestrial amphibians were conducted at 40 locations in the region north of Shasta Lake Reservoir (Nauman and Olson 2004). Three species of reptiles and nine species of amphibians were detected, including the federally listed Shasta salamander. Along the McCloud River canyon and arm of the reservoir, the Shasta salamander, which is not known to occur anywhere else on earth, can be found in limestone outcrops and caverns.

Amphibians and aquatic reptiles are integral and often abundant members of aquatic ecosystems and have often been found to constitute the highest fraction of vertebrate biomass in an ecosystem.

Additionally, both amphibians and aquatic reptiles provide important links within and across aquatic and terrestrial food webs, consuming large amounts of invertebrate prey from both habitats and sustaining numerous predators at multiple trophic levels.

The California Golden Beaver, formerly native to the region, was extirpated (likely by fur trappers) before recorded history (Naiman, et al. 1988). The benefits of the presence of beaver include more persistent native tree numbers, groundwater recharge, and the development of more habitable stream refugia for fish (Benson-Ayers 1997; Gard 1961). There is some interest in the region in reintroducing the beaver to regional waterways, which has been successfully accomplished in other parts of California.

Fish

Fish are, of course, directly associated with aquatic communities. Due to the particular concern of fish relative to this IRWM plan, fish are discussed in this separate section, along with related management issues.

Historically, the fish population within the USR in general included large seasonal runs of anadromous salmonids (winter, spring and fall salmon and winter steelhead), and migratory populations of sturgeon (*Acipenser spp.*). However, anadromous fishes have not been found in the region since the completion of Shasta Dam in 1943, and sturgeon are limited to a white sturgeon (*Acipenser transmontanus*) population in Shasta Reservoir. The current fish assemblage in the area is composed primarily of native, introduced, and regularly stocked resident coldwater and warm water fish. The non-native trout in the basin are a result of hatchery introductions that began in the late 1800s and include coastal rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), and brook trout (*Salvelinus fontinalis*).

The fish assemblage in the watershed varies by sub-region. For example, the species in the headwaters portion of the Upper Sacramento Watershed consist primarily of introduced char and possibly a few remnant minnows and suckers in isolated locations. Exceptions to this include reservoirs such as Lake Siskiyou, which supports a diverse assemblage of primarily introduced warm and coldwater fishes. The

fish assemblage in the central watershed sub-region is dominated by rainbow trout. In addition to trout, rivers in the region are home to Sacramento sucker, Sacramento squawfish, carp, riffle sculpin, smallmouth bass, blackfish, golden shiner, and hardhead minnow.

These species are generally present in the main stem of the Sacramento River, but are largely absent from the tributaries, with the exception of the riffle sculpin. Several non-native warm water species are present in the main stem of the Sacramento River, with increasing presence in the southern end, close to Shasta Lake Reservoir. However, these species are also largely absent from the tributaries.

All three of the major rivers in this region have trout fisheries that are unique in number and size and are highly-prized by the sport-fishing community. The McCloud River, for one, is known as a premier trout stream with an abundance of large rainbow and brown trout. The abundance of large fish is a function of the excellent quality of the habitat, and benefits from special fishing regulations and limited access to the lower reaches of the river where large tracts of private ownership limit the take of fish. The Lower McCloud River from the McCloud Dam downstream to Shasta Lake Reservoir is designated as a 'Wild Trout Stream' by the California Department of Fish and Wildlife. The McCloud River historically had the southernmost and only bull trout (*Salvelinus confluentus*) population in the state of California until it was extirpated in 1975. Many of the streams in the upper McCloud River basin originate in terrain where soil is composed of porous volcanic ash.

Consequently, many of the streams are isolated, beginning as springs and then soon sinking back into the ground a short distance downstream. Redband trout in these small stream populations reach a maximum size of around 12 inches with a lifespan of three to seven years. The Redband trout found in the larger waters of the McCloud River may reach sizes of 20 inches and weights of up to three pounds.

The Lower Pit River supports warm water fish species (e.g., bass, crappie, catfish, and bullhead), and an outstanding coldwater fishery for native rainbow trout in the lower reaches of the river. Native and non-native fish species are important prey items for the significant population of bald eagles.

Shasta Lake Reservoir and its tributaries provide very productive habitats for coldwater fish species, which typically prefer or require temperatures cooler than 70° F. During the cooler months, coldwater species such as rainbow trout, brown trout (*Salmo trutta*), and landlocked Chinook (*Oncorhynchus tshawytscha*) may be found rearing throughout the lake; however, these species do not spawn in the lake, preferring to spawn in tributary streams.

Native species such as white sturgeon, hardhead (*Mylopharodon conocephalus*), riffle sculpin, Sacramento sucker (*Catostomus occidentalis*), and Sacramento pikeminnow (*Ptychocheilus grandis*) tend to reside in cooler water strata in the reservoir and in and near tributary inflows. Trout may also congregate near the mouths of the reservoir's tributaries, including the Upper Sacramento River and the McCloud River, at various times of the year for various purposes including thermal refuge, foraging, and spawning, when conditions are favorable for these species.

The warm water fish habitats of Shasta Lake Reservoir occupy two ecological zones: the littoral shoreline/rocky/vegetated) and the pelagic (open water). The littoral zone lies along the reservoir shoreline down to the maximum depth of light penetration on the reservoir bottom and supports populations of spotted bass (*Micropterus punctulatus*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), and other warm water species. Warm water species, such as largemouth bass, smallmouth bass, spotted bass, and other sunfishes, were introduced into the reservoir and have become well established with naturally sustaining populations.

Some waters, including the PG&E-owned/operated Pit 6 reservoir on the Pit River, support a population of hardhead, a California species of concern and a Forest Service sensitive species (FERC 2011).

Riparian Biotic Communities

The term “riparian” pertains to the moist soil zone immediately outside of aquatic wetlands, perennial and intermittent watercourses, and other freshwater bodies. These areas may be regarded as the interfaces between aquatic communities and adjacent terrestrial communities. Riparian vegetation is considered to be important in determining the structure and function of stream ecosystems. Streams are characteristically shaded and kept cool by overhanging riparian vegetation that moderates stream temperatures. While fish are not typically considered part of riparian communities, they interact directly with riparian habitat in a variety of ways, including feeding on terrestrial insects, supplying nutrients to terrestrial species, or using flooded vegetation for spawning.

Riparian woodlands form an important link between aquatic and terrestrial wildlife communities. Most aquatic insects are either directly or indirectly dependent on riparian vegetation at some stage in their life cycles. The predominant form of a riparian biotic community in the region is the montane riparian community.

Beavers were once integral to the riparian habitat along stream corridors throughout California. These mammals represent an integral link between aquatic and terrestrial habitats, in the riparian corridors.

Terrestrial Biotic Communities

The term terrestrial is applied to biotic communities that are generally upslope of the more water- defined characteristics of aquatic and riparian communities. As noted in the *Upper Sacramento River Watershed Assessment*, many natural processes in terrestrial communities, such as erosion, nutrient cycling, input of organic material, evaporative water loss, and movement of wildlife, result in direct interactions with neighboring aquatic and riparian communities. The conditions of upslope soil and vegetation can significantly affect the capability of a watershed to retain moisture and modulate surface and subsurface runoff into streams.

A wide variety of terrestrial biotic communities are found in this region. Following, in **Table 3.7**, is a brief list of some of these communities. Readers should refer to the *Upper Sacramento River Watershed Assessment*, as well as other relevant watershed analyses, for a more thorough account of these biotic communities and species that are characteristic of these areas. (Note: Although biotic communities comprise both animals and plants, communities typically are named on the basis of the dominant plant species or site characteristics.)

Table 3.7: Terrestrial Biotic Communities Found in the USR	
Sierran Mixed Conifer	Jeffrey Pine
Montane Hardwood	Klamath Mixed Conifer
Alpine Dwarf-Shrub	Mixed Chaparral
Annual Grassland	Montane Chaparral
Barren	Mixed Hardwood-Conifer
Bitterbrush	Pasture
Blue Oak Gray Pine	Ponderosa Pine
Closed-Cone Pine-Cypress	Red Fir
Cropland	Sagebrush
Deciduous Orchard	Subalpine Conifer
Douglas-Fir	White Fir

Table 3.7: Terrestrial Biotic Communities Found in the USR

Eastside Pine	Wet Meadow
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Urban habitat is another component of terrestrial communities, and includes roadways, residential areas, and commercial areas. Urban areas are largely denuded of native vegetation; what vegetation does exist is predominantly non-native or ornamental. The wildlife species most often associated with urban areas are those that are most tolerant of periodic human disturbances, including several introduced species such as European starlings, rock doves, and house mice. Native species that are able to use these habitats include western fence lizards, American robins, Brewer’s blackbirds, northern mockingbirds, mourning doves, house finches, black-tailed jackrabbits, and striped skunks. In addition, bats that forage in nearby habitats may make use of small cavities around the eaves of structures.

3.8.1.2 Special Status Designations

The designation of species as having “special status” can be applied to both plant and animal communities in California with slightly different criteria.

For the Upper Sacramento River Watershed the California Natural Diversity Database (CNDDDB) indicates 42 special-status plants known to occur in the watershed. Information on the habitat requirements of these species was obtained from the California Native Plant Society (CNPS) online Inventory of Rare and Endangered Plants, which features information on the habitats and statewide distribution of special-status plants in California. The *Upper Sacramento River Watershed Assessment* should be consulted for more information.

Special-status fish and wildlife typically include:

- Species listed or proposed for listing as threatened or endangered under the Federal Endangered Species Act,
- Species listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act,
- Species designated as “species of special concern” by the California Department of Fish and Wildlife (CDFW),
- Species designated as “fully-protected” by CDFW,
- Species considered sensitive or endemic by the U.S. Forest Service, or
- Birds designated as “birds of conservation concern” by the U.S. Fish and Wildlife Service.

Plants

The distribution and abundance of rare plants in the watershed is governed by a combination of: availability of suitable habitat; connectivity of habitat for dispersal and colonization; and losses of local populations from human impacts, climatic fluctuations, and other environmental events such as floods, fires, and diseases.

Assessments of potentially occurring special-status plants typically include a search of the CNDDDB. The CNDDDB is a database consisting of historical observations of special-status plant species, wildlife species, and natural communities. It is limited to reported sightings and is not a comprehensive list of special-status species that may occur in a particular area. Therefore, additional special-status plants may occur in the watershed, and CNDDDB information may be supplemented by other assessments. The Upper Sacramento River Watershed Assessment includes a list of USFS Sensitive and Endemic Plants potentially occurring in the region.

Insects and Wildlife

In the *Upper Sacramento River Watershed Assessment*, 36 special-status wildlife species that are known to occur or may occur in the watershed were listed. Their distribution, legal status, general habitat requirements, and known occurrences in the watershed were listed, based on CNDDDB information, as well as information from the California Wildlife Habitat Relationships (CWHR) system maintained by the California Department of Fish and Wildlife. (Note: CWHR is an online information system for California's wildlife and contains life history, geographic range, habitat relationships, and management information on 694 species of amphibians, reptiles, birds, and mammals known to occur in the state.)

The list of federal- or state-listed threatened and endangered insect and wildlife species in the *Upper Sacramento River Watershed Assessment* includes special recognition of the following species (this list is not intended to indicate all threatened and endangered species that may be found in the region):

- Shasta Salamander (*Hydromantes shastae*): Known habitat consists primarily of limestone bluffs, cliffs, and outcrops near Shasta Lake Reservoir;
- American peregrine falcon (*Falco peregrines anatum*): Requires cliffs for nesting. Has been recorded nesting in the region;
- Bald Eagle (*Haliaeetus leucocephalus*): Although delisted as a threatened species, the bald eagle continues to be protected under the federal Bald and Golden Eagle Protection Act;
- Northern Spotted Owl (*Strix occidentalis caurina*): Associated with late-successional forest conditions. Critical habitat designation includes units within the region;
- Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*): Considered extremely rare in most areas and possibly extirpated from this region;
- Willow Flycatcher (*Empidonax traillii*): Nests in dense riparian thickets. Considered to be a rare spring and fall migrant in this area;
- Pacific Fisher (*Martes pennant pacifica*): This mammal has been recorded in numerous locations in the region; and
- Sierra Nevada Red Fox (*Vulpes vulpes nector*): Inhabits various habitats in alpine and subalpine zones. Sightings of this mammal have been recorded near Mount Shasta.

Other species that also warrant mention as special status species are: the Valley Elderberry Longhorn Beetle, golden eagle, northern goshawk, bank swallow, greater sandhill crane, American marten, California wolverine, ringtail, pallid bat, spotted bat, Townsend's big-eared bat, western red bat, western mastiff bat, tailed frog, foothill yellow-legged frog, northwestern pond turtle, and 10 species of terrestrial mollusks — six of which are considered Forest Service special status species.

McCloud Redband Trout

The McCloud Redband Trout is a former candidate species for protection under the federal Endangered Species Act. Due to the enactment of a Candidate Conservation Agreement, the McCloud Redband Trout (or McCloud Redband) was removed from candidate status in October 2000. A series of conservation actions implemented by the Upper McCloud River Redband Trout Core Group have been designed to help recover this fish and reduce the need for listing under the Endangered Species Act. Conservation of McCloud Redband Trout is ongoing under joint efforts of California Trout, the Shasta-Trinity National Forest, the California Department of Fish and Wildlife, and other partners in this effort. The forging of the Redband Trout Conservation Agreement in 2007 was an important step towards protecting these fish and their habitats. As noted in the purpose statement of the Redband Trout Conservation Agreement:

“This Conservation Agreement has been prepared to provide for genetic integrity, secure populations and long-term viability of the upper McCloud redband while respecting existing land uses, resource uses, and private property rights and while providing for angling and other recreational opportunities. The purpose of this document is to provide specific direction that will conserve this species and reduce or remove the threats that could cause it to be listed as threatened or endangered. This will be done through an adaptive management process of implementing, monitoring and adjusting conservation measures by the Upper McCloud River Redband Trout Core Group (Redband Core Group).” (Shasta Trinity National Forest 1998)

The Conservation Agreement recommends several actions to protect the McCloud River redband trout, including establishing a McCloud redband refuge, maintaining and enhancing existing habitats, and protecting the genetic integrity of existing populations by eliminating planting of hatchery fish in streams of the upper McCloud Basin. Additional recommendations are to develop and enforce angling regulations for the protection of redbands, a complete genetic evaluation of all redband populations, and establishing a regular population-monitoring program. Actions to help conserve the McCloud River Redband Trout include a conservation easement from the Blue Heron/Whiskey Creek drainages downstream, held by The Pacific Forest Trust.

Anadromous Fish

Fish species in the region include several USFS-sensitive species as well as species listed as threatened and endangered under the Endangered Species Act (ESA). While the anadromous species are no longer present, they may be reintroduced per the NOAA Fisheries Recovery Plan as is discussed below. ESA-listed species include Sacramento River winter run Chinook, Central Valley spring- and fall-run Chinook, North Coast winter coho, Northern California steelhead, Great Basin Redband trout, and the Rough Sculpin. Most of these species are already at risk due to loss of habitat and habitat fragmentation. Additional stress to species is probable due to influences of warming on hydrologic processes. Periods of extended drought would also exacerbate the effects of drying on small aquatic habitats. Timing and volume of hydrographs are likely to shift. These increased stresses could result in loss of habitats and the species they support.

Concerning the presence of coho salmon, a U.S. Bureau of Reclamation report entitled “Coho Salmon (*Oncorhynchus kisutch*) Life History Patterns in the Pacific Northwest and California” (2007) also states:

“In the Sacramento River, Behnke (2002) states that coho salmon were always extremely rare and says it is unclear why conditions are so ill-fitted for this species. Brown et al. (1994), however, suggests that coho may not have been entirely rare in the system historically. Moyle (2002), citing Leidy (1984), states that coho were never common in the Sacramento basin but small numbers probably once spawned in the McCloud and upper Sacramento rivers, in excess of 300 miles from the marine environment.”

The Keswick and Shasta dams on the Sacramento River are existing barriers to upstream passage of anadromous salmonids including Chinook salmon and steelhead. Prior to construction of Shasta dam in 1942, Chinook salmon and other anadromous fishes were able to travel up the rivers of the region. On the McCloud River, prior to construction of the McCloud Dam, they could travel as far as the 20-foot-high Lower Falls (FERC 2011). In 1941 when Shasta Dam was under construction, it was estimated from studies of Chinook salmon runs that would be blocked by the dam that a total annual run of approximately 27,000 fish would be blocked when the dam was completed (Needham, et al. 1941).

Chinook salmon have been extirpated from the rivers in this region. In addition, the extirpation of Chinook populations had further impacts by affecting other species in the system, notably bull trout (originally identified as Dolly Varden) that fed on early life stages of the Chinook (FERC 2011).

Downstream of the region, the population of Chinook salmon in the Sacramento River has significantly declined over the past 40 years (DFG 2010). Numerous factors have contributed to this decline, including unstable water temperature, loss of historic spawning areas and suitable rearing habitat, water diversions from the Sacramento River, drought conditions, limited suitable spawning gravels, fluctuations in river flows, toxic acid mine drainage, high rates of predation, unsustainable fish harvests, and unsuitable ocean conditions. As a result, Sacramento River winter-run Chinook salmon have been listed as endangered under the Federal Endangered Species Act, and spring-run Chinook salmon have been listed as threatened, along with other anadromous fish species in the upper Sacramento River, including Central Valley steelhead and North American green sturgeon.

Proposals for Salmon Restoration

Note: This issue is also addressed in the Challenges section of Chapter 6, Issues and Interests.

The National Marine Fisheries Service (NMFS) has drafted a plan entitled the “Central Valley Salmon and Steelhead Recover Plan” (Recovery Plan). The goal of the Recovery Plan is to address the viability of endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, and threatened Central Valley steelhead. NMFS’ Endangered and Threatened Species Recovery Planning Guidance describes the recovery planning goal as the long- term sustainability of an endangered or threatened species and, therefore, delisting of the species.

The Recovery Plan is an issue in the IRWM region because the Recovery Plan identifies particular diversity groups related to California’s Central Valley, one of which, referred to as the Basalt and Porous Lava Diversity Group, is identified in connection with the Upper Sacramento watersheds (i.e., the Upper Sacramento, McCloud, and Pit rivers). Diversity groups are biogeographic regions of similar climatological, hydrological, and geological characteristics that historically supported, or in some cases continue to support, self-sustaining spawning populations. (It is interesting to note that the Recovery Plan uses the name “Little Sacramento River” for what is more commonly known as the “Upper Sacramento”. NMFS appears to apply the name “Upper Sacramento” to the reach of the Sacramento River between Keswick Dam and Red Bluff.) None of these listed fishes would be expected to have access to habitat in the upper waters until upstream migration is facilitated past Keswick and Shasta dams and through Shasta Lake Reservoir.

NMFS proposes that addressing the primary threats and risk factors for each species will require reintroducing populations to historic but currently unoccupied habitats. These areas include watersheds that are currently inaccessible because of existing dams (e.g., the “Little” Sacramento River and McCloud River). The recovery plan identifies candidate areas for re-introduction and proposes that primary watersheds have the highest potential to support spawning populations of anadromous fish, while secondary watersheds have less potential, or more information is needed to assess reintroduction potential. As identified in the Recovery Plan, priority areas for reintroduction include both the Little Sacramento River and the McCloud River for winter- and spring-run Chinook salmon and steelhead. Therefore, one of the Recovery Plan’s “Priority 1 Recovery Actions” is:

- Develop and implement a phased reintroduction plan to re-colonize winter-run, spring-run, and steelhead to the Little Sacramento and McCloud Rivers above Shasta and Keswick Dams.

The program, as outlined in the Recovery Plan, is only in the pilot stage and many aspects of the plan are still undetermined. Recovery plans are not regulatory documents. NMFS states that the successful

implementation and recovery of listed species will require the support, efforts and resources of many entities, from federal and state agencies to individual members of the public.

For the Winnemem Wintu Tribe, there is a strong cultural perspective concerning the issue of restoring Chinook salmon (which they regard as the “Nur”) to the McCloud River in particular. Salmon were not only an important food source for the Winnemem people in the days before the Shasta Dam project cut off the passage of spawning anadromous fish, salmon were also a key element in their spiritual traditions. The Winnemem Wintu are proponents for recovery of salmon to the McCloud River, especially restoration of salmon from New Zealand where eggs from the McCloud River were long ago used to establish a stable fishery. The tribe has supported proposals with the National Oceanic and Atmospheric Administration and the Bureau of Reclamation to develop passageways or other means to enable returning spawning salmon and outgoing ocean bound fingerlings to move past barriers including Shasta Dam, and to otherwise support maintenance of a viable salmon population in the McCloud River.

One aspect of local concern that has been expressed is whether or not the NMFS recovery program will include provisions for “safe harbor”. Landowners often have various assurances prior to recovery efforts that involve habitat on or adjoining private property. As described by the U.S. Fish and Wildlife Service, the Safe Harbor Policy provides incentives for property owners to restore, enhance and maintain habitats for listed species. Because many endangered and threatened species occur exclusively, or to a large extent, on non-federally owned property, the involvement of non-federal property owners in the conservation and recovery of listed species is considered critical to the success of these efforts. Under the policy, the federal agencies can provide participating property owners with technical assistance to develop Safe Harbor Agreements that manage habitat for listed species, and provide assurances that additional land, water, and/or natural resource use restrictions will not be imposed as a result of their voluntary conservation actions to benefit covered species.

As part of IRWM Plan deliberations, the Winnemem Wintu tribe proposed and encouraged a project of coordination and cooperation between the tribe, landowners and regulatory agencies to facilitate reintroduction of salmon above Shasta Lake reservoir, particularly into the McCloud River. Such a project is proposed to address the feasibility of the proposal, as well as to consider the relevant mitigation measures, regulations and management agreements that could make the proposal possible.

Unique Ecological Communities

There are areas in the region that are considered to be unique ecological communities. These areas often receive special management consideration. Two examples are serpentine soils and Port Orford cedar.

Serpentine soils can occur in a number of the biotic communities discussed above. They have a high proportion of endemic plants (i.e., plants that are restricted to unique site characteristics; in this case, to serpentine soils). This is because of the harsh nature of serpentine soils, which stems from its special chemical and physical characteristics. Serpentine soils have high concentrations of heavy metals and magnesium, low calcium concentrations, and low concentrations of essential plant nutrients. Most communities occurring on serpentine soil consist of only a few small populations of dwarfs and xerophytes (plants designed to conserve water). In addition, some species have adapted so well to these harsh conditions that they are endemic and grow exclusively on serpentine soils. A number of plants that are known to occur, or potentially occur, in the region are generally found on serpentine soils, including special-status species such as serpentine Beegum onion (*Allium hoffmanii*), goldenbush (*Ericameria ophitidis*), Trinity buckwheat (*Eriogonum alpinum*), peanut sandwort (*Minuartia rosei*), and Red Mountain catchfly (*Silene campanulata ssp. campanulata*).

Port Orford cedar has a very limited range, occurring naturally (the species has been widely cultivated as an ornamental) only in northwestern California and southwestern Oregon. The species range is primarily along the Pacific coast; however, a major inland disjunction includes small populations along the upper Trinity and upper Sacramento River drainages. It is often described as a serpentine endemic, but it is also found on other soil types. With the exception of the northern part of its range, Port Orford cedar usually grows primarily along streams and in areas with year-round seepage. Port Orford cedar is the largest member of the cypress family (*Cupressaceae*), and has been a valuable commercial species, both for its use in landscaping and as a finished wood product.

Management of Port Orford cedar has become difficult in much of its range because of the presence of *Phytophthora lateralis*, a fatal root rot.

3.8.1.3 Invasive Species

For over two centuries, people have imported animals and plants into California that are not native to the state. Whether brought here intentionally for food, sport, ornament, as pets, or by accident, many of these species have now been introduced into the wild (California Department of Fish and Game 2003). Although Californians have benefited from the introduction of plant and animal species necessary for food or other human pursuits, many introduced species can wreak havoc on the state's environment and economy. Those species that cause harm and, once established, spread quickly from their point of introduction are often called "invasive" or "nuisance" species.

Invasive species threaten the diversity or abundance of native species through competition for resources, predation, interbreeding with native populations, parasitism, transmitting diseases, or causing physical or chemical changes to the invaded habitat.

Through their impacts on natural ecosystems, agricultural and other developed lands, water delivery and flood protection systems, invasive species may also negatively affect human health and/or the economy. Examples of direct impacts to human activities include the clogging of navigable waterways and water delivery systems, weakening flood control structures, damaging crops, introducing diseases to animals that are raised or harvested commercially, and diminishing sport-fish populations (California Department of Fish and Game 2008a). A few of the more common introduced/invasive wildlife and plant species present in the watershed are discussed below.

In December 2007, the New Zealand mud snail was confirmed to live in Shasta Lake Reservoir. New Zealand mud snails can reproduce rapidly and can crowd out native insects that aquatic wildlife is dependent upon for survival. Snail colonies disrupt the base of the food chain by consuming algae and competing with native bottom-dwelling invertebrates. A population decline of invertebrates can follow the introduction of New Zealand mud snails, which reduces fish forage. With a decrease in food availability, fish populations can decline as well. New Zealand mud snails can grow as large as one-quarter inch but are often much smaller and are parthenogenic (i.e., able to start a new population with only one snail). They have the potential of extraordinary population densities — up to nearly one million snails per square meter and comprising up to 95% of the invertebrate biomass of a river. It is believed that populations in New Zealand are kept in check naturally by a native parasite. In North America, however, native stream communities can be altered because the snail has no natural predators or parasites and its populations have flourished where they have been introduced. It is not believed they can be eradicated once established.

The Shasta-Trinity National Forest has an ongoing alert posted on its website concerning Quagga and Zebra mussels for the area including Shasta Lake Reservoir. The alert notes that these mussels are a threat to the area and can alter fish and aquatic ecosystems and can cause extensive damage including damage to

water intake facilities. According to the California Department of Fish and Wildlife, Zebra mussels arrived in North America from Europe in the 1980s, followed shortly thereafter by their close relative the Quagga mussel. Quagga mussels were discovered in Lake Mead in Nevada in January 2007 and later throughout Lake Mead's lower basin. It was the first discovery of either of these mussels west of the Continental Divide. Subsequent surveys found smaller numbers of Quagga mussels in Lakes Mohave and Havasu in the Colorado River and in the Colorado River Aqueduct System (Fish and Wildlife, 2013).

As prodigious water filterers, they remove substantial amounts of phytoplankton, zooplankton and suspended particulate from the water, which reduces the food sources for zooplankton and small fish, altering the food web. With the filtering out of suspended particulates and phytoplankton, water clarity increases allowing sunlight to penetrate the water deeper triggering increased vegetation growth that can affect oxygen levels resulting in fish die offs. The mussels have also been associated with outbreaks of botulism poisoning in wild birds. Quagga/Zebra mussels clog water intake structures, such as pipelines and screens, reducing pumping capabilities for power and water treatment facilities. Recreation-based industries and activities are also affected by the mussels, which take up residence on docks, break-walls, buoys, boats, and beaches.

The American bullfrog is native to the eastern and mid-western United States and southeast Canada. It has been accidentally and intentionally introduced (e.g., for food in the 1920s by commercial frog farmers due to its large meaty legs) throughout the world. The American bullfrog is now established throughout most of the western United States and southwestern Canada. Their large size, high mobility, generalized eating habits, and huge reproductive capabilities have made bullfrogs extremely successful invaders and a threat to biodiversity. Bullfrogs prey on native amphibians as well as young western pond turtles, ducklings, and other aquatic and riparian vertebrates.

“Invasive” and “naturalized” are terms used frequently in reference to both non-native plants in wildland areas and to garden plants. The term “naturalized” is used to describe a non-native plant that is capable of surviving and reproducing without human intervention for an indefinite period. Naturalized plants that do not spread away from where they were introduced are not generally a significant problem in a natural habitat. However, naturalized species that do spread and survive in new areas are called invasive plants.

“Noxious” is a legal term used by regulatory agencies, such as the California Department of Food and Agriculture (CDFA) and the U. S. Department of Agriculture Animal Plant Health Inspection Service (USDA-APHIS). To be considered noxious, a plant must be listed on a noxious weed list maintained by one or both of these agencies. Listing is typically based upon the threat of this weed to agriculture or non-crop areas and allows these agencies, along with the county agricultural commissioner, to ban, quarantine, or eradicate these plants.

The California Invasive Plant Inventory categorizes non-native invasive plants that threaten the state's wildlands. Categorization is based on an assessment of the ecological impacts of each plant. The Inventory represents the best available knowledge of invasive plant experts in the state. Non-native invasive plants may spread as a result of fire. In some local areas, for example, species with significant potential to spread and affect natural plant communities due to their ecological impacts and potential response to fire disturbance may include French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*), yellow starthistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*), and bull thistle (*Cirsium vulgare*). Sweet pea (*Lathyrus latifolius*) is also a common invasive plant in this region. These and other species have potential for substantial negative ecological effects by expanding their distribution as a result of fire.

A few of the more common introduced/invasive species present in this IRWM region are discussed below:

- Black locust (*Robinia pseudoacacia*) is particularly invasive in some areas and favors disturbed sites. The Lower McCloud River Watershed Analysis (1998) discusses how locust was planted at the Ah-Di-Na homestead over a hundred years ago and has had a major impact. In some areas along the McCloud River near the Ah-Di-Na campground, this species has replaced much of the riparian vegetation.
- Introduced non-native blackberries, including Himalayan berry (*Rubus discolor*) and cut-leaved blackberry (*Rubus laciniatus*) have become established in thickets in many locations and may contribute to the permanent loss of fragile native riparian plant communities.
- Yellow star-thistle (*Centaurea solstitialis*) has the ability to grow aggressively and prevent native plant species from competing for site occupancy. Over time, this invasive plant can dominate sites.

3.8.2 Overview of Reference Conditions

The purpose of this section is to provide an overview of how the environmental conditions of watersheds in the Upper Sacramento Region have generally changed over time as a result of natural forces and human influences. This section is not a comprehensive description of reference conditions or an in-depth examination of the transition of natural conditions that has occurred as a result of various impacts. Rather, this discussion is intended to provide a general overview on the subject, and frames that overview by highlighting general characteristics and some noteworthy changes relative to selected topics including natural processes, vegetation and stream characteristics, and changes related to land use and development. It also provides some notes concerning ownership patterns and, due to the direct impact on water resources, impacts related to the development of dams in the region.

The following discussion is largely drawn from various watershed analyses that have been prepared by the Shasta-Trinity National Forest. In those analyses, reference conditions are described for comparison with current conditions and with the expected results of Forest Service management objectives. For more information about reference conditions in particular areas of the region, please refer to the applicable watershed analysis. A collection of watershed analyses has been available from the Shasta-Trinity National Forest at: <http://www.fs.usda.gov/main/stnf/landmanagement/planning>.

Various approaches have been taken in local watershed analyses to recognize time periods by which reference conditions can be described. Discussions of physical features, biological features and human uses can generally be considered in two historic periods:

- Pre-European Settlement: During this period, significant Anglo-American influences were absent. Indigenous peoples occupied and used the area; however, the ecosystem was functioning under essentially natural conditions during that time.
- Post-European Settlement: In some areas of this region the European or Anglo-American settlement period can be considered to have begun in the 1830s⁷. In some of the more remote parts of the region, European settlement and land use had little impact until 1880 and after (see Section 8.2.2 on vegetation and fire characteristics). During this period human influences began to affect natural processes in the watershed. The area experienced increased effects from

⁷The [California malaria epidemic of the 1830s](#) ~~felt by indigenous people that killed an estimated 20,000 Wintu, Yana, Patwin, Nomlaki, and individuals of other tribes living at lower elevations~~ would have affected the ecosystem through the decimation of the populations of those communities — largely the ecosystem and natural resource managers of that day.

settlement, mining, wildfire suppression, timber management and harvest, and construction activities.

It is also common for Forest Service watershed analyses prepared for areas in the lower watersheds of this region to further divide the post-European settlement period into two periods; pre-1945 and 1945-present. The year 1945 is primarily marked by completion of Shasta Dam and the consequences that it had on the watersheds of the Upper Sacramento, McCloud, and Pit rivers. The period since 1945 also encompasses the general expansion of community and infrastructure development in California that occurred following World War II.

3.8.2.1 Natural Processes

In terms of geology and climate, the region has experienced substantial changes over time. Topography and stream channels were fundamentally formed and altered as a result of the uplift of the Klamath Mountains and the periodic eruptions and lava flows of Mount Shasta and the Medicine Lake Highlands volcanoes. Natural processes that affected water resources have included climate, mass wasting activities, peak flows, and fire. Volcanic eruptions, ash fall, and pyroclastic flows had periodic impacts. Mudflows, including those that happened during the retractions of ice ages and glacial activity as well as related to volcanic activity, shaped the landscape and affected stream channel morphology.

Stream channels were not significantly affected by human use activities prior to European settlement, but were frequently impacted by natural disturbance processes. Streams fed by glacial melt have experienced multiple debris flows in the past 500 years. Large debris flows occur on Mt. Shasta at a rate of roughly four per century. The largest debris flow event to occur in the past 100 years in the region was the Mud Creek flow that occurred over several years in the 1920s and 30s. The rapid melting of the Koniwakiton Glacier triggered these debris flows. The flows transported large quantities of sediment down Mud Creek where debris was deposited onto the Mud Creek alluvial fan, the McCloud River, and ultimately into the lower Sacramento River.

Natural processes that controlled peak and base flows in the region's watersheds prior to European settlement have not changed substantially from reference to current conditions. Peak and base flows within the watershed were controlled by the prevailing climate and variations in annual precipitation. Variations in the amounts and distribution of vegetation within the watershed also affected peak and base flows. Wetter periods brought increased rainfall that reduced wildfire activity and stimulated vegetative growth.

Primarily fluvial erosion processes and mass wasting activity have influenced channel morphologies. Prior to European settlement channel morphologies were controlled by peak flows and hill slope erosion processes. Frequent fires and mass wasting activity affected channel development and influenced channel stability. Swales, colluvial, bedrock and cascade channels located in upland areas that burned frequently probably exhibited unstable characteristics as a result of the high sediment inputs and the lack of large woody debris needed for channel stabilization. It is expected that these upland channel types hosted aquatic and terrestrial plant and wildlife species adapted to frequently burned, early seral habitats rather than those adapted to the forested riparian areas found throughout the region's watersheds today.

3.8.2.2 Vegetation Characteristics and Fire Regimes

At the beginning of the nineteenth century, vegetation in much of the region is believed to have been dominated by open stands of pine and mixed conifer forest with a chaparral understory in lower elevations. Species of conifer and chaparral were the same as presently exist. Pine was probably a more dominant species in the mixed conifer forest. Seral stage diversity was greater with more old growth and

late successional stands. Generally, late successional forest probably made up 40-50% of the forestlands in the area. Mid-seral forest probably made up 20-30% of the forested lands and early seral forest the remaining 20-40% (STNF 2000). Natural disturbances such as lightning-caused fire, winds, and snow had the greatest influence on stand structure and composition, though Native American management likely had an effect on a smaller scale. Timber belts in the higher elevations, typically white fir and red fir, are largely dominated by these shade tolerant species. The white bark pine belt, which makes up the highest reaching extent of trees, has very few other trees existing in that belt and few changes have occurred since the late 1800s.

Wildfire was an important natural process that controlled fuels and the distribution and age of vegetative communities throughout the watershed. Wildfires kept most stands in open conditions with the riparian areas having the greatest stand densities. Fire was a common occurrence in local watersheds. Regular lightning storms along with the use of fire by native people promoted frequent surface fires of mostly low to moderate severity. Indigenous people utilized fire to promote food production and growth of basket material, improve hunting conditions, gather food, and for ceremonial purposes.

Long-term alterations of fire patterns in the region have occurred as a result of changes in climate and human interactions. Fire suppression in the area generally began around the 1880s in response to fires burning along railroad lines. Organized fire suppression efforts were further instituted after the establishment of the National Forest. Since the onset of fire suppression, and with the increased effectiveness of mechanized suppression techniques (fire engines, bulldozers, aircraft, etc.), the amount of area burned by fires has been greatly reduced and the intervals of time between reoccurring fires increased compared to historic levels.

Reducing and, in some areas, totally excluding fire from the landscape for over 100 years has resulted in ecosystem composition structures and functions that are significantly altered from earlier historical conditions. As a result of successful fire suppression, fuels and vegetation density has increased, expanding the potential for fires to become more intense and difficult to control. Under current fire suppression strategies, fire as an ecosystem process has been dramatically reduced. This has resulted in the development of more homogeneous vegetation patterns. Concerns over the effects of fire to resources (e.g., wildlife habitat, soils, human uses, hydrology, air quality, etc.) have also increased over time. A challenge for both public and private land managers is how to safely and effectively re-introduce fire into land management practices.

Timber Management

The character of vegetation in the region has also been altered over time by timber harvesting and management activity. Beginning in the mid-1800s, miners and settlers began to harvest timber in the watershed. The structure and composition of the forest changed as logging activities increased.

Plantations are now found on both National Forest and private lands within the region. Plantations vary greatly in acreage and age with some mid seral age pine plantations mostly representing large shrub conversion projects dating from the 1940s to 1970s. Early seral (seedling) plantations represent those established since the 1980s. Many of the plantations were planted as ponderosa pine, although neither National Forest nor private timber companies plant in monocultures any longer (since 1990/95). While ~~natural~~ monocultures do happen naturally, with an increased awareness of the importance of having species diversity in stands, plantations have increasingly been planted with a mix of conifer species. Species diversity helps in avoiding beetle infestation and other management challenges with monocultures (blue stain and black stain among them), especially as projected climate change effects include increased drought occurrence, which is a stressor on the trees and can make them vulnerable to

black stain and pine beetles. In addition, many plantations retained some residual trees (typically white fir and incense cedar) that became seed sources to provide a greater diversity of species.

Invasive Species

Most of California's invasive plants originated from the Mediterranean area and have been spread by post-European settlement and subsequent human activity. Noxious weeds have competitive advantages that often allow them to colonize a site quickly (e.g., rapid growth rates and prolific seed crops, seeds that are spread easily by wind, water, and wildlife, etc.). Road building, logging, wild and prescribed fires, and grazing tend to expose bare mineral soils which may then be colonized by invasive plants due to a reduction in competition for space and resources.

3.8.2.3 Stream Characteristics, Morphology, and Native Fish Populations

The channel morphologies of step-pool and pool-riffle channels in the past were probably similar to those found in the watershed today. Because impacts from burning appear to have affected mid-slopes and ridge-tops more than inner gorge areas, it is believed that the larger channel types such as step-pool and pool-riffle channels probably were not impacted appreciably by wildfires or mass wasting activity. Gravel and fine sediment probably accumulated in step-pool and pool-riffle channels following large wildfires and floods, however the sediment deposited during these events was probably flushed from the channel network during smaller bank-full flows occurring over the following years. Large woody debris probably played a significant role in controlling the morphologies of smaller step-pool channels; however, most large wood was probably flushed through the larger step-pool and pool-riffle channels.

Historically, natural stream processes have provided excellent fish habitat. Bedload movement and large woody debris in balance with channel functions likely provided an abundance of deep pools and runs. Under these conditions, large fish would have been common. Stream systems were healthy enough to support large and consistent salmon runs. It is apparent that riparian habitats and tributaries underwent periodic changes, to which associated aquatic species adapted.

Large runs of Chinook salmon and steelhead once ascended the Sacramento River and its main tributaries. It is estimated that indigenous tribes harvested 8.5 million pounds, annually, from four distinct runs in the Sacramento River (Yoshiyama, et al. 1998). Anadromous fish ascended the Pit River, the Upper Sacramento River, and the McCloud River up to Lower Falls (about six miles above present McCloud Reservoir). Coho salmon were also present but in much smaller numbers. Bull trout and rainbow trout, as well as Sacramento sucker and riffle sculpin, were common inhabitants. Local Native Americans used native fish assemblages in the region as an important source of food, and salmon especially had important cultural significance.

Indigenous peoples of the region, because of their dependence on the return of salmon each year, took great care to honor these fish and the ecosystem that preserved their existence. They were careful not to take too much and allowed the majority of the fish to pass and complete their lifecycle.

Changes to fish populations and aquatic habitat began taking place in the late 1800s and continued into the 1900s. Even prior to the construction of Shasta Dam, the growth of the population in the area and downstream along the Sacramento River impacted the fishery resources of the region. Miners and settlers capitalized on the fishery for both personal and commercial consumption. The runs of Chinook salmon were most impacted by this pressure. By the late 1800s, diminishing runs of salmon were already noticeable in the Sacramento River and its upper tributaries as a result of local consumption as well as downstream impacts including growing communities, commercial fishing and canneries, mining and smelting operations, railroad construction and operation, and other factors.

The Forest Service has noted that the increasing trend in land use activities, especially since 1945, generally correlates to an increase in effects to stream channel morphology and water quality. The impacts associated from timber harvest activities on Forest Service lands, for example, affect increased sedimentation in upland channels (STNF 2011). The Forest Service has reported in documents such as the Squaw Valley Creek Watershed Analysis that roads appear to have had a more chronic impact generally than timber harvest activities on the morphology of upland stream channels throughout the various watersheds, especially as a result of erosion and sedimentation from unmaintained road systems. Impacts have been generally concentrated at stream crossings and in areas where roads were constructed on unstable slopes within or adjacent to inner stream gorges.

Impacts to step-pool and pool-riffle channels have mostly been in the form of increased sediment inputs, which have contributed to increased deposition in pools and impairment of fish habitat.

Common impacts to stream channels from roads include channel degradation below stream crossings, gullying along poorly drained roads, and channel aggradation above plugged or partially plugged culverts.

3.8.2.4 Land Use and Development Effects

The impact of indigenous cultures on the landscape of local watersheds appears to have been slight. Native American groups inhabited the watershed for thousands of years prior to European settlement. (Note: The Ethnographies section of the Region Description contains more information about some of the indigenous people of this area and their relationship with water features.) Archaeological information from sites at lower elevations in the area indicates that people have probably occupied the watersheds of this region continuously for the last 8,000 years, although the presence of earlier sites in other parts of northeastern California suggests that people may have occupied local watersheds as early as 10,000-12,500 before the present.

The local prehistoric material culture evolved over time, reflecting adaptations to changing physical and cultural landscapes. Villages were generally located on terraces lining rivers and major streams. The rivers in the region were a bountiful source of salmon and other fish, and tributary creeks were rich with suckers. The indigenous people traveled to the upland, forested areas of the watershed to collect acorns, gray pine nuts, buckeye, and other food and non-food materials. They also visited upland sites such as Panther Meadows and Medicine Lake for spiritual purposes. Approximately 10 archaeological sites have been identified on the forested mid-slopes around Mount Shasta, mostly on the southeast side of the mountain (STNF 2012).

Early populations are assumed to have been organized in mobile small groups that focused on large game hunting. Later, large semi-sedentary village sites in the valleys and an abundance of temporary camps and hunting features in the uplands appears to have been the prevailing pattern. This site distribution pattern suggests that people followed a foraging strategy in which small hunting parties left residential camps for prolonged periods of time to hunt. The availability of resources dictated the carrying capacity of different locations relative to the population of the villages.

Indigenous peoples who occupied parts of the region at the beginning of the European settlement period and after included people (in various bands) of the Modoc Tribe, the Pit River Tribe, the Shasta Tribe, and the Wintu Tribe, particularly the Winnemem Wintu.

The past 150 years of the post-European Settlement period brought many changes to the physical, biological, and human elements of the region. Hudson Bay trappers first explored the Sacramento River trail in 1830. The trail came to be known as the west branch of the California-Oregon trail. During the

gold rush episodes in Northern California and Oregon, the route became a major mule trail and later a wagon road connecting the Redding area with Yreka and points north.

During the 1841 Wilkes Expedition (United States Exploring Expedition), it was noted in journals that the Mt. Shasta Region was populated entirely by indigenous people (STNF 2012). It is tragic to note that one of the first major impacts in the region caused by the influx of Europeans was the decimation of the indigenous peoples by introduced diseases, murder, and seizure of territory and resources. In one incident in the early 1830s, as much as 75% of the [Wintu, Yana, Nomlaki and Patwin](#) ~~native population in one area—the Central Valley~~ died in a malaria epidemic brought in by trappers. Other tribes in the area experienced similar impacts and virtual annihilation of their population. By some estimates, during the two decades after 1848 when California became part of the United States, the [State offered bounties for the scalps of men, women, and children, encouraging the genocide, and the](#) native population in the state plummeted by 90%. The indigenous population in this region suffered a similar catastrophic fate.

European Settlement and Community Growth

Settlement of the area by non-indigenous people (primarily Europeans or Anglo-Americans) began after 1850. Modification of natural drainages occurred in order to drain wetland areas and facilitate European-style agriculture, settlement, and community growth. Examples of landscape modifications occurring in the lower watersheds included mining activity, establishment of log ponds associated with mill locations, draining of wetlands, and development of springs for crop irrigation and other domestic uses. Livestock grazing and homesteading began to change the native landscape. Attempts to extirpate wildlife species that were considered threats, such as the grizzly bear and wolf, continued. Elk were also extirpated, probably due to overhunting (though efforts were made beginning in 1911 to reintroduce Elk in the area).

Settlement of the Mt. Shasta area began after 1850. The first effects to springs and wet meadow habitats occurred on the lower slopes of the mountain in the areas now occupied by McCloud and Mount Shasta City and were associated with the development of water sources for human uses. Early settlers established homesteads, small farms, saw mills, and eventually stage stations and hotels. This area was first known as Strawberry Valley and then later as Berryvale. With the coming of the Central Pacific Railroad in 1886 the town grew around the railroad route and was incorporated in 1905 as Sisson. It was renamed Mount Shasta in 1924.

As the Central Pacific Railroad was extended northward from Redding, settlements sprang up along many of the railroad stops such as Morley, Elmore, Pollack, Antlers and Delta, many of which are now under the waters of Shasta Reservoir. The completion of the railroad along the line of the Siskiyou Trail in 1887 led to the creation of the community that was to become Dunsmuir. Dunsmuir was incorporated as a city in 1909.

In 1916 the California-Oregon trail was modernized by the Division of Highways and renamed the Pacific Highway and later regarded as Highway 99. Highway 99 was eventually improved and, in some areas, relocated to become Interstate 5, as it is known today.

The town of McCloud was first established as a lumber company town. The McCloud River Lumber Company built the town in 1897 to house and provide services for the families of millworkers. The company built a standard gauge railroad from Mt. Shasta to McCloud over the southeast slope of Mt. Shasta. The company owned the buildings until 1963, when the mill was sold to U.S. Plywood. The houses were sold to individuals living in them. The McCloud Community Services District was formed to operate community services.

The establishment and growth of communities in the region and the urban character of development and land uses in and around these communities directly altered the conditions of the landscape in those areas

with grading, paving, construction of buildings, and other alterations of the natural setting. Management of storm water runoff, especially from the impervious surfaces of roads, highways and developed areas, became necessary to reduce erosion and impacts on water quality.

Mining

Concerning changes to the landscape and general environment, mining was one of the first human activities to result in major impacts to the land and water in the region. Although some gold mining was conducted in the region as early as 1850 at places such as Kennett and Dogtown (Delta), the area did not play a major role in the mining industry until the 1890s when the copper boom began. The areas of the region in which copper mining activities took place include what was known as the West Shasta Mining District. For about 20 years, copper and zinc ore was produced from numerous underground mines.

The impacts of mining, especially impacts related to copper mining and processing, took a toll on the natural conditions of the area. The forests surrounding the mines were cut down for the timber needed in mine tunnels and for building fires under the mountainous piles of ore for open-air roasting. The toxic smoke released from the chimneys of copper smelters created an overwhelming environmental disaster as toxic fumes killed vegetation for miles around. Farmers and other citizens, with some success, brought damage suits against the mining companies. By 1919 the smelters had been shut down by a combination of legal action and changing market conditions following the end of World War I. However, the closure of the smelters did not bring a complete end to the pollution. To this day toxic water from acid mine drainage continues to seep into Shasta Lake Reservoir and the Sacramento River, adversely impacting water quality and wildlife.

Land Ownership and Management Patterns

Please see Section 3.8.2 for a review of pre-history and the land ownership traditions and patterns affecting aboriginal people.

Nothing in the natural history of the pre-European settlement period could have anticipated the checkerboard ownership and land management pattern that was stamped over much of the landscape as a result of railroad land grants. These grants were primarily the result of the Pacific Railroad Act of 1862, which was intended to encourage construction of the transcontinental railroad. Through that act, the federal government deeded large parcels (up to 640 acres each), mostly in a checkerboard pattern, to railroad companies such as Union Pacific Railroad. Nationwide the land deeded to the railroads amounted to millions of acres. Many of those parcels located in what is now recognized as the Upper Sac IRWM region were eventually sold by the railroad companies and are now (largely) owned and managed by private timber companies.

Following the railroad grants, a major historic event to affect the landscape and management of resources in the region was the creation of the Shasta National Forest in 1905 from the remaining public domain lands. The multiple-use management mandate of the Forest Service, which considers recreation uses and other resource objectives in addition to timber management, has had a significant influence over time on the regional landscape and resources.

Landscape and resource management efforts continue to be affected by the checkerboard ownership pattern because the pattern interferes with what would otherwise be more consolidated ownership and management by either private land owners or the Shasta-Trinity National Forest. The geometric pattern, having virtually no relation to the natural character of the landscape, imposes a variety of challenges for property and resource management (such as fire management, timber production, and roads). Land exchanges between the Forest Service and private land owners have been proposed and implemented to

some extent in an effort to consolidate federally-managed land, and thereby address and help resolve some of the challenges created by this land ownership pattern.

Land-use activities that have generated changes in the landscape and watersheds of the region include development of the urban interface, local infrastructure, and transportation systems, primarily along the Upper Sacramento River corridor. Also, over the past 70 years, numerous recreation facilities have been developed around Shasta Lake reservoir (including facilities related to the National Recreation Area designation) and in other areas of the region, including trails, campgrounds, and boat ramps. Land use pressures, including demand for expanded infrastructure, have increased as a result of growing population and recreation use.

3.8.2.5 Water Management Infrastructure

As noted in several places of this Region Description, the construction of Shasta Dam and filling of Shasta Lake Reservoir had a tremendous impact on the surrounding natural environment. Hydrologic conditions of the lower portions of watersheds in the region were dramatically altered following completion of the dam in 1945. Large areas of these watersheds were inundated with creation of the reservoir. For example, approximately 30 miles of the Pit River and 13 miles of the McCloud River were inundated. The dam blocked the historic runs of salmon and steelhead from accessing the watersheds, thereby removing an important human food source and cultural element for indigenous people in the region. The elimination of anadromous fish runs also changed the ecology of the streams by altering the fish community structure, disrupting the flow of nutrients that large runs of anadromous fish contribute to the food web, and genetically isolating native rainbow trout.

It is noted that much of the traditional land of the Winnemem Wintu Tribe was inundated by development of the Shasta dam and reservoir. Many village sites, burial sites and other sacred locations are now below the surface of Shasta reservoir. This is especially noteworthy in that proposals to increase the height of Shasta Dam and the reservoir level would result in the inundation of many of the remaining sites that are culturally significant to the Winnemem Wintu Tribe along the McCloud River in this IRWM region. More information on this topic is available in Section 5.7, Dams, Reservoirs and Hydroelectric Infrastructure.

Other dams and diversions in this region, including those that make up PG&E's hydroelectric facilities on the McCloud River and the Pit River, and Box Canyon Dam and Lake Siskiyou reservoir on the Upper Sacramento River, have resulted in a variety of changes to the natural conditions of those streams. The full range and significance of changes caused to local streams by dams in the region are beyond the scope of this overview, but it is acknowledged that such facilities have altered the reference conditions of the watersheds to achieve particular objectives (e.g., water storage, power production, flood control, public recreation) and have necessitated measures intended to mitigate or compensate for various impacts. McCloud Dam, for example, by 1965 had blocked bull trout in the lower reaches of the McCloud River from swimming upstream to spawn and flooded six miles of prime bull trout habitat. That project contributed to the demise of the bull trout that, in the 1970s, was considered to be extirpated from California. The diversion of approximately 80% of the flow of the McCloud River to the Pit River for hydroelectric production also resulted in reduced flows in the lower McCloud and disrupted sediment regimes and increased water temperatures. These influences further altered the aquatic habitat of the lower McCloud and its tributaries.

3.8.3 Vegetation Management Issues

While vegetation management issues can take many forms, the risk of catastrophic fire is the primary concern in the USR. Similar to many source water areas, these watersheds are composed of a variety of

complex and dynamic relationships, and many factors are relevant to an understanding of the current conditions of a watershed and how the conditions may change in the future. Fire is one of the most important factors in this context and will become even more of a concern as climate change alters historic hydrology and the dry season extends earlier into the spring and later into the fall.

The occurrence of past wildfires has been an important factor affecting current vegetation conditions in the region, including the amount of late-successional habitat. Changes brought about by fire suppression alter the forest structure, stand density, and species composition in many areas, and have had a direct effect on forest health. Patterns of fire severity are important in determining the structural diversity of forests. Soils, air, water, and site biology are all affected by fire and, in some important ways, by the lack of fire.

Fire regime refers to the patterns of fire that occur over periods of time, and the effects that fire can have in the environment in which it occurs. While there are a variety of ways to define a fire regime, it can be said to be a function of the frequency of fire occurrence, fire intensity, and the amount of fuel consumed. Fire suppression has been applied widely throughout the planning region and has generally changed the fire regime in many areas from frequent low-intensity surface fires to infrequent but relatively high-intensity fires. Long intervals between fires allow for a greater accumulation of fuels that result in hotter, more severe fires when ignited.

Forests in areas that have not experienced low-intensity fires become more closed and multi-storied. Tree species composition has succeeded towards more shade tolerant, fire sensitive species such as white fir, and away from more shade intolerant, fire-resistant species such as ponderosa pine. Pure stands of oak along with the oak component of mixed conifer forests have been encroached upon by conifers and have become less vigorous and more decadent. [Tribal members of RWAG have noted that previous to fire suppression, indigenous tribes included use of fire in managing forests for food, medicine, and basket making material.](#)

Due to the lack of periodic fires, knobcone pines have colonized some areas such as in the vicinities of McCloud and the City of Mt. Shasta. Many of these stands became established following wildfires that occurred over 60 years ago. These stands are now beyond maturity and most of the trees have already died in some areas. In decadent knobcone stands, large numbers of dead and dying trees have increased the potential threat of wildfire to public and private lands. As these dead trees fall, hazardous levels of surface fuels accumulate. Past reforestation projects on knobcone pine stands have been largely successful in converting those areas to healthier and less fire-prone stands of ponderosa pine and other conifer species. (STNF 2005)

Changes in vegetation composition and successional stages related to the lack of periodic fires of low and moderate intensity have, in-turn, influenced the wildlife species present in those environments.

Large fires present a substantial risk to water quality as a result of causing a cascading sequence of accelerated erosion, flooding, channel scour, and increased sedimentation that can destroy productive habitats over large area for decades. When wildfire occurs in watersheds, the severity of the fire combined with the slope conditions (e.g., steepness, aspect) will determine the susceptibility of the burn area to soil erosion, which may have a direct impact of sedimentation in waterways. The erosion potential following wildfire can be significant.

Predictably, this largely forested IRWM region is susceptible to large fires. As a fairly recent example, in August 2012, the Bagley fire started near Big Bend. Burning generally northward around Iron Canyon Reservoir and toward McCloud Reservoir, the fire ultimately charred an estimated 46,011 acres. As

another example, in 1992, the Fountain Fire burned 300 homes and 64,000 acres, much of it in the southeastern portion of this IRWM region.

It is expected, due in part to the trend of changes in the climate, that there will be an increase in the potential for catastrophic fires. Climate change models predict hotter, drier conditions in the west. While future climate scenarios differ in the expected changes to California's climate, there is general agreement that increases in temperature are likely to result in significant changes in the composition of forests and rangelands throughout the state. In some cases, environmental effects from climate change have already been observed in California forests and rangelands. The effects from climate change and expected long periods of drought are likely to include shifts in vegetation types, changes in snowpack with earlier snowmelt, changes in the frequency of wildfire, and greater mortality of trees due to changes in pest disturbance.

As in many areas of the western United States, suburban development in the wildland-urban interface areas of the region has complicated fire management strategies and practices. Vegetation types that naturally burn with high intensity and rapid spread are increasingly being interspersed with new homes, increasing the number of people and amount of property at risk. The use of controlled burns to reduce fuel loads becomes more problematic as the presence and resulting risks increase to homes and other structures. In some communities, community volunteers have organized local Fire Safe Councils such as the councils in the areas of Dunsmuir, Lakehead, McCloud and Mount Shasta. There is also a Shasta County Fire Safe Council and a Fire Safe Council of Siskiyou County. Some fire safe councils have prepared Community Wildfire Protection Plans. The intent of these community-based fire protection plans is to identify and take measures to reduce the risk of wildfires.

The Shasta-Trinity National Forest engages in the use of prescribed burning with the understanding that the removal of accumulated vegetation is an important part of maintaining healthy and resilient forests. Managing prescribed fires is a tool to restore and enhance forest ecosystems. Prescribed fires are used to re-introduce fire to its natural role in the ecosystem and to treat hazardous accumulations of forest debris and other fuels, reducing the future risk of severe wildland fire. Techniques included burning piled slash and broadcast burning, in which fuel on the forest floor is ignited directly.

The use of prescribed fires can be complicated by complex ownership patterns and property configurations. Checkerboard property configurations, which originated as a result of railroad land grants, are common in many areas of the region, often interspersing privately owned sections of land with sections of land managed by the Forest Service.