

V. WATER QUALITY

5.1. Water Quality Standards

Water quality data is only meaningful if one understands water quality standards, how they are developed, and how they are relevant to society. The purpose of this section is to provide an overview of the water quality standards applicable to the Bear Creek watershed.

OVERVIEW

The U.S. Environmental Protection Agency (EPA) determines water quality standards by two legislative acts: the Federal Clean Water Act and the Federal Safe Drinking Water Act. States may adopt more stringent standards, but cannot adopt standards that are less stringent than federal standards. The State of California passed the Porter-Cologne Water Quality Control Act, thereby establishing the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCB) as the principal State agencies responsible for coordinating and controlling water quality in California; the SWRCB has authority over the nine Regional Water Quality Control Boards. The California Water Code (Section 13240) requires the nine Regional Water Quality Control Boards to adopt Water Quality Control Plans (Basin Plans). Basin Plans establish the beneficial uses of water, water quality standards, and actions necessary to maintain these standards for each water body to be protected.

Water quality standards set in each Basin Plan by the RWQCB are based on the existing and potential beneficial uses. In establishing water quality standards, the RWQCB considers the following factors:

- Past, present, and probable future beneficial uses.
- Environmental characteristics of the hydrographic unit under consideration, including current water quality.
- Water quality conditions reasonably achievable through coordinated control of all factors affecting water quality.

The Central Valley RWQCB prepared the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (hereafter referred to as the Water Quality Control Plan), which established water quality standards for the Bear Creek watershed. The Water Quality Control Plan consists of the Sacramento and San Joaquin River Basins encompassing 43,090 square miles (RWQCB, 1998). The Sacramento River Basin covers 27,210 square miles and includes all watersheds tributary to the Sacramento River north of the Consumnes River. The San Joaquin River Basin includes all watersheds tributary to the San Joaquin River and the Delta south of the Sacramento River. The Basin covers 15,880 square miles and includes the area drained by the San Joaquin River.

BENEFICIAL USES

None of the tributaries in the Bear Creek watershed have specific beneficial uses designated in the Basin Plan. However, Bear Creek and Ash Creek are both tributary to the Sacramento River, and therefore, the “tributary rule” applies (e.g., all designated

beneficial uses of the Sacramento River apply to Bear Creek and Ash Creek). The designated beneficial uses of the Sacramento River (from Shasta Dam to the Colusa Basin Drain) are the following:

MUNICIPAL AND DOMESTIC SUPPLY

Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

AGRICULTURAL SUPPLY

Uses of water for farming, horticulture, or ranching, including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.

INDUSTRIAL SERVICE SUPPLY

Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

NAVIGATION

Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

HYDROPOWER GENERATION

Uses of water for hydropower generation.

WATER CONTACT RECREATION (REC-1)

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, or use of natural hot springs.

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, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

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.

COLD FRESHWATER HABITAT

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.

WILDLIFE HABITAT

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.

MIGRATION OF AQUATIC ORGANISMS

Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

SPAWNING, REPRODUCTION, AND/OR EARLY DEVELOPMENT

Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

STANDARDS

A summary of the standards in the Water Quality Control Plan applicable to the Bear Creek watershed are included in Table 5-1. A complete discussion of each numeric limit can be found at the RWQCB offices or on the Internet at <http://www.swrcb.ca.gov/rwqcb5>.

Table 5-1. Bear Creek Watershed Assessment 2005

Summary of Standards in the Water Quality Control Plan that Apply to the Bear Creek Watershed

Surface Waters	Bacteria	In waters designated for contact recreation, the concentration based on at least 5 samples for any 30-day period, shall not exceed an average of 200/100 ml, nor shall more than 10 percent of the samples taken for any 30-day period exceed 400/100 ml. A proposed amendment to the Water Quality Control Plan would mandate that In all waters designated for contact recreation (REC-1), the <i>E. coli</i> concentration, based on a minimum of not less than five samples equally spaced over a 30-day period, shall not exceed a geometric mean of 126/100 ml in any single sample.	
	Biostimulatory Substances	Water shall not contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses.	
	Chemical Constituents ¹	Arsenic	0.01 mg/l
		Barium	0.1 mg/l
		Cadmium	0.00022 mg/l
		Copper	0.0056 mg/l
		Cyanide	0.01 mg/l
		Iron	0.3 mg/l
		Manganese	0.05 mg/l
		Silver	0.01 mg/l
		Zinc	0.016 mg/l
		Lead	0.015 mg/l
	Color	Waters shall be free of discoloration that causes nuisance or adversely affects beneficial uses.	
	Dissolved Oxygen ²	Cold Water Fishery	7.0 mg/l
		Warm Water Fishery	5.0 mg/l
		Spawning Fishery	7.0 mg/l
		Sacramento River from Keswick Dam to Hamilton City & from June 1 to August 31	9.0 mg/l
	Floating Material / Oil & Grease	Shall not contain amounts that cause nuisance or adversely affect beneficial uses.	
	pH	Between 6.5 and 8.5	
	Salinity	Electrical conductivity at 77°F shall not exceed 230 µmhos/cm.	
	Water Temperature	Cold or warm intrastate waters shall not be increased more than 5°F above natural receiving water temperature. The Sacramento River from Keswick Dam to Hamilton City shall not be elevated above 56°F.	
	Toxicity	See new California Toxic Rule for NPDES discharges.	
	Turbidity	Varies as a percentage over background.	
	Suspended & Settable Sediment	Shall not be altered in such a manner that causes nuisance or adversely impacts beneficial uses.	
	Tastes & Odors	Shall not contain taste- or odor-producing substances in concentrations that cause nuisance or affect beneficial uses.	
Ground Waters	Bacteria	The number of coliforms of any 7-day period shall not exceed 2.2/100 ml.	
	Chemical Constituents	Shall not exceed MCLs specified in Title 22 of the California Code of Regulations.	
	Tastes & Odors	Shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.	
	Toxicity	Shall be free of toxic substances that produce detrimental affects to plants and animals.	

1 = Values listed are the maximum allowed for dissolved concentrations.

2 = Values listed are the minimum allowed.

REFERENCE CONDITIONS

No information is available for the Bear Creek watershed concerning water quality reference conditions. Prior to European settlement in the area, water quality was assumed to be a function of the natural chemical and geological processes in the watershed.

5.2. Surface Waters

WATER QUALITY OBJECTIVES FOR SURFACE WATERS

This section summarizes applicable water quality objectives for surface waters in the Bear Creek watershed.

BACTERIA

A variety of methods are used to assess the presence of harmful pathogens. Fecal coliform counts are widely used to assess a water body for solid waste contamination by humans or animals. Fecal coliforms are bacteria (e.g., *E. coli*) that live in the digestive tract of animals and are excreted in their feces. Alone, they do not pose a threat to human health. However, they are generally associated with other disease causing microbes, such as those that cause typhoid, dysentery, hepatitis A, and cholera. Therefore, the presence of fecal coliforms in a water body is an important indicator of the presence of other disease causing microbes. Sources of fecal coliform in a water body include leaking septic tanks, runoff from animal feedlots, and human or animal defecation near a water body.

The Water Quality Control Plan mandates that in waters designated for contact recreation, the fecal coliform concentration, based on a minimum of five samples over a 30-day period shall not to exceed an average of 200/100 ml, nor shall more than 10 percent of the total number of samples taken during any 30-day period exceed 400/100 ml (RWQCB, 1998). In 2002, the RWQCB proposed an amendment to the Water Quality Control Plan that would establish a new objective for bacteria for water bodies designated Water Contact Recreation (REC-1). In all waters designated for contact recreation (REC-1), the *E. coli* concentration, based on a minimum of not less than five samples equally spaced over a 30-day period, shall not exceed a geometric mean of 126/100 ml in any single sample. If any single sample limits are exceeded for *E. coli*, the RWQCB may require repeat sampling on a daily basis until the sample falls below the single limit or for five days, whichever is less, in order to determine the persistence of the exceedance. When repeat sampling is required because of an exceedance of any one single sample limit, values from all samples collected during that 30-day period will be used to calculate the geometric mean.

BIOSTIMULATORY SUBSTANCES

The Water Quality Control Plan mandates that surface waters shall not contain biostimulatory substances (e.g., nitrogen and phosphorus compounds) in concentrations that cause nuisance or adversely affect beneficial uses.

CHEMICAL CONSTITUENTS

Chemical constituents in surface waters include dissolved metals and organic compounds. Metals that occur in water bodies in very small quantities are often referred to as trace metals. The trace metals consist of: arsenic, barium, boron, cadmium, copper, cyanide, iron, manganese, molybdenum, selenium, silver, lead, and zinc. Lead is sometimes included as a trace metal but is sometimes monitored separately. The

concentrations of these metals are generally taken as dissolved concentrations (measured in mg/l) and their toxicity varies with water hardness. The concentration of these metals in a water body is an important measure of water quality. Primary sources of dissolved metals are effluent from mines or water leaching from solid waste disposal sites into groundwater supplies.

The Water Quality Control Plan has set maximum concentration levels (in mg/l) for arsenic (0.01), barium (0.01), cadmium (0.00022), copper (0.0056), cyanide (0.01), iron (0.3), manganese (0.05), silver (0.01), and zinc (0.016) (RWQCB, 1998). In addition, water designated for use as domestic or municipal water supply shall not contain lead in excess of 0.015 mg/l.

COLOR

The Water Quality Control Plan mandates that surface waters shall be free of discoloration that cause nuisance or adversely affects beneficial uses.

DISSOLVED OXYGEN

The concentration of dissolved oxygen profoundly influences species richness and the distribution of biota in a water body. The primary sources of dissolved oxygen in a water body are from water turbulence and photosynthetic plants and algae. Dissolved oxygen is removed from a water body through respiration by animals and by decomposition of organic matter. The concentration of dissolved oxygen within a water body varies with water temperature, which is influenced by water depth and time of day. Solar heating warms surface waters, thus lowering the concentration of dissolved oxygen in this stratum. Deeper water is colder and contains a higher concentration of dissolved oxygen because it receives less solar heating.

For surface water bodies outside the Delta, the monthly average of the average daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water body, and the 95 percentile concentration shall not fall below 75 percent of saturation. The Water Quality Control Plan mandates that in waters designated Warm Freshwater Habitat, dissolved oxygen shall not be less than 5.0 mg/l, and for waters designated Cold Freshwater Habitat, dissolved oxygen shall not be less than 7.0 mg/l.

FLOATING MATERIAL/OIL AND GREASE

The Water Quality Control Plan mandates that surface waters shall not contain floating material, oils, greases, waxes, or other materials that cause nuisance or adversely affect beneficial uses.

pH

The pH, or potential of hydrogen, is a measure of the hydrogen ion concentration (or acidity) in water, and is used as an indicator of water quality. The pH scale ranges from 0 to 14. A pH value less than 7.0 is considered acidic, while a value greater than 7.0 is basic. A pH value of 7.0 is considered neutral (it is neither acidic or basic). The pH scale is logarithmic. For example, a sample that has a pH of 4.0 has ten times more hydrogen ions (or is ten times more acidic) as a sample that has a pH of 5.0 and 100 times more hydrogen ions (or is 100 times more acidic) as a sample that has a pH of 6.0. Most stream biota are sensitive to changes in water pH, but generally tolerate pH between 6.5 and 9.0.

The Water Quality Control Plan mandates that the pH of surface waters range from 6.5 to 8.5. In addition, changes in normal ambient pH levels are not to exceed 0.5 in freshwaters with designated Cold or Warm beneficial uses (RWQCB, 1998).

NUTRIENTS

The principle nutrients that affect water quality are nitrogen and phosphorus. These nutrients are often present in the form of nitrates and phosphates in pesticides and household soaps. Nitrates and phosphates typically enter a water body from storm drain and agricultural runoff, septic tanks, and leach fields. The amount of nitrates and phosphates present in a water body influences water quality in several ways. For instance, under appropriate conditions, high levels of nitrates and phosphates in a water body can promote unsightly algal blooms. These blooms deplete the concentration of dissolved oxygen and can be lethal to fish and other aquatic animals.

SALINITY

Salinity is a measure of the total salt content in water and is usually indicated as parts per thousand (ppt). Evaporation increases water salinity, whereas precipitation decreases water salinity. Water salinity is also greatly influenced by the underlying geology. Percolating groundwater often leaches minerals from bedrock which causes the water salinity of groundwater to increase.

Aquatic organisms are generally sensitive to changes in water salinity. Stenohaline organisms (e.g., amphibians) are unable to withstand fluctuations in water salinity, whereas euryhaline organisms (e.g., anadromous fish) can tolerate a wide range of salinities.

Electrical conductivity is a measure of the ability to conduct an electrical current. Electrical conductivity is measured in $\mu\text{mhos/cm}$. There is a direct relationship between water salinity and electrical conductivity. Higher water salinity is associated with greater electrical conductivity. The Water Quality Control Plan mandates that electrical conductivity at 77°F shall not exceed 230 $\mu\text{mhos/cm}$ (RWQCB, 1998).

SEDIMENT/TURBIDITY

Turbidity is a measure of the suspended particles in a water sample. Turbidity historically was measured in Jackson Turbidity Units (JTUs), but is more commonly measured in Nephelometric Turbidity Units (NTU); the JTu is not identical to the NTU, but it closely approximates it. Elevated levels of suspended sediments increase turbidity, reduce the penetration of light into a water body, and limit the growth of aquatic plants (EPA, 1999). Suspended sediments that eventually settle out of the water column can degrade spawning gravel for fish and benthic invertebrates. Sources of sediments include erosion from human activities, such as timber harvests or the construction of roads and culverts. Erosion from natural events such as fire or a landslide adjacent to a water body can deliver sediments directly into that body of water.

The Water Quality Control Plan mandates that the suspended load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses (RWQCB, 1998). This mandate requires that:

- Where natural turbidity is between 0 and 5 NTUs, increases shall not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.

- Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
- Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

SUSPENDED AND SETTLEABLE MATERIAL

The Water Quality Control Plan mandates that surface waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.

TASTES AND ODORS

The Water Quality Control Plan mandates that surface waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.

WATER TEMPERATURE

Water temperature is an important limiting factor for aquatic life and is an important determinant in the spatial distribution of species within a stream. Temperature readings of flowing water are influenced by flow velocity, shade, and channel morphology. Water temperature concerns in the Bear Creek watershed focus primarily on the effect on anadromous salmonids, notably Central Valley steelhead and the different runs of Chinook salmon.

Temperature requirements of Chinook salmon vary with life history stages. Spawning migrations by adults occur when water temperatures are between 57 and 67°F. Spawning occurs in water temperatures from 42 to 56°F, but the optimal water temperature for spawning is 52°F (California Department of Fish and Game, 1993). Water temperatures above 57.5°F result in high egg mortalities and temperatures above 62°F result in total mortality. Sustained water temperatures above 80°F are lethal to adults (Moyle et al., 1995).

The Water Quality Control Plan mandates that at no time or place shall the temperature of cold or warm intrastate waters be increased more than 5°F above natural receiving water temperature. In addition, water temperature shall not be elevated above 56°F in the Sacramento River from Keswick Dam to Hamilton City.

TOXICITY

The Water Quality Control Plan mandates that surface waters shall be maintained free of concentrations of toxic substances that produce detrimental physiological responses in human, plant, animal, or aquatic wildlife.

RWQCB MONITORING IN THE BEAR CREEK WATERSHED

The RWQCB conducted periodic water quality sampling at four sites in the Bear Creek watershed in 2001, 2002, and 2003. The purpose of this baseline water quality investigation was to begin to assess existing water quality conditions in the Bear Creek watershed and provide a foundation for comparison of past and future water quality studies. The RWQCB monitored for the following parameters and constituents: bacteria, dissolved

oxygen, pH, salinity, turbidity, water temperature, and aquatic macroinvertebrates. Due to some quality assurance concerns, the RWQCB water quality data included in this report is for general baseline information purposes only and is inconclusive.

BACTERIA

In the Bear Creek watershed, water samples collected by the RWQCB were taken to Basic Laboratory in prepared 130 ml sample containers for analysis of total and fecal coliform bacteria using the 15-tube analysis. In addition, analysis of *E. coli* concentration was performed by Basic Laboratory and by the RWQCB using the Colilert quanti-tray method of analysis.

DISSOLVED OXYGEN

In the Bear Creek watershed, the RWQCB measured dissolved oxygen using a YSI 556 Multi-Probe Field Meter. Dissolved oxygen readings were periodically checked with a Hach Dissolved Oxygen kit using the modified Winkler method of analysis. Generally, checks were made at least twice in a sample day.

PH

In the Bear Creek watershed, the RWQCB measured pH using a YSI 556 Multi-Probe Field Meter.

SALINITY

In the Bear Creek watershed, the RWQCB measured conductivity using a YSI 556 Multi-Probe Field Meter.

TURBIDITY

In the Bear Creek watershed, the RWQCB measured turbidity using a Hach 2100 portable field turbidity unit. The unit was calibrated quarterly with current standards and checked with portable standards the day prior to sampling.

WATER TEMPERATURE

In the Bear Creek watershed, the RWQCB measured water temperature using Onset temperature data loggers and a YSI field meter. Data loggers were placed at sites with continuous flow and shaded areas.

WORLD WATER MONITORING DAY

The World Water Monitoring Day (WWMD) was started by America's Clean Water Foundation on October 18, 2002. Timed to coincide with the 30th Anniversary of the enactment of the Clean Water Act, this event was designed to introduce stakeholders to issues in their local watersheds as well as continue the worldwide efforts to preserve and protect our water resources.

The Bear Creek Watershed Group has participated annually in the WWMD since October 18, 2002. Watershed group members selected twelve sites throughout the Bear Creek watershed including the North and South Forks of Bear Creek, Dickerson Creek, Snow Creek, Sheridan Creek, Sheridan Ditch, and Lack Creek.

At each site the group takes water quality readings using two different methods. One group uses the WWMD kit that measures temperature, pH, dissolved oxygen and

turbidity. Another group uses water quality instruments provided by the California Department of Fish and Game (DFG) that measure temperature, pH, dissolved oxygen, turbidity, conductivity, and salinity.

Water temperature tables in the Water Quality Information By Tributary section show WWMD data at the bottom of each list. For comparison, readings taken with the WWMD kit are listed in a separate column. Because the kit was designed to be highly portable and user-friendly, readings taken with the kit are less precise than those taken with calibrated water quality instruments.

WATER QUALITY INFORMATION BY TRIBUTARY

No comprehensive water quality study has been conducted in the Bear Creek watershed. Most of the available data has been collected in the main stem of Bear Creek, North Fork Bear Creek, South Fork Bear Creek, Dickerson Creek, Lack Creek, Sheridan Creek, and Snow Creek. The locations of water sampling stations in the Bear Creek watershed are shown in Figure 5-1. Because water quality measurements were recorded by different agencies using different protocols and instruments, water quality data collected cannot be accurately compared among streams or within streams.

BEAR CREEK – MAIN STEM

Water Temperature. The California Department of Water Resources (DWR) monitored water temperature in the main stem of Bear Creek at station A04070 near Anderson, CA in 2000 and 2001. The RWQCB monitored water temperature in the main stem of Bear Creek beneath the Highway 44 Bridge and beneath the Parkville Road Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, water temperature was measured in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge. Measurements of water temperature are presented in Table 5-2.

**Table 5-2. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in the Main Stem of Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Sample Location</i>	<i>Water Temperature (°F)</i>	<i>Water Temperature (Kit) (°F)</i>
12/7/00	DWR	Near Anderson, CA	42.8	
1/8/01	DWR	Near Anderson, CA	42.62	
2/5/01	DWR	Near Anderson, CA	45.14	
3/6/01	DWR	Near Anderson, CA	47.48	
4/9/01	DWR	Near Anderson, CA	48.92	
5/8/01	DWR	Near Anderson, CA	66.56	
6/4/01	DWR	Near Anderson, CA	76.46	
3/18/02	DWR	Near Anderson, CA	46.58	
5/29/02	RWQCB	Highway 44 Bridge	75.6	
6/4/02	RWQCB	Highway 44 Bridge	75.2	
6/12/02	RWQCB	Highway 44 Bridge	72.3	
6/20/02	RWQCB	Highway 44 Bridge	73.7	
6/26/02	RWQCB	Highway 44 Bridge	81.5	
7/3/02	RWQCB	Highway 44 Bridge	80.6	
7/11/02	RWQCB	Highway 44 Bridge	84.2	
7/19/02	RWQCB	Highway 44 Bridge	81.9	
7/26/02	RWQCB	Highway 44 Bridge	81.5	
7/31/02	RWQCB	Highway 44 Bridge	83.9	
8/7/02	RWQCB	Highway 44 Bridge	74.7	

**Table 5-2. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in the Main Stem of Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Sample Location</i>	<i>Water Temperature (°F)</i>	<i>Water Temperature (Kit) (°F)</i>
<i>(continued)</i>				
8/15/02	RWQCB	Highway 44 Bridge	74.8	
10/17/02	RWQCB	Highway 44 Bridge	54.8	
7/2/03	RWQCB	Highway 44 Bridge	66.8	
7/28/03	RWQCB	Highway 44 Bridge	74.6	
10/18/02	WWMD	Highway 44 Bridge	52.52	64.4
10/15/03	WWMD	Highway 44 Bridge	50.9	53.6
9/23/04	WWMD	Highway 44 Bridge	52.28	
5/29/02	RWQCB	Parkville Road Bridge	84.9	
6/4/02	RWQCB	Parkville Road Bridge	85.0	
6/12/02	RWQCB	Parkville Road Bridge	82.4	
6/20/02	RWQCB	Parkville Road Bridge	85.0	
6/26/02	RWQCB	Parkville Road Bridge	90.9	
7/3/02	RWQCB	Parkville Road Bridge	90.0	
7/11/02	RWQCB	Parkville Road Bridge	92.8	
7/19/02	RWQCB	Parkville Road Bridge	84.7	
7/26/02	RWQCB	Parkville Road Bridge	89.4	
7/31/02	RWQCB	Parkville Road Bridge	88.0	
8/7/02	RWQCB	Parkville Road Bridge	84.0	
8/15/02	RWQCB	Parkville Road Bridge	72.0	
10/17/02	RWQCB	Parkville Road Bridge	64.1	
7/2/03	RWQCB	Parkville Road Bridge	71.5	
7/28/03	RWQCB	Parkville Road Bridge	78.1	
10/18/02	WWMD	Parkville Road Bridge	64.22	64.4
10/15/03	WWMD	Parkville Road Bridge	61.52	60.8
9/23/04	WWMD	Parkville Road Bridge	73.4	75.2

Bacteria. The RWQCB monitored levels of coliforms in the main stem of Bear Creek in 1996, 2002, 2003, and 2004. Samples were collected from three locations: beneath the Highway 44 Bridge, beneath the Dersch Road Bridge, and beneath the Parkville Road Bridge. The RWQCB used Basic Lab to analyze water samples collected in the main stem of Bear Creek beneath Parkville Road Bridge and at Highway 44 in 2002 and 2003. Measurements of coliforms are presented in Table 5-3.

**Table 5-3. Bear Creek Watershed Assessment 2005
Measurements of Coliforms in the Main Stem Bear Creek**

Date	Sample Location	RWQCB Data			RWQCB / Basic Lab Data		
		Total Coliform (MPN ^a)	Fecal Coliform (MPN)	Ratio Total to Fecal	Total Coliform (MPN/100 ml)	Fecal Coliform (MPN/100 ml)	E. coli (MPN/100 ml)
6/18/96	Highway 44	300	27	11.11			
6/18/96	Highway 44	130	30	4.33			
5/15/02	Highway 44				130	23	
5/24/02	Highway 44				1,413		13
5/29/02	Highway 44	980	29		>2,400		26
6/4/02	Highway 44	> 2,400	7		>2,400		14
6/12/02	Highway 44	1,986	29		>2,400		19
6/20/02	Highway 44	> 2,400	22				
6/26/02	Highway 44	> 2,400	16				
6/27/03	Highway 44				>2,419		27
7/28/03	Highway 44	> 2,400	22.8				
8/18/03	Highway 44	> 2,400	4.1				
9/26/03	Highway 44	1,986	7				
2/17/04	Highway 44	416	13				
6/18/96	Dersch Road	300	80	3.75			
6/18/96	Dersch Road	900	80	11.25			
6/18/96	Parkville Road Bridge	300	170	1.76			
6/18/96	Parkville Road Bridge	240	80	3.00			
5/15/02	Parkville Road Bridge				300	240	
5/24/02	Parkville Road Bridge				1,553		22
5/29/02	Parkville Road Bridge	> 2,400	98		>2,400		72
6/4/02	Parkville Road Bridge	1,733	43		>2,400		36
6/12/02	Parkville Road Bridge	> 2,400	110		>2,400		71
6/20/02	Parkville Road Bridge	> 2,400	35				
6/26/02	Parkville Road Bridge	> 2,400	150				
7/28/03	Parkville Road Bridge	> 2,400	235.9				
9/26/03	Parkville Road Bridge	> 2,400	110				
6/27/03	Parkville Road Bridge				>2,419		105
2/17/04	Parkville Road Bridge	687	33				

a = MPN (Mean probable number)

Value exceeds the Water Quality Control Plan objective for total coliform MPN (x < 2,300) and for fecal coliform MPN (x < 200/100 mL).

Dissolved Oxygen. The DWR monitored dissolved oxygen in the main stem of Bear Creek at station A04070 near Anderson, CA in 2000 and 2001. The RWQCB monitored the concentration of dissolved oxygen in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge, in 2002 and 2003. On WWMD in 2002, 2003, and 2004, dissolved oxygen was measured in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge. Measurements of dissolved oxygen are presented in Table 5-4.

**Table 5-4. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen Concentration
in the Main Stem of Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Sample Location</i>	<i>Dissolved Oxygen (mg/l)</i>	<i>Dissolved Oxygen (Kit) (ppm)</i>
12/7/00	DWR	Near Anderson, CA	12.3	
1/8/01	DWR	Near Anderson, CA	12.0	
2/5/01	DWR	Near Anderson, CA	12.8	
3/6/01	DWR	Near Anderson, CA	11.0	
4/9/01	DWR	Near Anderson, CA	11.1	
5/8/01	DWR	Near Anderson, CA	8.9	
6/4/01	DWR	Near Anderson, CA	10.0, 8.7	
3/18/02	DWR	Near Anderson, CA	11.7	
5/29/02	RWQCB	Highway 44 Bridge	4.4	
6/4/02	RWQCB	Highway 44 Bridge	6.5	
6/12/02	RWQCB	Highway 44 Bridge	8.3	
6/20/02	RWQCB	Highway 44 Bridge	6.7	
6/26/02	RWQCB	Highway 44 Bridge	5.1	
7/3/02	RWQCB	Highway 44 Bridge	4.2	
7/11/02	RWQCB	Highway 44 Bridge	8.0	
7/19/02	RWQCB	Highway 44 Bridge	3.1	
7/26/02	RWQCB	Highway 44 Bridge	10.0	
7/31/02	RWQCB	Highway 44 Bridge	7.4	
8/7/02	RWQCB	Highway 44 Bridge	10.0	
8/15/02	RWQCB	Highway 44 Bridge	6.2	
10/17/02	RWQCB	Highway 44 Bridge	9.0	
7/2/03	RWQCB	Highway 44 Bridge	12.2	
7/28/03	RWQCB	Highway 44 Bridge	8.12	
8/18/03	RWQCB	Highway 44 Bridge	8.51	
10/18/02	WWMD	Highway 44 Bridge	10.9	8.0
10/15/03	WWMD	Highway 44 Bridge	9.8	4.0
9/23/04	WWMD	Highway 44 Bridge	8.9	
5/29/02	RWQCB	Parkville Road Bridge	3.4	
6/4/02	RWQCB	Parkville Road Bridge	6.3	
6/12/02	RWQCB	Parkville Road Bridge	9.9	
6/20/02	RWQCB	Parkville Road Bridge	8.8	
6/26/02	RWQCB	Parkville Road Bridge	8.3	
7/3/02	RWQCB	Parkville Road Bridge	6.9	
7/11/02	RWQCB	Parkville Road Bridge	11.5	
7/19/02	RWQCB	Parkville Road Bridge	2.3	
7/26/02	RWQCB	Parkville Road Bridge	14.4	
7/31/02	RWQCB	Parkville Road Bridge	8.7	
8/7/02	RWQCB	Parkville Road Bridge	11.0	
8/15/02	RWQCB	Parkville Road Bridge	5.5	
10/17/02	RWQCB	Parkville Road Bridge	9.0	
7/2/03	RWQCB	Parkville Road Bridge	11.49	

**Table 5-4. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen Concentration
in the Main Stem of Bear Creek**
(continued)

Date	Source	Sample Location	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)
7/28/03	RWQCB	Parkville Road Bridge	7.9	
10/18/02	WWMD	Parkville Road Bridge	11.3	8.0
10/15/03	WWMD	Parkville Road Bridge	11.7	8.0
9/23/2004	WWMD	Parkville Road Bridge	10.5	3.0

Value is less than the Water Quality Control Plan objective ($x > 5.0$ mg/L).

pH. The DWR monitored pH in the main stem of Bear Creek at station A04070 near Anderson, CA irregularly between 1955 and 2001. The RWQCB monitored pH in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge, in 2002 and 2003. On WWMD in 2002, 2003, and 2004, pH was measured in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge. Measurements of pH are presented in Table 5-5.

**Table 5-5. Bear Creek Watershed Assessment 2005
Measurements of pH in the Main Stem of Bear Creek**

Date	Source	Sample Location	pH (Lab)	pH (Field)	pH	pH (Kit)
1/27/55	DWR	Near Anderson, CA	7.4			
5/5/60	DWR	Near Anderson, CA	7.6			
10/6/60	DWR	Near Anderson, CA	8.3			
1/28/67	DWR	Near Anderson, CA	7.0			
5/11/77	DWR	Near Anderson, CA	7.5			
6/28/77	DWR	Near Anderson, CA	7.4			
6/29/77	DWR	Near Anderson, CA	7.7, 7.5			
6/30/77	DWR	Near Anderson, CA	7.5, 7.7			
8/11/77	DWR	Near Anderson, CA	7.3, 7.6, 8.6, 7.5			
9/13/77	DWR	Near Anderson, CA	8.7			
9/14/77	DWR	Near Anderson, CA	8.2			
1/10/78	DWR	Near Anderson, CA	7.7			
1/8/79	DWR	Near Anderson, CA	7.6			
4/10/79	DWR	Near Anderson, CA	7.6, 7.7, 7.5, 7.6			
4/11/79	DWR	Near Anderson, CA	7.7, 7.5, 7.7			
1/14/80	DWR	Near Anderson, CA	7.5			
2/19/80	DWR	Near Anderson, CA	7.5			
12/7/00	DWR	Near Anderson, CA		7.8		
1/8/01	DWR	Near Anderson, CA		7.6		
2/5/01	DWR	Near Anderson, CA		7.6		
3/6/01	DWR	Near Anderson, CA		7.3		
4/9/01	DWR	Near Anderson, CA		7.8		
5/8/01	DWR	Near Anderson, CA		8.0		
6/4/01	DWR	Near Anderson, CA		8.4		
1/14/80	DWR	Near Anderson, CA		7.5		
2/19/80	DWR	Near Anderson, CA		7.5		
3/18/02	DWR	Near Anderson, CA		7.5		
5/29/02	RWQCB	Highway 44 Bridge			8.90	
6/4/02	RWQCB	Highway 44 Bridge			8.72	
6/12/02	RWQCB	Highway 44 Bridge			8.36	

**Table 5-5. Bear Creek Watershed Assessment 2005
Measurements of pH in the Main Stem of Bear Creek**
(continued)

Date	Source	Sample Location	pH (Lab)	pH (Field)	pH	pH (Kit)
6/20/02	RWQCB	Highway 44 Bridge			8.08	
6/26/02	RWQCB	Highway 44 Bridge			8.42	
7/3/02	RWQCB	Highway 44 Bridge			8.70	
7/11/02	RWQCB	Highway 44 Bridge			8.70	
7/19/02	RWQCB	Highway 44 Bridge			8.87	
7/26/02	RWQCB	Highway 44 Bridge			9.0	
7/31/02	RWQCB	Highway 44 Bridge			8.93	
8/7/02	RWQCB	Highway 44 Bridge			8.76	
8/15/02	RWQCB	Highway 44 Bridge			7.94	
10/17/02	RWQCB	Highway 44 Bridge			7.87	
7/2/03	RWQCB	Highway 44 Bridge			6.68	
7/28/03	RWQCB	Highway 44 Bridge			7.62	
8/18/03	RWQCB	Highway 44 Bridge			7.5	
10/18/02	WWMD	Highway 44 Bridge			6.90	8.00
10/15/03	WWMD	Highway 44 Bridge			7.66	8.00
9/23/04	WWMD	Highway 44 Bridge			8.60	
5/29/02	RWQCB	Parkville Road Bridge			8.79	
6/4/02	RWQCB	Parkville Road Bridge			8.94	
6/12/02	RWQCB	Parkville Road Bridge			8.55	
6/20/02	RWQCB	Parkville Road Bridge			8.57	
6/26/02	RWQCB	Parkville Road Bridge			8.80	
7/3/02	RWQCB	Parkville Road Bridge			9.07	
7/11/02	RWQCB	Parkville Road Bridge			9.07	
7/19/02	RWQCB	Parkville Road Bridge			9.0	
7/26/02	RWQCB	Parkville Road Bridge			9.09	
7/31/02	RWQCB	Parkville Road Bridge			9.05	
8/7/02	RWQCB	Parkville Road Bridge			8.94	
8/15/02	RWQCB	Parkville Road Bridge			7.93	
10/17/02	RWQCB	Parkville Road Bridge			8.26	
7/2/03	RWQCB	Parkville Road Bridge			7.73	
7/28/03	RWQCB	Parkville Road Bridge			7.71	
10/18/02	WWMD	Parkville Road Bridge			8.65	7.00
10/15/03	WWMD	Parkville Road Bridge			8.22	8.1
9/23/04	WWMD	Parkville Road Bridge			8.80	8.50

Value is outside the Water Quality Control Plan objective range (6.5 – 8.5), but is not considered a concern.

Nutrients. The DWR monitored nutrients in the main stem of Bear Creek at station A04070 near Anderson, CA irregularly between 1955 and 2001. The RWQCB monitored the concentration of nutrients in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge, in 2002 and 2003. Measurements of nutrients are presented in Table 5-6.

**Table 5-6. Bear Creek Watershed Assessment 2005
Measurements (mg/l) of Nutrients in the Main Stem of Bear Creek**

Date	Source	Sample Location	Dis. NH ₃	Dis. NO ₃	Dis. NH ₃ as N	Dis. NO ₃ as N	Dis. NO ₃ & NO ₂	Dis. Ortho-PO ₄ as P	Dis. SO ₄	Total NH ₃ as N	Total P as P	Total Org. N as N	Total NH ₃ & Org. N
1/27/55	DWR	Near Anderson, CA		0.30					3.90				
5/5/60	DWR	Near Anderson, CA		0.50					1.50				
10/6/60	DWR	Near Anderson, CA		0.40					4.10				
1/28/67	DWR	Near Anderson, CA		0.70					1.00				
12/4/70	DWR	Near Anderson, CA			0.00	0.28					0.06	0.20	0.20
12/27/71	DWR	Near Anderson, CA				0.46		0.00			0.01		0.20
1/21/72	DWR	Near Anderson, CA				0.26		0.04					0.20
5/11/77	DWR	Near Anderson, CA				0.03			6.90		0.03		0.20
6/29/77	DWR	Near Anderson, CA				0.06		0.00		0.01			
8/11/77	DWR	Near Anderson, CA				0.07					0.04		1.30
9/14/77	DWR	Near Anderson, CA				0.07		0.01		0.00	0.02	0.20	0.20
10/14/77	DWR	Near Anderson, CA				0.01		0.03		0.06	0.03	0.10	0.16
1/10/78	DWR	Near Anderson, CA				0.10					0.06		0.40
8/18/78	DWR	Near Anderson, CA					0.06	0.00			0.04		0.60
1/8/79	DWR	Near Anderson, CA					0.01				0.07		0.70
1/12/79	DWR	Near Anderson, CA					0.41				0.05		1.40
4/11/79	DWR	Near Anderson, CA					0.03				0.03		0.20
1/14/80	DWR	Near Anderson, CA			0.03		0.09	0.00			0.06		0.30
2/19/80	DWR	Near Anderson, CA					0.03	0.01			0.20		0.70
12/7/00	DWR	Near Anderson, CA									0.47		
1/8/01	DWR	Near Anderson, CA	0.02				0.09	< 0.01	4.00		0.02		
2/5/01	DWR	Near Anderson, CA	< 0.01				0.04	< 0.01	4.00		< 0.01		
3/6/01	DWR	Near Anderson, CA	0.02	0.20		0.20	< 0.1	0.01	2.00		0.09		
4/9/01	DWR	Near Anderson, CA	< 0.01	0.10		0.10	0.02	< 0.01	3.00		0.03		
5/8/01	DWR	Near Anderson, CA	0.01				0.05	< 0.01	4.00		0.02		
6/4/01	DWR	Near Anderson, CA	< 0.02				<0.05	< 0.01	6.00		0.01		
3/18/02	DWR	Near Anderson, CA					0.07	< 0.01	2.00		< 0.01		
6/4/02	RWQCB	Highway 44 Bridge	0.05	0.06							0.16		
6/12/02	RWQCB	Highway 44 Bridge	0.05								0.26		
6/20/02	RWQCB	Highway 44 Bridge	0.10								0.16		
6/27/03	RWQCB	Highway 44 Bridge	0.04	< 0.05							0.03		
6/4/02	RWQCB	Parkville Road Bridge	0.07								0.25		
6/12/02	RWQCB	Parkville Road Bridge	0.08								0.18		
6/20/02	RWQCB	Parkville Road Bridge	0.08								0.33		
6/27/03	RWQCB	Parkville Road Bridge	0.23	< 0.05							0.07		

Conductivity, Electrical Conductivity, Specific Conductance, and Salinity. The DWR monitored electrical conductivity in the main stem of Bear Creek at station A04070 near Anderson, CA irregularly between 1955 and 2001. The RWQCB monitored conductivity levels in the main stem of Bear Creek, beneath the Highway 44 Bridge, and beneath the Parkville Road Bridge, in 2002 and 2003. On WWMD in 2002, 2003, and 2004, conductivity and salinity were measured in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge. These measurements of are presented in Table 5-7.

**Table 5-7. Bear Creek Watershed Assessment 2005
Measurements of Conductivity, Electrical Conductivity, Specific Conductance, and Salinity
in the Main Stem of Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Sample Location</i>	<i>Conductivity (μmh/cm)</i>	<i>Electrical Conductivity (Lab) (μmh/cm)</i>	<i>Electrical Conductivity (Field) (μmh/cm)</i>	<i>Specific Conductance (μmh/cm)</i>	<i>Salinity (ppt)</i>
1/27/55	DWR	Near Anderson, CA				119	
5/5/60	DWR	Near Anderson, CA				127	
10/6/60	DWR	Near Anderson, CA				229	
1/28/67	DWR	Near Anderson, CA				68	
12/4/70	DWR	Near Anderson, CA				54	
5/11/77	DWR	Near Anderson, CA				180	
1/10/78	DWR	Near Anderson, CA				65	
1/8/79	DWR	Near Anderson, CA				184	
1/14/80	DWR	Near Anderson, CA				60	
2/19/80	DWR	Near Anderson, CA				49	
12/7/00	DWR	Near Anderson, CA		182	182		
1/8/01	DWR	Near Anderson, CA		163	166		
2/5/01	DWR	Near Anderson, CA		164	162		
3/6/01	DWR	Near Anderson, CA		86	84		
4/9/01	DWR	Near Anderson, CA		130	128		
5/8/01	DWR	Near Anderson, CA		179	177		
6/4/01	DWR	Near Anderson, CA		202	202		
3/18/02	DWR	Near Anderson, CA			116		
5/29/02	RWQCB	Highway 44 Bridge	151				
6/4/02	RWQCB	Highway 44 Bridge	189				
6/12/02	RWQCB	Highway 44 Bridge	187				
6/20/02	RWQCB	Highway 44 Bridge	201				
6/26/02	RWQCB	Highway 44 Bridge	202				
7/3/02	RWQCB	Highway 44 Bridge	193				
7/11/02	RWQCB	Highway 44 Bridge	212				
7/19/02	RWQCB	Highway 44 Bridge	223				
7/26/02	RWQCB	Highway 44 Bridge	219				
7/31/02	RWQCB	Highway 44 Bridge	221				
8/7/02	RWQCB	Highway 44 Bridge	227				
8/15/02	RWQCB	Highway 44 Bridge	226				
10/17/02	RWQCB	Highway 44 Bridge	151				
7/2/03	RWQCB	Highway 44 Bridge	136				
7/28/03	RWQCB	Highway 44 Bridge	169				
8/18/03	RWQCB	Highway 44 Bridge	172				
10/18/02	WWMD	Highway 44 Bridge	235.1			173.5	0.1
10/15/03	WWMD	Highway 44 Bridge	199.2			144.1	0.1
9/23/04	WWMD	Highway 44 Bridge	241.2			193.5	0.1
5/29/02	RWQCB	Parkville Road Bridge	167				
6/4/02	RWQCB	Parkville Road Bridge	217				

**Table 5-7. Bear Creek Watershed Assessment 2005
Measurements of Conductivity, Electrical Conductivity, Specific Conductance, and Salinity
in the Main Stem of Bear Creek**

<i>(continued)</i>							
<i>Date</i>	<i>Source</i>	<i>Sample Location</i>	<i>Conductivity (μmhos/cm)</i>	<i>Electrical Conductivity (Lab) (μmhos/cm)</i>	<i>Electrical Conductivity (Field) (μmhos/cm)</i>	<i>Specific Conductance (μmhos/cm)</i>	<i>Salinity (ppt)</i>
6/12/02	RWQCB	Parkville Road Bridge	214				
6/20/02	RWQCB	Parkville Road Bridge	223				
6/26/02	RWQCB	Parkville Road Bridge	224				
7/3/02	RWQCB	Parkville Road Bridge	216				
7/11/02	RWQCB	Parkville Road Bridge	226				
7/19/02	RWQCB	Parkville Road Bridge	243				
7/26/02	RWQCB	Parkville Road Bridge	231				
7/31/02	RWQCB	Parkville Road Bridge	245				
8/7/02	RWQCB	Parkville Road Bridge	249				
8/15/02	RWQCB	Parkville Road Bridge	256				
10/17/02	RWQCB	Parkville Road Bridge	176				
7/2/03	RWQCB	Parkville Road Bridge	143				
7/28/03	RWQCB	Parkville Road Bridge	179				
10/18/02	WWMD	Parkville Road Bridge	241.0			208.4	0.1
10/15/03	WWMD	Parkville Road Bridge	212.7			177.5	0.1
9/23/04	WWMD	Parkville Road Bridge	238.6			229.3	0.1

Value exceeds the Water Quality Control Plan objective ($x < 230 \mu\text{mhos/cm}$), but is not considered a concern.

Chemical Constituents. The DWR monitored the dissolved concentration of various chemical constituents in the main stem of Bear Creek irregularly at station A04070 near Anderson, CA between 1955 and 2001. Metals measured as dissolved, total, or equivalents per million (epm) are shown in Table 5-8. Measurements of non-metals, alkalinity, and hardness are shown in Table 5-9, and measurements of organic compounds are presented in Table 5-10.

Table 5-8. Bear Creek Watershed Assessment 2005
Measurements of Metals in the Main Stem of Bear Creek by the DWR at Sample Site A04070 Near Anderson, CA

Date	Al ¹	Ag ²	As ³	Cd ⁴	Ca ⁵	Cr ⁶	Cu ⁷	Fe ⁸	K ⁹	Mg ¹⁰	Mn ¹¹	Me-Hg ^{*12}	Hg ¹³	Na ¹⁴	Ni ¹⁵	Pb ¹⁶	Zn ¹⁷	B ¹⁸	p(Ca+Mg)
Measured As Dissolved (mg/l)																			
1/27/55	0.01		0.00		12.00	0.00	0.01	0.06	0.80	5.20	0.00			4.80		0.00	0.00	0.01	
5/5/60					11.00				0.90	6.00				4.20				0.03	
10/6/60					20.00				1.80	13.00				9.80				0.08	
1/28/67									1.40	1.80				2.80				0.00	
12/4/70			0.00				0.00	0.02			0.00					0.00	0.00		
1/21/72			0.06				0.01	1.80			0.08					0.00	0.09		
5/11/77					10.00				1.30	10.00				6.70				0.00	
8/11/77				0.04			0.01	0.02			0.02					0.01	0.01		
1/10/78														2.30					
1/8/79					15.00					10.00				8.00					
1/14/80					5.00				0.90	3.00				2.00				0.00	
2/19/80					4.00				0.80	2.00				2.00				0.00	
12/7/00	1.0	0.003	0.23	<0.006	16.00	0.39	0.37	32.0	1.10	10.00	3.93	<0.018*		7.00	0.15	0.017	0.47	<0.1	3.09
1/8/01	<5.9	<0.001	0.223	<0.006	14.00	0.69	0.30	16.7	1.10	9.00	3.08			6.00	0.34	0.007	0.48	<0.1	3.14
2/5/01	1.6	<0.001	0.206	<0.003	14.00	0.51	0.77	17.5	0.90	8.00	3.57	0.027*		6.00	0.42	0.023	0.96	<0.1	3.17
3/6/01	4.3	0.002	0.126	0.002	7.00	0.20	0.79	14.3	0.80	5.00	1.76	0.030*		4.00	0.59	0.014	0.45	<0.1	3.42
4/9/01					11.00				0.90	7.00				5.00				<0.1	3.25
5/8/01	5.6	0.005	0.275	<0.001	15.00	0.20	0.34	38.8	1.30	9.00	3.29	0.115*		6.00	<0.09	<0.004	0.11	<0.1	
6/4/01	1.3	<0.004	0.553	<0.002	18.00	0.12	0.41	24.1	1.40	11.00	1.05	0.106*		8.00	0.24	<0.005	0.12	<0.1	
3/18/02					10.00				0.80	6.00				4.00				<0.1	
Measured as Total																			
12/7/00	30.4	0.003	0.229	<0.006		0.58	0.36	66.5			5.61		0.42		0.09	0.014	0.17		
1/8/01	130.0	<0.002	0.21	0.006		0.99	0.45	121			7.67		1.84		0.32	0.501	0.62		
2/5/01	60	<0.003	0.183	<0.002		0.6	0.42	94.4			3.88		0.8		0.23	<0.017	0.19		
3/6/01	958	0.005	0.16	<0.003		1.29	1.43	841			12		3.26		1.03	0.195	1.46		
4/9/01	502	0.002	0.202	<0.002		1.1		615			11.1				0.61	0.132	1.18		
5/8/01	26.7	<0.010	0.345	<0.003		0.37	0.4	83.9			8.73		0.81		0.32	<0.004	0.22		
Measured as epm																			
12/7/00					0.80					0.82				0.30					
1/8/01					0.70					0.74				0.26					
2/5/01					0.70					0.66				0.26					
3/6/01					0.35					0.41				0.17					
4/9/01					0.55					0.58				0.22					
5/8/01					0.75					0.74				0.26					
6/4/01					0.90					0.90				0.35					

1 – Aluminum

7 – Copper

13 – Mercury

2 – Silver

8 – Iron

14 – Sodium

3 – Arsenic

9 – Potassium

15 – Nickel

4 – Cadmium

10 – Magnesium

16 – Lead

5 – Calcium

11 – Manganese

17 – Zinc

6 – Chromium

12 – Methyl Mercury

18 – Boron

*Dissolved Me-Hg measured in ng/L

Value exceeds water quality objective.

**Table 5-9. Bear Creek Watershed Assessment 2005
Measurements of Non-Metals, Alkalinity, Hardness, and Other Parameters in the Main Stem of Bear Creek
by the DWR at Sample Site A04070 Near Anderson, California**

Date	Dissolved (mg/l)					Total		Other				
	Selenium	Chloride	Fluoride	Silica	Hardness (CaCO ₃)	Selenium	Alkalinity (mg/l)	HCO ₃ ⁻ + CO ₃ epm	SAR ^a	pALK	ASAR ^b	pK2-pKc
1/27/55		0.00	0.40	32.00	52.00		59.00					
5/5/60		0.30	0.20	31.00	52.00		59.00					
10/6/60		6.10	0.10		102.00		118.00					
1/28/67		2.10			26.00		28.00					
5/11/77		0.00			79.00		101.00					
6/28/77							91.00					
6/29/77							92.00					
6/29/77							97.00					
6/30/77							88.00					
6/30/77							98.00					
8/11/77							75.00					
9/13/77							121.00					
9/14/77							128.00					
1/10/78		0.50					28.00					
1/8/79		2.00			78.00		84.00					
1/14/80		0.00			25.00							
2/19/80		0.00			18.00		21.00					
12/7/00	<0.44				81.00	<0.44	84.00	1.68	.03	2.77	0.5	2.16
1/8/01	<0.09	1.00			72.00	<.011	71.00	1.42	0.3	2.85	0.4	2.15
2/5/01	<0.06	1.00			68.00	<0.17	73.00	0.00	0.3			2.15
3/6/01	<0.11	<1.0			38.00	<0.11	43.00	0.00	0.3			2.13
4/9/01		1.00			56.00	<0.10	62.00	0.00	0.3			2.14
5/8/01	0.14	1.00			75.00	<0.15	84.00	0.00	0.3			
6/4/01	0.12	1.00			90.00		100.00	0.00	0.4			
3/18/02		<1.0			50.00							

a = Sodium Adsorption Ratio

b = Adjusted Sodium Adsorption Ratio

**Table 5-10. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Organic Compounds
in Main Stem of Bear Creek by the DWR
at Sample Site A04070 Near Anderson, California**

<i>Organic Compound</i>	<i>12/7/00 (µg/L)</i>	<i>3/6/01 (µg/L)</i>
1,1,1,2-Tetrachloroethane	<0.5	<0.5
1,1,1,-Trichloroethane	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5
1,1,2-Trichloroethane	<0.5	<0.5
1,1-Dichloroethane	<0.5	<0.5
1,1-Dichloroethene	<0.5	<0.5
1,1-Dichloropropene	<0.5	<0.5
1,2,3-Trichlorobenzene	<0.5	<0.5
1,2,3-Trichloropropane	<0.5	<0.5
1,2,4-Trichlorobenzene	<0.5	<0.5
1,2,4-Trimethylbenzene	<0.5	<0.5
1,2-Dibromo-3-chloropropane	<0.5	<0.5
1,2-Dibromoethane (EDB)	<0.5	<0.5
1,2-Dichlorobenzene	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5
1,2-Dichloropropane	<0.5	<0.5
1,3,5-Trimethylbenzene	<0.5	<0.5
1,3-Dichlorobenzene	<0.5	<0.5
1,3-Dichloropropane	<0.5	<0.5
1,4-Dichlorobenzene	<0.5	<0.5
2,2-Dichloropropane	<0.5	<0.5
2,4,5-T	<0.1	<0.1
2,4,5-TP (Silvex)	<0.1	<0.1
2,4-D	<0.1	<0.1
2,4-DB	<0.1	<0.1
2-Chlorotoluene	<0.5	<0.5
3-Hydroxycarbofuran	<2	<3
4-Chlorotoluene	<0.5	<0.5
4-Isopropyltoluene	<0.5	<0.5
Alachlor	<0.05	<0.05
Aldicarb	<2	<3
Aldicarb sulfone	<2	<4
Aldicarb sulfoxide	<2	<3
Aldrin	<0.01	<0.01
Aminomethylphosphonic acid	<100	
Atrazine	<0.02	<0.02
Azinphos methyl (Guthion)	<0.05	<0.05
BHC-alpha	<0.01	<0.01
BHC-beta	<0.01	<0.01
BHC-delta	<0.01	<0.01
BHC-gamma (Lindane)	<0.01	<0.01
Benfluralin	<0.01	<0.01
Benzene	<0.5	<0.5
Bromacil	<1	<1
Bromobenzene	<0.5	<0.5
Bromochloromethane	<0.5	<0.5
Bromodichloromethane	<0.5	<0.5
Bromoform	<0.5	<0.5
Bromomethafne	<0.5	<0.5
Captan	<0.02	<0.02
Carbaryl	<2	<5
Carbofuran	<2	<0.5

**Table 5-10. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Organic Compounds
in Main Stem of Bear Creek by the DWR
at Sample Site A04070 Near Anderson, California
(continued)**

<i>Organic Compound</i>	<i>12/7/00 (µg/L)</i>	<i>3/6/01 (µg/L)</i>
Carbon tetrachloride	<0.5	<0.5
Carbophenothion (Trithion)	<0.02	<0.02
Chlordane	<0.05	<0.05
Chlorobenzene	<0.5	<0.5
Chloroethane	<0.5	<0.5
Chloroform	<0.5	<0.5
Chloromethane	<0.5	<0.5
Chlorothalonil	<0.01	<0.01
Chlorpropham	<0.02	<0.02
Chlorpyrifos	<0.01, <0.01	<0.01, <0.01
Cyanazine	<0.3, <0.3	<0.3, <0.3
Dacthal (DCPA)	<0.1, <0.01	<0.1, <0.01
Demeton	<0.02	<0.02
Diazinon	<0.01	<0.01
Dibromochloromethane	<0.5	<0.5
Dibromomethane	<0.5	<0.5
Dicamba	<0.1	<0.1
Dichloran	<0.01	<0.01
Dichlorodiflouromethane	<0.05	<0.05
Dichlorprop	<0.1	<0.1
Dicofol	<0.05	<0.05
Dieldrin	<0.01	<0.01
Dimethoate	<0.01	<0.01
Dinoseb (DNPB)	<0.1	<0.1
Disulfoton	<0.01	<0.01
Diuron	<0.25	<0.25
Endosulfan sulfate	<0.02	<0.02
Endosulfan-I	<0.01	<0.01
Endosulfan-II	<0.01	<0.01
Endrin	<0.01	<0.01
Endrin aldehyde	<0.01	<0.01
Ethion	<0.01	<0.01
Ethyl benzene	<0.5	<0.5
Formetanate hydrochloride	<100	
Glyphosate	<100	<25
Heptachlor	<0.01	<0.01
Heptachlor epoxide	<0.01	<0.01
Hexachlorobutadiene	<0.5	<0.5
Isopropylbenzene	<0.5	<0.5
MCPA	<0.1	<0.1
MCPP	<0.1	<0.1
Malathion	<0.01	<0.01
Methidathion	<0.02	<0.02
Methiocarb	<4	
Methomyl	<2	<2
Methoxychlor	<0.05	<0.05
Methyl tert-butyl ether (MTBE)	<1	<1
Methylene chloride	<0.5	<0.5
Metolachlor	<0.2	<0.2
Mevinphos	<0.01	<0.01
Naled	<0.02	<0.02

**Table 5-10. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Organic Compounds
in Main Stem of Bear Creek by the DWR
at Sample Site A04070 Near Anderson, California
(continued)**

<i>Organic Compound</i>	<i>12/7/00 (µg/L)</i>	<i>3/6/01 (µg/L)</i>
Naphthalene	<0.5	<0.5
Napropamide	<5	<5
Norflurazon	<5	<5
Oxamyl	<2	<20
Oxyflourfen	<0.2	<0.2
PCB-1016	<0.1	<0.1
PCB-1221	<0.1	<0.1
PCB-1232	<0.1	<0.1
PCB-1242	<0.1	<0.1
PCB-1248	<0.1	<0.1
PCB-1254	<0.1	<0.1
PCB-1260	<0.1	<0.1
Parathion (Ethyl)	<0.01	<0.01
Parathion, Methyl	<0.01	<0.01
Pendimethalin	<5	<5
Pentachloronitrobenzene (PCNB)	<0.01	<0.01
Pentachlorophenol (PCP)	<0.1	<0.1
Phorate	<0.01	<0.01
Phosalone	<0.02	<0.02
Phosmet	<0.02	<0.02
Picloram	<0.1	<0.1
Profenofos	<0.01	<0.01
Prometryn	<0.05	<0.05
Propetamphos	<0.1	<0.1
Simazine	<0.02	<0.02
Styrene	<0.5	<0.5
Tetrachloroethene	<0.5	<0.5
Thiobencarb	<0.02	<0.02
Toluene	<0.5	<0.5
Toxaphene	<0.4	<0.4
Trichloroethene	<0.5	<0.5
Trichloroflouromethane	<0.5	<0.5
Triclopyr	<0.1	<0.1
Trifluralin	<0.01	<0.01
Vinyl chloride	<0.5	<0.5
cis-1,2-Dichloroethene	<0.5	<0.5
cis-1,3-Dichloropropene	<0.5	<0.5
m + p Xylene	<0.5	<0.5
n-Butylbenzene	<0.5	<0.5
n-Propylbenzene		<0.5
o-Xylene		<0.5
p,p'-DDD		<0.01
p,p'-DDE		<0.01
p,p'-DDT		<0.05
s,s,s-Tributyl Phosphorothrithiolate		<0.01
sec-Butylbenzene		<0.5
tert-Butylbenzene		<0.5
trans-1,2-Dichloroethene		<0.5
trans-1,3-Dichloropropene		<0.5

Turbidity. The DWR monitored turbidity in the main stem of Bear Creek at station A04070 near Anderson, CA irregularly between 1955 and 2001. The RWQCB monitored turbidity in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge, in 2002 and 2003. On WWMD in 2002, 2003, and 2004, turbidity was measured in the main stem of Bear Creek, beneath the Highway 44 Bridge and beneath the Parkville Road Bridge. Measurements of turbidity are presented in Table 5-11.

**Table 5-11. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in the Main Stem of Bear Creek**

Date	Source	Sample Location	Turbidity (NTU)	Turbidity (Kit) (JTU)	Mineral Turbidity Hellige	Mineral Turbidity Hach	Nutrient Turbidity Hach	Total Susp. Solids	Total Dis. Solids
1/27/55	DWR	Near Anderson, CA			2.00				
1/28/67	DWR	Near Anderson, CA			31.00				
12/21/70	DWR	Near Anderson, CA				9.00			
1/16/71	DWR	Near Anderson, CA				70.00			
11/30/73	DWR	Near Anderson, CA				22.00			
1/17/74	DWR	Near Anderson, CA				67.00			
1/18/74	DWR	Near Anderson, CA				116.00			
1/3/77	DWR	Near Anderson, CA				18.00			
5/12/77	DWR	Near Anderson, CA				19.00			
6/15/77	DWR	Near Anderson, CA				1.00			
6/28/77	DWR	Near Anderson, CA				1.00			
6/29/77	DWR	Near Anderson, CA				0.00	0.00		
6/30/77	DWR	Near Anderson, CA				1.00			
8/11/77	DWR	Near Anderson, CA				5.00, 4.00, 3.00, 2.00	4.00		
9/13/77	DWR	Near Anderson, CA				1.00			
9/14/77	DWR	Near Anderson, CA				1.00	1.00		
9/19/77	DWR	Near Anderson, CA				1.00			
11/7/77	DWR	Near Anderson, CA				1.00			
11/23/77	DWR	Near Anderson, CA				42.00			
12/2/77	DWR	Near Anderson, CA				4.00			
12/15/77	DWR	Near Anderson, CA				41.00			
1/10/78	DWR	Near Anderson, CA				28.00	28.00		
3/15/78	DWR	Near Anderson, CA				5.00			
5/11/78	DWR	Near Anderson, CA				1.00			
6/22/78	DWR	Near Anderson, CA				1.00, 1.00, 1.00			
6/23/78	DWR	Near Anderson, CA				1.00, 1.00			
8/16/78	DWR	Near Anderson, CA				1.00			
8/17/78	DWR	Near Anderson, CA				1.00, 1.00			
8/18/78	DWR	Near Anderson, CA				1.00, 1.00			
1/8/79	DWR	Near Anderson, CA				10.00	10.00		
1/12/79	DWR	Near Anderson, CA				14.00			
2/27/79	DWR	Near Anderson, CA				4.00			
3/1/79	DWR	Near Anderson, CA				11.00			
4/10/79	DWR	Near Anderson, CA				1.00, 1.00, 1.00, 1.00			
4/11/79	DWR	Near Anderson, CA				1.00, 1.00, 1.00			
1/14/80	DWR	Near Anderson, CA				23.00			
2/19/80	DWR	Near Anderson, CA				95.00			
1/27/81	DWR	Near Anderson, CA				43.00			
2/19/82	DWR	Near Anderson, CA				10.00			
12/22/82	DWR	Near Anderson, CA				12.00			
12/7/00	DWR	Near Anderson, CA	0.6					3.00	
1/8/01	DWR	Near Anderson, CA	2.7					4.00	110.00
2/5/01	DWR	Near Anderson, CA	1.5					<1.00	122.00
3/6/01	DWR	Near Anderson, CA	15					2.00	80.00
4/9/01	DWR	Near Anderson, CA	13					2.00	92.00

Table 5-11. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in the Main Stem of Bear Creek
(continued)

Date	Source	Sample Location	Turbidity (NTU)	Turbidity (Kit) (JTU)	Mineral Turbidity Hellige	Mineral Turbidity Hach	Nutrient Turbidity Hach	Total Susp. Solids	Total Dis. Solids
5/8/01	DWR	Near Anderson, CA	0.8					<1.00	121.00
6/4/01	DWR	Near Anderson, CA	0.5					<1.00	137.00
3/18/02	DWR	Near Anderson, CA						3.00	73.00
5/29/02	RWQCB	Highway 44 Bridge	1.84						
6/2/02	RWQCB	Highway 44 Bridge	1.10						
6/4/02	RWQCB	Highway 44 Bridge	1.28						
6/12/02	RWQCB	Highway 44 Bridge	0.87						
6/26/02	RWQCB	Highway 44 Bridge	0.96						
7/3/02	RWQCB	Highway 44 Bridge	0.65						
7/11/02	RWQCB	Highway 44 Bridge	0.68						
7/19/02	RWQCB	Highway 44 Bridge	0.84						
7/26/02	RWQCB	Highway 44 Bridge	1.51						
7/31/02	RWQCB	Highway 44 Bridge	0.94						
8/7/02	RWQCB	Highway 44 Bridge	0.93						
8/15/02	RWQCB	Highway 44 Bridge	1.03						
10/17/02	RWQCB	Highway 44 Bridge	0.48						
7/15/03	RWQCB	Highway 44 Bridge	7.19						
7/2/03	RWQCB	Highway 44 Bridge	7.19						
7/28/03	RWQCB	Highway 44 Bridge	0.78						
8/18/03	RWQCB	Highway 44 Bridge	1.12						
2/17/04	RWQCB	Highway 44 Bridge	3.34						
10/18/02	WWMD	Highway 44 Bridge	0.41	0 – 10					
10/15/03	WWMD	Highway 44 Bridge		0					
9/23/04	WWMD	Highway 44 Bridge	0.13						
5/29/02	RWQCB	Parkville Road Bridge	1.92						
6/4/02	RWQCB	Parkville Road Bridge	0.78						
6/12/02	RWQCB	Parkville Road Bridge	0.90						
6/20/02	RWQCB	Parkville Road Bridge	0.75						
6/26/02	RWQCB	Parkville Road Bridge	0.79						
7/3/03	RWQCB	Parkville Road Bridge	0.60						
7/11/02	RWQCB	Parkville Road Bridge	0.56						
7/19/02	RWQCB	Parkville Road Bridge	0.79						
7/26/02	RWQCB	Parkville Road Bridge	0.64						
7/31/02	RWQCB	Parkville Road Bridge	2.54						
8/7/02	RWQCB	Parkville Road Bridge	1.98						
8/15/02	RWQCB	Parkville Road Bridge	1.17						
10/17/02	RWQCB	Parkville Road Bridge	0.88						
1/15/03	RWQCB	Parkville Road Bridge	8.95						
7/2/03	RWQCB	Parkville Road Bridge	8.95						
7/28/03	RWQCB	Parkville Road Bridge	1.01						
2/17/04	RWQCB	Parkville Road Bridge	2.89						
10/18/02	WWMD	Parkville Road Bridge	0.46	0 – 10					
10/15/03	WWMD	Parkville Road Bridge		10					
9/23/04	WWMD	Parkville Road Bridge	0.27	10					

Value is within a range of concern and/or instrument calibration is uncertain.

Table 5-12 identifies those chemical constituents detected in water samples for which the California Department of Public Health and the federal EPA have established maximum contaminant levels. In addition, this table also lists the water quality objectives for some dissolved metals.

Table 5-12. Bear Creek Watershed Assessment 2005
Drinking Water Standards and Water Quality Objectives for Some Nutrients, Dissolved Organic Compounds,
and Dissolved Metals Identified in Water Samples Collected in Main Stem of Bear Creek

(Source: http://www.swrcb.ca.gov/rwqcb5/available_documents/wq_goals/limit_tables_2003.xls)

	<i>California</i>			<i>Federal</i>	
	<i>State Water Resources Control Board</i>	<i>Department of Public Health</i>		<i>Environmental Protection Agency</i>	
	Objectives (in mg/l) Identified in the Water Quality Control Plan	Primary MCL (mg/l)	Secondary MCL (mg/l)	Primary MCL (mg/l)	Secondary MCL (mg/l)
Nutrients					
Nitrate		45		10	
Nitrite		1		1	
Sulfate			250	500	250
Dissolved Metals					
Arsenic	0.01	0.05		0.01	
Aluminum		1	0.2		0.05 - 0.2
Cadmium	0.00022	0.005		0.005	
Chloride			250		250
Chromium		0.05		0.1	
Copper	0.0056	1.3	1	1.3	1
Fluoride		2		4	2
Iron	0.3		0.3		0.3
Lead	0.015	0.015		0.015	
Manganese	0.05		0.05		0.05
Nickel		0.1			
Selenium		0.05		0.05	
Silver	0.01		0.1		0.1
Zinc	0.016		5		
Dissolved Organic Compounds					
1,1,1,-Trichloroethane		0.2		0.2	
1,1,2,2-Tetrachloroethane		0.001			
1,1-Dichloroethane		0.005			
1,2,4-Trichlorobenzene		0.005		0.07	
1,2-Dibromoethane (EDB)		0.00005		0.00005	
1,2-Dichlorobenzene		0.6		0.6	0.01
1,2-Dichloroethane		0.0005		0.005	
1,2-Dichloropropane		0.005		0.005	
1,4-Dichlorobenzene		0.005		0.075	0.005
2,4,5-TP (Silvex)		0.05		0.05	
2,4-D		0.07		0.07	
Alachlor		0.002		0.002	
Aldicarb				0.003	
Aldicarb sulfone				0.003	
Aldicarb sulfoxide				0.004	
Atrazine		0.001		0.003	
BHC-gamma (Lindane)		0.0002		0.0002	
Benzene		0.001		0.005	
Bromodichloromethane		0.1		0.08	
Bromoform		0.1		0.08	
Carbofuran		0.018		0.04	
Carbon tetrachloride		0.0005		0.005	
Chlordane		0.0001		0.002	
Chlorobenzene		0.07		0.1	
Chloroform		0.1		0.08	
Dibromochloromethane		0.1		0.08	
Dinoseb (DNPB)		0.007		0.007	

Table 5-12. Bear Creek Watershed Assessment 2005
Drinking Water Standards and Water Quality Objectives for Some Nutrients, Dissolved Organic Compounds,
and Dissolved Metals Identified in Water Samples Collected in Main Stem of Bear Creek
 (Source: http://www.swrcb.ca.gov/rwqcb5/available_documents/wq_goals/limit_tables_2003.xls)

(continued)

	<i>California</i>			<i>Federal</i>	
	<i>State Water Resources Control Board</i>	<i>Department of Public Health</i>		<i>Environmental Protection Agency</i>	
	Objectives (in mg/l) Identified in the Water Quality Control Plan	Primary MCL (mg/l)	Secondary MCL (mg/l)	Primary MCL (mg/l)	Secondary MCL (mg/l)
Dissolved Organic Compounds					
Endrin		0.002		0.002	
Ethyl benzene		0.3		0.7	0.03
Glyphosate		0.7		0.7	
Heptachlor		0.00005		0.0004	
Heptachlor epoxide		0.00005		0.0002	
Methoxychlor		0.03		0.04	
Methyl tert-butyl ether (MTBE)		0.013	0.005		
Oxamyl		0.05		0.2	
PCB-1016		0.0005		0.0005	
PCB-1221		0.0005		0.0005	
PCB-1232		0.0005		0.0005	
PCB-1242		0.0005		0.0005	
PCB-1248		0.0005		0.0005	
PCB-1254		0.0005		0.0005	
PCB-1260		0.0005		0.0005	
Pentachlorophenol (PCP)		0.001		0.001	
Picloram		0.5		0.5	
Simazine		0.004		0.004	
Styrene		0.1		0.1	0.01
Thiobencarb		0.07	0.001		
Toluene		0.15		1	0.04
Toxaphene		0.003		0.003	
Vinyl chloride		0.0005		0.002	

NORTH FORK BEAR CREEK

Water Temperature. The RWQCB monitored water temperature in North Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, water temperature was measured in North Fork Bear Creek, beneath the Ponderosa Way Bridge, and above and below the confluence with Dickerson Creek. Measurements of water temperature are presented in Table 5-13.

Table 5-13. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in North Fork Bear Creek

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>Water Temperature (°F)</i>	<i>Water Temperature (Kit) (°F)</i>
5/29/02	RWQCB	Beneath Ponderosa Way Bridge	62.5	
6/4/02	RWQCB	Beneath Ponderosa Way Bridge	62.7	
6/12/02	RWQCB	Beneath Ponderosa Way Bridge	58.6	
6/20/02	RWQCB	Beneath Ponderosa Way Bridge	58.9	
6/26/02	RWQCB	Beneath Ponderosa Way Bridge	67.5	
7/3/02	RWQCB	Beneath Ponderosa Way Bridge	69.1	
7/11/02	RWQCB	Beneath Ponderosa Way Bridge	66.4	
7/19/02	RWQCB	Beneath Ponderosa Way Bridge	70.2	
7/26/02	RWQCB	Beneath Ponderosa Way Bridge	66.6	

Table 5-13. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in North Fork Bear Creek
(continued)

Date	Source	Location	Water Temperature (°F)	Water Temperature (Kit) (°F)
7/31/02	RWQCB	Beneath Ponderosa Way Bridge	70.7	
8/7/02	RWQCB	Beneath Ponderosa Way Bridge	63.4	
8/15/02	RWQCB	Beneath Ponderosa Way Bridge	63.4	
10/17/02	RWQCB	Beneath Ponderosa Way Bridge	49.0	
7/2/03	RWQCB	Beneath Ponderosa Way Bridge	55.0	
10/18/02	WWMD	Beneath Ponderosa Way Bridge	49.1	64.4
10/15/03	WWMD	Beneath Ponderosa Way Bridge	48.56	50.0
9/23/04	WWMD	Beneath Ponderosa Way Bridge	52.7	57.2
10/18/02	WWMD	Above Confl. With Dickerson Ck.		64.4
10/15/03	WWMD	Above Confl. With Dickerson Ck.		50.0
9/23/04	WWMD	Above Confl. With Dickerson Ck.	52.7	
10/18/02	WWMD	Below Confl. With Dickerson Ck.		64.4
10/15/03	WWMD	Below Confl. With Dickerson Ck.		53.6
9/23/04	WWMD	Below Confl. With Dickerson Ck.		

Bacteria. The RWQCB monitored levels of coliforms in North Fork Bear Creek in 1996, 2002, 2003, and 2004. Samples were collected near Di Hill and beneath the Ponderosa Way Bridge. The RWQCB used Basic Lab to analyze water samples collected at these locations in 2002 and 2003. Measurements of coliforms are presented in Table 5-14.

Table 5-14. Bear Creek Watershed Assessment 2005
Measurements of Coliforms in North Fork Bear Creek

Date	Sample Location	RWQCB Data			RWQCB/ Basic Lab		
		Total Coliform (MPN)	Fecal Coliform (MPN)	Ratio Total to Fecal	Total Coliform (MPN/ 100 ml)	Fecal Coliform (MPN/100 ml)	E. coli (MPN/ 100 ml)
6/18/96	Near Di Hill	190	70	2.71			
6/18/96	Near Di Hill	500	170	2.94			
5/15/02	Near Di Hill				900	30	
5/24/02	Near Di Hill				1,300		59
5/29/02	Ponderosa Way Bridge	1,120	276		>2,400		345
6/4/02	Ponderosa Way Bridge	> 2,400	921		>2,400		727
6/12/02	Ponderosa Way Bridge	> 2,400	387		>2,400		225
6/20/02	Ponderosa Way Bridge	1,300	179				
6/26/02	Ponderosa Way Bridge	2,400	201				
6/27/03	Ponderosa Way Bridge				>2,419		1,550
6/28/03	Ponderosa Way Bridge	> 2,400	133.3				
9/26/03	Ponderosa Way Bridge	1,414	727				
2/17/04	Ponderosa Way Bridge	1,733	55				

Value exceeds the Water Quality Control Plan objective for total coliform MPN ($x < 2,300$), fecal coliform MPN ($x < 200/100$ mL), and *E. coli* MPN (126/100 mL).

Dissolved Oxygen. The RWQCB monitored the concentration of dissolved oxygen in North Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, dissolved oxygen was measured in North Fork Bear Creek, beneath the Ponderosa Way Bridge and above and below the confluence with Dickerson Creek. Measurements of dissolved oxygen are presented in Table 5-15.

**Table 5-15. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen in North Fork Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>Dissolved Oxygen (mg/l)</i>	<i>Dissolved Oxygen (Kit) (ppm)</i>
5/29/02	RWQCB	Ponderosa Way Bridge	3.5	
6/4/02	RWQCB	Ponderosa Way Bridge	7.9	
6/12/02	RWQCB	Ponderosa Way Bridge	8.9	
6/20/02	RWQCB	Ponderosa Way Bridge	7.1	
6/26/02	RWQCB	Ponderosa Way Bridge	6.3	
7/3/02	RWQCB	Ponderosa Way Bridge	6.1	
7/11/02	RWQCB	Ponderosa Way Bridge	7.0	
7/19/02	RWQCB	Ponderosa Way Bridge	2.9	
7/26/02	RWQCB	Ponderosa Way Bridge	7.8	
7/31/02	RWQCB	Ponderosa Way Bridge	8.0	
8/7/02	RWQCB	Ponderosa Way Bridge	9.0	
8/15/02	RWQCB	Ponderosa Way Bridge	8.2	
10/17/02	RWQCB	Ponderosa Way Bridge	10.0	
7/2/03	RWQCB	Ponderosa Way Bridge	9.0	
8/18/03	RWQCB	Ponderosa Way Bridge	8.63	
10/18/02	WWMD	Ponderosa Way Bridge	10.5	6.0
10/15/03	WWMD	Ponderosa Way Bridge	10.9	7.0
9/23/04	WWMD	Ponderosa Way Bridge	8.6	4.0
10/18/02	WWMD	Above Confl. With Dickerson Ck.		8.0
10/15/03	WWMD	Above Confl. With Dickerson Ck.		6.5
9/23/04	WWMD	Above Confl. With Dickerson Ck.		4.0
10/18/02	WWMD	Below Confl. With Dickerson Ck.		8.0
10/15/03	WWMD	Below Confl. With Dickerson Ck.		5.0

Value is less than the Water Quality Control Plan objective ($x > 5.0$ mg/L).

pH. The RWQCB monitored pH in North Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, pH was measured in North Fork Bear Creek, beneath the Ponderosa Way Bridge, and above and below the confluence with Dickerson Creek. Measurements of pH are presented in Table 5-16.

**Table 5-16. Bear Creek Watershed Assessment 2005
Measurements of pH in North Fork Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>pH</i>	<i>pH (Kit)</i>
5/29/02	RWQCB	Ponderosa Way Bridge	8.26	
6/4/02	RWQCB	Ponderosa Way Bridge	8.03	
6/12/02	RWQCB	Ponderosa Way Bridge	7.49	
6/20/02	RWQCB	Ponderosa Way Bridge	7.12	
6/26/02	RWQCB	Ponderosa Way Bridge	7.83	
7/3/02	RWQCB	Ponderosa Way Bridge	7.91	
7/11/02	RWQCB	Ponderosa Way Bridge	7.07	
7/19/02	RWQCB	Ponderosa Way Bridge	8.30	
7/26/02	RWQCB	Ponderosa Way Bridge	7.72	

**Table 5-16. Bear Creek Watershed Assessment 2005
Measurements of pH in North Fork Bear Creek
(continued)**

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>pH</i>	<i>pH (Kit)</i>
7/31/02	RWQCB	Ponderosa Way Bridge	8.32	
8/7/02	RWQCB	Ponderosa Way Bridge	8.29	
8/15/02	RWQCB	Ponderosa Way Bridge	7.70	
10/17/02	RWQCB	Ponderosa Way Bridge	8.50	
7/2/03	RWQCB	Ponderosa Way Bridge	6.90	
8/18/03	RWQCB	Ponderosa Way Bridge	7.70	
10/18/02	WWMD	Ponderosa Way Bridge	7.75	7.75
10/15/03	WWMD	Ponderosa Way Bridge	7.79	7.50
9/23/04	WWMD	Ponderosa Way Bridge	8.20	8.00
10/18/02	WWMD	Above Confl. With Dickerson Ck.		8.0
10/15/03	WWMD	Above Confl. With Dickerson Ck.		7.0
9/23/04	WWMD	Above Confl. With Dickerson Ck.		8.0
10/18/02	WWMD	Below Confl. With Dickerson Ck.		7.0
10/15/03	WWMD	Below Confl. With Dickerson Ck.		8.0

Nutrients. The RWQCB monitored the concentration of ammonia, nitrate, and phosphorus in North Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. Measurements of nutrients are presented in Table 5-17.

**Table 5-17. Bear Creek Watershed Assessment 2005
Measurements of Nutrients in North Fork Bear Creek
Beneath Ponderosa Way Bridge by the RWQCB**

<i>Date</i>	<i>Ammonia</i>	<i>Nitrate</i>	<i>Phosphorus</i>
6/4/02	0.06		0.29
6/12/02	0.11		0.17
6/20/02	0.06	0.05	0.2
6/27/03	< 0.02	< 0.05	0.03

Conductivity, Specific Conductance, and Salinity. The RWQCB monitored conductivity levels in North Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. Conductivity, specific conductance, and salinity were measured in North Fork Bear Creek at the same location on WWMD in 2002, 2003, and 2004. These measurements are presented in Table 5-18.

Table 5-18. Bear Creek Watershed Assessment 2005 Measurements of Conductivity, Specific Conductance, and Salinity in North Fork Bear Creek at Ponderosa Way Bridge				
<i>Date</i>	<i>Source</i>	<i>Conductivity (μmhos/cm)</i>	<i>Specific Conductance (μmhos/cm)</i>	<i>Salinity (ppt)</i>
5/29/02	RWQCB	103		
6/4/02	RWQCB	130		
6/12/02	RWQCB	123		
6/20/02	RWQCB	128		
6/26/02	RWQCB	130		
7/3/02	RWQCB	132		
7/11/02	RWQCB	138		
7/19/02	RWQCB	143		
7/26/02	RWQCB	138		
7/31/02	RWQCB	147		

Table 5-18. Bear Creek Watershed Assessment 2005 Measurements of Conductivity, Specific Conductance, and Salinity in North Fork Bear Creek at Ponderosa Way Bridge <i>(Continued)</i>				
<i>Date</i>	<i>Source</i>	<i>Conductivity</i> ($\mu\text{mhos/cm}$)	<i>Specific</i> <i>Conductance</i> ($\mu\text{mhos/cm}$)	<i>Salinity</i> (ppt)
8/7/02	RWQCB	151		
8/15/02	RWQCB	154		
10/17/02	RWQCB	106		
7/2/03	RWQCB	81		
8/18/03	RWQCB	112		
10/18/02	WWMD	180.4	127.0	0.1
10/15/03	WWMD	160.3	112.0	0.1
9/23/04	WWMD	168.7	124.7	0.1

Turbidity. The RWQCB monitored turbidity in North Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, turbidity was measured in North Fork Bear Creek beneath the Ponderosa Way bridge, and above and below the confluence with Dickerson Creek. Measurements of turbidity are presented in Table 5-19.

Table 5-19. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in North Fork Bear Creek

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>Turbidity</i> (NTU)	<i>Turbidity (Kit)</i> (JTU)
5/29/02	RWQCB	Ponderosa Way Bridge	2.34	
6/4/02	RWQCB	Ponderosa Way Bridge	1.75	
6/12/02	RWQCB	Ponderosa Way Bridge	1.45	
6/20/02	RWQCB	Ponderosa Way Bridge	1.24	
6/26/02	RWQCB	Ponderosa Way Bridge	2.39	
7/3/02	RWQCB	Ponderosa Way Bridge	1.99	
7/11/02	RWQCB	Ponderosa Way Bridge	1.46	
7/19/02	RWQCB	Ponderosa Way Bridge	2.06	
7/26/02	RWQCB	Ponderosa Way Bridge	1.21	
7/31/02	RWQCB	Ponderosa Way Bridge	2.51	
8/7/02	RWQCB	Ponderosa Way Bridge	1.05	
8/15/02	RWQCB	Ponderosa Way Bridge	1.97	
10/17/02	RWQCB	Ponderosa Way Bridge	0.78	
1/15/03	RWQCB	Ponderosa Way Bridge	7.37	
7/2/03	RWQCB	Ponderosa Way Bridge	7.37	
8/18/03	RWQCB	Ponderosa Way Bridge	1.99	
10/18/02	WWMD	Ponderosa Way Bridge	0.82	0 – 10
10/15/03	WWMD	Ponderosa Way Bridge		8
9/23/04	WWMD	Ponderosa Way Bridge	7.61	20
10/18/02	WWMD	Above Confl. With Dickerson Ck.		0 – 10
10/15/03	WWMD	Above Confl. With Dickerson Ck.		0
9/23/04	WWMD	Above Confl. With Dickerson Ck.		0
10/18/02	WWMD	Below Confl. With Dickerson Ck.		0 – 10
10/15/03	WWMD	Below Confl. With Dickerson Ck.		0

Value is within a range of concern and/or instrument calibration is uncertain.

SOUTH FORK BEAR CREEK

Water Temperature. The RWQCB monitored water temperature in South Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, water temperature was measured in South Fork Bear Creek near Hundred Road. Measurements of water temperature are presented in Table 5-20.

**Table 5-20. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in South Fork Bear Creek**

Date	Source	Location	Water Temperature (°F)	Water Temperature (Kit) (°F)
5/29/02	RWQCB	Ponderosa Way Bridge	59.9	
6/4/02	RWQCB	Ponderosa Way Bridge	61.9	
6/12/02	RWQCB	Ponderosa Way Bridge	56.7	
6/20/02	RWQCB	Ponderosa Way Bridge	57.1	
6/26/02	RWQCB	Ponderosa Way Bridge	61.9	
7/3/02	RWQCB	Ponderosa Way Bridge	64.0	
7/11/02	RWQCB	Ponderosa Way Bridge	62.1	
7/19/02	RWQCB	Ponderosa Way Bridge	63.3	
7/26/02	RWQCB	Ponderosa Way Bridge	61.5	
7/31/02	RWQCB	Ponderosa Way Bridge	62.9	
8/7/02	RWQCB	Ponderosa Way Bridge	60.1	
8/15/02	RWQCB	Ponderosa Way Bridge	58.4	
10/17/02	RWQCB	Ponderosa Way Bridge	50.2	
7/2/03	RWQCB	Ponderosa Way Bridge	54.3	
10/18/02	WWMD	Hundred Road	48.2	64.4
10/15/03	WWMD	Hundred Road	48.02	50.0
9/23/04	WWMD	Hundred Road	50.2	51.8

Bacteria. The RWQCB monitored the levels of coliforms in South Fork Bear Creek in 1996, 2002, 2003, and 2004. Samples were collected from five locations: along Ritts Mill Road, along Crooks Springs Road, along Inwood Road, near Bear Creek Falls, and beneath the Ponderosa Way Bridge. The RWQCB used Basic Lab to analyze water samples collected beneath Ponderosa Way Bridge in 2002 and 2003. Measurements of coliforms are presented in Table 5-21.

**Table 5-21. Bear Creek Watershed Assessment 2005
Measurements of Coliforms in South Fork Bear Creek**

Year	Sample Location	RWQCB Data			RWQCB/ Basic Lab		
		Total Coliform (MPN/100 ml)	Fecal Coliform (MPN/100 ml)	Ratio Total to Fecal	Total Coliform (MPN/100 ml)	Fecal Coliform (MPN/100 ml)	E. coli (MPN/100 ml)
6/18/96	Ritts Mill Road	280	120	2.33			
6/18/96	Ritts Mill Road	220	110	2.00			
6/18/96	Crooks Springs Road	6	< 2				
6/18/96	Crooks Springs Road	2	< 2				
6/18/96	Inwood Road	80	50	1.60			
6/18/96	Inwood Road	130	17	7.65			
6/18/96	Near Bear Creek Falls	> 1,600	500				
6/18/96	Near Bear Creek Falls	90	240	0.38			
5/15/02	Ponderosa Way Bridge				1,600	4	
5/24/02	Ponderosa Way Bridge				204		6
5/29/02	Ponderosa Way Bridge	488	117		2,400		66
6/4/02	Ponderosa Way Bridge	> 2,400	308		2,400		228

**Table 5-21. Bear Creek Watershed Assessment 2005
Measurements of Coliforms in South Fork Bear Creek**
(continued)

Year	Sample Location	RWQCB Data			RWQCB/ Basic Lab		
		Total Coliform (MPN/100 ml)	Fecal Coliform (MPN/100 ml)	Ratio Total to Fecal	Total Coliform (MPN/100 ml)	Fecal Coliform (MPN/100 ml)	E. coli (MPN/100 ml)
6/12/02	Ponderosa Way Bridge	435	140		1,730		108
6/20/02	Ponderosa Way Bridge	548	44				
6/26/02	Ponderosa Way Bridge	> 2,400	99				
6/27/03	Ponderosa Way Bridge				1,730		20
7/28/03	Ponderosa Way Bridge	1,299.7	40.8				
8/18/03	Ponderosa Way Bridge	186	15.6				
9/26/03	Ponderosa Way Bridge	488	47				
2/17/04	Ponderosa Way Bridge	140	8				

Value exceeds the Water Quality Control Plan objective for total coliform MPN ($x < 2,300$).

Dissolved Oxygen. The RWQCB monitored the concentration of dissolved oxygen in South Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, dissolved oxygen was measured in South Fork Bear Creek near Hundred Road. Measurements of dissolved oxygen are presented in Table 5-22.

**Table 5-22. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen in South Fork Bear Creek**

Date	Source	Location	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)
5/29/02	RWQCB	Ponderosa Way Bridge	6.0	
6/4/02	RWQCB	Ponderosa Way Bridge	7.4	
6/12/02	RWQCB	Ponderosa Way Bridge	8.2	
6/20/02	RWQCB	Ponderosa Way Bridge	8.6	
6/26/02	RWQCB	Ponderosa Way Bridge	8.4	
7/3/02	RWQCB	Ponderosa Way Bridge	7.0	
7/11/02	RWQCB	Ponderosa Way Bridge	8.5	
7/19/02	RWQCB	Ponderosa Way Bridge	3.8	
7/26/02	RWQCB	Ponderosa Way Bridge	11.1	
7/31/02	RWQCB	Ponderosa Way Bridge	9.5	
8/7/02	RWQCB	Ponderosa Way Bridge	9.0	
8/15/02	RWQCB	Ponderosa Way Bridge	8.7	
10/17/02	RWQCB	Ponderosa Way Bridge	10.0	
7/2/03	RWQCB	Ponderosa Way Bridge	10.0	
8/18/03	RWQCB	Ponderosa Way Bridge	9.09	
10/18/02	WWMD	Hundred Road	10.6	4.0
10/15/03	WWMD	Hundred Road	10.5	5.0
9/23/04	WWMD	Hundred Road	9.0	1.0

Value is less than the Water Quality Control Plan objective ($x > 5.0$ mg/L).

pH. The RWQCB monitored pH in South Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, pH was measured in South Fork Bear Creek near Hundred Road. These measurements are presented in Table 5-23.

**Table 5-23. Bear Creek Watershed Assessment 2005
Measurements of pH in South Fork Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>pH</i>	<i>pH (Kit)</i>
5/29/02	RWQCB	Ponderosa Way Bridge	8.23	
6/4/02	RWQCB	Ponderosa Way Bridge	8.22	
6/12/02	RWQCB	Ponderosa Way Bridge	7.92	
6/20/02	RWQCB	Ponderosa Way Bridge	7.32	
6/26/02	RWQCB	Ponderosa Way Bridge	7.85	
7/3/02	RWQCB	Ponderosa Way Bridge	7.98	
7/11/02	RWQCB	Ponderosa Way Bridge	7.98	
7/19/02	RWQCB	Ponderosa Way Bridge	8.24	
7/26/02	RWQCB	Ponderosa Way Bridge	8.07	
7/31/02	RWQCB	Ponderosa Way Bridge	8.42	
8/7/02	RWQCB	Ponderosa Way Bridge	8.48	
8/15/02	RWQCB	Ponderosa Way Bridge	7.96	
10/17/02	RWQCB	Ponderosa Way Bridge	8.10	
7/2/03	RWQCB	Ponderosa Way Bridge	7.0	
8/18/03	RWQCB	Ponderosa Way Bridge	7.5	
10/18/02	WWMD	Hundred Road	7.59	6.5
10/15/03	WWMD	Hundred Road	6.63	7.5
9/23/04	WWMD	Hundred Road	8.10	7.00

Nutrients. The RWQCB monitored the concentration of ammonia, nitrate, and phosphorus in South Fork Bear Creek in 2002 and 2003. Water samples were collected beneath the Ponderosa Way Bridge and are presented in Table 5-24.

**Table 5-24. Bear Creek Watershed Assessment 2005
Measurements of Nutrients in South Fork Bear Creek
Beneath Ponderosa Way Bridge by the RWQCB**

<i>Date</i>	<i>Ammonia</i>	<i>Nitrate</i>	<i>Phosphorus</i>
6/4/02	0.06	N	0.25
6/12/02	0.07	0.05	0.08
6/20/02	0.06	0.06	0.14
6/27/03	0.02	< 0.05	< 0.02

Conductivity, Specific Conductance, and Salinity. The RWQCB monitored conductivity levels in South Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, conductivity, specific conductance, and salinity were measured in South Fork Bear Creek near Hundred Road. These measurements are presented in Table 5-25.

**Table 5-25. Bear Creek Watershed Assessment 2005
Measurements of Conductivity, Specific Conductance, and Salinity
in South Fork Bear Creek**

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>Conductivity (μhos/cm)</i>	<i>Specific Conductance (μhos/cm)</i>	<i>Salinity (ppt)</i>
5/29/02	RWQCB	Ponderosa Way Bridge	95		
6/4/02	RWQCB	Ponderosa Way Bridge	122		
6/12/02	RWQCB	Ponderosa Way Bridge	110		
6/20/02	RWQCB	Ponderosa Way Bridge	112		
6/26/02	RWQCB	Ponderosa Way Bridge	110		
7/3/02	RWQCB	Ponderosa Way Bridge	114		
7/11/02	RWQCB	Ponderosa Way Bridge	110		
7/19/02	RWQCB	Ponderosa Way Bridge	112		

Table 5-25. Bear Creek Watershed Assessment 2005
Measurements of Conductivity, Specific Conductance, and Salinity
in South Fork Bear Creek
(continued)

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>Conductivity (μmhos/cm)</i>	<i>Specific Conductance (μmhos/cm)</i>	<i>Salinity (ppt)</i>
7/26/02	RWQCB	Ponderosa Way Bridge	121		
7/31/02	RWQCB	Ponderosa Way Bridge	115		
8/7/02	RWQCB	Ponderosa Way Bridge	122		
8/15/02	RWQCB	Ponderosa Way Bridge	128		
10/17/02	RWQCB	Ponderosa Way Bridge	101		
7/2/03	RWQCB	Ponderosa Way Bridge	86		
8/18/03	RWQCB	Ponderosa Way Bridge	108		
10/18/02	WWMD	Hundred Road	158.0	106.0	0.1
10/15/03	WWMD	Hundred Road	152.2	105.4	0.1
9/23/04	WWMD	Hundred Road	155.3	110.8	0.1

Turbidity. The RWQCB monitored turbidity in South Fork Bear Creek beneath the Ponderosa Way Bridge in 2002 and 2003. On WWMD in 2002, 2003, and 2004, turbidity was measured in South Fork Bear Creek near Hundred Road. Measurements of turbidity are presented in Table 5-26.

Table 5-26. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in South Fork Bear Creek

<i>Date</i>	<i>Source</i>	<i>Location</i>	<i>Turbidity (NTU)</i>	<i>Turbidity (Kit) (JTU)</i>
5/29/02	RWQCB	Ponderosa Way Bridge	2.18	
6/4/02	RWQCB	Ponderosa Way Bridge	1.76	
6/12/02	RWQCB	Ponderosa Way Bridge	1.94	
6/20/02	RWQCB	Ponderosa Way Bridge	1.76	
6/26/02	RWQCB	Ponderosa Way Bridge	1.74	
7/3/02	RWQCB	Ponderosa Way Bridge	1.44	
7/11/02	RWQCB	Ponderosa Way Bridge	1.31	
7/19/02	RWQCB	Ponderosa Way Bridge	1.43	
7/26/02	RWQCB	Ponderosa Way Bridge	1.52	
7/31/02	RWQCB	Ponderosa Way Bridge	1.36	
8/7/02	RWQCB	Ponderosa Way Bridge	1.09	
8/15/02	RWQCB	Ponderosa Way Bridge	1.29	
10/17/02	RWQCB	Ponderosa Way Bridge	1.18	
1/15/03	RWQCB	Ponderosa Way Bridge	2.88	
7/2/03	RWQCB	Ponderosa Way Bridge	2.88	
8/18/03	RWQCB	Ponderosa Way Bridge	0.8	
2/17/04	RWQCB	Ponderosa Way Bridge	2.34	
10/18/02	WWMD	Hundred Road	0.05	0 – 10
10/15/03	WWMD	Hundred Road		0
9/23/04	WWMD	Hundred Road	0.85	0

Value is within a range of concern and/or instrument calibration is uncertain.

DICKERSON CREEK

Water Temperature. Water temperature was measured in Dickerson Creek on WWMD in 2002, 2003, and 2004. Measurements of water temperature are presented in Table 5-27.

**Table 5-27. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in Dickerson Creek on WWMD**

10/18/02		10/15/03		9/23/04	
Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)
	64.4		50	55.4	

pH. Measurements of pH were taken in Dickerson Creek on WWMD in 2002, 2003, and 2004. Measurements of pH are presented in Table 5-28.

**Table 5-28. Bear Creek Watershed Assessment 2005
Measurements of pH in Dickerson Creek on WWMD**

10/18/02		10/15/03		9/23/04	
pH	pH (Kit)	pH	pH (Kit)	pH	pH (Kit)
	8.0		8.0		8.0

Dissolved Oxygen. Dissolved oxygen was measured in Dickerson Creek on WWMD in 2002, 2003, and 2004. Measurements of dissolved oxygen are presented in Table 5-29.

**Table 5-29. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen in Dickerson Creek on WWMD**

10/18/02		10/15/03		9/23/04	
Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)
	8.0		5.0		4.0

Turbidity. Turbidity was measured in Dickerson Creek on WWMD in 2002, 2003, and 2004. Measurements of turbidity are presented in Table 5-30.

**Table 5-30. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in Dickerson Creek on WWMD**

10/18/02		10/15/03		9/23/04	
Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)
	0 – 10		0		0

LACK CREEK

Water Temperature. Water temperature was measured in Lack Creek on WWMD in 2002, 2003, and 2004. Water samples were collected beneath the upper bridge on Dersch Road and are presented in Table 5-31.

Table 5-31. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in Lack Creek on WWMD
(Beneath Upper Bridge on Dersch Road)

10/18/02		10/15/03		9/23/04	
Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)
58.1	64.4	57.74	57.2	65.8	68

pH. Measurements of pH were taken in Lack Creek on WWMD in 2002, 2003, and 2004. Water samples were collected beneath the upper bridge on Dersch Road Creek and are presented in Table 5-32.

Table 5-32. Bear Creek Watershed Assessment 2005
Measurements of pH in Lack Creek on WWMD
(Beneath the Upper Bridge on Dersch Road)

10/18/02		10/15/03		9/23/04	
pH	pH (Kit)	pH	pH (Kit)	pH	pH (Kit)
8.58	8.25	8.14	8.2	8.5	8.5

Value is outside the Water Quality Control Plan objective range (6.5 – 8.5), but is not considered a concern.

Dissolved Oxygen. Dissolved oxygen was measured in Lack Creek on WWMD in 2002, 2003, and 2004. Water samples were collected beneath the upper bridge on Dersch Road and are presented in Table 5-33.

Table 5-33. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen in Lack Creek on WWMD
(Beneath the Upper Bridge on Dersch Road)

10/18/02		10/15/03		9/23/04	
Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)
9.9	8.0	9.1	8.0	7.3	4.0

Turbidity. Turbidity was measured in Lack Creek on WWMD in 2002, 2003, and 2004. Water samples were collected beneath the upper bridge on Dersch road and are presented in Table 5-34.

Table 5-34. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in Lack Creek on WWMD
(Beneath the Upper Bridge on Dersch Road)

10/18/02		10/15/03		9/23/04	
Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)
1.26	0 – 10		5	0.28	10

Salinity. Salinity, conductivity and specific conductivity were measured in Lack Creek on WWMD in 2002, 2003, and 2004. Water samples were collected beneath the upper bridge on Dersch road and are presented in Table 5-35.

Table 5-35. Bear Creek Watershed Assessment 2005
Measurements of Salinity, Conductivity and Specific Conductivity in Lack Creek on WWMD
 (Beneath the Upper Bridge on Dersch Road)

10/18/02			10/15/03			9/23/04		
Conductivity (μ hos/cm)	Specific conductivity (μ hos/cm)	Salinity (ppt)	Conductivity (μ hos/cm)	Specific Conductivity (μ hos/cm)	Salinity (ppt)	Conductivity (μ hos/cm)	Specific Conductivity (μ hos/cm)	Salinity (ppt)
288.4	230.4	0.1	278.4	221.5	0.1	238.6	229.3	0.1

SHERIDAN CREEK

Water Temperature. Water temperature was measured in Sheridan Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at three locations and measurements are presented in the Table 5-36.

Table 5-36. Bear Creek Watershed Assessment 2005
Measurements of Water Temperature in Sheridan Creek on WWMD

Location	10/18/02		10/15/03		9/23/04	
	Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)
Christian's	54.32	64.4	53.96	53.6	60.6	62.6
Sheridan Ditch at Eichelberger's	52.34	64.4	51.8	53.6	55.9	57.2
Hidden Creek Lane		64.4	71.6	71.6	57.2	59

pH. Measurements of pH were taken in Sheridan Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at three locations and measurements are presented in the Table 5-37.

Table 5-37. Bear Creek Watershed Assessment 2005
Measurements of pH in Sheridan Creek on WWMD

Location	10/18/02		10/15/03		9/23/04	
	pH	pH (Kit)	pH	pH (Kit)	pH	pH (Kit)
Christian's	8.16	8.50	8.02	8.2	8.20	8.00
Sheridan Ditch at Eichelberger's	8.14	8.25	7.81	8.0	8.00	8.30
Hidden Creek Lane		8.2	7.93	7.5	7.90	8.00

Dissolved Oxygen. Dissolved oxygen was measured in Sheridan Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at three locations and measurements are presented in the Table 5-38.

**Table 5-38. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen in Sheridan Creek on WWMD**

Location	10/18/02		10/15/03		9/23/04	
	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)
Christian's	10.2	7.0	10.2	6.0	9.5	3.0
Sheridan Ditch at Eichelberger's	10.0	8.0	10.5	7.9	9.5	5.0
Hidden Creek Lane		3.8	9.9	8.0	9.2	3.0

Turbidity. Turbidity was measured in Sheridan Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at three locations and measurements are presented in the Table 5-39.

**Table 5-39. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in Sheridan Creek on WWMD**

Location	10/18/02		10/15/03		9/23/04	
	Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)
Christian's	3.65	0 – 10	0	30	3.91	10
Sheridan Ditch at Eichelberger's	2.46	20		30	4.0	0.0
Hidden Creek Lane		30 – 35		20	1.03	0.0

Salinity. Salinity, conductivity, and specific conductivity were measured in Sheridan Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at three locations and measurements are presented in the Table 5-40.

**Table 5-40. Bear Creek Watershed Assessment 2005
Measurements of Salinity, Conductivity, and Specific Conductivity in Sheridan Creek on WWMD**

Location	10/18/02			10/15/03			9/23/04		
	Conductivity (μmhos/cm)	Specific conductivity (μmhos/cm)	Salinity (ppt)	Conductivity (μmhos/cm)	Specific Conductivity (μmhos/cm)	Salinity (ppt)	Conductivity (μmhos/cm)	Specific Conductivity (μmhos/cm)	Salinity (ppt)
Christian's	155.3	117.9	0.1	157.8	119.1	NA	157.5	130.0	0.1
Sheridan Ditch at Eichelberger's	166.4	122.7	0.1	162.4	118.7	0.1	159.3	123.7	0.1
Hidden Creek Lane				118.2	88.9	0.1	112.8	89.0	0.1

SNOW CREEK

Water Temperature. Water temperature was measured in Snow Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at Bonnie Craigs Ranch and measurements are presented in Table 5-41.

Table 5-41. Bear Creek Watershed Assessment 2005
Water Temperature in Snow Creek on WWMD
 (at Bonnie Craigs Ranch)

10/18/02		10/15/03		9/23/04	
Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)	Water Temperature (°F)	Water Temperature (Kit) (°F)
51.8	64.4	51.98	53.6	56.5	60.8

pH. Measurements of pH were taken in Snow Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at Bonnie Craigs Ranch and are presented in Table 5-42.

Table 5-42. Bear Creek Watershed Assessment 2005
Measurements of pH in Snow Creek on WWMD
 (at Bonnie Craigs Ranch)

10/18/02		10/15/03		9/23/04	
pH	pH (Kit)	pH	pH (Kit)	pH	pH (Kit)
8.18	8.25	7.67	7.5	8.10	8.00

Dissolved Oxygen. Dissolved oxygen was measured in Snow Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at Bonnie Craigs Ranch and are presented in Table 5-43.

Table 5-43. Bear Creek Watershed Assessment 2005
Measurements of Dissolved Oxygen in Snow Creek on WWMD
 (at Bonnie Craigs Ranch)

10/18/02		10/15/03		9/23/04	
Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)	Dissolved Oxygen (mg/l)	Dissolved Oxygen (Kit) (ppm)
10.0	7.7	9.2	7.5	9.5	4.0

Turbidity. Turbidity was measured in Snow Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at Bonnie Craigs Ranch and are presented in Table 5-44.

Table 5-44. Bear Creek Watershed Assessment 2005
Measurements of Turbidity in Snow Creek on WWMD
 (at Bonnie Craigs Ranch)

10/18/02		10/15/03		9/23/04	
Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)	Turbidity (NTU)	Turbidity (Kit) (JTU)
1.44	0 – 10		15	1.28	20

Salinity. Salinity, conductivity, and specific conductivity were measured in Snow Creek on WWMD in 2002, 2003, and 2004. Water samples were collected at Bonnie Craigs Ranch and are presented in Table 5-45.

Table 5-45. Bear Creek Watershed Assessment 2005
Measurements of Salinity, Conductivity, and Specific Conductivity in Snow Creek on WWMD
 (at Bonnie Craigs Ranch)

10/18/02			10/15/03			9/23/04		
Conductivity (μ mhos/cm)	Specific Conductivity (μ mhos/cm)	Salinity (ppt)	Conductivity (μ mhos/cm)	Specific Conductivity (μ mhos/cm)	Salinity (ppt)	Conductivity (μ mhos/cm)	Specific Conductivity (μ mhos/cm)	Salinity (ppt)
199.3	146.4	0.1	181.3	131.9	0.1	191.8	150.1	0.1

MACROINVERTEBRATE SAMPLING

Macroinvertebrates are among the most abundant forms of animal life in streams. They live under rocks, among algae, and plants, and play an important role in food webs.

The RWQCB sampled the main stem of Bear Creek, North Fork Bear Creek, and South Fork Bear Creek for macroinvertebrates in 2002. Macroinvertebrate sampling and data analysis followed the California Stream Bioassessment Protocol developed by the DFG. The RWQCB staff who collected macroinvertebrates had previously received one day of training by the personnel from the DFG. Samples were delivered to the DFG's Aquatic Bioassessment Laboratory in Chico, CA for analysis. This data is presented in Tables 5-46, 5-47, and 5-48.

Five metrics were selected for comparison of macroinvertebrate populations at sampling locations in the Bear Creek watershed: Taxonomic Richness, Ephemeroptera-Plecoptera-Trichoptera (EPT) Index, Shannon Diversity Index, and Percent Intolerant Taxa. Taxonomic Richness is a measure of the total number of different species present. The EPT index is the total number of species within the three most pollution-sensitive aquatic insect orders: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). As water quality diminishes, so does the EPT index. The Shannon Diversity Index is a measure of the number of species present relative to the number of individuals of each species. Percent Intolerant Taxa is a measure of the percentage of species present which are considered intolerant of pollution.

In regard to the macroinvertebrate data collected, one would expect stronger, more robust metrics for invertebrate populations at the upper watershed stations relative to the lower stations. This relationship is evident in the Bear Creek samples for Taxonomic Richness, Percent Intolerant Taxa, and Percent Tolerant Taxa. The Shannon Diversity Index and EPT Index were relatively constant at the four sampling locations. Macroinvertebrate data is most useful for comparing long-term trends at individual sites. Limited information and conclusions can be extracted from one sample set at one point in time. Caution must be used when comparing one site with another site because of possible differences in substrate and habitat. When compared to recent macroinvertebrate samples collected and community metrics collected in the adjacent Cow Creek watershed, the Bear Creek samples show macroinvertebrate communities which are equal to or better than samples collected in the Cow Creek watershed, with regard to abundance and species diversity.

Table 5-46. Bear Creek Watershed Assessment 2005
Macroinvertebrates Sampled in the Main Stem of Bear Creek, North Fork Bear Creek, and South Fork Bear Creek
by the RWQCB on June 11, 2002

	<i>North Fork Bear Creek</i>			<i>South Fork Bear Creek</i>			<i>Bear Creek at HWY 44</i>			<i>Bear Creek at Parkville Road</i>		
	<i>T1</i> <i>(#10145)</i>	<i>T2</i> <i>(#10146)</i>	<i>T3</i> <i>(#10147)</i>	<i>T1</i> <i>(#10148)</i>	<i>T2</i> <i>(#10149)</i>	<i>T3</i> <i>(#10150)</i>	<i>T1</i> <i>(#10151)</i>	<i>T2</i> <i>(#10152)</i>	<i>T3</i> <i>(#10153)</i>	<i>T1</i> <i>(#10153)</i>	<i>T2</i> <i>(#10153)</i>	<i>T3</i> <i>(#10153)</i>
Taxonomic Richness	36	38	43	36	38	46	33	31	22	34	22	25
Percent Dominant Taxon	28	41	25	17	15	12	25	26	39	25	37	22
Plecoptera Taxa	4	3	4	3	6	6	4	1	3	0	0	0
Trichoptera Taxa	11	8	9	8	8	10	7	7	4	7	7	7
EPT Taxa	21	17	18	19	22	26	16	14	12	13	11	11
EPT Index (%)	38	33	36	56	69	57	58	50	57	56	46	55
Sensitive EPT Index (%)	29	29	28	38	49	44	24	11	8	44	22	28
Shannon Diversity	2.8	2.5	2.9	3.0	3.1	3.3	2.9	2.6	2.1	2.6	2.1	2.5
Tolerance Value	4.3	4.6	4.3	3.7	3.2	3.5	4.0	4.3	4.7	4.3	4.8	4.6
Percent Baetidae	7	4	6	16	19	12	27	27	39	7	7	18
Percent Chironomidae	47	49	43	6	3	17	12	10	5	14	37	19
Percent Hydropsychidae	1	0	0	0	0	0	6	9	9	2	15	7
Percent Intolerant Taxa (0-2)	23	19	24	33	43	37	22	10	7	12	5	5
Percent Tolerant Taxa (8-10)	1	4	1	1	0	0	1	1	0	14	6	10
Percent Collectors	55	54	52	32	26	35	49	49	51	26	48	41
Percent Filterers	2	1	2	1	1	2	6	11	28	3	17	10
Percent Scrapers	18	10	20	30	41	29	27	30	16	3	2	8
Percent Predators	12	12	16	11	8	13	13	8	3	15	8	11
Percent Shredders	6	5	5	5	9	10	1	0	0	5	1	0
Abundance (#/sample)	2,040	930	1,522	851	403	1,221	1,097	355	5,416	2,003	1,637	2,207

**Table 5-47. Bear Creek Watershed Assessment 2005
Macroinvertebrates Sampled in the Main Stem of Bear Creek, North Fork Bear Creek,
and South Fork Bear Creek by the RWQCB on June 11, 2002**

	<i>North Fork</i>		<i>South Fork</i>		<i>Main Stem Bear Creek at HWY 44</i>		<i>Main Stem Bear Creek at Parkville Road</i>	
	<i>Mean</i>	<i>CV</i>	<i>Mean</i>	<i>CV</i>	<i>Mean</i>	<i>CV</i>	<i>Mean</i>	<i>CV</i>
Taxonomic Richness	29	0.20	27	0.23	39	0.09	40	0.13
Cululative Data	48		46		51		56	
Percent Dominant Taxon	30	0.25	28	0.29	32	0.27	15	0.19
EPT Taxa	14	0.14	12	0.10	19	0.11	22	0.16
EPT Index (%)	55	0.08	52	0.11	36	0.07	61	0.11
Sensitive EPT Index (%)	14	0.61	31	0.37	29	0.02	44	0.12
Cumulative EPT Taxa	23		16		22		28	
Shannon Diversity	2.5	0.14	2.4	0.12	2.7	0.07	3.1	0.05
Tolerance Value	4.3	0.08	4.6	0.05	4.4	0.04	3.5	0.08
Percent Chironomidae	9	0.40	23	0.53	46	0.06	9	0.85
Percent Intolerant Taxa (0-2)	13	0.64	8	0.54	22	0.11	38	0.13
Percent Tolerant Taxa (8-10)	1	0.57	10	0.41	2	0.94	1	0.83
Percent Collectors	49	0.03	38	0.29	54	0.03	31	0.13
Percent Filterers	15	0.75	10	0.71	2	0.39	1	0.59
Percent Scrapers	24	0.31	4	0.77	16	0.31	33	0.21
Percent Predators	8	0.63	11	0.33	13	0.18	11	0.27
Percent Shredders	0	1.00	2	1.15	5	0.08	8	0.31
Abundance (#/sample)	2,289		1,949		1,497		825	

Table 5-48. Bear Creek Watershed Assessment 2005
Macroinvertebrates Identified in the Main Stem of Bear Creek, North Fork Bear Creek, and South Fork Bear Creek
by the RWQCB on June 11, 2002

	Stage	TV	FFG ¹	North Fork Bear Creek			South Fork Bear Creek			Main Stem Bear Creek at HWY 44			Main Stem Bear Creek at Parkville Road		
				T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Arthropoda															
Insecta															
Coleoptera															
Elmidae															
<i>Microcyloepus</i> sp.	Adult	4	CG							7	16	13		1	1
<i>Narpus</i> sp.	Adult	4	CG						1	1					
<i>Optioservus</i> sp.	Adult	4	SC			2	1	3		5	3				
<i>Zaitzevia</i> sp.	Adult	4	SC	5	3	12	1	2		23	44	26		1	
<i>Ampumixis dispar</i>	Adult	4	CG			1	2	2	1						
<i>Ordobrevia nubifera</i>	Adult			1		1									
<i>Dubiraphia</i> sp.	Larvae	4	CG										1		
<i>Microcyloepus</i> sp.	Larvae	4	CG							2	1	3		3	
<i>Narpus</i> sp.	Larvae	4	CG				1								
<i>Optioservus</i> sp.	Larvae	4	SC		1		10	4	13			3	2		8
<i>Zaitzevia</i> sp.	Larvae	4	SC	15	9	14	4	5	1	13	19	5			
<i>Ampumixis dispar</i>	Larvae	4	CG	1		1	17	2	1						
Hydraenidae															
<i>Hydraena</i> sp.	Adult	5	SC	5	3	2		3							
Psephenidae															
<i>Eubrianax edwardsii</i>	Larvae	4	SC	2	1	4	6	13	5						
<i>Psephenus falli</i>	Larvae	4	SC							16	22	8			1
Diptera															
Ceratopogonidae															
<i>Bezzia</i> / <i>Palpomyia</i>		6	P			1					1				1
Chironomidae		6	CG								31	15	43	112	59
Chironominae															
Chironomini		5	CG	33	10	26			3	7					
Tanytarsini		6	CG	90	128	80	12		21	21					
Diamesinae		2	CG					2							
Orthocladiinae		5	CG	24	9	27	5	6	27	8					
Tanypodinae		7	P	3	5	3	3	1	1						
Empididae															
<i>Chelifera</i> / <i>Metachela</i>							2								
<i>Neoplasta</i> sp.		6	P		1										
<i>Wiedemannia</i> sp.		6	P				1								
Empididae	Pupae										1				
Psychodidae															
<i>Maruina lanceolata</i>		2	SC			1									

Simuliidae														
<i>Simulium</i> sp.	6	CF	3	2	1		2	5		3	54	2	2	6
Stratiomyidae														
<i>Caloparyphus</i> /									2	1				
<i>Euparyphus</i>														
<i>Euparyphus</i> sp.	8	CG											1	3
<i>Nemotelus</i> sp.	8	CG										1		
Tipulidae														
<i>Antocha</i> sp.	3	CG								5	2	1	4	
<i>Dicranota</i> sp.	3	P			2		1							
Tipulidae					1									
Ephemeroptera														
Ameletidae														
<i>Ameletus</i> sp.	0	CG				4		1						
Baetidae	4	G										2		
<i>Baetis</i> sp.	5	CG	21	10	15	41	46	33	76	82	118	1	8	8
<i>Centroptilum</i> sp.	2	CG										3		
<i>Dipheter hageni</i>	5	CG	3	1	3	10	11	2	8	3	1			
<i>Fallceon quilleri</i>	4	CG										15	14	48
Ephemerellidae														
<i>Drunella</i> sp.	0	CG				4	2	1						
<i>Serratella</i> sp.	2	CG		6	2				11	9	2			
Heptageniidae														
<i>Cinygma</i> sp.	2	SC				1	1	5						
<i>Epeorus</i> sp.	0	SC	24	10	19	46	33	35	23	4	5			
<i>Ironodes</i> sp.	3	SC	2				8	11						
<i>Leucrocuta</i> sp.	1	g										18	3	
<i>Nixe</i> sp.	2	g	3	10				4						
<i>Rhithrogena</i> sp.	0	SC				4	8	1	2					
Isonychiidae														
<i>Isonychia velma</i>	2	CF									4			
Leptohyphidae														
<i>Tricorythodes</i> sp.	4	CG								2		9	2	4
Leptophlebiidae														
<i>Paraleptophlebia</i> sp.	4	CG	2	2	3	6	2	5		1				
Hemiptera														
Corixidae	10	P										2		
Naucoridae														
<i>Ambrysus</i> sp.	5	P								1		26	22	22
Megaloptera														
Corydalidae														
<i>Corydalus</i> sp.	0	P							1	1				
<i>Orohermes</i>	0	P		1	2	3	3	2						
<i>crepusculus</i>														

[illegible]

Hydropsychidae													
<i>Cheumatopsyche</i> sp.	5	CF						1			1		
<i>Hydropsyche</i> sp.	4	CF	2		1		1	1	17	28	26	6	47 23
Hydroptilidae													
<i>Neotrichia</i> sp.	4	SC	1		2					1			
<i>Ochrotrichia</i> sp.	4	PH							1		5		
Lepidostomatidae													
<i>Leptidosoma</i> sp.	1	SH	3	7	3	2	1	4				17	4 1
Leptocercidae													
<i>Nectopsyche</i> sp.	3	OM										23	1 3
Limnephilidae													
<i>Discomoeus</i> sp.	1	OM	1	1						1			
Odontoceridae													
<i>Marilia flexuosa</i>												1	
Philopotamidae													
<i>Chimarra</i> sp.	4	CF							1	3			2 1
<i>Wormaldia</i> sp.	3	CF	1	1	5								
Polycentropodidae													
<i>Polycentropus</i> sp.	6	P				1		1				2	
Rhyacophilidae													
<i>Rhyacophila</i> sp.	0	P	4	1	1	1	3	3	3	6			
Sericostomatidae													
<i>Gumaga</i> sp.	3	SH				6	9	3					
Uenoidae													
<i>Neophylax</i> sp.	3	g	1	2		4	6	3	5	4	3		
Crustacea													
Malacostraca													
Amphipoda													
Crangonyctidae													
<i>Stygobromus</i> sp.	4	CG											2
Hyalellidae													
<i>Hyalella</i> sp.	8	CG										2	
Ostracoda	8	CG										1	
Chelicerata													
Arachnida													
Trombidiformes													
Eylidae													
<i>Eylais</i> sp.				1									
Hydryphantidae													
<i>Protzia</i> sp.	8	P	1										
Hygrobatidae													
<i>Atractides</i> sp.	8	P					1		1				
<i>Hygrobates</i> sp.	8	P		1	1							1	
Lebertiidae													
<i>Lebertia</i> sp.	8	P		1		1		1				2	2

Sperchontidae														
<i>Sperchon</i> sp.	8	P			1	1			2	3	1			5
Torrenticolidae														
<i>Testudacarus</i> sp.	5	P		1	1			1						
<i>Torrenticola</i> sp.	5	P	6	14	8	12		9		1	1			4
Annelida														
Clitellata														
Oligochaeta	5	CG	3	2	5		4	5	7	1	1	2	1	3
Lumbricina		CG					3	3						
Mollusca														
Bivalvia														
Veneroida														
Sphaeriidae														
<i>Pisidium</i> sp.	8	CF				2								
<i>Sphaerium</i> sp.	8	CG										2		
Gastropoda														
Basommatophora														
Physidae														
<i>Physa</i> sp.	8	g	1	9	1							31	16	23
Planorbidae														
<i>Gyraulus</i> sp.	8	SC										2	1	
<i>Planorbella</i> sp.	6	SC										4		3
Neotaenioglossa														
Pleuroceridae														
<i>Juga</i> sp.	7	g		1	1	54	35	19	5					
Platyhelminthes														
Turbellaria														
Tricladida														
Planariidae	4	P		1	1			1	3			3		
Total Organisms			322	310	314	319	302	301	307	311	305	313	304	318
Total Organisms Recovered			322	310	314	319	302	301	307	311	305	313	304	318
Extra Organisms			39	0	51	0	0	83	71	25	85	0	4	22
Total Picked (includes extras)			348	324	361	322	305	478	372	351	387	305	304	325
Grids Processed			0.5	1.0	1.5	3.0	3.0	3.0	1.0	2.0	0.5	1.3	0.8	1.3
Total Grids Possible			3.0	3.0	6.0	8.0	4.0	8.0	3.0	2.0	8.0	8.0	4.0	8.0
Sorted			300	300	300	300	300	300	300	300	300	300	300	300
Discards			0	0	0	0	0	0	0	0	0	0	0	0
Abundance (#/sample)			2,040	930	1,522	851	403	1,221	1,097	355	5,416	2,003	1,637	2,207
Average Abundance (#/sample)			1,497			825			2,289			1,949		

5.3. Ground Waters

WATER QUALITY OBJECTIVES FOR GROUNDWATER

The Water Quality Control Plan identifies water quality objectives for groundwaters for the following parameters: bacteria, chemical constituents, tastes and odors, and toxicity. Although no water quality information is available for groundwaters in the Bear Creek watershed, the water quality objectives for these parameters are described.

BACTERIA

The Water Quality Control Plan mandates that in groundwaters used for domestic and municipal supply, the most probable number of coliform organisms over any seven-day period shall not exceed 2.2/100 ml.

CHEMICAL CONSTITUENTS

The Water Quality Control Plan mandates that groundwaters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. Groundwaters designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels specified in the following provisions of Title 22 of the California Code of Regulations: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. In addition, the concentration of lead shall not exceed 0.015 mg/l.

TASTES AND ODORS

The Water Quality Control Plan mandates that groundwaters shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

TOXICITY

The Water Quality Control Plan mandates that groundwaters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial uses.

5.4. Conclusions

Several water quality parameters were identified as potentially exceeding the state standard or as being within a range of concern in several streams in the Bear Creek watershed. In the main stem of Bear Creek these include water temperature, bacteria, dissolved oxygen, and some dissolved metals (e.g., arsenic, cadmium, copper, iron, manganese, and zinc). In North Fork Bear Creek, these include fecal coliforms and dissolved oxygen. In South Fork Bear Creek, these include fecal coliforms and dissolved oxygen. These parameters should be further investigated, as meeting water quality standards is important for maintaining healthy ecosystems, which have a direct bearing on human health.

Water quality of surface waters in the Bear Creek watershed is affected by a variety of different land uses. Poor development planning and road construction have the potential

to adversely affect water quality. Unrestricted grazing near streams can erode stream banks and introduce large amounts of sediments into the stream. Livestock defecating along or in streams can degrade water quality by introducing fecal coliforms into the water. Timber harvesting on steep slopes near streams and road construction can disturb the soil enough so that run-off from rainfall carries sediment into streams. Prescribed fires remove most vegetation from the soil, making it more susceptible to erosion and entry into nearby streams. There are several adverse effects of sediment entering a stream. It can degrade important spawning habitat for fish and amphibians. Suspended sediments make the water turbid and unsightly.

Water quality of groundwater in the Bear Creek watershed is affected by natural conditions that exist. The watershed has a variety of geologic rock units, each with a different chemical composition and erodibility. Water percolating through these easily erodible rock units will leech large amounts of minerals and produce what is called a "hard water". Although some springs and wells in the watershed are known to have hard water, no comprehensive sampling of groundwater has been conducted.

5.5. References

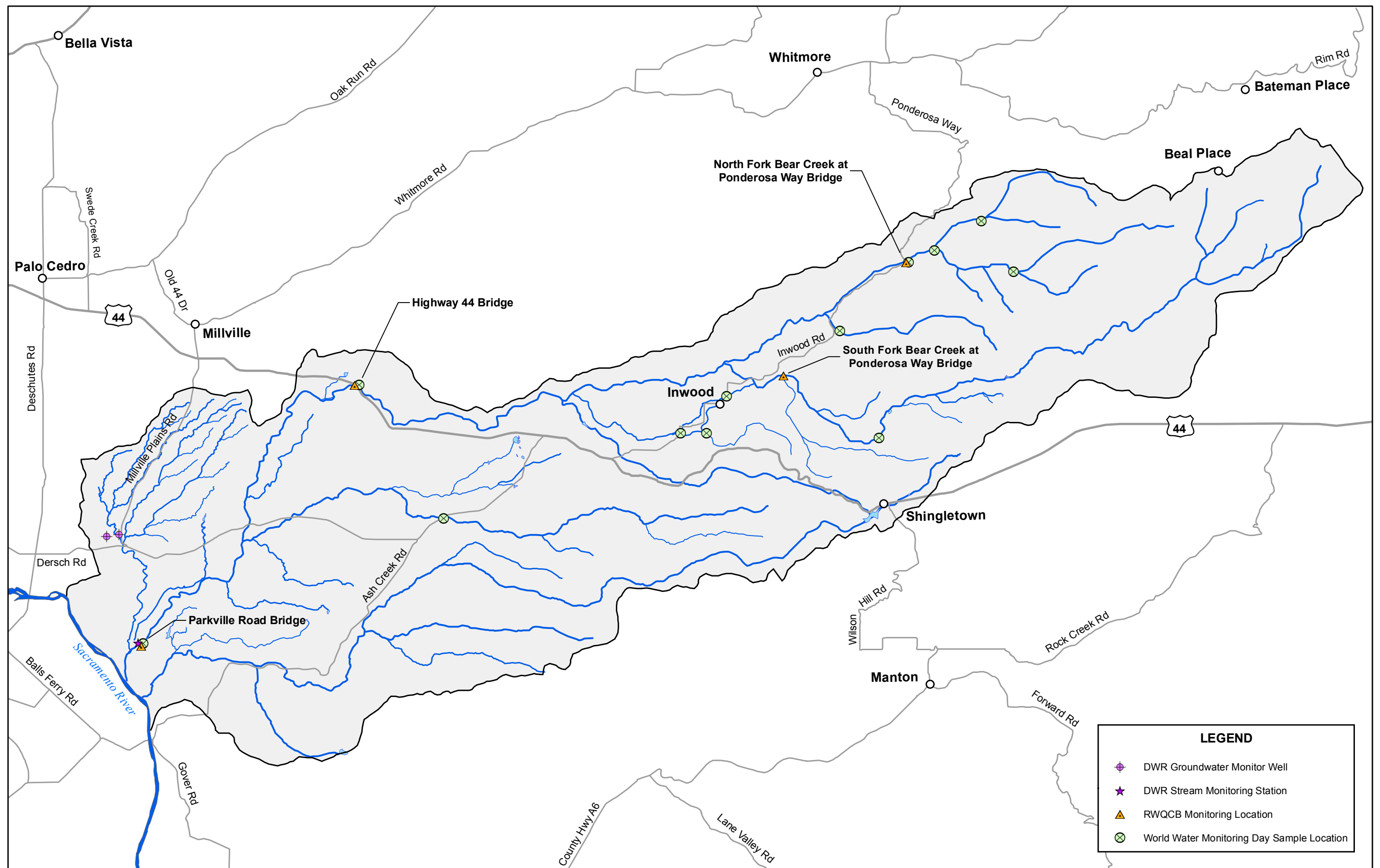
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LEGEND

- DWR Groundwater Monitor Well
- DWR Stream Monitoring Station
- RWQCB Monitoring Location
- World Water Monitoring Day Sample Location

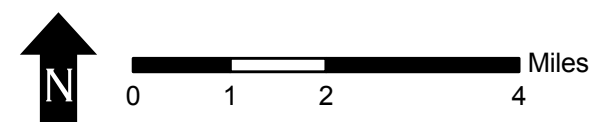


Figure 5-1
Water Quality Sampling Locations
Bear Creek Watershed Assessment 2005



VI. BOTANICAL RESOURCES

6.1. Reference Conditions

The vegetation of the Bear Creek watershed has changed since the arrival of the first European Americans in the early 1800s. These changes are primarily the result of prescribed fires, suppression of natural wildfires, timber harvest practices, agricultural use and the introduction of a variety of non-native weeds.

The natural fire regime in forests in the Bear Creek watershed likely approximated that in the Sierra Nevada, which produced open forests with a mosaic of stands of different sizes and ages. In grasslands, fire reduced encroachment by shrubs. For many plant species, fire is essential for seed dispersal and regeneration. The very high temperatures that occur during a wildfire will rupture the seed coat and release the seed into the soil. In addition, the seed coat of some plants is known to rupture in the presence of certain chemicals in smoke (C. Weidert, pers. com.).

Human activities, particularly those of European Americans, altered the character of vegetation communities in the Bear Creek watershed. When European settlers arrived in the Shingletown Ridge area, the Asagewis, Yana, and Wintu tribes were using the land (California Board of Forestry, 1996). However, it is unknown whether these tribes used fire in the watershed and to what extent such uses of fire altered the character of vegetation communities in the Bear Creek watershed. As more European Americans settled in the watershed during the mid-1800s, Native Americans were displaced and the forest was viewed as a source of economic profit. In the mid- to late 1800s, extensive timber harvesting was conducted throughout the watershed and sawmills provided lumber to markets as far away as Sacramento (Allen, 1979; DuBose, 1998). In addition, the suppression of natural wildfires and the use of prescribed burning by government agencies and private landowners over the past 100 years have changed the structure of the vegetation communities in the watershed. Some chaparral and woodlands have been converted to grazing land as a result of prescribed fires. In other areas, forests are denser as a result of wildfire exclusion.

The number of non-native weeds introduced into California increased dramatically during the period of Spanish control of California in the 1700s. Imported cattle introduced a number of non-native weeds throughout California. These cattle often harbored the seeds of a variety of weeds native to Europe and the Mediterranean. Once established, these non-native weeds spread rapidly and displaced native plant species. Many of these non-native weeds are now classified as noxious or invasive by State and Federal agencies and several are known to occur in the Bear Creek watershed.

6.2. Existing Conditions

VEGETATION TYPES IN THE BEAR CREEK WATERSHED

Several classification systems (e.g., California Wildlife Habitat Relationships [WHR], Cal Veg, Holland [1986], Cheatham and Holler [1975], and Sawyer and Keeler-Wolf [1995]) have been developed to describe the vegetation of California. Each classification system reflects a variety of descriptive scales, philosophies, and purposes (Sawyer and Keeler-Wolf, 1995). The designations used for naming vegetation types in the Bear Creek watershed for this document are based on the WHR classification system. The goal of this classification system is to identify and classify existing vegetation types important to wildlife.

The system was not intended to provide a final word on vegetation classification. Rather, it was developed to recognize and logically categorize major vegetation complexes at a scale sufficient to predict wildlife-habitat relationships. The Bear Creek watershed contains 17 WHR vegetation types (Table 6-1), as mapped by the California Department of Forestry and Fire Protection's Land Cover Mapping and Monitoring Program. The geographic information system data used in this analysis was derived from 1997-2001 Landsat Imagery, tiled by county with a 2.5-acre minimum mapping unit. Figure 6-1 shows the location of these vegetation types. A general description of each WHR vegetation type is presented below, including the composition, extent and general location of the vegetation types in the Bear Creek watershed. It should be noted that the vegetation types and their acreages reported in this section are based on California Department of Forestry and Fire Protection (CDF) Landsat satellite imagery interpretation and have not been field verified.

**Table 6-1. Bear Creek Watershed Assessment 2005
Vegetation Types and Acreage in the Bear Creek Watershed¹**

<i>WHR Vegetation Type</i>	<i>Acre</i>	<i>Percentage of Watershed</i>
Tree-Dominated Habitats		
Blue Oak-Foothill Pine	7,258	7.22%
Blue Oak Woodland	29,143	28.98%
Douglas Fir	28	0.02%
Lodgepole Pine	32	0.03%
Montane Hardwood	5,474	5.44%
Montane Hardwood-Conifer	2,162	2.15%
Montane Riparian	NA	
Ponderosa Pine	12,366	12.29%
Red Fir	3	0.01%
Sierran Mixed Conifer	18,049	17.95%
Valley Foothill Riparian	NA	
Valley Oak Woodland	512	0.51%
White Fir	82	0.08%
Shrub-Dominated Habitats		
Mixed Chaparral	9,398	9.34%
Montane Chaparral	1,025	1.02%
Herbaceous-Dominated Habitats		
Annual Grassland	12,796	12.72%
Wet Meadow	640	0.63%

¹ Source: CDF 2003

TREE-DOMINATED HABITATS

Blue Oak-Foothill Pine. Blue oak-foothill pine occurs between 500 and 3,000 feet in elevation. This habitat's structure is diverse, both vertically and horizontally (DFG, 2002). At lower elevations, the overstory is dominated by blue oak (*Quercus douglasii*) and to a lesser extent by foothill pine (*Pinus sabiniana*). At higher elevations, foothill pine tends to be the dominant species in the overstory. Other trees that may associate with blue oak foothill pine are interior live oak (*Quercus wizlizenii*) and California buckeye (*Aesculus californica*). Common shrubs include ceanothus, greenleaf manzanita (*Arctostaphylos manzanita*), whiteleaf manzanita (*Arctostaphylos viscida*), poison oak (*Toxicodendron diversilobum*), western redbud (*Cercis occidentalis*), and blue elderberry (*Sambucus mexicana*). In the Bear Creek watershed, poison oak is sparse above 3,000 feet in elevation.

Blue Oak Woodland. Blue oak woodland is found from 500 to 2,000 feet in elevation on the west slope of the Sierra Nevada (DFG, 2002). Generally, scattered trees comprise the overstory, but some sites may have a completely closed canopy. Blue oak is the dominant tree, accounting for 85-100 percent of the trees present. Other trees associated with this vegetation type include interior live oak and valley oak (*Quercus lobata*). Common shrubs include poison oak, hoary coffeeberry (*Rhamnus tomentella*), buckbrush (*Ceanothus cuneatus*), California buckeye, and various species of manzanita. Ground cover is comprised mainly of annuals, such as foxtail, wild oats, brome grass, filaree, fiddleneck (*Amsinckia intermedia*), and needlegrasses (*Achnatherum* spp.). The blue oak woodland is supplanted at higher elevation and drier sites by black oak woodland [a montane hardwood vegetation type dominated by California black oak (*Quercus kelloggii*), interspersed with ponderosa pine (*Pinus ponderosa*)] or foothill pine-oak woodlands; at lower elevations it is interspersed with grasslands (Holland, 1986).

Douglas Fir. Douglas fir (*Pseudotsuga menziesii*) forests are often mixed and are the result of geologic, topographic, and successional variation within its range (DFG, 2002). These forests occur from 1,000 to 4,000 feet in elevation. Soil type is an important determinant of tree and shrub diversity. In deep mesic soils, Douglas fir is the dominant tree species. In hydric soils, Pacific yew (*Taxus brevifolia*) may occur with Douglas fir. The shrub layer is generally composed of canyon live oak (*Quercus chrysolepis*), Oregon grape (*Berberis nervosa*), California blackberry (*Rubus ursinus*), and poison oak. Sedimentary soils support shrubs such as snowbrush ceanothus (*Ceanothus velutinus*), and Oregon grape. A variety of grasses and forbs may associate with Douglas fir, including Pacific trillium (*Trillium ovatum*), western swordfern (*Polystichum munitum*), western starflower (*Trientalis latifolia*), prince's pine (*Chimaphila menziesii*), and western rattlesnake plantain (*Goodyera oblongifolia*).

In the Bear Creek watershed, Douglas fir forests comprise approximately 28 acres and are found near the headwaters of South Fork Bear Creek. However, a careful survey of the watershed may reveal that there are more than 28 acres present.

Lodgepole Pine. Lodgepole pine (*Pinus contorta* ssp. *murrayana*) forests are composed of slender trees, often in nearly pure stands, in cold, moist sites. This vegetation type may also occur in more open stands on dry sites, or near timberline. There is much less litter in the drier, more open stands. Stands are generally 45 to 60 feet in height, but may reach 120 feet in fertile soils. The understory is normally sparse in dense stands, but low shrubs and perennial herbs occur abundantly in forest openings. Lodgepole pine forests generally occur at elevations characterized by long, snowy winters and cool, dry summers. Lodgepole pine forests are colder in winter and usually drier than red fir forests (Holland, 1986).

Lodgepole pine forests are scattered and poorly developed in the Klamath Mountains. More extensive stands occur east of Mt. Shasta on the Modoc Plateau and in the Warner Mountains. Lodgepole pine forests are well developed in the vicinity of Mt. Lassen between 6,000 and 8,000 feet in elevation. In the Sierra Nevada, lodgepole pines are abundant from Sierra County to southern Tulare County, but their distribution is patchy in the northern Sierra Nevada. In the Bear Creek watershed, lodgepole pine forests are uncommon occurring in the vicinity of Latour Butte.

Montane Hardwood. Montane hardwood is composed of a definite hardwood tree layer with a sporadic and poorly developed shrub layer (DFG, 2002). Montane hardwood generally occurs between 3,000 feet and 9,000 feet in elevation. At higher elevations in the southern Cascades and northern Sierra Nevada, the dominant trees are canyon live oak, Douglas fir, and California black oak. At lower elevations in these mountains, foothill pine, knobcone pine (*Pinus attenuata*), and California laurel (*Kalmia polifolia*) occur. Understory shrubs are Oregon grape, currants (*Ribes* spp.), wood rose (*Rosa gymnocarpa*), snowberry (*Symphoricarpos albus*), manzanita, and poison oak.

Most montane hardwood forests border the western edge of the ponderosa pine forests, and occur below 3,000 feet in elevation. However, some montane hardwood forests are found along Highway 44 just east of the Millville Plains. Altogether, the montane hardwood accounts for 5,474 acres in the watershed.

Montane Hardwood-Conifer. Montane hardwood-conifer includes both hardwoods and conifers, with at least 1/3 of the trees being conifers and 1/3 being broadleaved (DFG, 2002). This vegetation type usually occurs between 1,000 and 4,000 feet in elevation along the western slope of the Sierra Nevada. Tree diversity varies widely by geography. In the northern interior of California, California black oak, and big leaf maple (*Acer macrophyllum*) are common broadleaf tree species, with ponderosa pine, white fir (*Abies concolor*), sugar pine (*Pinus lambertiana*), Douglas fir, and California incense cedar (*Calocedrus decurrens*) comprising the overstory.

Montane Riparian. Montane riparian habitat occurs along stream at middle to high elevation. This habitat is highly variable and structurally diverse (DFG, 2002). Montane riparian habitat typically occurs as a narrow, often dense grove of broadleaved, winter deciduous trees of to 100 feet tall with little to no understory. In northeastern California, the montane riparian is composed primarily of black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), white alder (*Alnus rhombifolia*), and thin-leaf alder (*Alnus incana* ssp. *tenuifolia*).

In the Bear Creek watershed, montane riparian occurs along perennial streams east of Shingletown and Inwood.

Ponderosa Pine. Ponderosa pine forests generally occur from 800 to 5,000 feet in elevation in the northern Sierra Nevada (DFG, 2002). Ponderosa pine forests may be monotypic or mixed with white fir, California incense cedar, sugar pine, Jeffrey pine (*Pinus jeffreyi*), Douglas fir, canyon live oak, and California black oak. Common shrubs include manzanita, ceanothus, Pacific dogwood (*Cornus nuttallii*), California buckthorn, poison oak, and Sierra gooseberry (*Ribes roezlii*). Ground plants include blue grasses (*Poa* spp.), bedstraws (*Galium* spp.), lupines (*Lupinus* spp.), and Orcutt brome (*Bromus orcuttianus*).

Ponderosa pine forests occupy a broad belt that extends from the Bear Creek watershed boundary south of Shingletown to the vicinity of Miners Gulch and Dickerson Creek.

Red Fir. Red fir (*Abies magnifica*) forests are generally monotypic, even aged, and occur between 6,000 and 9,000 feet in elevation. The dense canopy prevents the growth of shrubs and ground cover. Red-fir forests typically occur on coarse, well-drained, but moist soils. They are found in the highest parts of the northern Coast Ranges, from Snow

Mountain (Lake County) northward. More extensive forests are found in upper elevation areas of the Klamath Mountains and northern Sierra Nevada (Holland, 1986).

In the Bear Creek watershed, red fir forests are uncommon and account for three acres. They are limited to high elevation sites in the eastern region of the watershed in the vicinity of Latour Butte.

Sierran Mixed Conifer. Sierran mixed conifer is an assemblage of conifer (white fir, Douglas fir, ponderosa pine, sugar pine, and California incense cedar) and hardwood (California black oak) species that form a multilayered forest. These forests have closed, multilayered canopies, with almost 100 percent overlapping cover. Sierran mixed conifer occurs between 2,500 and 4,000 feet in elevation. Old-growth forests that have not been exposed to fire are generally two storied, with an overstory of mixed conifers and an understory dominated by white fir and California incense cedar. Shrubs common in Sierran mixed conifer include deerbrush, manzanita, bitter cherry, squawcarpet (*Ceanothus prostratus*), whitethorn ceanothus, gooseberries (*Ribes* spp.), and wood rose. Over 100 species of grasses and forbs associate with Sierran mixed conifer. Common species are mountain brome (*Bromus marginatus*), iris, buckwheats (*Eriogonium* spp.), bull thistle (*Cirsium vulgare*), needlegrasses, sedges (*Carex* spp.), and rushes (*Juncus* spp.).

Next to blue oak woodland, Sierran mixed conifer is the most common vegetation type in the Bear Creek watershed. Sierran mixed conifer accounts for 18,049 acres and occupies most of the area between Shingletown and Latour Butte.

Valley Foothill Riparian. Valley foothill riparian generally occurs below 3,000 feet in elevation and is found along streams in the foothills and on the floor of the Central Valley (DFG,2002). Most trees are winter deciduous. Common species in the canopy layer include cottonwoods (*Populus* spp.), California sycamore (*Platanus racemosa*), and valley oak. White alder, California boxelder (*Acer negundo*), and Oregon ash (*Fraxinus latifolia*) comprise the subcanopy. A dense understory shrub layer is typically present, and includes wild grape (*Vitis californica*), wild rose (*Rosa californica*), California blackberry, blue elderberry, poison oak, buttonbrush (*Cephalanthus occidentalis*), and various willows (*Salix* spp.). The herbaceous layer includes sedges, rushes, grasses, miner's lettuce (*Claytonia perfoliata*), Douglas' sagewort (*Artemisia douglasiana*), poison-hemlock (*Conium maculatum*), and hoary nettle (*Urtica dioica* ssp. *holosericea*).

In the Bear Creek watershed, valley foothill riparian is found along perennial and intermittent streams west of Shingletown and Inwood.

Valley Oak Woodland. Valley oak woodland consists of savannah-like to forest-like stands of mostly winter-deciduous, broad-leaved trees. They generally occur below 2,000 feet in elevation in California's Central Valley (Holland, 1986). Valley oak is the dominant tree species. Other trees, which may be present in small numbers, include interior live oak and blue oak. Understory shrubs include poison oak, blue elderberry, California wild grape, California coffeeberry, and California blackberry. The ground cover plants include wild oats, brome, barley, ryegrass, and needlegrass. Valley oak woodlands generally occur on deep, well drained alluvial soils, usually in valley bottoms.

In the Bear Creek watershed, valley oak woodland accounts for 512 acres and is found near the mouths of Bear Creek and Ash Creek.

White Fir. White fir forests are generally monotypic, occurring between 5,000 and 6,000 feet in elevation in the Cascades and Sierra Nevada (DFG, 2002). White fir forests tend to occur between the Sierran mixed conifer forests and red fir forests. Jeffrey pine may also be found in white fir forests. Shrubs such as greenleaf manzanita and currant dominate the understory.

In the Bear Creek watershed, white fir forests are uncommon, accounting for 82 acres. White fir is restricted to the south slope of Latour Butte.

SHRUB-DOMINATED HABITATS

Mixed Chaparral. Mixed chaparral is a brushland dominated by shrubs with thick, stiff, heavily cutinized (waxy) evergreen leaves, occurring below 5,000 feet in elevation (DFG, 2002). At maturity, mixed chaparral is very dense and nearly impenetrable, with more than 80 percent absolute shrub cover. Canopy height is generally 3 to 12 feet, but occasionally reaches 18 feet. Common shrubs include yerba santa (*Eriodictyon californicum*), poison oak, and various species of ceanothus and manzanita.

In the Bear Creek watershed, mixed chaparral is widespread in the low to middle elevation sites.

Montane Chaparral. Montane chaparral is characterized by evergreen shrubs that may grow prostrate or up to nine feet tall. Deciduous or partly deciduous species may also be present (DFG, 2002). Species composition varies widely throughout California. Species diversity is the result of elevation, geographic range, soil type, and aspect. Generally, one or more of the following species typifies montane chaparral: whitethorn ceanothus (*Ceanothus cordulatus*), snowbrush ceanothus, greenleaf manzanita (*Arctostaphylos patula*), pinemat manzanita (*Arctostaphylos nevadensis*), bitter cherry (*Prunus emarginata*), hoary manzanita (*Arctostaphylos canescens*), or Fremont silktassel (*Garrya fremontii*). Montane chaparral occurs in shallow to deep soils on gentle to steep slopes between 3,000 and 9,000 feet in elevation.

In the Bear Creek watershed, montane chaparral has a patchy distribution at middle and high elevation sites in the watershed. Most occurrences are between Shingletown and Latour Butte.

HERBACEOUS-DOMINATED HABITATS

Annual Grassland. Annual grassland consists mainly of introduced annual grasses and forbs and occurs below 3,900 feet in elevation (DFG, 2002). Common annual grasses include wild oats (*Avena* spp.), soft chess (*Bromus hordeaceus*), wild barley (*Hordeum* spp.), and foxtail fescue (*Vulpia myuros*). Common forbs include broadleaf filaree (*Erodium botrys*), redstem filaree (*Erodium cicutarium*), California bur-clover (*Medicago polymorpha*), and popcorn flowers (*Cryptantha* spp.).

Wet Meadow. Wet meadows occur where, following spring run-off, water is at or near the surface for the duration of the growing season (DFG, 2002). Wet meadows are relatively simple in structure, consisting of a layer of herbaceous plants. Trees and shrubs are generally absent in the meadow itself, but are often present around the margin. Several genera are common to wet meadows and include *Agrostis*, *Carex*, *Danthonia*, *Juncus*, *Salix*, and *Scirpus*.

In the Bear Creek watershed, wet meadows account for 640 acres and have a patchy occurrence throughout the watershed. Thatchers Meadows and Dersch Meadows,

located near the headwaters of South Fork Bear Creek, are among the largest wet meadows in the watershed. Other wet meadows are known to occur in the vicinity of Inwood (Mallory et al., 1952).

UNIQUE NATURAL COMMUNITIES IN THE BEAR CREEK WATERSHED

Information on the occurrence of unique natural communities in the Bear Creek watershed was obtained from the California Natural Diversity Data Base (CNDDDB) and from residents who participated in the Bear Creek watershed meetings.

CNDDDB

Review of the CNDDDB found that three unique natural communities are known to occur in the Bear Creek watershed: Great Valley mixed riparian forest, Great Valley valley oak riparian forest, and northern interior cypress forest (Table 6-2). These communities are subcomponents of the vegetation types described above; for example Great Valley valley oak riparian forest is a subcomponent of the valley oak woodland vegetation type described in the WHR system. Because no comprehensive field surveys have been conducted to document the occurrence of natural communities in the Bear Creek watershed, the actual number of unique natural communities in the watershed may be larger. For each unique natural community known to occur in the Bear Creek watershed, a general description is provided, based on Holland (1986), and its general location is given.

**Table 6-2. Bear Creek Watershed Assessment 2005
Unique Natural Communities in the Bear Creek Watershed
(DFG, 2004a)**

Great Valley Mixed Riparian Forest
Great Valley Valley Oak Riparian Forest
Northern Interior Cypress Forest

Great Valley Mixed Riparian Forest. Great Valley mixed riparian forests have a dense mixture of tall, mature cottonwoods and willows, as well as California boxelder, the non-native black walnut (*Juglans hindsii*), and alders (*Alnus* spp.) (Holland, 1986). Shrubs such as buttonbrush, blackberries (*Rubus* spp.), and poison oak are also present. California grape vines extend well up into the canopy and are draped on the overstory trees. Great Valley mixed riparian forests may occur far from active stream channels but still experience overbank flooding during the winter.

The CNDDDB lists an occurrence of the Great Valley mixed riparian forest in the Bear Creek watershed at the confluence of Ash Creek and the Sacramento River.

Great Valley Valley Oak Riparian Forest. This broadleaved, winter-deciduous, closed-canopy, riparian forest is dominated by valley oak (*Quercus lobata*). Common sub-canopy species may include Oregon ash, black walnut, as well as young valley oak (Holland, 1986). Historically, this community was extensive on low-gradient, alluvial reaches of the major streams of the Sacramento and northern San Joaquin valleys. The San Joaquin watershed and the floodplains of the Kings and Kaweah rivers supported scattered stands. This forest has been nearly eliminated by agriculture and firewood harvesting.

The CNDDDB lists an occurrence of Great Valley valley oak riparian forest in the Bear Creek watershed along the Sacramento River just south of the confluence with Cow Creek.

Northern Interior Cypress Forest. The northern interior cypress forest is an open, fire-maintained scrubby “forest” similar to the knobcone pine forest but dominated by one of several cypress species such as Baker cypress (*Cupressus bakeri*) and Macnab cypress (*Cupressus macnabiana*) (Holland, 1986). This community typically occurs on arid, rocky, sterile, often ultramafic soils, frequently associated with chaparral. The northern interior cypress forest has a patchy distribution throughout the Siskiyou Mountains, North and South Coast Ranges, Cascades, and northern Sierra Nevada.

The CNDDDB lists occurrences of the northern interior cypress forest in the Bear Creek watershed in the vicinity of Lack Creek and Ash Creek. These unique McNab cypress stands occur on basalt and ash flows instead of serpentine soils.

OTHER UNIQUE COMMUNITIES IDENTIFIED IN THE BEAR CREEK WATERSHED

Residents in the Bear Creek watershed report three additional unique natural communities not reported in the CNDDDB: Pacific yew forest, Oregon white oak woodland, and northern hardpan vernal pools.

Pacific Yew Forest. The Pacific yew is a tree that commonly occurs as an understory tree in a variety of forest cover types in western North America. In dry-interior forests, Pacific yews grow best in shady canyons and ravines (Bolsinger and Jaramillo, 1990). In the Bear Creek watershed, almost pure stands of Pacific yews are reported on steep, north-facing slopes along South Fork Bear Creek (C. Weidert, pers. com.) and Snow Creek (G. Aldridge, pers. com.). Pacific yews are also reported along Dickerson Creek (R. Weidenkeller, pers. com.).

Oregon White Oak Woodland. Oregon white oak woodland is distributed throughout the Klamath Mountains and Coast Range. Oregon white oak (*Quercus garryana*) exists in tree form and shrub form. The southern-most population of tree-size Oregon white oak is reported to occur in the Bear Creek watershed near the junction of Ponderosa Way and Highway 44 (C. Weidert, pers. com.).

Northern Hardpan Vernal Pools. Northern hardpan vernal pools are seasonally flooded depressions found on ancient soils with an impermeable hardpan layer. Vernal pools are covered by shallow water for variable periods from winter to spring, and are typically dry for most of the summer and fall. Vernal pools are typically isolated, but are sometimes connected by swales. Vernal pools support a characteristic vegetation type, often including jointed coyote thistle (*Eryngium articulatum*), popcorn flowers (*Plagiobothrys* spp.), creeping spikerush (*Eleocharis macrostachya*), downingias (*Downingia* spp.) and other unique plants.

Although the CNDDDB does not list any occurrences of vernal pools within the Bear Creek Watershed, these features are known to occur in the Millville Plains and in association with Toomes-Guenoc soils in the Lack Creek drainage (C. Weidert, pers. com.).

SPECIAL-STATUS PLANTS IN THE BEAR CREEK WATERSHED

Information on special-status plant species occurring in the Bear Creek watershed was obtained from the CNDDDB, ENPLAN's in-house records, the Jepson Online Interchange, as well as consultation with biologists from the California Department of Fish and Game and the U.S. Fish and Wildlife Service. The CNDDDB reports were reviewed for U.S. Geological Survey 7.5 minute quadrangles that occur entirely or partly in the

watershed to develop a list of special-status plant species that occur in the watershed (Table 6-3).

**Table 6-3. Bear Creek Watershed Assessment 2005
Occurrences of Special Status Plant Species
in the Bear Creek Watershed**
(DFG, 2004a)

SPECIES	Status
Ahart's paronychia, <i>Paronychia ahartii</i>	FSC, CNPS 1B
Butte County fritillary, <i>Fritillaria eastwoodiae</i>	FSC, CNPS 3
Red Bluff dwarf rush, <i>Juncus leiospermus</i> var. <i>leiospermus</i>	FSC, CNPS 1B
Shasta clarkia, <i>Clarkia borealis</i> ssp. <i>arida</i>	FSC, CNPS 1B
Silky cryptantha, <i>Cryptantha crinita</i>	FSC, CNPS 1B
Slender Orcutt grass, <i>Orcuttia tenuis</i>	FT, SE, CNPS 1B

Status

FSC = Federal Species of Concern

FT = Federal Threatened

SE = State Endangered

CNPS 1B = California Native Plant Society's designation for plants that are native California species, subspecies or varieties that are rare, threatened, or endangered in California and elsewhere.

CNPS 3 = California Native Plant Society's designation for plants which we need more information about.

As documented in Table 6-3, six special-status plant species have been reported in the Bear Creek watershed. Of the special-status plant species, only slender Orcutt grass (*Orcuttia tenuis*) is formally listed as Threatened or Endangered by the state or federal governments. The other special-status plants species are listed as a Federal Species of Concern by the U.S. Fish and Wildlife Service or assigned various designations by the California Native Plant Society. The habitat requirements of each special-status plant species that occurs in the Bear Creek watershed and the general location where it has been reported are described below.

AHART'S PARONYCHIA

Ahart's paronychia (*Paronychia ahartii*), a Federal Species of Concern, occurs in well-drained rocky areas of oak woodlands, valley and foothill grasslands, and vernal pools in the Sacramento Valley in northern California (Nakamura and Nelson, 2001). The species' elevation range is from the valley floor to approximately 1,600 feet.

The CNDDDB lists several occurrences of Ahart's paronychia in the Bear Creek watershed. Ahart's paronychia has been reported on the Millville plains and along Ash Creek Road.

BUTTE COUNTY FRITILLARY

Butte County fritillary (*Fritillaria eastwoodiae*), a Federal Species of Concern, occurs in a variety of habitats such as mixed-conifer forests, chaparral, and woodlands (Nakamura and Nelson, 2001). It ranges between 1,000 and 4,000 feet in elevation and is often associated with serpentine soils. The flowering period is from March to May.

The CNDDDB lists one occurrence of Butte County fritillary in the Bear Creek watershed. This occurrence is reported along Ponderosa Way, Withrow Road, Wilson Hill Road, and Highway 44, thus placing it in the vicinity of Shingletown and Inwood.

RED BLUFF DWARF RUSH

Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*), a Federal Species of Concern, occurs in the northern Sacramento Valley between 200 and 1,000 feet in elevation (Nakamura and Nelson, 2001). It is generally found the edges of vernal pools and swales in chaparral, valley grasslands, and foothill woodlands. This plant flowers from April to early June.

The CNDDDB lists an occurrence of Red Bluff dwarf rush within the Bear Creek watershed, on the Millville Plains.

SHASTA CLARKIA

Shasta clarkia (*Clarkia borealis* ssp. *arida*), a Federal Species of Concern, is found in openings in foothill pine and black oak woodlands on south- and west-facing slopes between 1,600 and 1,700 feet in elevation (Nakamura and Nelson, 2001). Shasta clarkia flowers from late June to early August.

The CNDDDB lists one occurrence of Shasta clarkia in the Bear Creek watershed. This occurrence is reported 7.7 miles west of Shingletown, approximately 1.2 miles east of the junction with County Road A-17.

SILKY CRYPTANTHA

Silky cryptantha (*Cryptantha crinita*), a Federal Species of Concern, is found in sand and gravel deposits of intermittent and perennial streams below 1,000 feet in elevation in Shasta and Tehama counties (Nakamura and Nelson, 2001). The flowering period is April and May.

The CNDDDB lists several occurrences of silky cryptantha in the Bear Creek watershed. Silky cryptantha has been reported at several locations on the Millville Plains and it has been reported along Ash Creek Road near the confluence of Ash Creek and the Sacramento River.

SLENDER ORCUTT GRASS

Slender Orcutt grass, a Federal Threatened and State Endangered species, is a blue-green, aromatic, annual member of the grass family (DFG, 2004b). It is found on the bottom of vernal pools associated with valley grassland, blue oak woodland, and lower montane conifer forest. It is known from Lake, Lassen, Plumas, Sacramento, Shasta, Siskiyou, and Tehama counties in northern California. Approximately 70 occurrences of slender Orcutt grass are known. However, a significant amount of vernal pool habitat capable of supporting the species has been damaged or eliminated as a result of agricultural conversion and urbanization.

The CNDDDB lists several occurrences of slender Orcutt grass in the Bear Creek watershed. These occurrences are on the Millville Plains and between the Millville Plains and the Stillwater Plains, approximately ½ to 1 mile east of Cow Creek.

PLANT DIVERSITY IN THE BEAR CREEK WATERSHED

The Bear Creek watershed is inhabited by a diversity of trees, shrubs, and flowers. Plant diversity is very high in the mid-elevation canyons where the interaction of soils and slope produce an assortment of microhabitats. Some areas within the Bear Creek watershed have a diverse assemblage of plants that include Douglas fir, white fir, ponderosa pine, foothill pine, knobcone pine, California incense cedar, Pacific yew, canyon live oak, interior live oak, blue oak, California black oak, oracle oak (*Quercus moreha*),

California buckeye, Oregon ash, white alder, vine maple (*Acer circinatum*), big leaf maple, mountain mahogany (*Cercocarpus* sp.), California bay (*Umbellularia californica*), California laurel, cascara (*Rhamnus purshiana*), black walnut, willow, and Pacific dogwood (R. Weidenkeller, pers. com.).

The Bear Creek watershed also hosts several plants of interest that are not considered special status. The oracle oak, a hybrid formed from the crossing of canyon live oak and black oak, is an uncommon tree in the watershed. The oracle oak is known to occur near Inwood (R. Weidenkeller, pers. com.). However, its distribution within the watershed is unknown. The Pacific yew is another tree that is uncommon in the Bear Creek watershed. The riparian zone along Dickerson Creek once hosted a stand of Pacific yew trees, but these were cut in the late 1980s or early 1990s to extract taxol from their bark (R. Weidenkeller, pers. com.). Like the oracle oak, its distribution in the watershed is unknown.

INTRODUCED PLANTS

As humans colonized California, they significantly altered its flora. The most dramatic changes occurred following the arrival of Europeans, who brought with them a culture based largely on cattle grazing and agriculture. Their activities introduced new species into the California flora, most of which were native to Mediterranean Europe. Many valley and foothill regions were cleared of trees and became dominated by annual grasses of European origin. (Hickman, 1993)

Currently, on the order of 18 percent of the plant species in California are introduced. Some of these are aggressive invaders and pose serious commercial and ecological threats. Two regulatory terms used to describe these plants are noxious weeds and invasive plants. Noxious weeds and invasive plants are of concern because they have prolific reproductive rates and do not have natural predators to control their numbers. In addition, these plants degrade wildlife habitat and forage, threaten endangered species and native plants, increase erosion and groundwater loss, and prevent recreational activities.

NOXIOUS WEEDS

Noxious weeds are managed by the U.S. Department of Agriculture (USDA) and by the California Department of Food and Agriculture (CDFA). The USDA regulates noxious weeds under the Federal Noxious Weed Act of 1974. This Act provides for the control and management of non-native weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The CDFA classifies noxious weeds based on their statewide importance, likelihood that control or eradication is feasible and their overall distribution throughout the state. The CDFA classifies noxious weeds as follows: "A", "B", "C", "Q", and "D" (CDFA, 2004).

- "A" rated weeds are organisms of known economic importance and are subject to eradication, containment, rejection, or other holding action by the state or county.
- "B" rated weeds are organisms of known economic importance and are subject to eradication, containment, control, or other holding action at the discretion of the individual county agricultural commissioner. They also include organisms of known economic importance and are subject to state endorsed holding action and eradication only when found in a nursery.

- “C” rated weeds are organisms subject to no state enforced action outside of nurseries except to retard dispersal. They are also organisms subject to no state enforced action except to provide for pest cleanliness in nurseries.
- “Q” rated weeds are organisms or disorder requiring temporary “A” action pending determination of a permanent rating. The organism is suspected to be of economic importance but its status is uncertain because of incomplete identification or inadequate information. In the case of an established infestation, at the discretion of the Assistant Director for Plant Industry, the Department will conduct surveys and will convene the Division Pest Study Team to determine a permanent rating.
- “D” rated weeds are suspected to be of economic importance but their status is uncertain due to incomplete identification or inadequate information. No action is required for such weeds.

The Shasta County Department of Agriculture/ Weights & Measures identified 17 species of noxious weeds that are present in Shasta County for which the Shasta County Department of Agriculture or other agencies currently have active control programs. Table 6-4 identifies these 17 species and indicates which are known to occur in the Bear Creek watershed. The actual number of noxious weed species in the watershed is likely larger because field surveys have not been conducted.

**Table 6-4. Bear Creek Watershed Assessment 2005
Noxious Weeds Reported in Shasta County by the
Shasta County Department of Agriculture/ Weights & Measures**

Weed Rating & Species	Verified in the Bear Creek Watershed
CLASS “A” NOXIOUS WEEDS	
Scotch thistle, <i>Onopordum</i> spp.	
Musk thistle, <i>Carduus nutans</i>	
Spotted knapweed, <i>Centaurea maculosa</i>	1
Squarrose knapweed, <i>Centaurea maculosa</i>	
Diffuse knapweed, <i>Centaurea diffusa</i>	
Dalmation toadflax, <i>Linaria dalmatica</i>	
Skeleton weed, <i>Chondrilla juncea</i>	
CLASS “A” NOXIOUS WEEDS	
Hydrilla, <i>Hydrilla verticillata</i>	
CLASS “B” NOXIOUS WEEDS	
Canada thistle, <i>Cirsium arvense</i>	
Mediterranean sage, <i>Salvia aethiopsis</i>	
Perennial pepperweed, <i>Lepidium latifolium</i>	
Marlahan mustard (Dyer’s woad), <i>Isatis tinctoria</i>	
CLASS “C” NOXIOUS WEEDS	
Scotch broom, <i>Cytisus scoparius</i>	1, 4
French broom, <i>Genista monspessulana</i>	1
Yellow star thistle, <i>Centaurea solstitialis</i>	2A, 2B, 3
Klamathweed, <i>Hypericum perforatum</i>	2A, 2B
Puncturevine, <i>Tribulus terrestris</i>	4

1 = Shasta County Department of Agriculture/ Weights & Measures

2A = ENPLAN (2001)

2B = ENPLAN (Unpublished data collected for the Shingletown Meadows Project)

3 = VESTRA (2002)

4 = Carl Weidert

Descriptions of Noxious Weeds Known to Occur in the Bear Creek Watershed.

Based on discussions with residents present at Bear Creek watershed meetings, as well as a review of records maintained by the Shasta County Department of Agriculture/ Weights & Measures, VESTRA, and ENPLAN, the following species of noxious weeds are known to occur in the Bear Creek watershed: spotted knapweed (*Centaurea maculosa*), Scotch broom (*Cytisus scoparius*), French broom (*Genista monspessulana*), yellow star-thistle (*Centaurea solstitialis*), Klamathweed (*Hypericum perforatum*), and puncturevine (*Tribulus terrestris*). This section provides a general description of each noxious weed identified in the Bear Creek watershed.

Spotted Knapweed. Spotted knapweed is an annual thistle native to Europe and Asia. It was introduced into North America in the late 1800s via shipments of alfalfa from overseas (The Nature Conservancy, undated). Shortly after it was introduced in North America, it became established in California. Each plant is capable of producing up to 600 seeds. Seeds generally fall within 35 feet of the parent plant, but may be transported over long distances by animals and wind. Spotted knapweed is particularly problematic on ranchlands. Overgrazing by cattle often results in colonization by spotted knapweed because it is able to out-compete native vegetation at disturbed sites. Once established, it is generally avoided by grazing cattle.

Scotch Broom. Scotch broom is a shrub native to Europe and North Africa. It was introduced to California in the 1850s as an ornamental in the Sierra Nevada foothills, and later used to prevent erosion and stabilize dunes (Bossard et al., 2000). It is capable of spreading rapidly, as one medium-sized shrub can produce over 12,000 seeds per year. Seeds are dispersed locally by ants and birds, but may be transported over long distances on the undercarriages of vehicles. Scotch broom presently occupies approximately 700,000 acres in California. Scotch broom is considered a nuisance because it displaces native plant species, is unpalatable to livestock, and is difficult to control. In the Bear Creek watershed, Scotch broom has been reported near Shingletown (C. Weidert, pers. com.).

French Broom. French broom is a shrub native to the Mediterranean region and is closely related to Scotch broom. It was introduced into California in the mid-1800s as an ornamental (Bossard et al., 2000). A single plant can produce over 8,000 seeds annually. Seeds are often dispersed locally by ants and birds, but may be dispersed long distances if they are encased in mud on the undercarriages of vehicles. Once established, French broom typically forms dense stands. French broom presently occupies approximately 100,000 acres in California. French broom is considered a noxious plant because it spreads rapidly, displaces native plants species, causes digestive problems in livestock, and is expensive to eradicate.

Yellow Star-thistle. Yellow star-thistle is native to southern Europe and western Eurasia. It was introduced into California in 1848 (Bossard et al., 2000). By 1917, it was reported to be widespread in the Sacramento Valley. Yellow star-thistle had spread to over a million acres of California by the late 1950s and nearly two million acres by 1965. By the mid-1990s, yellow star-thistle was estimated to have spread to 10 to 12 million acres. Human activities are the primary mechanisms for the

dispersal of yellow star-thistle seed. Seeds may be transported over long distances if they are incased in mud on the undercarriages of vehicles. The movement of contaminated hay and uncertified seed is also responsible for long-distance dispersal.

Klamathweed. Klamathweed, also known as St. John's wort, was introduced into California around 1900. By 1950, Klamathweed occupied over two million acres throughout California. Klamathweed spreads both by underground and above-ground creeping stems, and by seeds. Each plant is capable of producing between 15,000 and 33,000 seeds annually. Klamathweed is considered a noxious weed because it is toxic to livestock, grows vigorously in pastures, displaces native plant species, and has a high reproductive capability (Turner and Szczawinski, 1991; Mitich, 1994).

Puncturevine. Puncturevine is an annual herb that is native to the Mediterranean. Puncturevine is widespread throughout California and is reported from 1,000 to 3,300 feet in elevation. It thrives on disturbed, dry, sandy soils. Puncturevine is a nuisance because it is not grazed by livestock and is toxic if consumed. In the Bear Creek watershed, puncturevine has been reported in the vicinity of Inwood (C. Weidert, pers. com.).

INVASIVE PLANTS

The California Invasive Plant Council (Cal-IPC), formerly the California Exotic Pest Plant Council, is a group of technical experts that developed a list of plant pests specific to California's wildlands. The Cal-IPC list, formerly known as the Exotic Pest Plants of Greatest Ecological Concern in California, is based on information submitted by land managers, botanists, and researchers throughout the state, and on published sources. The list highlights non-native plants that are serious problems in areas that support native ecosystems, including parks, reserves, wildlife areas, national forests, as well as some working landscapes such as rangelands.

The Cal-IPC classifies invasive plants into the following categories:

- List A: Most invasive wildland pest plants; documented as aggressive invaders that displace natives and disrupt natural habitats. Includes two sub-lists; list A-1: Widespread pests that are invasive in more than three Jepson regions, and list A-2: Regional pests invasive in three or fewer Jepson regions.
- List B: Wildland pest plants of lesser invasiveness; invasive pest plants that spread less rapidly and cause a lesser degree of habitat destruction; may be widespread or regional.
- Red Alert: Pest plants with potential to spread explosively; infestations currently small or localized. If found, alert the Cal-IPC, County Agricultural Commissioner, or California Department of Food and Agriculture.
- Need More Information: Plants for which current information does not adequately describe the nature of threat to wildlands, distribution, or invasiveness.
- Annual Grasses: A preliminary list of annual grasses, abundant and widespread in California, that pose significant threats to wildlands.

- Considered, But Not Listed: Plants that, after review of status, do not appear to pose a significant threat to wildlands.

A list of Cal-IPC invasive plants known to occur in Shasta County is presented in Table 6-5. Invasive plants known to occur in the Bear Creek watershed include spotted knapweed, yellow start thistle, Scotch broom, French broom, Himalayan blackberry (*Rubus discolor*), medusahead (*Taeniatherum caput-medusae*), tree of heaven (*Ailanthus altissima*), edible fig (*Ficus carica*), pennyroyal (*Mentha pulegium*), bull thistle (*Cirsium vulgare*), poison hemlock, tall fescue (*Festuca arundinacea*), velvet grass (*Holcus lanatus*), Klamathweed, ox-eye daisy (*Leucanthemum vulgare*), woolly mullein (*Verbascum thapsus*), Mediterranean mustard (*Hirschfeldia incana*), wild oat (*Avena fatua*), ripgut brome (*Bromus diandrus*), annual ryegrass (*Lolium multiflorum*), field bindweed (*Convolvulus arvensis*), wild teasel (*Dipsacus fullonum*), and milk thistle (*Silybum marianum*). Although identified as invasive and occurring in the Bear Creek watershed, the following feed grasses are considered beneficial for livestock: tall fescue, velvet grass, Harding grass (*Phalaris aquatica*), smilo grass (*Piptatherum miliaceum*), wild oat, annual ryegrass, California bur clover, and yellow sweet clover (*Melilotus officinalis*). Two other invasive plants not verified in the watershed, but considered important feed grasses to livestock include cheat grass (*Bromus tectorum*) and slender wild oat (*Avena barbatum*).

**Table 6-5. Bear Creek Watershed Assessment 2005
Cal-IPC Invasive Plants Known to Occur in Shasta County**

<i>Invasive Plants Identified by the California Invasive Plant Council</i>	<i>Verified in Bear Creek Watershed</i>
RED ALERT - SPECIES WITH POTENTIAL TO SPREAD EXPLOSIVELY; INFESTATIONS CURRENTLY RESTRICTED.	
Spotted knapweed, <i>Centaurea maculosa</i>	1
Hydrilla, <i>Hydrilla verticillata</i>	
Purple loosestrife, <i>Lythrum salicaria</i>	
LIST A-1 – MOST INVASIVE WILDLAND PEST PLANTS; WIDESPREAD	
Giant reed (arundo), <i>Arundo donax</i>	
Cheat grass (downy brome), <i>Bromus tectorum</i>	
Yellow starthistle, <i>Centaurea solstitialis</i>	2A, 2B, 3
Pampas grass, <i>Cortaderia selloana</i>	5
Scotch broom, <i>Cytisus scoparius</i>	1
French broom, <i>Genista monspessulana</i>	1
Perennial pepperweed (tall whitetop), <i>Lepidium latifolium</i>	
Himalayan blackberry, <i>Rubus discolor</i>	2A, 3
Medusahead, <i>Taeniatherum caput-medusae</i>	2B
Tamarisk (salt cedar), <i>Tamarix chinensis</i> , <i>T. gallica</i> , <i>T. parviflora</i> , & <i>T. ramosissima</i>	
LIST A-2 - MOST INVASIVE WILDLAND PEST PLANTS; REGIONAL	
Tree of heaven, <i>Ailanthus altissima</i>	2A, 3
Red brome, <i>Bromus madritensis</i> ssp. <i>rubens</i>	
White top (hoary cress), <i>Cardaria draba</i>	
Brazilian waterweed, <i>Egeria densa</i>	
Russian olive, <i>Elaeagnathus angustifolia</i>	
Edible fig, <i>Ficus carica</i>	2A
Pennyroyal, <i>Mentha pulegium</i>	2A
LIST B – WILDLAND PEST PLANTS OF LESSER INVASIVENESS	
Black mustard, <i>Brassica nigra</i>	
Lens-podded white-top, <i>Cardaria chalapensis</i>	
Italian thistle, <i>Carduus pycnocephalus</i>	
Tocalote (Malta starthistle), <i>Centaurea melitensis</i>	

**Table 6-5. Bear Creek Watershed Assessment 2005
Cal-IPC Invasive Plants Known to Occur in Shasta County**

<i>Invasive Plants Identified by the California Invasive Plant Council</i>	<i>Verified in Bear Creek Watershed</i>
<i>(continued)</i>	
Canada thistle, <i>Cirsium arvense</i>	
Bull thistle, <i>Cirsium vulgare</i>	2B, 3
Poison hemlock, <i>Conium maculatum</i>	3
Tall fescue, <i>Festuca arundinacea</i>	2B
English ivy, <i>Hedera helix</i>	5
Velvet grass, <i>Holcus lanatus</i>	2B
Klamathweed, <i>Hypericum perforatum</i>	2A, 2B
Yellow water iris (yellow flag), <i>Iris pseudoacorus</i>	
Ox-eye daisy, <i>Leucanthemum vulgare</i>	2A, 2B
Parrot's feather, <i>Myriophyllum aquaticum</i>	5
Harding grass, <i>Phalaris aquatica</i>	4, 5
Curlyleaf pondweed, <i>Potamogeton crispus</i>	5
Black locust, <i>Robinia pseudoacacia</i>	
Spanish broom, <i>Spartium junceum</i>	
Woolly mullein (common mullein), <i>Verbascum thapsus</i>	2A, 2B
Periwinkle, <i>Vinca major</i>	5
NEED MORE INFORMATION	
Silver wattle, <i>Acacia dealbata</i>	
Green wattle, <i>Acacia decurrens</i>	
Pacific bentgrass, <i>Agrostis avenacea</i>	
Flixweed (tansy mustard), <i>Descurainia sophia</i>	
Western mannagrass, <i>Glyceria occidentalis</i>	
Marlahan mustard (Dyer's woad), <i>Isatis tinctoria</i>	
Mediterranean mustard (short pod mustard), <i>Hirschfeldia incana</i>	2A, 2B
Rough cat's ear, <i>Hypochaeris radicata</i>	
Smilo grass, <i>Piptatherum miliaceum</i>	4
Chinese pistache, <i>Pistacia chinensis</i>	
Cherry plum, <i>Prunus cerasifera</i>	
Water primrose, <i>Ludwigia uruguayensis</i>	
Monterey pine, <i>Pinus radiata</i> cultivars	
Pyracantha, <i>Pyracantha angustifolia</i>	5
Russian thistle (tumbleweed), <i>Salsola tragus</i>	
Mediterranean sage, <i>Salvia aethiopsis</i>	
Tall vervain, <i>Verbana bonariensis</i> & <i>Verbana litoralis</i>	
ANNUAL GRASSES	
Barbed goatgrass, <i>Aegilops triuncialis</i>	
Slender wild oat, <i>Avena barbata</i>	
Wild oat, <i>Avena fatua</i>	2A
False brome, <i>Brachypodium distachyon</i>	
Ripgut brome, <i>Bromus diandrus</i>	2A
Annual ryegrass, <i>Lolium multiflorum</i>	2A
CONSIDERED, BUT NOT LISTED	
Field bindweed, <i>Convolvulus arvensis</i>	2A, 2B
Wild teasel (Fuller's teasel), <i>Dipsacus sativus</i> & <i>Dipsacus fullonum</i>	2B
California bur clover, <i>Medicago polymorpha</i>	4, 5
Yellow sweet clover, <i>Melilotus officinalis</i>	4
Oleander, <i>Nerium oleander</i>	3
Milk thistle, <i>Silybum marianum</i>	2A
Spiny cocklebur, <i>Xanthium spinosum</i>	5
Other Invasive Plants	
Scotch thistle, <i>Onopordum</i> spp.	
Musk thistle, <i>Carduus nutans</i>	
Squarrose knapweed, <i>Centaurea maculosa</i>	
Diffuse knapweed, <i>Centaurea diffusa</i>	
Dalmation toadflax, <i>Linaria dalmatica</i>	

**Table 6-5. Bear Creek Watershed Assessment 2005
Cal-IPC Invasive Plants Known to Occur in Shasta County**

<i>Invasive Plants Identified by the California Invasive Plant Council</i>	<i>Verified in Bear Creek Watershed</i>
I(continued)	
Skeleton weed, <i>Chondrilla juncea</i>	
Puncturevine, <i>Tribulus terrestris</i>	6
Osage orange, <i>Maclura pomifera</i>	3

1 = Shasta County Department of Agriculture/ Weights & Measures

2A = ENPLAN (2001)

2B = ENPLAN (Unpublished data collected for the Shingletown Meadows Project)

3 = VESTRA (2002)

4 = Aldridge Ranch

5 = R. Weidenkeller

6 = C. Weidert

CONTROL OF NOXIOUS AND INVASIVE WEEDS

The control of noxious or invasive weeds may be accomplished through physical control, biological control, or chemical control. This section summarizes techniques described in Bossard et al. (2000) for controlling noxious and invasive weeds. Landowners are encouraged contact the Western Shasta RCD regarding the proper technique for controlling the spread of invasive species, as some techniques may not be appropriate depending upon the circumstances.

Physical Control. Physical control of noxious or invasive weeds involves the use of manual control techniques, prescribed fire, and mulching.

Manual. Manual control of noxious or invasive weeds involves uprooting individual weeds by hand or machine. Uprooting individual weeds by hand is very effective, but time consuming. Bulldozers are particularly effective at uprooting many weeds simultaneously. However, this technique may cause significant disturbance to the soil, is expensive, and care must be taken to ensure that the disturbed site is not recolonized by weeds. Mowing yellow-star thistle in late spring is effective at controlling the spread of this weed.

Prescribed Fire. Prescribed fire can be an effective way of reducing or eliminating noxious or invasive weeds in native communities that evolved with fire. Fire can also be used to induce seeds of some species to germinate so the seed bank can be flushed and the resulting seedlings can then be killed with another fire or some other method.

Individuals considering prescribed burning should be trained, certified, and coordinate with the CDF to ensure safe, effective, and legal burns. Good logistical planning, careful timing with respect to weather (winds, moisture conditions), and coordination with air quality agencies are required to carry out an effective and safe burn. In most parts of California it is necessary to address air quality concerns and to obtain permission from the regional air quality board. Fires that escape containment pose a danger to life and property and are expensive to suppress.

While prescribed fires are effective at reducing or eliminating noxious or invasive weeds, there are several disadvantages associated with its use. Prescribed fires may aid the establishment of some noxious or invasive weeds, and so should be used with caution. In addition, hot fires can sterilize the soil, volatilize important

nutrients, and kill microorganisms that provide plants with nutrients. The removal of vegetation by fire can also increase soil erosion and stream sedimentation.

Mulching. Mulching is the application of hay, straw, sawdust, wood chips, rice hulls, or black film over noxious or invasive weeds. This technique eliminates the target population because it prevents the plants from conducting photosynthesis, a vital process that allows them to grow in the presence of sunlight. The most effective mulches are black paper or plastic because of their uniform coverage. Mulch materials and application can be expensive, but may be suitable to eliminate small infestations.

Biological Control. Biological control involves the use of animals, fungi, or other microbes that prey upon, consume, or parasitize a target species. Ideal target species are those whose success in new environments may be due in part to the absence of their natural predators and pathogens. Biological control involves the selection and introduction of one or more natural enemies to the target species' new habitat to reduce or eliminate target populations. Successful biological control programs result in the permanent establishment of the control agent or agents and permanent reduction or elimination in target species populations in a particular area. It may require subsequent releases to ensure the establishment of an agent. In some cases, it may require several years before the effects of biological control are apparent. Biological control is effective because once an agent is established, it will persist indefinitely and may spread on its own to cover most or all of the area infested by the weed, generally without additional costs. Biological control may become detrimental if the agent begins to attack desirable species as well as the pest it was introduced to control.

Competition and Restoration. The use of native plants to out-compete noxious or invasive weeds is an often overlooked, but very effective technique. In some cases, the native plants must be planted into the habitat and cared for until they are well established. This technique may be possible in grasslands, woodlands, or forest communities that have noxious or invasive weeds present.

Grazing. Grazing animals are effective at controlling or suppressing some target species. However, grazing animals may inadvertently spread the target population due to the presence of seeds in their droppings. Grazing animals include cattle, sheep, goats, geese, chickens, and grass carp. For grazing to be effective, it must be continued until the weed's seed bank is eliminated, as the suppressed plants may otherwise become re-established.

Chemical Control. Chemical control of noxious weeds or invasive plants involves the use of herbicides. This technique is very effective at eliminating some species. However, herbicides are very dangerous and should be used only after careful consideration of other options and only with extreme care. The environmental risks of using herbicides include drift, volatilization, persistence in the environment, groundwater contamination, and its harmful effects on animals.

6.3. Conclusions

The vegetation in the Bear Creek watershed has been modified significantly over the past 150 years as a result of human activities, such as land development, fire suppression, prescribed burning, timber harvest practices, and the introduction of non-native plant species. These activities have affected species diversity and density, as well the structure of forests in the watershed. Preserving the watershed's vegetation types and natural communities should be a high priority.

In the preparation of this document, several data gaps were identified. In the absence of recent field surveys, the state of vegetation types and unique natural communities in the Bear Creek watershed is largely unknown. Field surveys throughout the watershed are needed to document the presence and distribution of noxious and invasive weeds and to assess their impact on vegetation types, unique natural communities, and special-status plants. Comprehensive surveys are also needed to identify the extent and quality of riparian habitat, snag densities, coarse woody debris, overstocked stands.

6.4. References

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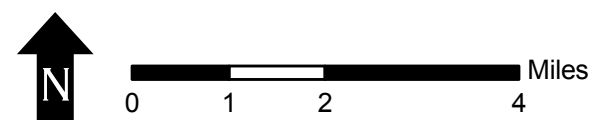
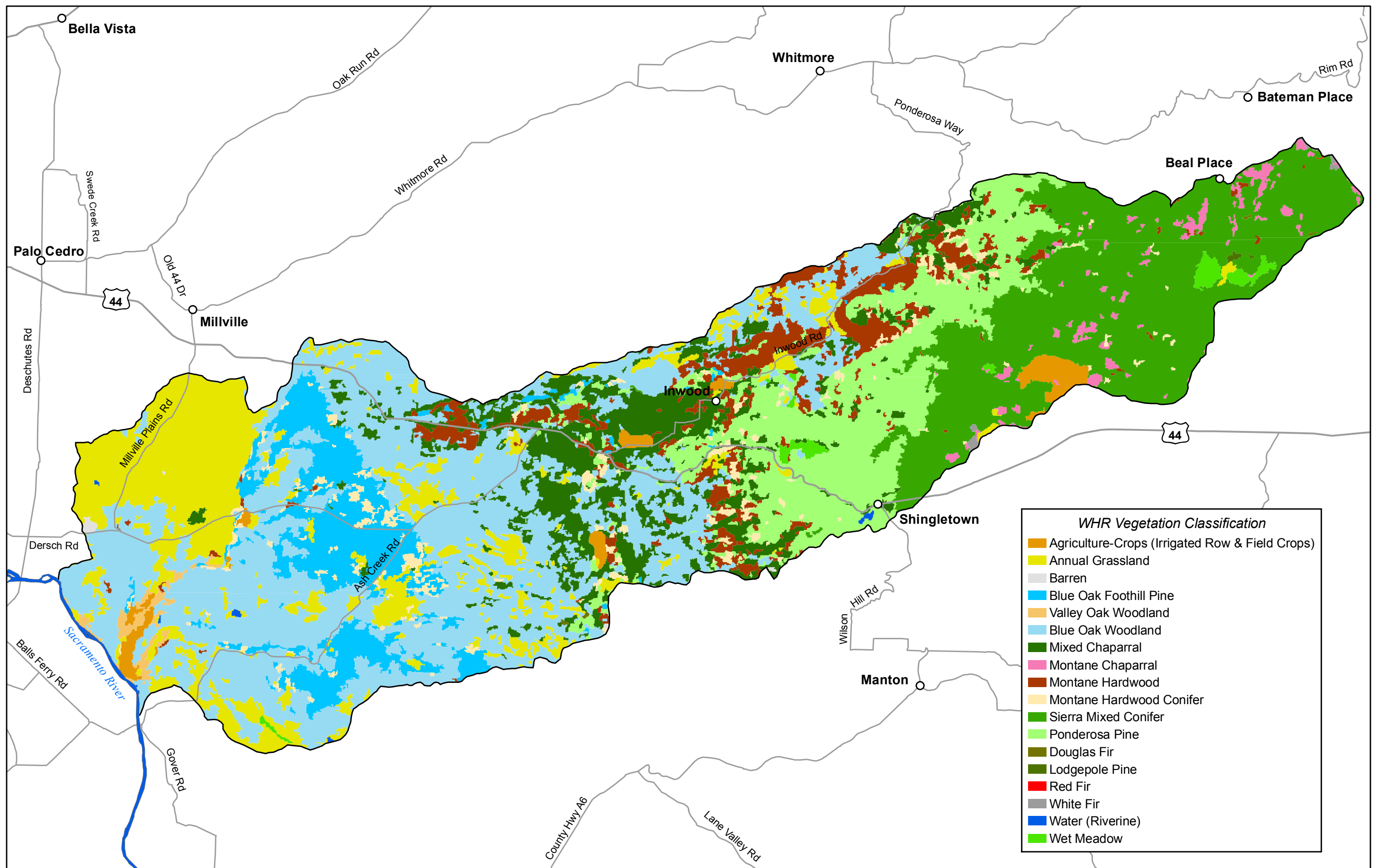


Figure 6-1
Wildlife Habitat Relationship (WHR) Vegetation Classification
Bear Creek Watershed Assessment 2005

VII. WILDLIFE RESOURCES

7.1. Introduction

The Bear Creek watershed encompasses approximately 157 square miles in Shasta County east of the Sacramento River. The elevation in the watershed ranges from 350 feet at the Sacramento River to approximately 6,740 feet at Latour Butte. The watershed includes a variety wildlife habitat types that are used by a variety of wildlife species. The focus of this section is to identify the current wildlife habitat types and wildlife that occur in the Bear Creek watershed.

7.2. Reference Conditions

No historical information (prior to 1850) is available on the relative abundance of wildlife species in the watershed. Prior to European American settlement in the watershed, wildlife habitats were not as fragmented as they currently are. These intact habitats likely supported larger numbers of some wildlife species.

7.3. Wildlife Habitats

The Bear Creek watershed has 20 habitat types recognized by the California Department of Fish and Game's (DFG) Wildlife Habitat Relationships System (WHR) (Table 7-1). Each WHR habitat type was reviewed to identify those wildlife species predicted by the WHR to potentially occur in the Bear Creek watershed and find habitat of at least moderate quality. The WHR is a predictive system based on scientific information regarding wildlife species and their known habitat relationships. It provides a broad view of wildlife species potentially occurring in the watershed. A list of wildlife species predicted by WHR to potentially occur in the watershed and find moderate or high quality habitat is shown in Table 7-2. The following discussion addresses the value each WHR habitat type has for wildlife and identifies wildlife species that may find habitat of high quality.

Table 7-1. Bear Creek Watershed Assessment 2005
Habitat Types in the Bear Creek Watershed and Acreage of Each Type

<i>WHR Habitat Type</i>	<i>Acres</i>	<i>Percentage of Watershed</i>	<i>WHR Habitat Type</i>	<i>Acres</i>	<i>Percentage of Watershed</i>
Agriculture-Crops	1,360	1.35%	Montane Hardwood-Conifer	2,162	2.15%
Annual Grass	12,796	12.72%	Montane Riparian	NA	
Barren	82	0.08%	Ponderosa Pine	12,366	12.29%
Blue Oak Foothill Pine	7,258	7.22%	Red Fir	3	0.01%
Blue Oak Woodland	29,142	28.98%	Sierran Mixed Conifer	18,049	17.95%
Douglas Fir	28	0.02%	Valley Foothill Riparian	NA	
Lodgepole Pine	32	0.03%	Valley Oak Woodland	512	0.51%
Mixed Chaparral	9,398	9.34%	Water (Riverine)	130	0.13%
Montane Chaparral	1,025	1.02%	Wet Meadow	640	0.63%
Montane Hardwood	5,474	5.44%	White Fir	82	0.08%

**Table 7-2. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by WHR to Potentially Occur in the Watershed
and Find Moderate or High Quality Habitat**

<i>Amphibians</i>	<i>Mammals (Cont.)</i>	<i>Birds (Cont.)</i>	<i>Birds (Cont.)</i>	<i>Birds (Cont.)</i>
Rough-skinned newt California newt Ensatina California slender salamander Black salamander Shasta salamander Pacific giant salamander Long-toed salamander Western toad Western spadefoot Bullfrog Pacific tree frog Foothill yellow-legged frog Tailed frog California red-legged frog Cascades frog Northern leopard frog Spotted frog	Northern flying squirrel Belding's ground squirrel Botta's pocket gopher Western pocket gopher Mountain pocket gopher Great basin pocket mouse American beaver Mountain beaver Western harvest mouse Deer mouse Brush mouse Pinon mouse House mouse Western jumping mouse Dusky-footed woodrat Bushy-tailed woodrat California vole Creeping vole Western red-backed vole Montane vole Long-tailed vole Common muskrat Black rat California kangaroo rat Common porcupine Coyote Gray fox Black bear Ringtail Raccoon Long-tailed weasel American mink Western spotted skunk Striped skunk Northern river otter Mountain lion Bobcat Wild pig Elk Mule deer Mountain cottontail Snowshoe hare Yellow-bellied marmot Pine (American) marten Fisher (Pacific fisher) Ermine	American kestrel Merlin Peregrine falcon Prairie falcon Ring-necked pheasant Ruffed grouse Blue grouse Wild turkey California quail Mountain quail Killdeer Spotted sandpiper Forster's tern Caspian tern Black tern Band-tailed pigeon Rock Dove Mourning dove Barn owl Western screech owl Great horned owl Northern pygmy owl California spotted owl Long-eared owl Northern saw-whet owl Barred owl Short-eared owl Flammulated owl Burrowing owl Lesser nighthawk Common nighthawk White-throated swift Black swift Vaux's swift Black-chinned hummingbird Anna's hummingbird Calliope hummingbird Rufous hummingbird Belted kingfisher Lewis' woodpecker Acorn woodpecker Red-breasted sapsucker Williamson's sapsucker Nuttall's woodpecker Downy woodpecker Hairy woodpecker White-headed woodpecker Black-headed woodpecker Pileated woodpecker Northern flicker Western wood-pewee Willow flycatcher Pacific-slope flycatcher Ash-throated flycatcher Olive-sided flycatcher Hammond's flycatcher Dusky flycatcher Blue-gray gnat catcher Black phoebe Say's phoebe Western kingbird Tree swallow Violet-green swallow Northern rough-winged swallow Bank swallow Cliff swallow Barn swallow Steller's jay Western scrub-jay Pinyon jay Gray jay Clark's nutcracker Yellow-billed magpie Black-billed magpie American crow Common raven Chestnut-backed chickadee Mountain chickadee Oak titmouse Bushtit	Pygmy nuthatch White-breasted nuthatch Red-breasted nuthatch Canyon wren Rock wren Bewick's wren House wren Winter wren Ruby-crowned kinglet Golden-crowned kinglet Western bluebird Mountain bluebird Townsend's solitaire Swainson's thrush Hermit thrush American robin Varied thrush California thrasher Cedar waxwing Loggerhead shrike Northern shrike European starling Cassin's vireo Hutton's vireo Warbling vireo Orange-crowned warbler Nashville warbler Yellow warbler Yellow-rumped warbler Black-throated gray warbler Townsend's warbler Hermit warbler Macgillivray's warbler Wilson's warbler Common yellowthroat Yellow-breasted chat Western tanager Black-headed grosbeak Evening grosbeak Blue grosbeak Lazuli bunting Green-tailed towhee Spotted towhee California towhee Chipping sparrow Brewer's sparrow Black-chinned sparrow Lark sparrow Sage sparrow Vesper sparrow Harris's sparrow Fox sparrow Song sparrow Lincoln's sparrow Golden-crowned sparrow White-crowned sparrow Rufous-crowned sparrow White-throated sparrow Savannah sparrow Dark-eyed junco Red-winged blackbird Tricolored blackbird Brewer's blackbird Yellow-headed blackbird Brown-headed cowbird Bullock's oriole Gray-crowned rosy finch Cassin's finch Purple finch House finch Pine siskin Lesser goldfinch Lawrence's goldfinch American goldfinch Plumbeous vireo Purple martin Brown creeper American dipper American white pelican Black-necked stilt	American avocet Long-billed curlew Baird's sandpiper Western sandpiper Least sandpiper Dunlin Long-billed dowitcher Common snipe Wilson's phalarope Red phalarope Ring-billed gull California gull Herring gull Thayer's gull Glaucous-winged gull Common poorwill Horned lark American pipit Tundra swan Greater white-fronted goose Snow goose Canada goose Ross' goose Eurasian wigeon American wigeon Sandhill crane Northern mockingbird Pied-billed grebe Eared-grebe Western grebe Clark's grebe Ring-necked duck Gadwall Cinnamon teal Blue-winged teal Green-winged teal Northern pintail Canvasback Redhead Northern shoveler Lesser scaup American coot Greater yellowlegs Willet Red crossbill Wrentit Greater roadrunner Lapland longspur Western meadowlark Phainopepla Virginia rail Sora
<i>Reptiles</i>				
Western pond turtle Western whiptail Western fence lizard Sagebrush lizard Northern alligator lizard Southern alligator lizard Western skink Ringneck snake Sharp-tailed snake Racer Striped racer Gopher snake Common kingsnake California mountain kingsnake Common garter snake Western terrestrial garter snake Western aquatic garter snake Night snake Western rattlesnake Pacific coast aquatic garter snake Rubber boa				
<i>Mammals</i>				
Virginia opossum Vagrant shrew Trowbridge's shrew Water shrew Shrew mole Broad-footed mole Yuma myotis Little brown myotis Long-eared myotis Fringed myotis Long-legged myotis California myotis Western small-footed myotis Silver-haired bat Big brown bat Western red bat Hoary bat Townsend's big-eared bat Pallid bat Brazilian free-tailed bat Western mastiff bat Brush rabbit Desert cottontail Black-tailed jackrabbit White-tailed jackrabbit Allen's chipmunk Sonoma chipmunk Yellow-pine chipmunk Lodgepole chipmunk Eastern fox squirrel Douglas' squirrel California ground squirrel Golden-mantled ground squirrel Western gray squirrel	American pika American badger Red fox Wolverine Pronghorn			
	<i>Birds</i>			
	Double-crested cormorant Great blue heron Green heron Black-crowned night heron Great egret Snowy egret Wood duck Mallard Barrow's goldeneye Common goldeneye Hooded merganser Common merganser Turkey vulture Osprey White-tailed kite Bald eagle Northern harrier Sharp-shinned hawk Cooper's hawk Northern goshawk Red-shouldered hawk Swainson's hawk Red-tailed hawk Ferruginous hawk Rough-legged hawk Golden eagle			

AGRICULTURE-CROPS (IRRIGATED ROW AND FIELD CROPS)

In the Bear Creek watershed, agricultural croplands exist near the mouths of Bear Creek and Ash Creek, and near Shingletown. These lands provide important habitat for a variety of wildlife. Stock ponds and irrigation ditches typically contain a variety of introduced fish and frogs. The presence of aquatic habitat typically attracts garter snakes (*Thamnophis* spp.) which feed on amphibians and introduced fish. In turn, garter snakes are hunted by owls and raptors. Cattails growing along the edge of a stock pond provide nesting habitat for many species of birds and waterfowl. Cultivated fields and irrigated pastures are important habitat for a variety of small mammals and birds. Grain crops provide an abundant food source for mice and birds. Other crops may attract black-tailed deer (*Odocoileus hemionus*) and rabbits which browse on the plants.

The WHR predicts that agriculture-crops within the Bear Creek watershed may provide habitat of at least moderate quality for 69 species of wildlife. Table 7-3 lists the subset of 40 species that may find high quality habitat in this type.

**Table 7-3. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed and Find
High-Quality Habitat in Agriculture-Crops (Irrigated Row and Field Crops)**

Great blue heron	California gull	Blue grosbeak	Mountain pocket gopher
Great egret	Rock dove	Red-winged blackbird	Western harvest mouse
Tundra swan	Barn owl	Tricolored blackbird	House mouse
Snow goose	Short-eared owl	Brewer's blackbird	Striped skunk
White-tailed kite	Lesser nighthawk	European starling	Wild pig
American kestrel	Common nighthawk	Desert cottontail	Elk
Merlin	Northern rough-winged swallow	Black-tailed jackrabbit	Brush rabbit
Ring-necked pheasant	Bank swallow	Belding's ground squirrel	
Sandhill crane	Cliff swallow	California ground squirrel	
Killdeer	Barn swallow	Botta's pocket gopher	
Western sandpiper	American crow	Western pocket gopher	

ANNUAL GRASS

In the Bear Creek watershed, annual grass occurs predominantly on the Millville Plains and provides habitat for many wildlife species. Annual grassland can occupy large areas or it may be interspersed within oak woodlands. Grasses and forbs produce an abundance of seeds, attracting insects and providing food for small mammals, which are hunted by snakes, owls, and raptors. Black-tailed deer forage in grasslands during winter. The coyote (*Canis latrans*) is a year-long resident in annual grasslands. A variety of migratory birds, such as the western meadowlark (*Sturnella neglecta*) and horned lark (*Eremophila alpestris*) associate with annual grasslands in spring and summer.

The WHR predicts that annual grass within the Bear Creek watershed may provide habitat of at least moderate quality for 147 species. Table 7-4 lists the subset of 108 species that may find high quality habitat in this type.

**Table 7-4. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Annual Grass**

Western spadefoot	American kestrel	Purple martin	Brown-headed cowbird
Pacific chorus frog	Peregrine falcon	Tree swallow	Lawrence's goldfinch
Bullfrog	Prairie falcon	Violet-green swallow	Vagrant shrew
Great blue heron	Ring-necked pheasant	Northern rough-winged swallow	Broad-footed mole
Great egret	Wild turkey	Bank swallow	Big brown bat
Tundra swan	California quail	Cliff swallow	Pallid bat
Greater white-fronted goose	American coot	Barn swallow	Western mastiff bat
Snow goose	Killdeer	Yellow-billed magpie	Brush rabbit
Ross' goose	Long-billed curlew	American crow	Black-tailed jackrabbit
Canada goose	Wilson's phalarope	Common raven	California ground squirrel
Green-winged teal	Rock dove	Western bluebird	Botta's pocket gopher
Mallard	Mourning dove	Mountain bluebird	Western pocket gopher
Northern pintail	Barn owl	American robin	California kangaroo rat
Blue-winged teal	Western screech owl	American pipit	Western harvest mouse
Northern shoveler	Great horned owl	Loggerhead shrike	Pinon mouse
Gadwall	Burrowing owl	European starling	California vole
Eurasian wigeon	Long-eared owl	Common yellowthroat	Long-tailed vole
American wigeon	Short-eared owl	Blue grosbeak	House mouse
Lesser scaup	Lesser nighthawk	Rufous-crowned sparrow	Coyote
Turkey vulture	Common nighthawk	Chipping sparrow	Black bear
White-tailed kite	White-throated swift	Vesper sparrow	Long-tailed weasel
Northern harrier	Lewis' woodpecker	Lark sparrow	American badger
Swainson's hawk	Northern flicker	Savannah sparrow	Striped skunk
Red-tailed hawk	Black phoebe	Lapland longspur	Pronghorn
Ferruginous hawk	Say's phoebe	Red-winged blackbird	Racer
Rough-legged hawk	Western kingbird	Tricolored blackbird	Gopher snake
Golden eagle	Horned lark	Western meadowlark	Common garter snake

BARREN

In the Bear Creek watershed, barren habitat (e.g., cliffs and rock outcrops) is uncommon. Most of this habitat occurs at the western edge of Bear Creek watershed boundary, west of the intersection of Dersch Road and Millville Plains Road. Barren habitats generally support few wildlife species due to the absence of plants. Barren habitats provide valuable nesting habitat for peregrine falcon (*Falco peregrinus*) and golden eagle (*Aquila chrysaetos*). Turkey vultures (*Cathartes aura*) may perch on outcrops to thermoregulate. Rock outcrops provide important habitat for reptiles. The western rattlesnake (*Crotalus viridis*) often dens in crevices between rocks and thermoregulates on large rocks. The western fence lizard (*Sceloporus occidentalis*) is also abundant in rock areas.

The WHR predicts that barren habitats within the Bear Creek watershed may provide habitat of at least moderate quality for 63 species. Table 7-5 lists the subset of 55 species that may find high quality habitat in this type.

**Table 7-5. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Barren Habitat**

American white pelican	Least sandpiper	Common poorwill	American pipit
Double-crested cormorant	Dunlin	Black swift	Gray-crowned rosy-finch
Turkey vulture	Long-billed dowitcher	White-throated swift	Baird's sandpiper
Swainson's hawk	California gull	Belted kingfisher	Little brown myotis
Red-tailed hawk	Herring gull	Black phoebe	Fringed myotis
Golden eagle	Thayer's gull	Say's phoebe	Long-legged myotis
American kestrel	Glaucous-winged gull	Horned lark	California myotis
Peregrine falcon	Caspian tern	Violet-green swallow	Western small-footed myotis
Killdeer	Forster's tern	Northern rough-winged swallow	Big brown bat
Black-necked stilt	Barn owl	Bank swallow	Pallid bat
American avocet	Great horned owl	Common raven	Brazilian free-tailed bat
Spotted sandpiper	Burrowing owl	Rock wren	American pika
Long-billed curlew	Lesser nighthawk	Canyon wren	Yellow-bellied marmot
Western sandpiper	Common nighthawk	American dipper	

BLUE OAK FOOTHILL PINE

Blue oak foothill pine occurs in the foothills east of the Millville Plains and to the south of Highway 44 and provides habitat for many species of wildlife. Acorns from oak trees and pine cone seeds from foothill pines are important sources of food for a variety of wildlife. Tree cavities provide nesting sites for bats, and birds such as woodpeckers and northern flickers (*Colaptes chrysoides*). Turkey vultures often perch on the limbs of large blue oaks or foothill pines to thermoregulate. Shade beneath a large blue oak often provides a cool resting place for wildlife during summer. Downed wood debris provides important cover for various lizards and snakes.

The WHR predicts that the blue oak foothill pine within the Bear Creek watershed may provide habitat of at least moderate quality for 200 species. Table 7-6 lists the subset of 147 species that may find high quality habitat in this type.

**Table 7-6. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Blue Oak Foothill Pine**

Rough-skinned newt	Lesser nighthawk	Mountain bluebird	Plumbeous vireo
California newt	Common nighthawk	Hermit thrush	Barred owl
Ensatina	Common poorwill	American robin	Fringed myotis
Black salamander	White-throated swift	Wrentit	Big brown bat
Shasta salamander	Black-chinned hummingbird	Northern mockingbird	Hoary bat
Great blue heron	Anna's hummingbird	Cedar waxwing	Brush rabbit
Great egret	Rufous hummingbird	Phainopepla	Desert cottontail
Wood duck	Lewis' woodpecker	Loggerhead shrike	Black-tailed jackrabbit
Turkey vulture	Acorn woodpecker	European starling	Sonoma chipmunk
White-tailed kite	Red-breasted sapsucker	Cassin's vireo	California ground squirrel
Sharp-shinned hawk	Nuttall's woodpecker	Hutton's vireo	Western gray squirrel
Cooper's hawk	Northern flicker	Warbling vireo	Northern flying squirrel
Red-shouldered hawk	Western wood-pewee	Orange-crowned warbler	Botta's pocket gopher
Swainson's hawk	Pacific-slope flycatcher	Yellow warbler	Brush mouse
Red-tailed hawk	Say's phoebe	Yellow-rumped warbler	Dusky-footed woodrat
Ferruginous hawk	Ash-throated flycatcher	Black-throated gray warbler	Black rat
Rough-legged hawk	Western kingbird	Hermit warbler	House mouse
Golden eagle	Horned lark	Wilson's warbler	Coyote
American kestrel	Purple martin	Western tanager	Gray fox
Merlin	Violet-green swallow	Black-headed grosbeak	Black bear
Peregrine falcon	Northern rough-winged swallow	Lazuli bunting	Ringtail
Prairie falcon	Cliff swallow	Spotted towhee	Raccoon
Wild turkey	Barn swallow	California towhee	Long-tailed weasel
California quail	Western scrub-jay	Chipping sparrow	American badger
Mountain quail	Yellow-billed magpie	Lark sparrow	Western spotted skunk
Band-tailed pigeon	American crow	Savannah sparrow	Striped skunk
Mourning dove	Common raven	Golden-crowned sparrow	Mountain lion
Greater roadrunner	Oak titmouse	White-crowned sparrow	Western pond turtle
Barn owl	Bushtit	Dark-eyed junco	Western fence lizard
Western screech owl	White-breasted nuthatch	Western meadowlark	Western skink
Great horned owl	Rock wren	Brown-headed cowbird	Southern alligator lizard
Northern pygmy owl	Bewick's wren	Bullock's oriole	Ringneck snake
Burrowing owl	House wren	House finch	Sharp-tailed snake
California spotted owl	Ruby-crowned kinglet	Pine siskin	Gopher snake
Long-eared owl	Blue-gray gnatcatcher	Wild pig	Western terrestrial garter snake
Northern saw-whet owl	Western bluebird	Mule deer	Western rattlesnake
Lesser goldfinch	Lawrence's goldfinch	Bobcat	

BLUE OAK WOODLAND

Blue oak woodland is the predominant vegetation type from the western boundary of the Bear Creek watershed to any point along Highway 44 and provides habitat for a variety of wildlife species. Blue oak acorns are a valuable food source for a variety of animals. Blue oaks also provide nesting habitat for a variety of birds and bats. The California ground squirrel (*Otospermophilus beecheyi*) is a year-long resident of this woodland, foraging on fallen acorns. California ground squirrels often construct their burrow in the soil near the base of blue oaks. Western rattlesnakes hunt California ground squirrels and may seek refuge in their burrows. Large mammals, such as black-tailed deer and coyote often associate with blue oak woodland.

The WHR predicts that the blue oak woodland within the Bear Creek watershed may provide habitat of at least moderate quality for 194 species. Table 7-7 lists the subset of 144 species that may find high quality habitat in this type.

**Table 7-7. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Blue Oak Woodland**

Rough-skinned newt	Common poorwill	Mountain bluebird	Lawrence's goldfinch
California newt	White-throated swift	Hermit thrush	Plumbeous vireo
Ensatina	Black-chinned hummingbird	American robin	Yuma myotis
California slender salamander	Anna's hummingbird	Varied thrush	Fringed myotis
Great blue heron	Rufous hummingbird	Wrentit	Big brown bat
Great egret	Lewis' woodpecker	Northern mockingbird	Hoary bat
Black-crowned night heron	Acorn woodpecker	Cedar waxwing	Pallid bat
Wood duck	Red-breasted sapsucker	Phainopepla	Desert cottontail
Turkey vulture	Nuttall's woodpecker	Loggerhead shrike	Black-tailed jackrabbit
White-tailed kite	Downy woodpecker	European starling	Sonoma chipmunk
Sharp-shinned hawk	Hairy woodpecker	Cassin's vireo	California ground squirrel
Cooper's hawk	Northern flicker	Hutton's vireo	Western gray squirrel
Red-shouldered hawk	Western wood-pewee	Warbling vireo	Northern flying squirrel
Swainson's hawk	Pacific-slope flycatcher	Orange-crowned warbler	Botta's pocket gopher
Red-tailed hawk	Say's phoebe	Yellow warbler	Brush mouse
Ferruginous hawk	Ash-throated flycatcher	Yellow-rumped warbler	Black rat
Rough-legged hawk	Western kingbird	Black-throated gray warbler	House mouse
Golden eagle	Horned lark	Townsend's warbler	Coyote
American kestrel	Purple martin	Hermit warbler	Gray fox
Merlin	Violet-green swallow	Wilson's warbler	Ringtail
Peregrine falcon	Northern rough-winged swallow	Western tanager	Raccoon
Prairie falcon	Cliff swallow	Black-headed grosbeak	Long-tailed weasel
Wild turkey	Barn swallow	Lazuli bunting	American badger
California quail	Western scrub-jay	Spotted towhee	Western spotted skunk
Band-tailed pigeon	Yellow-billed magpie	California towhee	Striped skunk
Mourning dove	American crow	Chipping sparrow	Bobcat
Greater roadrunner	Common raven	Lark sparrow	Wild pig
Barn owl	Oak titmouse	Savannah sparrow	Mule deer
Western screech owl	Bushtit	Golden-crowned sparrow	Western pond turtle
Great horned owl	White-breasted nuthatch	White-crowned sparrow	Western fence lizard
Northern pygmy owl	Rock wren	Dark-eyed junco	Western skink
Burrowing owl	Bewick's wren	Western meadowlark	Southern alligator lizard
Long-eared owl	House wren	Bullock's oriole	Racer
Northern saw-whet owl	Ruby-crowned kinglet	House finch	Gopher snake
Lesser nighthawk	Blue-gray gnatcatcher	Pine siskin	Western terrestrial garter snake
Common nighthawk	Western bluebird	Lesser goldfinch	Western rattlesnake

DOUGLAS FIR

In the Bear Creek watershed, a relatively small Douglas fir forest occurs near the headwaters of South Fork Bear Creek. Douglas fir forests are inhabited by many species of wildlife. The dense canopy provides important nesting sites for many species of birds, including the California spotted owl (*Strix occidentalis caurina*). Squirrels also nest in Douglas fir trees. Fir cones provide food for numerous small mammals, which in turn, are hunted by a variety of owls and raptors. Black-tailed deer and black bears (*Ursus americanus*) often browse on the foliage of understory shrubs and their berries.

The WHR predicts that the Douglas fir within the Bear Creek watershed may provide habitat of at least moderate quality for 162 species. Table 7-8 lists the subset of 100 species that may find high quality habitat in this type.

**Table 7-8. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Douglas Fir**

Rough-skinned newt	Rufous hummingbird	Golden-crowned sparrow	Bushy-tailed woodrat
California slender salamander	Red-breasted sapsucker	Dark-eyed junco	Creeping vole
Black salamander	Pileated woodpecker	Western meadowlark	Common porcupine
Tailed frog	Olive-sided flycatcher	Purple finch	Coyote
Pacific giant salamander	Western wood-pewee	Red crossbill	Gray fox
Turkey vulture	Hammond's flycatcher	Pine siskin	Black bear
Osprey	Pacific-slope flycatcher	Barred owl	Ringtail
Sharp-shinned hawk	Purple martin	Harris's sparrow	Raccoon
Northern goshawk	Barn swallow	Trowbridge's shrew	Pine (American) marten
Red-tailed hawk	Gray jay	Shrew-mole	Fisher (Pacific fisher)
Golden eagle	Steller's jay	Long-eared myotis	Ermine
Peregrine falcon	Common raven	Silver-haired bat	Long-tailed weasel
Prairie falcon	Chestnut-backed chickadee	Hoary bat	Western spotted skunk
Blue grouse	Red-breasted nuthatch	Brush rabbit	Striped skunk
Ruffed grouse	Brown creeper	Snowshoe hare	Mountain lion
Band-tailed pigeon	Winter wren	Mountain beaver	Bobcat
Barn owl	Golden-crowned kinglet	Yellow-pine chipmunk	Elk
Flammulated owl	Hermit thrush	Golden-mantled ground squirrel	Mule deer
Great horned owl	American robin	Douglas' squirrel	Western fence lizard
Northern pygmy owl	Varied thrush	Northern flying squirrel	Northern alligator lizard
California spotted owl	Wrentit	Botta's pocket gopher	Rubber boa
Northern saw-whet owl	Yellow-rumped warbler	Western pocket gopher	Racer
Common nighthawk	Townsend's warbler	Brush mouse	Common garter snake
Black swift	Hermit warbler	Pinon mouse	Western terrestrial garter snake
Vaux's swift	Wilson's warbler	Dusky-footed woodrat	Western rattlesnake

LODGEPOLE PINE

In the Bear Creek watershed, lodgepole pine forests occur in the vicinity of Latour Butte. These forests occur at high elevation and are subject to heavy snow-pack in winter. Because lodgepole pine forests have low structural diversity, they are inhabited by relatively fewer species of wildlife. Birds and small mammals constitute the majority of wildlife in lodgepole pine forests. Seeds from the lodgepole pine cone are an important food source for many small mammals and birds. In addition, a variety of woodpeckers consume insects that associate with the bark of lodgepole pines. Amphibians and reptiles tend to be poorly represented in lodgepole pine forests.

The WHR predicts that the lodgepole pine within the Bear Creek watershed may provide habitat of at least moderate quality for 108 species. Table 7-9 lists the subset of 58 species that may find high quality habitat in this type.

**Table 7-9. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Lodgepole Pine**

Turkey vulture	Black-backed woodpecker	Dark-eyed junco	Coyote
Northern goshawk	Olive-sided flycatcher	Cassin's finch	Black bear
Red-tailed hawk	Western wood-pewee	Red crossbill	Raccoon
Golden eagle	Dusky flycatcher	Pine siskin	Pine (American) marten
Peregrine falcon	Gray jay	Silver-haired bat	Fisher (Pacific fisher)
Prairie falcon	Clark's nutcracker	Yellow-pine chipmunk	Ermine
Blue grouse	Common raven	Allen's chipmunk	Long-tailed weasel
Northern saw-whet owl	Mountain chickadee	Sonoma chipmunk	Wolverine
Black swift	White-breasted nuthatch	Lodgepole chipmunk	American badger
White-throated swift	Golden-crowned kinglet	Golden-mantled ground squirrel	Mountain lion
Calliope hummingbird	Ruby-crowned kinglet	Douglas' squirrel	Bobcat
Rufous hummingbird	Mountain bluebird	Northern flying squirrel	Mule deer
Red-breasted sapsucker	Hermit thrush	Deer mouse	Western terrestrial garter snake
Williamson's sapsucker	American robin	Western red-backed vole	
Hairy woodpecker	Yellow-rumped warbler	Long-tailed vole	

MIXED CHAPARRAL

Mixed chaparral occurs below 5,000 feet in elevation in the Bear Creek watershed and is inhabited by many species of wildlife. Mixed chaparral provides habitat for a variety of large and small mammals, reptiles, and birds. Mixed chaparral is important winter range for black-tailed deer. The black-tailed jackrabbit (*Lepus californicus*) forages in mixed chaparral. The western fence lizard and western skink (*Eumeces skiltonianus*) are generally abundant in mixed chaparral and are very active during daytime in summer. In contrast, the western rattlesnake is generally reclusive and remains well-concealed during daytime. The western scrub jay (*Aphelocoma coerulescens*) commonly forages for insects in mixed chaparral.

The WHR predicts that the mixed chaparral within the Bear Creek watershed may provide habitat of at least moderate quality for 127 species. Table 7-10 lists the subset of 64 species that may find high quality habitat in this type.

**Table 7-10. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Mixed Chaparral**

California newt	Common raven	Yellow-pine chipmunk	Western spotted skunk
Turkey vulture	Rock wren	Sonoma chipmunk	Striped skunk
White-tailed kite	Bewick's wren	California ground squirrel	Mountain lion
Red-tailed hawk	House wren	Golden-mantled ground squirrel	Bobcat
Golden eagle	Wrentit	Botta's pocket gopher	Wild pig
California quail	Northern mockingbird	Great basin pocket mouse	Elk
Greater roadrunner	California thrasher	California kangaroo rat	Mule deer
Barn owl	Orange-crowned warbler	Deer mouse	Western fence lizard
Western screech owl	Lazuli bunting	Brush mouse	Southern alligator lizard
Long-eared owl	Spotted towhee	Pinon mouse	Ringneck snake
Common poorwill	Rufous-crowned sparrow	Dusky-footed woodrat	Sharp-tailed snake
White-throated swift	Sage sparrow	Coyote	Striped racer
Anna's hummingbird	Fox sparrow	Gray fox	Gopher snake
Ash-throated flycatcher	Brush rabbit	Ringtail	Common kingsnake
Barn swallow	Desert cottontail	Long-tailed weasel	Common garter snake
Western scrub-jay	Black-tailed jackrabbit	American badger	Western rattlesnake

MONTANE CHAPARRAL

The montane chaparral is exposed to diverse environmental conditions. The montane chaparral is subjected to heavy snow pack in winter and spring, whereas in summer, it is very dry. In the Bear Creek watershed, montane chaparral occurs primarily between Shingletown and Latour Butte, and provides habitat for a variety of wildlife. Mammals and birds are the predominant wildlife observed in the montane chaparral. Mammals such as rodents and black-tailed deer are generally abundant in montane chaparral. Montane chaparral provides critical summer range foraging areas, escape cover, and fawning habitat for black-tailed deer. This habitat provides birds with a variety of food (e.g., seeds, berries, and insects), nesting habitat, and refuge from predators.

The WHR predicts that the montane chaparral within the Bear Creek watershed may provide habitat of at least moderate quality for 118 species. Table 7-11 lists the subset of 62 species that may find high quality habitat in this type.

**Table 7-11. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Montane Chaparral**

Turkey vulture	Say's phoebe	Sage sparrow	Ringtail
Sharp-shinned hawk	Northern rough-winged swallow	Fox sparrow	Long-tailed weasel
Red-tailed hawk	Barn swallow	Big brown bat	American badger
Golden eagle	Common raven	Brush rabbit	Western spotted skunk
American kestrel	Bushtit	Black-tailed jackrabbit	Striped skunk
Peregrine falcon	Rock wren	Yellow-pine chipmunk	Mountain lion
Prairie falcon	Bewick's wren	Sonoma chipmunk	Bobcat
California quail	Ruby-crowned kinglet	California ground squirrel	Wild pig
Mountain quail	American robin	Golden-mantled ground squirrel	Mule deer
Barn owl	Orange-crowned warbler	Botta's pocket gopher	Western fence lizard
Long-eared owl	Nashville warbler	Deer mouse	Sagebrush lizard
Common nighthawk	Yellow warbler	Brush mouse	Southern alligator lizard
Black swift	Green-tailed towhee	Pinon mouse	Northern alligator lizard
White-throated swift	Spotted towhee	Dusky-footed woodrat	Ringneck snake
Calliope hummingbird	Brewer's sparrow	Coyote	
Dusky flycatcher	Black-chinned sparrow	Gray fox	

MONTANE HARDWOOD

In the Bear Creek watershed, most montane hardwood forests border the western edge of the ponderosa pine forests. Montane hardwood forests have high value for many wildlife species. Acorns provide food for numerous species of birds and small mammals. Larger mammals browse on foliage and consume an abundance of berries. Amphibians and reptiles are poorly represented in this forest. Terrestrial salamanders such as the ensatina (*Ensatina eschscholtzii*) and rough-skinned newt (*Taricha granulosa*) may be found on the forest floor during or following a period of rainfall. The rubber boa (*Charina bottae*) is a small, reclusive snake that is occasionally encountered on the forest floor.

The WHR predicts that the montane hardwood within the Bear Creek watershed may provide habitat of at least moderate quality for 181 species. Table 7-12 lists the subset of 99 species that may find high quality habitat in this type.

**Table 7-12. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Montane Hardwood**

Turkey vulture	Acorn woodpecker	Hutton's vireo	Golden-mantled ground squirrel
Sharp-shinned hawk	Red-breasted sapsucker	Warbling vireo	Western gray squirrel
Cooper's hawk	Nuttall's woodpecker	Orange-crowned warbler	Botta's pocket gopher
Northern goshawk	Hairy woodpecker	Nashville warbler	Western pocket gopher
Red-tailed hawk	Northern flicker	Yellow-rumped warbler	Deer mouse
Golden eagle	Western wood-pewee	Black-throated gray warbler	Brush mouse
American kestrel	Hammond's flycatcher	Western tanager	Pinon mouse
Peregrine falcon	Pacific-slope flycatcher	Black-headed grosbeak	Dusky-footed woodrat
Prairie falcon	Ash-throated flycatcher	Green-tailed towhee	Bushy-tailed woodrat
Ruffed grouse	Western kingbird	Chipping sparrow	Coyote
Wild turkey	Purple martin	Fox sparrow	Gray fox
Mountain quail	Violet-green swallow	Dark-eyed junco	Black bear
Band-tailed pigeon	Northern rough-winged swallow	Bullock's oriole	Raccoon
Mourning dove	Barn swallow	Purple finch	Ermine
Barn owl	Steller's jay	Lesser goldfinch	Long-tailed weasel
Flammulated owl	Common raven	Lawrence's goldfinch	American badger
Western screech owl	Oak titmouse	Plumbeous vireo	Western spotted skunk
Great horned owl	White-breasted nuthatch	Barred owl	Striped skunk
Northern pygmy owl	Rock wren	Long-legged myotis	Mountain lion
California spotted owl	Ruby-crowned kinglet	Big brown bat	Bobcat
Northern saw-whet owl	Western bluebird	Hoary bat	Wild pig
White-throated swift	Townsend's solitaire	Black-tailed jackrabbit	Mule deer
Calliope hummingbird	Hermit thrush	Yellow-pine chipmunk	Northern alligator lizard
Rufous hummingbird	American robin	Sonoma chipmunk	Rubber boa
Lewis' woodpecker	Cassin's vireo	California ground squirrel	

MONTANE HARDWOOD-CONIFER

Montane hardwood-conifer has a patchy distribution in the Bear Creek watershed. At 1,000 to 4,000 feet in elevation, it is transitional between dense coniferous forests and montane hardwood, mixed chaparral, and woodlands. Montane hardwood-conifer provides valuable nesting habitat for many birds and bats and is important winter range for black-tailed deer. Amphibians present include terrestrial salamanders, such as the ensatina and rough-skinned newt.

The WHR predicts that the montane hardwood-conifer within the Bear Creek watershed may provide habitat of at least moderate quality for 196 species. Table 7-13 lists the subset of 118 species that may find high quality habitat in this type.

**Table 7-13. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Montane Hardwood-Conifer**

Rough-skinned newt	Acorn woodpecker	Wrentit	Western gray squirrel
Tailed frog	Red-breasted sapsucker	Cassin's vireo	Douglas' squirrel
Turkey vulture	Nuttall's woodpecker	Hutton's vireo	Northern flying squirrel
Osprey	Hairy woodpecker	Warbling vireo	Botta's pocket gopher
Sharp-shinned hawk	Northern flicker	Orange-crowned warbler	Western pocket gopher
Cooper's hawk	Pileated woodpecker	Nashville warbler	Deer mouse
Northern goshawk	Olive-sided flycatcher	Yellow-rumped warbler	Brush mouse
Red-tailed hawk	Western wood-pewee	Black-throated gray warbler	Pinon mouse
Golden eagle	Hammond's flycatcher	Hermit warbler	Creeping vole
American kestrel	Dusky flycatcher	Western tanager	Coyote
Peregrine falcon	Pacific-slope flycatcher	Black-headed grosbeak	Gray fox
Prairie falcon	Ash-throated flycatcher	Green-tailed towhee	Black bear
Ruffed grouse	Western kingbird	Chipping sparrow	Ringtail
Wild turkey	Purple martin	Fox sparrow	Raccoon
Mountain quail	Violet-green swallow	Dark-eyed junco	Pine (American) marten
Band-tailed pigeon	Northern rough-winged swallow	Bullock's oriole	Fisher (Pacific fisher)
Mourning dove	Barn swallow	Purple finch	Ermine
Barn owl	Steller's jay	Plumbeous vireo	Long-tailed weasel
Flammulated owl	Common raven	Barred owl	American badger
Western screech owl	Mountain chickadee	Trowbridge's shrew	Western spotted skunk
Great horned owl	Oak titmouse	Long-eared myotis	Striped skunk
Northern pygmy owl	White-breasted nuthatch	Long-legged myotis	Mountain lion
California spotted owl	Brown creeper	Big brown bat	Bobcat
Northern saw-whet owl	Rock wren	Hoary bat	Elk
Common nighthawk	Winter wren	Brush rabbit	Mule deer
Black swift	Golden-crowned kinglet	Mountain beaver	Western fence lizard
White-throated swift	Ruby-crowned kinglet	Yellow-pine chipmunk	Northern alligator lizard
Calliope hummingbird	Western bluebird	Sonoma chipmunk	Rubber boa
Rufous hummingbird	Hermit thrush	California ground squirrel	
Lewis' woodpecker	American robin	Golden-mantled ground squirrel	

MONTANE RIPARIAN

Montane riparian habitat provides provide food, water, migration and dispersal corridors, escape, nesting, and thermal cover for many species of wildlife (DFG, 2002a). A variety of amphibians associate with this habitat, including western toad, Pacific treefrog (*Hyla regilla*), foothill yellow-legged frog (*Rana boylei*), rough-skinned newt, and Pacific giant salamander (*Dicamptodon tenebrosus*). Garter snakes forage for salamanders and frogs.

The WHR predicts that the montane riparian within the Bear Creek watershed may provide habitat of at least moderate quality for 220 species. Table 7-14 lists the subset of 149 species that may find high quality habitat in this type.

**Table 7-14. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Montane Riparian**

Rough-skinned newt	Lewis' woodpecker	Warbling vireo	American beaver
Ensatina	Acorn woodpecker	Orange-crowned warbler	Western harvest mouse
Black salamander	Red-breasted sapsucker	Nashville warbler	Deer mouse
Tailed frog	Williamson's sapsucker	Yellow warbler	Brush mouse
Pacific chorus frog	Nuttall's woodpecker	Yellow-rumped warbler	Western red-backed vole
Pacific giant salamander	Downy woodpecker	Macgillivray's warbler	California vole
Great blue heron	Hairy woodpecker	Common yellowthroat	Long-tailed vole
Black-crowned night heron	Northern flicker	Wilson's warbler	Creeping vole
Wood duck	Western wood-pewee	Western tanager	Common muskrat
Common merganser	Willow flycatcher	Black-headed grosbeak	Western jumping mouse
Turkey vulture	Hammond's flycatcher	Lazuli bunting	Coyote
Osprey	Dusky flycatcher	Fox sparrow	Black bear
Sharp-shinned hawk	Pacific-slope flycatcher	Song sparrow	Ringtail
Cooper's hawk	Black phoebe	Lincoln's sparrow	Raccoon
Northern goshawk	Purple martin	White-crowned sparrow	Pine (American) marten
Red-shouldered hawk	Tree swallow	Dark-eyed junco	Fisher (Pacific fisher)
Red-tailed hawk	Violet-green swallow	Brown-headed cowbird	Ermine
Golden eagle	Northern rough-winged swallow	Bullock's oriole	Long-tailed weasel
American kestrel	Bank swallow	Plumbeous vireo	American mink
Peregrine falcon	Cliff swallow	Barred owl	Western spotted skunk
Prairie falcon	Barn swallow	Vagrant shrew	Striped skunk
Ruffed grouse	Steller's jay	Water shrew	Mountain lion
Wild turkey	Black-billed magpie	Shrew-mole	Bobcat
Mountain quail	Common raven	Broad-footed mole	Elk
Band-tailed pigeon	White-breasted nuthatch	Long-eared myotis	Mule deer
Mourning dove	Canyon wren	Long-legged myotis	Western skink
Barn owl	Bewick's wren	Silver-haired bat	Southern alligator lizard
Western screech owl	House wren	Big brown bat	Rubber boa
Great horned owl	Winter wren	Hoary bat	Ringneck snake
Northern pygmy owl	American dipper	Western mastiff bat	Sharp-tailed snake
California spotted owl	Western bluebird	Brush rabbit	Gopher snake
Long-eared owl	Mountain bluebird	Snowshoe hare	California mountain kingsnake
Northern saw-whet owl	Swainson's thrush	Mountain beaver	Western terrestrial garter snake
Black swift	Hermit thrush	Yellow-pine chipmunk	Western aquatic garter snake
White-throated swift	American robin	Sonoma chipmunk	Pacific coast aquatic garter snake
Calliope hummingbird	Varied thrush	Northern flying squirrel	
Rufous hummingbird	Cassin's vireo	Botta's pocket gopher	
Belted kingfisher	Hutton's vireo	Western pocket gopher	

PONDEROSA PINE

Ponderosa pine forests tend to occur in a broad band above the oak woodlands and below the higher elevation mixed coniferous forests. Ponderosa pine forests occupy a wide belt that extends from the Bear Creek watershed boundary south of Shingletown to the vicinity of Miners Gulch and Dickerson Creek and support a variety of wildlife species. Pine seeds provide food for a variety of small mammals, which in turn, are hunted by numerous species of owls and raptors. Ponderosa pine forests are inhabited by a variety of woodpeckers, which bore into the bark of ponderosa pines in search of insects and beetles.

The WHR predicts that the ponderosa pine within the Bear Creek watershed may provide habitat of at least moderate quality for 172 species. Table 7-15 lists the subset of 101 species that may find high quality habitat in this type.

**Table 7-15. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Ponderosa Pine**

Tailed frog	Red-breasted sapsucker	Cassin's vireo	Botta's pocket gopher
Great blue heron	Williamson's sapsucker	Nashville warbler	Western pocket gopher
Turkey vulture	Hairy woodpecker	Yellow warbler	Mountain pocket gopher
Osprey	White-headed woodpecker	Yellow-rumped warbler	Deer mouse
Bald eagle	Northern flicker	Black-throated gray warbler	Pinon mouse
Sharp-shinned hawk	Pileated woodpecker	Hermit warbler	Dusky-footed woodrat
Northern goshawk	Western wood-pewee	Western tanager	Common porcupine
Red-tailed hawk	Dusky flycatcher	Green-tailed towhee	Coyote
Golden eagle	Pacific-slope flycatcher	Chipping sparrow	Gray fox
American kestrel	Purple martin	Dark-eyed junco	Black bear
Peregrine falcon	Violet-green swallow	Red crossbill	Raccoon
Prairie falcon	Northern rough-winged swallow	Barred owl	Fisher (Pacific fisher)
Wild turkey	Barn swallow	Trowbridge's shrew	Ermine
Mountain quail	Steller's jay	Long-eared myotis	Long-tailed weasel
Band-tailed pigeon	Common raven	Long-legged myotis	American badger
Mourning dove	Mountain chickadee	Silver-haired bat	Western spotted skunk
Flammulated owl	Red-breasted nuthatch	Hoary bat	Striped skunk
Great horned owl	White-breasted nuthatch	Black-tailed jackrabbit	Mountain lion
Northern pygmy owl	Pygmy nuthatch	Yellow-pine chipmunk	Bobcat
California spotted owl	Brown creeper	Allen's chipmunk	Mule deer
Northern saw-whet owl	Golden-crowned kinglet	Sonoma chipmunk	Western fence lizard
Common nighthawk	Ruby-crowned kinglet	California ground squirrel	Rubber boa
White-throated swift	Townsend's solitaire	Golden-mantled ground squirrel	Western rattlesnake
Rufous hummingbird	Hermit thrush	Western gray squirrel	
Lewis' woodpecker	American robin	Douglas' squirrel	
Acorn woodpecker	Varied thrush	Northern flying squirrel	

RED FIR

Red fir forests generally occur between 6,000 and 9,000 feet in elevation. In the Bear Creek watershed, a very small red fir forest occurs in the vicinity of Latour Butte and supports significantly fewer species of wildlife than other forest types (Laacke and Tappeiner, 1996). These forests are subject to heavy snow pack in winter and have a short growing season in summer. There are relatively few year-round resident species of wildlife in red fir forests. Most year-round residents are birds, including blue grouse (*Dendragapus obscurus*), hairy woodpecker (*Picoides villosus*), Steller's jay (*Cyanocitta stelleri*), and mountain chickadee (*Poecile gambeli*). Mammals that commonly associate with this habitat include the golden-mantled ground squirrel (*Spermophilus lateralis*) and Douglas's squirrel (*Tamiasciurus douglasii*).

The WHR predicts that the red fir within the Bear Creek watershed may provide habitat of at least moderate quality for 109 species. Table 7-16 lists the subset of 58 species that may find high quality habitat in this type.

**Table 7-16. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Red Fir**

Tailed frog	Hairy woodpecker	Hermit warbler	Long-tailed vole
Turkey vulture	White-headed woodpecker	Western tanager	Coyote
Osprey	Black-backed woodpecker	Fox sparrow	Black bear
Northern goshawk	Olive-sided flycatcher	Dark-eyed junco	Raccoon
Red-tailed hawk	Western wood-pewee	Cassin's finch	Pine (American) marten
Golden eagle	Hammond's flycatcher	Red crossbill	Fisher (Pacific fisher)
Peregrine falcon	Gray jay	Barred owl	Ermine
Prairie falcon	Steller's jay	Silver-haired bat	Long-tailed weasel
Blue grouse	Common raven	Yellow-pine chipmunk	Wolverine
California spotted owl	Mountain chickadee	Allen's chipmunk	Mountain lion
Common nighthawk	Red-breasted nuthatch	Golden-mantled ground squirrel	Bobcat
Black swift	Brown creeper	Douglas' squirrel	Mule deer
Rufous hummingbird	Golden-crowned kinglet	Northern flying squirrel	Western terrestrial garter snake
Red-breasted sapsucker	Hermit thrush	Deer mouse	
Williamson's sapsucker	Yellow-rumped warbler	Bushy-tailed woodrat	

SIERRAN MIXED CONIFER

Sierran mixed conifer comprises most of the area in the Bear Creek watershed between Shingletown and Latour Butte and is inhabited by a variety of wildlife. Pine seeds are consumed by small mammals, which in turn, are preyed upon by larger mammals and raptors. Large mammals feed on gooseberry currants (*Ribes* spp.) and blackberries (*Rhubus* spp.). Old-growth conifers provide important habitat for raptors, including the California spotted owl and northern goshawk (*Accipiter gentilis*).

The WHR predicts that the Sierran mixed conifer within the Bear Creek watershed may provide habitat of at least moderate quality for 176 species. Table 7-17 lists the subset of 110 species that may find high quality habitat in this type.

**Table 7-17. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Sierran Mixed Conifer**

Long-toed salamander	Red-breasted sapsucker	Nashville warbler	Douglas' squirrel
Rough-skinned newt	Williamson's sapsucker	Yellow warbler	Northern flying squirrel
Pacific giant salamander	Hairy woodpecker	Yellow-rumped warbler	Botta's pocket gopher
Turkey vulture	White-headed woodpecker	Hermit warbler	Western pocket gopher
Osprey	Northern flicker	Western tanager	Deer mouse
Bald eagle	Pileated woodpecker	Green-tailed towhee	Brush mouse
Sharp-shinned hawk	Olive-sided flycatcher	Chipping sparrow	Dusky-footed woodrat
Northern goshawk	Western wood-pewee	Fox sparrow	Creeping vole
Red-tailed hawk	Hammond's flycatcher	Dark-eyed junco	Common porcupine
Golden eagle	Dusky flycatcher	Purple finch	Coyote
American kestrel	Pacific-slope flycatcher	Cassin's finch	Gray fox
Peregrine falcon	Purple martin	Red crossbill	Black bear
Prairie falcon	Violet-green swallow	Evening grosbeak	Raccoon
Blue grouse	Barn swallow	Barred owl	Fisher (Pacific fisher)
Ruffed grouse	Gray jay	Trowbridge's shrew	Ermine
Mountain quail	Steller's jay	Shrew-mole	Long-tailed weasel
Band-tailed pigeon	Common raven	Long-eared myotis	American badger
Flammulated owl	Mountain chickadee	Long-legged myotis	Western spotted skunk
Great horned owl	Red-breasted nuthatch	Silver-haired bat	Striped skunk
Northern pygmy owl	Pygmy nuthatch	Big brown bat	Mountain lion
California spotted owl	Brown creeper	Hoary bat	Bobcat
Northern saw-whet owl	Winter wren	Brush rabbit	Elk
Common nighthawk	Golden-crowned kinglet	Mountain beaver	Mule deer
Black swift	Ruby-crowned kinglet	Yellow-pine chipmunk	Western fence lizard
White-throated swift	Townsend's solitaire	Allen's chipmunk	Northern alligator lizard
Calliope hummingbird	Hermit thrush	Sonoma chipmunk	Rubber boa
Rufous hummingbird	American robin	California ground squirrel	
Lewis' woodpecker	Warbling vireo	Golden-mantled ground squirrel	

VALLEY FOOTHILL RIPARIAN

Valley foothill riparian habitat provides provide food, water, migration and dispersal corridors, escape, nesting, and thermal cover for many species of wildlife (DFG, 2002a). A variety of songbirds nest or forage in valley foothill riparian habitat. Bats often roost in this habitat during daytime and forage for insects over water at night. Foothill yellow-legged frogs often escape predators by moving into valley foothill riparian habitat. Pacific treefrogs and western toads (*Bufo boreas*) commonly are found in this habitat. Western pond turtles (*Clemmys marmorata*) may construct nests in valley foothill riparian habitat. Alligator lizards (*Elgaria* spp.) are common in the valley foothill riparian, and consume a variety of small insects. Elderberry trees (*Sambucus* spp.) occur in valley foothill riparian habitat and are the host plant for the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). Raccoons (*Procyon lotor*) and black bears often forage in this habitat.

The WHR predicts that the valley foothill riparian within the Bear Creek watershed may provide habitat of at least moderate quality for 221 species. Table 7-18 lists the subset of 167 species that may find high quality habitat in this type.

**Table 7-18. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Valley Foothill Riparian**

Rough-skinned newt	Lesser nighthawk	Hutton's vireo	Desert cottontail
Ensatina	Common nighthawk	Warbling vireo	Sonoma chipmunk
California slender salamander	White-throated swift	Orange-crowned warbler	Western gray squirrel
Black salamander	Black-chinned hummingbird	Yellow warbler	Northern flying squirrel
Pacific chorus frog	Anna's hummingbird	Yellow-rumped warbler	Botta's pocket gopher
Foothill yellow-legged frog	Belted kingfisher	Black-throated gray warbler	American beaver
Bullfrog	Lewis' woodpecker	Hermit warbler	Western harvest mouse
Pacific giant salamander	Acorn woodpecker	Common yellowthroat	Deer mouse
Double-crested cormorant	Red-breasted sapsucker	Wilson's warbler	Brush mouse
Great blue heron	Nuttall's woodpecker	Yellow-breasted chat	Bushy-tailed woodrat
Great egret	Downy woodpecker	Western tanager	Creeping vole
Green heron	Hairy woodpecker	Black-headed grosbeak	Common muskrat
Black-crowned night heron	Northern flicker	Blue grosbeak	Black rat
Wood duck	Western wood-pewee	Lazuli bunting	Coyote
Hooded merganser	Willow flycatcher	Spotted towhee	Gray fox
Common merganser	Pacific-slope flycatcher	California towhee	Black bear
Turkey vulture	Black phoebe	Song sparrow	Ringtail
Osprey	Ash-throated flycatcher	Golden-crowned sparrow	Raccoon
Sharp-shinned hawk	Western kingbird	White-crowned sparrow	Long-tailed weasel
Cooper's hawk	Tree swallow	Dark-eyed junco	American mink
Red-shouldered hawk	Violet-green swallow	Tricolored blackbird	Western spotted skunk
Swainson's hawk	Northern rough-winged swallow	Brewer's blackbird	Striped skunk
Red-tailed hawk	Bank swallow	Brown-headed cowbird	Northern river otter
Golden eagle	Cliff swallow	Bullock's oriole	Mountain lion
American kestrel	Western scrub-jay	House finch	Bobcat
Merlin	Yellow-billed magpie	Pine siskin	Wild pig
Peregrine falcon	Common raven	Lesser goldfinch	Elk
Prairie falcon	Oak titmouse	Lawrence's goldfinch	Mule deer
Ruffed grouse	Bushtit	American goldfinch	Western pond turtle
Wild turkey	White-breasted nuthatch	Plumbeous vireo	Western fence lizard
California quail	Canyon wren	White-throated sparrow	Western skink
Mountain quail	Bewick's wren	Virginia opossum	Southern alligator lizard
Killdeer	House wren	Vagrant shrew	Ringneck snake
Spotted sandpiper	Winter wren	Broad-footed mole	Sharp-tailed snake
Band-tailed pigeon	Ruby-crowned kinglet	Yuma myotis	Gopher snake
Mourning dove	Western bluebird	Long-eared myotis	Common kingsnake
Barn owl	Swainson's thrush	Fringed myotis	Common garter snake
Western screech owl	Hermit thrush	Western small-footed myotis	Western terrestrial garter snake
Great horned owl	American robin	Big brown bat	Western aquatic garter snake
Northern pygmy owl	Varied thrush	Hoary bat	Western rattlesnake
Long-eared owl	European starling	Western mastiff bat	Pacific coast aquatic garter snake
Northern saw-whet owl	Cassin's vireo	Brush rabbit	

VALLEY OAK WOODLAND

Valley oak woodland and is found near the mouths of Bear Creek and Ash Creek in the Bear Creek watershed and provides important food and cover for many species of wildlife. Birds and mammals consume acorns produced by valley oaks. A variety of raptors may perch in these woodlands to spot prey. Black-tailed deer browse on the leaves and twigs of valley oaks. A variety of reptiles and amphibians associate with valley oak woodland. Reptiles reported in valley oak woodland include the western rattlesnake, gopher snake (*Pituophis catenifer*), western skink, and western fence lizard. Terrestrial salamanders such as the California slender salamander (*Batrachoseps attenuatus*) and the black salamander (*Aneides flavipunctatus*) may be found beneath fallen limbs that retain soil moisture. These salamanders are active at night and are typically found on moist surfaces.

The WHR predicts that the valley oak woodland within the Bear Creek watershed may provide habitat of at least moderate quality for 190 species. Table 7-19 lists the subset of 143 species that may find high quality habitat in this type.

**Table 7-19. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Valley Oak Woodland**

Rough-skinned newt	Common poorwill	Hermit thrush	Plumbeous vireo
California newt	White-throated swift	American robin	Yuma myotis
California slender salamander	Black-chinned hummingbird	Varied thrush	Fringed myotis
Black salamander	Anna's hummingbird	Wrentit	Big brown bat
Great blue heron	Rufous hummingbird	Northern mockingbird	Hoary bat
Great egret	Lewis' woodpecker	Cedar waxwing	Pallid bat
Black-crowned night heron	Acorn woodpecker	Phainopepla	Desert cottontail
Wood duck	Red-breasted sapsucker	Loggerhead shrike	Black-tailed jackrabbit
Turkey vulture	Nuttall's woodpecker	European starling	Sonoma chipmunk
White-tailed kite	Downy woodpecker	Cassin's vireo	California ground squirrel
Sharp-shinned hawk	Hairy woodpecker	Hutton's vireo	Western gray squirrel
Cooper's hawk	Northern flicker	Warbling vireo	Northern flying squirrel
Red-shouldered hawk	Western wood-pewee	Orange-crowned warbler	Botta's pocket gopher
Swainson's hawk	Pacific-slope flycatcher	Yellow warbler	Brush mouse
Red-tailed hawk	Say's phoebe	Yellow-rumped warbler	Black rat
Ferruginous hawk	Ash-throated flycatcher	Black-throated gray warbler	House mouse
Rough-legged hawk	Western kingbird	Townsend's warbler	Coyote
Golden eagle	Horned lark	Hermit warbler	Gray fox
American kestrel	Purple martin	Wilson's warbler	Ringtail
Merlin	Violet-green swallow	Western tanager	Raccoon
Peregrine falcon	Northern rough-winged swallow	Black-headed grosbeak	Long-tailed weasel
Prairie falcon	Barn swallow	Lazuli bunting	American badger
Wild turkey	Western scrub-jay	Spotted towhee	Western spotted skunk
California quail	Yellow-billed magpie	California towhee	Striped skunk
Band-tailed pigeon	American crow	Chipping sparrow	Bobcat
Mourning dove	Common raven	Lark sparrow	Wild pig
Greater roadrunner	Oak titmouse	Savannah sparrow	Mule deer
Barn owl	Bushtit	Golden-crowned sparrow	Western pond turtle
Western screech owl	White-breasted nuthatch	White-crowned sparrow	Western fence lizard
Great horned owl	Rock wren	Dark-eyed junco	Western skink
Northern pygmy owl	Bewick's wren	Western meadowlark	Southern alligator lizard
Burrowing owl	House wren	Bullock's oriole	Racer
Long-eared owl	Ruby-crowned kinglet	House finch	Gopher snake
Northern saw-whet owl	Blue-gray gnatcatcher	Pine siskin	Western terrestrial garter snake
Lesser nighthawk	Western bluebird	Lesser goldfinch	Western rattlesnake
Common nighthawk	Mountain bluebird	Lawrence's goldfinch	

WATER (RIVERINE)

Aquatic habitats such as streams and ponds are found throughout the Bear Creek watershed and are biologically diverse. The western portion of the watershed also includes a section of the Sacramento River. Animal groups present in aquatic habitats include fish, amphibians, reptiles, and invertebrates. Fish may be resident, anadromous, or introduced. Amphibians such as rough-skinned newt, Pacific treefrog, or western toad breed in aquatic habitats. Western pond turtles use aquatic habitats to forage or to escape from predators. Aquatic habitats are also inhabited by an assortment of invertebrates, which may occur beneath cobble, in mud, or on the water surface. Aquatic invertebrates are preyed on by fish and amphibians, which are preyed upon by garter snakes or small mammals. Large raptors, such as bald eagle (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) hunt fish in larger water bodies such as the Sacramento River.

The WHR predicts that the riverine habitat within the Bear Creek watershed may provide habitat of at least moderate quality for 102 species. Table 7-20 lists the subset of 70 species that may find high quality habitat in this type.

**Table 7-20. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Riverine**

Rough-skinned newt	Mallard	Long-billed curlew	Bank swallow
California newt	Cinnamon teal	Western sandpiper	Cliff swallow
Western toad	Gadwall	Least sandpiper	Barn swallow
Pacific chorus frog	Eurasian wigeon	Dunlin	American crow
California red-legged frog	American wigeon	Wilson's phalarope	Common raven
Cascades frog	Canvasback	Ring-billed gull	American dipper
Foothill yellow-legged frog	Lesser scaup	California gull	Baird's sandpiper
Bullfrog	Common goldeneye	Caspian tern	Water shrew
Pacific giant salamander	Hooded merganser	Forster's tern	American beaver
Pied-billed grebe	Common merganser	Common nighthawk	Common muskrat
Great blue heron	Turkey vulture	Black swift	Raccoon
Great egret	Osprey	White-throated swift	American mink
Snowy egret	Bald eagle	Belted kingfisher	Northern river otter
Green heron	Peregrine falcon	Black phoebe	Western pond turtle
Black-crowned night heron	American coot	Purple martin	Western aquatic garter snake
Tundra swan	Killdeer	Tree swallow	Pacific coast aquatic garter snake
Wood duck	Greater yellowlegs	Violet-green swallow	
Green-winged teal	Spotted sandpiper	Northern rough-winged swallow	

WET MEADOW

Wet meadows are found throughout the Bear Creek watershed, although most occur in the vicinity of Inwood and Shingletown. Wet meadows have very high value for wildlife. Pools in wet meadows provide important breeding habitat for amphibians, including the rough-skinned newt, Pacific treefrog, and western toad. Wet meadows that support large populations of amphibians also support an abundance of garter snakes, which feed on larval and adult amphibians. Large mammals browse on grass around meadows and may drink water from pools of water. A variety of birds associate with wet meadows. Raptors hunt small mammals and garter snakes in grasslands around meadows.

The WHR predict that wet meadows within the Bear Creek watershed may provide habitat of at least moderate quality for 192 species. Table 7-21 lists the subset of 122 species that may find high quality habitat in this type.

**Table 7-21. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in Wet Meadows**

California newt	Virginia rail	Violet-green swallow	Yellow-bellied marmot
Pacific chorus frog	Sora	Northern rough-winged swallow	Belding's ground squirrel
Cascades frog	American coot	Cliff swallow	Botta's pocket gopher
Great blue heron	Sandhill crane	Barn swallow	Mountain pocket gopher
Snowy egret	Killdeer	Black-billed magpie	American beaver
Black-crowned night heron	Greater yellowlegs	Yellow-billed magpie	Western harvest mouse
Tundra swan	Willet	Common raven	Bushy-tailed woodrat
Greater white-fronted goose	Spotted sandpiper	House wren	Montane vole
Snow goose	Long-billed curlew	Western bluebird	California vole
Ross' goose	Least sandpiper	Mountain bluebird	Long-tailed vole
Canada goose	Long-billed dowitcher	American robin	Creeping vole
Green-winged teal	Common snipe	American pipit	Western jumping mouse
Mallard	Wilson's phalarope	Northern shrike	Common porcupine
Northern pintail	Ring-billed gull	European starling	Coyote
Gadwall	California gull	Common yellowthroat	Red fox
American wigeon	Barn owl	Chipping sparrow	Gray fox
Ring-necked duck	Western screech owl	Savannah sparrow	Black bear
Lesser scaup	Great horned owl	Song sparrow	Raccoon
Turkey vulture	Northern pygmy owl	Lincoln's sparrow	Pine (American) marten
White-tailed kite	Long-eared owl	White-crowned sparrow	Ermine
Northern harrier	Short-eared owl	Red-winged blackbird	Long-tailed weasel
Red-shouldered hawk	Lesser nighthawk	Western meadowlark	Striped skunk
Red-tailed hawk	Common nighthawk	Yellow-headed blackbird	Elk
Rough-legged hawk	Calliope hummingbird	Brewer's blackbird	Sharp-tailed snake
Golden eagle	Rufous hummingbird	Brown-headed cowbird	California mountain kingsnake
American kestrel	Lewis' woodpecker	Gray-crowned rosy-finch	Common garter snake
Peregrine falcon	Willow flycatcher	Virginia opossum	Western terrestrial garter snake
Prairie falcon	Black phoebe	Vagrant shrew	Western aquatic garter snake
Ring-necked pheasant	Horned lark	Western mastiff bat	Pacific coast aquatic garter snake
Wild turkey	Purple martin	American pika	
California quail	Tree swallow	Mountain beaver	

WHITE FIR

White fir forests occur between 5,000 and 6,000 feet in elevation and are biologically diverse. Numerous birds and small mammals forage on seeds trapped in fir cones which litter the forest floor. Owls and raptors hunt small mammals foraging for food on the forest floor. A variety of songbirds roost and nest in white fir forests.

The WHR predicts that white fir habitat within the Bear Creek watershed may provide habitat of at least moderate quality for 169 species. Table 7-22 lists the subset of 107 species that may find high quality habitat in this type.

**Table 7-22. Bear Creek Watershed Assessment 2005
Wildlife Species Predicted by the WHR to Potentially Occur in the Watershed
and Find High-Quality Habitat in White Fir**

Rough-skinned newt	Rufous hummingbird	Hermit thrush	California ground squirrel
Tailed frog	Lewis' woodpecker	American robin	Golden-mantled ground squirrel
Pacific giant salamander	Red-breasted sapsucker	Nashville warbler	Douglas' squirrel
Turkey vulture	Williamson's sapsucker	Yellow warbler	Botta's pocket gopher
Osprey	Hairy woodpecker	Yellow-rumped warbler	Western pocket gopher
Bald eagle	White-headed woodpecker	Hermit warbler	Deer mouse
Sharp-shinned hawk	Northern flicker	Western tanager	Brush mouse
Northern goshawk	Pileated woodpecker	Green-tailed towhee	Dusky-footed woodrat
Red-tailed hawk	Olive-sided flycatcher	Chipping sparrow	Creeping vole
Golden eagle	Western wood-pewee	Fox sparrow	Common porcupine
American kestrel	Hammond's flycatcher	Dark-eyed junco	Coyote
Peregrine falcon	Dusky flycatcher	Purple finch	Gray fox
Prairie falcon	Violet-green swallow	Cassin's finch	Black bear
Blue grouse	Barn swallow	Red crossbill	Raccoon
Ruffed grouse	Gray jay	Evening grosbeak	Fisher (Pacific fisher)
Mountain quail	Steller's jay	Barred owl	Ermine
Band-tailed pigeon	Common raven	Trowbridge's shrew	Long-tailed weasel
Barn owl	Mountain chickadee	Shrew-mole	American badger
Flammulated owl	Red-breasted nuthatch	Long-eared myotis	Western spotted skunk
Great horned owl	White-breasted nuthatch	Long-legged myotis	Striped skunk
Northern pygmy owl	Pygmy nuthatch	Silver-haired bat	Mountain lion
California spotted owl	Brown creeper	Big brown bat	Bobcat
Northern saw-whet owl	Winter wren	Hoary bat	Elk
Common nighthawk	Golden-crowned kinglet	Mountain beaver	Mule deer
Black swift	Ruby-crowned kinglet	Yellow-pine chipmunk	Western fence lizard
White-throated swift	Mountain bluebird	Allen's chipmunk	Northern alligator lizard
Calliope hummingbird	Townsend's solitaire	Sonoma chipmunk	

7.4. Habitat Connectivity and Fragmentation

Maintaining functional wildlife habitats is important for wildlife, which require sufficient space to forage or reproduce. Activities such as timber harvesting, road construction, or dam construction can fragment habitats and adversely affect wildlife species that use these habitats. Often, fragmented habitats are too small to meet the needs of wildlife.

Migration corridors are used by many species of wildlife to move from one habitat to another. Prior to the onset of winter, black-tail deer migrate from their summer range at high elevation to low elevation areas in the northern and southern portion of the Bear Creek watershed (Smith et al., 1983). Winter range for black-tailed deer exists along Bear Creek Canyon in the vicinity of Inwood and south of Ash Creek. Riparian areas are important dispersal corridors for frogs, raccoons, and many species of birds.

7.5. Special-Status Wildlife Species

A special-status wildlife species is a species that is considered endangered, threatened, proposed, or of special concern by the DFG or the United States Fish and Wildlife Service (USFWS). Special-status species designated by the DFG as “State Endangered” or “State Threatened” are protected by State laws under the California Endangered Species Act, while special-status species designated by the USFWS as “Federal Endangered” or “Federal Threatened” are protected by Federal laws under the Endangered Species Act (DFG, 2004c). Species proposed for Federal listing are also afforded special protection, and conferencing is required. A species designated by the DFG as a “Species of Special Concern” or by the USFWS as a “Federal Species of Concern” is intended to result in special consideration for these animals by government agencies, land managers, consulting biologists, and others, and is intended to focus attention on the species to help avert the need for costly listing under Federal and State endangered species laws and cumbersome recovery efforts that might ultimately be required. This designation also is intended to stimulate collection of additional information on the biology, distribution, and status of poorly known at-risk species, and focus research and management attention on them.

Information on special-status wildlife species occurring in the Bear Creek watershed was obtained from the U.S. Fish and Wildlife Service, California Natural Diversity Database (CNDDB), University of California at Berkeley’s Museum of Vertebrate Zoology, California Academy of Sciences, ENPLAN’s records, other environmental consultants, as well as through consultation with biologists from the DFG and USFWS. The CNDDB reports were reviewed for U.S. Geological Survey 7.5-minute quadrangles that occur entirely or partly in the Bear Creek watershed to develop a list of special-status wildlife species that occur in or near the watershed (Table 7-23).

**Table 7-23. Bear Creek Watershed Assessment 2005
Occurrences of Special-Status Wildlife Species In or Near the Bear Creek Watershed**

SPECIAL STATUS WILDLIFE KNOWN TO OCCUR IN THE BEAR CREEK WATERSHED	Status	Source
Amphibians		
Foothill yellow-legged frog, <i>Rana boylei</i>	FSC	5
Reptiles		
Northwestern pond turtle, <i>Clemmys marmorata marmorata</i>	FSC, SSC	1, 3, 5, 8
Birds		
American dipper, <i>Cinclus mexicanus</i>	SLC	5
American white pelican, <i>Pelecanus erythrorhynchos</i>	SSC	5
Bald eagle, <i>Haliaeetus leucocephalus</i>	FT, SE	2, 4, 5
Bank swallow, <i>Riparia riparia</i>	CA, ST	1, 2
Black-capped chickadee, <i>Poecile atricapillus</i>	SSC	5
California horned lark, <i>Eremophila alpestris</i>	SSC	5
Cooper’s hawk, <i>Accipiter cooperii</i>	SSC	2, 5
Lawrence’s goldfinch, <i>Carduelis lawrencei</i>	FSC	5
Northern goshawk, <i>Accipiter gentilis</i>	FSC	5
Northern harrier, <i>Circus cyaneus</i>	SSC	5
Osprey, <i>Pandion haliaetus</i>	SSC	1, 2, 5
Peregrine falcon, <i>Falco peregrinus</i>	SE	5
Rufous hummingbird, <i>Selasphorus rufus</i>	FSC	5
Sandhill crane, <i>Grus canadensis</i>	ST, Fully Protected	5
Large-billed savannah sparrow, <i>Passerculus sandwichensis rostratus</i>	FSC	5
Vaux’s swift, <i>Chaetura vauxi</i>	SSC	5

Table 7-23. Bear Creek Watershed Assessment 2005
Occurrences of Special-Status Wildlife Species In or Near the Bear Creek Watershed
(continued)

SPECIAL STATUS WILDLIFE KNOWN TO OCCUR IN THE BEAR CREEK WATERSHED	Status	Source
Birds (continued)		
White-headed woodpecker, <i>Picoides albolarvatus</i>	FSC	5
White-tailed kite, <i>Elanus leucurus</i>	FSC, Fully Protected	5
Mammals		
Ringtail, <i>Bassariscus astutus</i>	Fully Protected	4, 5, 7
SPECIAL-STATUS WILDLIFE KNOWN OR EXPECTED TO OCCUR IN THE VICINITY		
Invertebrates		
California linderiella fairy shrimp, <i>Linderiella occidentalis</i>	FSC	1
Valley elderberry longhorn beetle, <i>Desmocerus californicus dimorphus</i>	FT	1
Vernal pool fairy shrimp, <i>Branchinecta lynchi</i>	FT	1
Vernal pool tadpole shrimp, <i>Lepidurus packardii</i>	FE	1
Mammals		
California wolverine, <i>Gulo gulo</i>	FSC, ST	1
Pacific fisher, <i>Martes pennanti pacifica</i>	CA	1
Pine marten, <i>Martes americana</i>	FSC	3
Sierra Nevada red fox, <i>Vulpes vulpes necator</i>	CA, ST	1
Amphibians		
California red-legged frog, <i>Rana aurora draytonii</i>	FT, SSC	6

Source

- 1 = CNDDDB (DFG, 2004b)
- 2 = VESTRA (2002)
- 3 = W.M. Beaty & Associates, Inc.
- 4 = G. Aldridge, pers. com.
- 5 = C. Weidert, pers. com.
- 6 = USFWS
- 7 = R. Weidenkeller, pers. com.
- 8 = S. Burton, pers. com.

Status

- FE = Federal Endangered
- FT = Federal Threatened
- FSC = Federal Species of Concern
- CA = Federal Candidate Species for Listing as Federal Threatened or
Federal Endangered
- SE = State Endangered
- ST = State Threatened
- SSC = State Species of Concern
- SLC = Federal Species of Local Concern

As documented in Table 7-23, 30 special-status wildlife species have been reported in or near the Bear Creek watershed. Of these, 21 have been reported in the Bear Creek watershed and nine have been reported in the vicinity. Special-status wildlife species reported in the Bear Creek watershed include foothill yellow-legged frog, northwestern pond turtle (*C. m. marmorata*), American dipper (*Cinclus mexicanus*), American white pelican (*Pelecanus erythrorhynchos*), bald eagle, bank swallow (*Riparia riparia*), black-capped chickadee (*Poecile atricapillus*), California horned lark (*Eremophila alpestris*), Cooper's hawk (*Accipiter cooperii*), Lawrence's goldfinch (*Carduelis lawrencei*), northern goshawk (*Accipiter gentilis*), northern harrier (*Circus cyaneus*), osprey, peregrine falcon, rufous hummingbird (*Selasphorus rufus*), sandhill crane (*Grus canadensis*), large-billed savannah sparrow (*Passerculus sandwichensis rostratus*), Vaux's swift (*Chaetura vauxi*), white-headed woodpecker (*Picoides albolarvatus*), white-tailed kite (*Elanus leucurus*), and ringtail (*Bassariscus astutus*). Special-status wildlife species that have been reported in the vicinity of the Bear Creek watershed include California linderiella fairy shrimp (*Linderiella occidentalis*), valley elderberry longhorn beetle, vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardii*), California wolverine (*Gulo gulo*), Pacific fisher (*Martes pennanti pacifica*), pine marten (*Martes americana*), Sierra Nevada red fox (*Vulpes vulpes necator*), and California red-legged frog (*Rana aurora draytonii*). Habitat information and life-history requirements for each special-status wildlife species occurring in or near the Bear Creek watershed are described below. Information on special-status fish

species occurring in the Bear Creek watershed is presented in Chapter Eight - Fisheries Resources.

SPECIAL-STATUS WILDLIFE KNOWN TO OCCUR IN THE BEAR CREEK WATERSHED

FOOTHILL YELLOW-LEGGED FROG

The foothill yellow-legged frog, a Federal Species of Concern, historically occurred in most Pacific drainages in Oregon and California from sea level to approximately 6,000 feet in elevation (Zweiffel, 1955). The foothill yellow-legged frog prefers shallow, partly shaded, low-gradient streams, with riffles and cobble substrate (Hayes and Jennings, 1988). Foothill yellow-legged frogs are rare or absent in habitats where introduced fishes and bullfrogs (*Rana catesbeiana*) are present (Moyle, 1973).

The CNDDDB does not list any occurrences of foothill yellow-legged frogs in the Bear Creek watershed. The nearest occurrence in the CNDDDB is in North Fork Battle Creek, several miles south of the watershed near Manton. However, foothill yellow-legged frogs have been observed in Bear Creek and its tributaries (C. Weidert, pers. com.).

NORTHWESTERN POND TURTLE

Northwestern pond turtle, a Federal and State Species of Concern, and a subspecies of the western pond turtle, occurs in drainages throughout the Pacific Northwest (DFG, 1994). In California, the northwestern pond turtle is known from drainages along the western foothills and the Sierra Nevada. This turtle has been found in a variety of habitats from sea level to approximately 6,000 feet in elevation (Stebbins, 1985). They are found in a variety of habitat types, including streams, ditches, ponds, rivers, lakes, reservoirs, and wetlands. Northwestern pond turtles may reach high densities where many aerial and aquatic basking sites are available.

The northwestern pond turtle is an aquatic turtle but typically leaves the aquatic site to reproduce, aestivate, or overwinter (DFG, 1994). Northwestern pond turtles may remain active in water during the winter season, or may overwinter on land. The level of activity increases when water temperatures near the surface consistently reach at least 59°F. Thus, northwestern pond turtles are generally present in aquatic habitats from March through September, and may migrate to overwintering sites in October and November (Storer, 1930).

Reproductively mature adults (7 to 11 years old) generally mate in late April or early May, but mating may occur year-round (DFG, 1994). Females travel from the aquatic site to an upland location to nest. The nest may be a considerable distance (1,200 feet or more) from the aquatic site, but is usually around 500 feet away. From 1 to 13 eggs are deposited in the shallow nest (five to six inches deep) excavated by the female. Nests are generally found in substrate that has a high clay or silt component. Nests also are generally located on an unshaded, south-facing slope, probably to ensure that substrate temperatures will be high enough to incubate the eggs. Females may lay more than one clutch a year. Most oviposition occurs in May and June, although some females may deposit eggs as early as April, or as late as August. Hatchlings may overwinter in the nest; hatchling-sized turtles have rarely been observed in an aquatic site during the fall. Most hatchling turtles are thought to emerge from the nest and move to the aquatic site in the spring. Hatchlings spend most of their time foraging in shallow water preferably containing relatively dense submergent or short emergent vegetation.

The CNDDDB lists an occurrence of the northwestern pond turtle in the Bear Creek watershed. This occurrence is at an impoundment on South Fork Bear Creek near Thatchers Meadows. The northwestern pond turtle is also reported in Snow Creek (G. Aldridge, pers. com.). In Bear Creek, the northwestern pond turtle is reported near Inwood (C. Weidert, pers. com.) and near the confluence with the Sacramento River (S. Burton, pers. com.).

AMERICAN DIPPER

The American dipper, a Federal Species of Concern, is a yearlong resident in California, although there may be some downslope movement or wandering from high altitudes to lowlands during the winter. The American dipper is common in the Cascade Range and Sierra Nevada, occupying riverine habitats up to 11,600 feet in elevation. American dippers require clear, fast-moving water and often perch on rocks or dead branches beside stream. The American dipper typically nests and roosts in a sheltered cavity or crevice along the stream bank. The nest may be in a crevice in rocks, behind a waterfall, in a stump or log, on the stream bank, or under a bridge or other human-made structure.

The CNDDDB does not list any occurrences of American dippers in the Bear Creek watershed. However, American dippers have been observed in the watershed (C. Weidert, pers. com.).

AMERICAN WHITE PELICAN

The American white pelican, a State Species of Special Concern, is a year-long resident in California. This species formerly nested in large numbers in freshwater wetlands throughout the Central Valley and at saltwater marshes along the Salton Sea (DFG, 2002a). Presently, the only nesting grounds known in California are at large freshwater lakes in the Klamath Basin in northeastern California. Breeding occurs from March through April. Clutch size ranges from two to six eggs, although the average clutch size is two eggs. Eggs hatch after incubating for approximately three weeks and young will fledge three to four weeks later.

The CNDDDB does not list any occurrences of American white pelicans in the Bear Creek watershed. However, American white pelicans have been observed in the watershed (C. Weidert, pers. com.).

BALD EAGLE

The bald eagle, a Federal Threatened and State Endangered species, occurs widely in North America. Bald eagles winter throughout most of California at lakes, reservoirs, river systems, and in some rangelands and coastal wetlands (DFG, 2001). Bald eagles are opportunistic foragers, usually feeding on fish or waterfowl, but they also feed on other small animals and eat carrion.

Bald eagles migrate from nesting areas in the Pacific Northwest to spend the winter in California, arriving during fall and early winter (DFG, 2001). California's resident breeding pairs remain in California during winter, typically in the vicinity of their nesting areas. However, when winter conditions are too severe they must move to lower elevations. In California, the breeding season lasts from about January through August. The breeding range is primarily in mountainous habitats near reservoirs, lakes and rivers, mainly in northern California and in the Central Coast Range. Large nests are usually built in the upper canopy of large conifers. The adults may repair the same nest annually, increasing

its size over time, or they may construct a new nest in their territory or repair one they had formerly occupied. Often, the breeding territory of a pair of eagles includes several nests. Between one and three eggs are laid in late winter or early spring. Incubation lasts approximately 35 days. Chicks fledge when they are between 9 and 14 weeks old. A few weeks after leaving the nest, most young birds migrate hundreds of miles to the north. In these post-nesting dispersal areas, the young birds join other bald eagles to feed on salmon and other plentiful food.

Following the passage of the Endangered Species Act in 1973, the U.S. Fish and Wildlife Service (USFWS) listed bald eagles as Endangered in 43 states (USFWS, no date - a). In five states (Michigan, Minnesota, Wisconsin, Washington, and Oregon), they were listed as Threatened (DFG, 2001). The Pacific Bald Eagle Recovery Plan, adopted by the USFWS in 1986, encompasses a seven-state area that includes California. Protection of nesting areas, restrictions on use of DDT, and other special wildlife management actions have enabled the population of bald eagles to rebound. In 1995, the USFWS reclassified bald eagles in the lower 48 states from Endangered to Threatened. Although it is still Federally listed, the USFWS made a formal delisting proposal in 1999. This petition is still being reviewed. In addition to the Endangered Species Act, bald eagles are also protected by the Eagle Protection Act.

The CNDDDB does not list any occurrences of bald eagles in the Bear Creek watershed. However, bald eagles have been observed in the watershed near the confluence of Bear Creek and the Sacramento River (VESTRA, 2002). Bald eagles have also been observed hunting in Bear Creek Canyon (C. Weidert, pers. com.) as well as on the Aldridge ranch in winter (G. Aldridge, pers. com.). In addition to these sightings, the CNDDDB lists several occurrences in the vicinity of the watershed. Bald eagles have been reported in the vicinity of the watershed near the confluence of Battle Creek and the Sacramento River, in the vicinity of McCumber Reservoir, and near two small impoundments of Rock Creek. It is estimated that there are at least four bald eagle nests within 10 miles of the Bear Creek watershed (B. Deuel, DFG, pers. com.).

BANK SWALLOW

The bank swallow, a State Threatened Species, is the smallest North American swallow. Bank swallows nest in colonies, building nests by burrowing into vertical banks consisting of fine-textured soils (DFG, 2000a). Bank swallows breed in California from April to August and spend the winter months in South America.

It is estimated that the range of bank swallows in California has been reduced by 50 percent since 1900 (DFG, 2000a). Historically, bank swallows occurred primarily along the coastline. Today, 75 percent of the state's population is concentrated on the banks of Central Valley streams, including several colonies on the Sacramento River. Remaining, scattered populations also exist in portions of Inyo and Mono counties and northern, north and central coastal regions of California. Bank swallows were eliminated from southern California when nearly every river and natural waterway was converted to flood control channels. In addition, due to increased human disturbance, bank swallows have abandoned many coastal nest sites. Healthy populations nest along the upper Sacramento River, where the river still meanders in a somewhat natural manner. The natural river system forms an alluvial plain, and in suitable soil types with sufficient erosion, provides prime nesting habitat.

A variety of human activities adversely impact bank swallows. Riprapping of natural stream banks associated with bank protection projects is the single most serious, human-

caused threat to the long-term survival of the bank swallow in California (DFG, 2000a). It is estimated that as much as 50 percent of the remaining population of bank swallows could be lost if all bank protection projects currently proposed are completed. Existing colonies and areas of potential habitat may be lost over the next several years if current planning is implemented. Since 1960, riprap installed by the U.S. Army Corps of Engineers under the Sacramento River Bank Protection Project has affected almost 150 miles of Sacramento River bank. Additional riprap proposed under this project may result in extensive loss of the remaining essential, eroding bank habitat.

Although the California Fish and Game Commission adopted a State Recovery Plan for the bank swallow in 1992, implementation of the plan's recommendations has not occurred (DFG, 2000a). The Recovery Plan identifies habitat preserves and a return to a natural, meandering riverine ecosystem as the two main strategies for recovery of the bank swallow.

The CNDDDB lists one occurrence of bank swallows in the Bear Creek Watershed. This occurrence is just south of the confluence of Cow Creek and the Sacramento River, along the bank of the Sacramento River.

BLACK-CAPPED CHICKADEE

Black-capped chickadee, a Federal Species of Concern, is an uncommon, but year-long resident in Humboldt County, Del Norte County, and Siskiyou County (DFG, 2002a). It associates with montane riparian habitats in the Coast Range and Klamath Mountains and in dry grasslands of the arid Shasta Valley. Nests are excavated in snags, branches, stumps, or woodpecker holes.

The CNDDDB does not list any occurrences of black-capped chickadees in the Bear Creek watershed. However, black-capped chickadees have been observed in the watershed (C. Weidert, pers. com.).

CALIFORNIA HORNED LARK

The California horned lark, a State Species of Special Concern, is a year-long resident in California (DFG, 2002a). It associates with a variety of habitats, from coastal grasslands to alpine dwarf shrub habitats above timberline. The California horned lark is less common in coniferous forests and chaparral communities. Breeding occurs from March through July. Grass-lined nests are constructed in shallow depressions on the ground. Clutch size is two to five eggs, and females may produce two broods per breeding season. Eggs typically hatch after incubating for 10 and 14 days and young will fledge from three to five days later.

The CNDDDB does not list any occurrences of California horned larks in the Bear Creek watershed. However, California horned larks have been observed in the watershed (C. Weidert, pers. com.).

COOPER'S HAWK

Breeding populations of Cooper's hawk, a State Species of Concern, have declined in California. This species historically nested throughout California. Cooper's hawks occur from sea level to 9,000 feet in elevation. Cooper's hawks generally construct nests in live oaks near riparian areas. Nests may also be built in second-growth conifers. Nests are usually found between 10 and 80 feet above the ground, but most nests are found between 20 and 50 feet. Breeding occurs between March and mid-August. Clutch size ranges from two to six eggs, with an average of four to five eggs. The female incubates the eggs for one to two months, while the male provides food during this period.

Breeding populations have completely disappeared from some areas, such as the Colorado River, and significant declines have been noted in the Sacramento Valley, Santa Clara County, Santa Cruz County, Santa Barbara County, northern San Diego County, and in the vicinity of Yosemite National Park.

The primary threat to the Cooper's hawk is habitat destruction, mainly in lowland riparian areas. Direct or indirect human disturbance at nest sites is also detrimental. In addition, illegal take of young is a potential threat, especially in populated areas.

The CNDDDB does not list any occurrences of Cooper's hawks in the Bear Creek watershed. However, Cooper's hawks have been observed in the watershed near the confluence of Bear Creek and the Sacramento River (VESTRA, 2002) and in the vicinity of Inwood.

LAWRENCE'S GOLDFINCH

Lawrence's goldfinch, a Federal Species of Concern, ranges throughout the Central Valley and coastal foothills of California, as well as into the northern portion of Baja California. Lawrence's goldfinches generally nest in arid, open woodlands near chaparral, weed fields, and small bodies of water. Breeding generally occurs between mid-April and late July. The species feeds primarily on seeds of annual plants, with a strong preference for fiddlenecks. These birds generally travel in pairs or flocks.

The CNDDDB does not list any occurrences of Lawrence's goldfinch in the Bear Creek watershed. However, Lawrence's goldfinch has been observed in the watershed (C. Weidert, pers. com.).

NORTHERN GOSHAWK

The northern goshawk, a Federal Species of Concern, is an uncommon permanent resident in the mountains of California. In the Sierra Nevada, northern goshawk occurs as far south as Tulare County. In the northern Coast Range, goshawks generally range south to Mendocino County. However, they are occasionally observed in the San Jacinto Mountains and Mount Pinos in the southern Coast Range during summer. The breeding population in California is likely very small and vulnerable (Remsen, 1978).

Northern goshawks associate with dense, mature conifer forests (DFG, 2002a). Since most of the habitat of this species is within public lands such as National Forests and National Parks, there is comparatively little threat in the way of habitat destruction, but both falconry and logging are potential threats. California populations are likely small enough that the timber harvests must be limited and carefully controlled.

The CNDDDB does not list any occurrences of northern goshawks in the Bear Creek watershed. The CNDDDB does list an occurrence near the confluence of Spring Creek and Bailey Creek, several miles south of the watershed. In addition, northern goshawks have been reported near South Cow Creek Meadows, several miles north of the watershed. However, northern goshawks have been observed within the Bear Creek watershed (C. Weidert, pers. com.).

NORTHERN HARRIER

The northern harrier, a Federal Species of Concern, occurs in a variety of habitats, including meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands (DFG, 2002a). Northern harriers are rarely reported in woodlands. The northern harrier is a permanent resident in the Modoc Plateau and in coastal areas, and is an uncommon resident in the Central Valley. Northern harriers feed on a variety of animals,

including small mammals (e.g., voles and squirrels), snakes, and occasionally frogs. Most nests are constructed in emergent wetlands or along rivers or lakes. However, nests may be constructed in grasslands, grain fields, or in sagebrush.

The CNDDDB does not list any occurrences of northern harrier in the Bear Creek watershed. However, northern harriers have been observed in the watershed (C. Weidert, pers. com.).

OSPREY

Osprey, a State Species of Concern, is found in association with large rivers and lakes (DFG, 1983). They generally require open, clear waters for foraging. Osprey feed primarily on fish, but also consume small mammals, birds, reptiles, amphibians, and invertebrates. Osprey historically bred throughout much of California. However, by the 1940s, this species had declined in numbers (DFG, 1983). In northern California, there still are healthy populations just inland along the coast north of Sonoma County, and in Shasta, Lassen, and Plumas counties. Small numbers occur elsewhere along the California-Oregon border. Principal nesting areas include: Eagle Lake in Lassen County, the Klamath National Forest in Siskiyou County, Humboldt Redwoods State Park in Humboldt County; Duncan Mills in Sonoma County, and Kent Lake in Marin County.

The CNDDDB lists three occurrences of ospreys in the Bear Creek watershed. Two occurrences are at the confluence of Bear Creek and the Sacramento River. The CNDDDB also lists an occurrence of a pair of ospreys in a nest along South Fork Bear Creek northwest of Shingletown. Ospreys have also been observed on Fenwood Ranch (VESTRA, 2002) and near the One Hundred Road (C. Weidert, pers. com.).

PEREGRINE FALCON

The peregrine falcon, a State Endangered species, is an uncommon bird in California. Peregrine falcons breed from early March to late August in the Coast Range north of Santa Barbara and in the woodlands of the northern Sierra Nevada (DFG, 2002a). Clutch size ranges from three to seven eggs. Females may produce a second clutch within the same breeding season if the initial clutch is preyed upon.

The CNDDDB does not list any occurrences of peregrine falcons within the Bear Creek watershed or in the vicinity. However, peregrine falcons have been observed nesting in the watershed (C. Weidert, pers. com.).

RUFIOUS HUMMINGBIRD

Rufous hummingbird, a Federal Species of Concern, breeds in coniferous forests of the Pacific Northwest (DFG, 2002a). Post-breeders migrate south along the foothills of the Cascade and Sierra Nevada. In California, the rufous hummingbird is an uncommon summer resident. Rufous hummingbirds use a variety of habitats, including riparian areas, open woodlands, chaparral, mountain meadows, and other habitats rich in nectar-producing flowers, including gardens and orchards.

The CNDDDB does not list any occurrences of rufous hummingbird in the Bear Creek watershed. However, rufous hummingbirds have been observed in the watershed (C. Weidert, pers. com.).

SANDHILL CRANE

The sandhill crane, a State Threatened and California Fully Protected species, is a year-long resident in California (DFG, 2002a). In summer, this species associates with wet

meadows, shallow lacustrine, and freshwater emergent wetlands. In winter, sandhill cranes associate with grasslands, croplands, and open emergent wetlands in California's Central Valley. Sandhill cranes roost at night in flocks standing in moist fields or in shallow water. Nests may be constructed in remote areas of wetlands. Often, nests are constructed on mats of wetland plants in shallow water. Breeding occurs from April through August in wetlands in northeastern California. Breeding pairs may remain paired for life. Clutch size ranges from one to three eggs. Eggs hatch after incubating for approximately 30 days. Young remain with adults for up to one year.

The CNDDDB does not list any occurrences of sandhill crane in the Bear Creek watershed. However, sandhill cranes have been observed in the watershed (C. Weidert, pers. com.).

LARGE-BILLED SAVANNAH SPARROW

Large-billed savannah sparrow, a Federal Species of Concern, breeds east of the Cascade Range and Sierra Nevada, and along the entire California Coast (DFG, 2002a). Preferred habitat includes grasslands, saline emergent wetland, and wet meadow habitats. In the Central Valley, breeding occurs in grasslands and meadows from April to July. Adults nest in hollows or on the ground. Clutch size is two to six eggs. Eggs hatch after incubating for 10 to 13 days and young will fledge 7 to 14 days later. Large-billed savannah sparrows are known to consume grasses, seeds, snails, and spiders.

The CNDDDB does not list any occurrences of long-billed savannah sparrow in the Bear Creek watershed. However, long-billed savannah sparrows have been observed in the watershed (C. Weidert, pers. com.).

VAUX'S SWIFT

Vaux's swift, a Federal Species of Concern, prefers redwood and Douglas-fir habitats with nest-sites in large hollow trees and snags, especially tall, burned-out stubs (DFG, 2002a). Vaux's swift feeds exclusively on flying insects. Adults occasionally roost in chimneys and buildings. Breeding occurs from May to mid-August. The most important habitat requirement appears to be an appropriate nest site in a large, hollow tree. The species does not nest in Shasta County and would only be found in April and May during its migration.

The CNDDDB does not list any occurrences of Vaux's swift in the Bear Creek watershed. However, Vaux's swift has been observed in the watershed (C. Weidert, pers. com.).

WHITE-HEADED WOODPECKER

The white-headed woodpecker, a Federal Species of Concern, is a year-long resident of montane coniferous forests and lodgepole pine forests in the Cascade Range, Sierra Nevada, and Warner Mountains (DFG, 2002a). Adults breed from mid-April to late August. Nests are excavated in snags or stumps at least two feet in diameter and from 6 to 50 feet in height. Clutch size is three to seven eggs. Eggs hatch after incubating for 13 to 15 days.

The CNDDDB does not list any occurrences of white-headed woodpecker in the Bear Creek watershed. However, white-headed woodpeckers have been observed in the watershed (C. Weidert, pers. com.).

WHITE-TAILED KITE

The white-tailed kite, a DFG Fully Protected species and a Federal Species of Concern, was once widespread throughout the lowlands of California, but during the early 1900s, the population severely declined. In the 1930s, extinction was predicted for this species in California. From the 1940s to the 1970s, the population size and distribution increased. California now has the largest number of white-tailed kites in North America. The species is found in virtually all lowlands of California west of the Sierra Nevada range and the southeast deserts. It is common in the Central Valley and along the entire California coast. The white-tailed kite breeds in lowland grasslands, agricultural fields, wetlands, oak-woodland and savannah habitats, and riparian areas associated with open areas. Summer habitat preferences include riparian zones, dry pastures, orchards, and rice stubble fields.

The CNDDDB does not list any occurrences of white-tailed kite in the Bear Creek watershed. However, white-tailed kites have been observed in the watershed (C. Weidert, pers. com.).

RINGTAIL

The ringtail, a DFG Fully Protected species, is widespread throughout the Sierra Nevada, Klamath Mountains, Coast Range, and Central Valley (Belluomini, 1980). Ringtails appear to be most abundant in northern California. Ringtails have been reported from sea level to 8,800 feet. Ringtails occur in a variety of habitats within their range, but prefer chaparral, rocky hillsides, and riparian areas. Ringtails are nocturnal and active throughout the year. They forage on the ground, in trees. Their diet consists of small rodents, birds and bird eggs, reptiles, fruits, and carrion. Mating occurs in early spring. Females build nests in rock crevices, tree hollows, logs, snags, abandoned burrows, and woodrat nests. Young are born between May and June. Litter size ranges from one to five, with an average of three.

Prior to 1967, the ringtail was harvested for its fur (Belluomini, 1980). It could be taken in season with no limit on the number of animals taken. The highest take of ringtails occurred in 1927 and 1928, with 4,368 animals harvested; the lowest take of ringtails occurred in 1964 and 1965, with 55 animals harvested. In 1968, the ringtail was classified as Fully Protected, thus it could not be taken in any manner at any time of the year, except for scientific purposes under special permit issued by the DFG.

The CNDDDB does not list any occurrences of ringtails in the Bear Creek watershed. However, ringtails have been observed on the Aldridge ranch (G. Aldridge, pers. com.), near Dickerson Creek (R. Weidenkeller, pers. com.), and along the 100 Road (C. Weidert, pers. com.).

SPECIAL-STATUS WILDLIFE KNOWN OR EXPECTED TO OCCUR IN THE VICINITY

CALIFORNIA LINDERIELLA FAIRY SHRIMP

California linderiella fairy shrimp, a Federal Species of Concern, is the most common fairy shrimp in the Central Valley, ranging from Shasta County south to Fresno County (USFWS, no date - b). It has been documented on a variety of land forms, geologic formations and soil types supporting vernal pools in California, at altitudes as high as 3,800 feet above sea level.

California linderiella fairy shrimp can tolerate water temperatures between 41° and 85°F (USFWS, no date - b). This range is the widest of any known fairy shrimp in California. Adults are typically collected between late December and early May. Eggs contained in brood sacs are either released by the female or sink to the sediment when she dies. These eggs will remain in the dry pool bed until the following winter when rainfall and other environmental factors stimulate the eggs to hatch.

Although the CNDDDB does not list any occurrences of California linderiella fairy shrimp in the Bear Creek watershed, they are known to occur in the vicinity. The CNNDDB lists occurrences of the California linderiella fairy shrimp in vernal pools on the Stillwater Plains and from vernal pools east of the Redding Airport. A review of aerial photos of the Bear Creek watershed shows that vernal pools are present on the Millville Plains, thus, it is possible that California linderiella fairy shrimp are present.

VALLEY ELDERBERRY LONGHORN BEETLE

The valley elderberry longhorn beetle, a Federal Threatened species, is associated with elderberry trees in California's Central Valley. In the Central Valley, the elderberry tree is associated with riparian forests along rivers and streams (USFWS, no date - c) and occur from near sea level to approximately 9,000 feet in elevation (Halstead and Oldham, 1999). Currently, the beetle persists in scattered localities along the Sacramento, American, San Joaquin, Kings, Kaweah, and Tule rivers, and their tributaries. The limiting factors affecting its distribution appears to be the age and quality of individual elderberry trees, which are its obligate host (USFWS, no date – c).

The beetle's entire life cycle involves elderberry trees that are at least one inch in diameter (USFWS, no date – c). As elderberry flowers begin to open during the spring, adult beetles emerge from pupation inside the wood. Exit holes formed by the emerging adults are distinctive small oval openings. Often these holes are the only indicators that the beetles occur in an area. Adults eat elderberry foliage until approximately June. After mating, females lay eggs in crevices in the bark. After hatching, the larvae tunnel into the wood where they will remain for one to two years. The interior wood is the larva's only food source.

Current efforts to conserve the valley elderberry longhorn beetle have focused on re-vegetating riparian habitats. The California Department of Water Resources (DWR) has assisted the USFWS in replanting elderberry plants along parts of the American River. Additional efforts are currently underway to reintroduce the beetle itself into areas which it formerly inhabited.

Although the CNDDDB does not list any occurrences of valley elderberry longhorn beetles in the Bear Creek watershed, they have been reported in the vicinity. They have been observed at the southern tip of Rancherie Island in the Sacramento River, several miles to the southwest of the watershed.

Elderberry trees have been observed throughout riparian areas of the Fenwood Ranch property, located near the mouth of Bear Creek, and along the 100 Road and Ponderosa Way near Inwood (C. Weidert, pers. com.). In addition, ENPLAN biologists have observed elderberry plants along Lack Creek at Dersch Road. Therefore, valley elderberry longhorn beetles may occur in the watershed if elderberry plants of sufficient diameter are present.

VERNAL POOL FAIRY SHRIMP

Vernal pool fairy shrimp, a Federal Threatened species, is widespread but not abundant. Known populations extend from Stillwater Plain in Shasta County through most of the Central Valley to Tulare County (USFWS, no date – d). They range from northern Solano County to San Benito County. Four additional, disjunct populations exist: one near Soda Lake in San Luis Obispo County, one in the mountain grasslands of northern Santa Barbara County, one on the Santa Rosa Plateau in Riverside County, and one near Rancho California in Riverside County.

The vernal pool fairy shrimp was first described in 1990 (USFWS, no date – d). Thus, it is largely unknown whether its distribution has contracted since Euro-American settlement. However, since it is currently known to occur in a wide range of vernal pool habitats, its historic distribution may have coincided with the historic distribution of Central Valley and Southern California vernal pools.

Vernal pool fairy shrimp have been collected from mid-November to early May (USFWS, no date – d). Females carry their eggs in a ventral brood sac. The eggs are either dropped to the pool bottom or remain in the brood sac until the mother dies and sinks. When the pool dries out, so do the eggs. They remain in the dry pool bed until rains and other environmental stimuli hatch them.

Although the CNDDDB does not list any occurrences of vernal pool fairy shrimp in the Bear Creek watershed, they are known to occur in the vicinity. The CNDDDB lists occurrences of vernal pool fairy shrimp in vernal pools on the Stillwater Plains, several miles west of the watershed. If vernal pool fairy shrimp are present in the watershed, they are possibly in the vernal pool complexes in the Millville Plains.

VERNAL POOL TADPOLE SHRIMP

Vernal pool tadpole shrimp, a Federal Endangered species, is known from 18 vernal pool complexes in the Central Valley, ranging from east of Redding in Shasta County, south to the San Luis National Wildlife Refuge in Merced County (USFWS, no date – e). Additionally, a vernal pool complex containing vernal pool tadpole shrimp occurs in Alameda County. Vernal pool tadpole shrimp inhabit vernal pools containing clear to very turbid water. The life history of the vernal pool tadpole shrimp is linked to the seasonal cycle of the vernal pool. After winter rainwater fills the pool, the shrimp emerge from cysts that lie dormant in the dry sediments. Sexually mature adults have been observed in vernal pools three to four weeks after the pools have been filled. Some cysts hatch immediately while others remain dormant in the soil, hatching later in the rainy season.

Although the CNDDDB does not list any occurrences of vernal pool tadpole shrimp in the Bear Creek watershed, they are known to occur on the Millville Plains, which is part of the watershed. The Millville Plains is known to support approximately 1,200 acres of vernal pool habitat, of which, 40 acres are protected by the BLM. The DFG plans to protect an additional 250 acres of vernal pool habitat using Federal grant money and may seek to protect another 230 acres using other grant money (Breitler, 2004). However, it is not known how many (if any) of the proposed conservation easements will include land in the Bear Creek watershed. The nearest occurrences of vernal pool tadpole shrimp to the Bear Creek watershed reported in the CNDDDB are in vernal pools on a plateau above Battle Creek and in vernal pools near the Redding Airport.

CALIFORNIA WOLVERINE

The California wolverine is a Federal Species of Concern and is listed by the State of California as Threatened. It has a large home range, and roams over hundreds of miles and use a variety of habitats. It has been reported from 1,600 to 14,000 feet in elevation (DFG, 2000b). In California, the historic range of the California wolverine included the remote areas of the Klamath Mountains and the Sierra Nevada (Copeland and Kucera, 1997). In general, California wolverines seem to use open habitat, mostly at or above timberline.

Although the CNDDDB does not list any occurrences of California wolverines in the Bear Creek watershed, it does list an occurrence near the watershed in the vicinity of Shingletown. This sighting in 1975 was along North Fork Battle Creek (near a borrow pit) and is approximately 1.7 miles south of the watershed.

PACIFIC FISHER

Pacific fisher, a Federal Candidate species, inhabits mature coniferous forests and deciduous-riparian habitats in the Klamath Mountains, Sierra Nevada, and Coast Range (DFG, 2002a). Pacific fishers are mostly nocturnal. They are carnivorous, feeding on rabbits, hares, rodents, shrews, birds, fruits, and carrion. Pacific fishers den in cavities in protected cavities, under brush-piles, or in logs. Females give birth to young in spring and remain with her until late autumn. Pacific fishers in California were legally trapped for their fur until 1946 (Lewis and Zielinski, 1996). However, their declining numbers as a result of trapping was the impetus two petitions for listing under the Endangered Species Act.

Although the CNDDDB does not list any occurrences of Pacific fishers in the Bear Creek watershed, it does list an occurrence approximately 0.25 miles west of Manzanita Lake in nearby Lassen Volcanic National Park. This locality is several miles to the east of the Bear Creek watershed.

PINE MARTEN

Pine marten, a Federal Species of Concern, historically inhabited mature conifer forests of the northern United States and Canada (Zielinski et al., 2001). In California, pine martens are found in the Sierra Nevada and Klamath Mountains, and occupy much of their historic range (Kucera et al., 1995). Pine martens live in mature, dense conifer forests, or mixed conifer-hardwood forests offering conifers and deciduous trees including hemlock, white pine, maple, fir and spruce. An important habitat component is understory with an abundance of large limbs and fallen trees. These forests provide prey, protection, and den sites.

Pine martens reach reproductive maturity at the age of two. The breeding season is July and August. Males and females may mate with several partners during the breeding season. The female makes a den lined with leaves, moss, and other vegetation in a hollow tree, stump or rock crevice (DFG, 2002a). She gives birth to two to four young in late March or April. Males do not participate in rearing the young. The young are almost full-grown at three months. Young martens normally disperse from their home territory in late summer or early fall to establish their own territories.

The CNDDDB does not list any occurrences of pine martens in the Bear Creek watershed. However, a pine marten was detected several miles north of the watershed at Peavine Gulch in 1997 (B. Carey, W.M. Beaty & Associates, Inc., pers. com.).

SIERRA NEVADA RED FOX

Sierra Nevada red fox, a State Threatened species, is one of 10 recognized North American fox subspecies (DFG, 2000c). The Sierra Nevada red fox inhabits remote mountainous areas where encounters with humans are rare. Relatively little is known of the life history of the Sierra Nevada red fox, but it is assumed that its habits are similar to those of other red foxes in terms of choice of dens, hunting tactics, and breeding behavior. The Sierra Nevada red fox occurs in habitats similar to those used by the pine marten and California wolverine. Sightings of the Sierra Nevada red fox have been reported from 3,900 feet in Yosemite Valley to 11,900 feet at Lake South America in the southern Sierra Nevada. The Sierra Nevada red fox distribution includes the northern California Cascades, eastward to the northern Sierra Nevada, and then south along the Sierran crest to Tulare County. Preferred habitat appears to be red fir and lodgepole pine forests in the subalpine and alpine zones of the Sierra Nevada. This species may hunt in forest openings, meadows, and barren rocky areas associated with its high elevation habitats. Threats to the Sierra Nevada red fox are unknown.

Although the CNDDDB does not list any occurrences of the Sierra Nevada red fox in the Bear Creek watershed, it does list an occurrence approximately three miles southeast of the watershed. Therefore, Sierra Nevada red foxes may be potentially present at high elevation areas in the Bear Creek watershed that have suitable habitat.

CALIFORNIA RED-LEGGED FROG

The California red-legged frog, a Federal Threatened species and a State Species of Special Concern, historically occurred from sea level to approximately 4,500 feet in elevation, in Pacific slope drainages throughout California and northern Baja Mexico (Storer, 1925). This native frog was abundant in intermittent and perennial streams, and ponds both on the floor of the Central Valley and in the nearby foothills. The presence of dense aquatic vegetation close to water, deep pools, and the absence of introduced predatory fish and bullfrogs are important habitat features that especially important to California red-legged frogs (Hayes and Jennings, 1988). California red-legged frogs were commercially harvested to supply markets in San Francisco between 1888 and 1935 (Jennings and Hayes, 1985). Introduction of exotic predatory fish and bullfrogs resulted in the extirpation of many populations (Moyle, 1973). The current range of the California red-legged frog is limited to a few isolated populations in the western foothills of the Sierra Nevada, and scattered populations in the Bay Area and Coast Range. California red-legged frogs were last reported in Shasta County (at Redding) in 1911. The nearest locality to the Bear Creek watershed recently reporting California red-legged frogs is at Sunflower Gulch in Tehama County. One adult was reported at this site in 1986. However, subsequent surveys at the site have failed to detect additional California red-legged frogs.

Areas of the Bear Creek watershed below 5,000 feet in elevation occur within the historic range of the California red-legged frog. These areas are included as part of the USFWS's Sierra Nevada Foothills and Central Valley Recovery Unit for the California red-legged frog. This recovery unit includes the Coast Range foothills, valley floor, and the western foothills of the Sierra Nevada lying within the Central Valley hydrographic basin, and ranges from sea level to approximately 5,000 feet in elevation (USFWS, 2002a). The USFWS assumes the species is present within its historic range, unless field surveys prove otherwise.

7.6. Non-Status Wildlife in or Near the Bear Creek Watershed

A variety of non-status wildlife species are known to occur in the Bear Creek watershed and vicinity. All non-status wildlife species that have been reported in or near the Bear Creek watershed by residents in the watershed are presented in Table 7-24.

**Table 7-24. Bear Creek Watershed Assessment 2005
Non-Status Wildlife Species Reported in or Near
the Bear Creek Watershed**

Amphibians	<i>Source</i>
Bullfrog, <i>Rana catesbeiana</i> ¹	2, 4A, 4B, 4C, 11
California newt, <i>Taricha torosa</i>	10, 11
Ensatina, <i>Ensatina eschscholtzii</i>	10
Pacific treefrog, <i>Hyla regilla</i>	2, 4A, 11
Rough-skinned newt, <i>Taricha granulosa</i>	2
Western toad, <i>Bufo boreas</i>	10
Reptiles	
Common kingsnake, <i>Lampropeltis getulus</i>	8, 10
California night snake, <i>Hypsiglena torquata</i>	10
Common garter snake, <i>Thamnophis sirtalis</i>	8
Gopher snake, <i>Pituophis catenifer</i>	8, 9
Northern alligator lizard, <i>Elgaria coerulea</i>	10
Northern Pacific rattlesnake, <i>Crotalus viridis</i>	2, 4C, 8, 9
Pacific ringneck snake, <i>Diadophis punctatus</i>	10
Rubber boa, <i>Charina bottae</i>	10
Sharp-tailed snake, <i>Contia tenuis</i>	9, 10
Southern alligator lizard, <i>Elgaria multicarinatus</i>	10
Western fence lizard, <i>Sceloporus occidentalis</i>	2, 9
Western skink, <i>Eumeces skiltonianus</i>	9
Western terrestrial garter snake, <i>Thamnophis elegans</i>	2
Western whiptail, <i>Cnemidophorus tigris</i>	10
Birds	
Acorn woodpecker, <i>Melanerpes formicivorus</i>	4A, 7
Allen's hummingbird, <i>Selasphorus sasin</i>	10
American coot, <i>Fulica americana</i>	10
American crow, <i>Corvus brachyrhynchos</i>	7
American goldfinch, <i>Carduelis tristis</i>	7, 10
American kestrel, <i>Falco sparverius</i>	2, 7, 10
American pipit, <i>Anthus rubescens</i>	7
American robin, <i>Turdus migratorius</i>	4A, 10
Anna's hummingbird, <i>Calypte anna</i>	10
Ash-throated flycatcher, <i>Myiarchus cinerascens</i>	10
Band-tailed pigeon, <i>Columba fasciata</i>	10
Barn swallow, <i>Hirundo rustica</i>	4A
Belted kingfisher, <i>Ceryle alcyon</i>	10
Black-chinned hummingbird, <i>Archilochus alexandri</i>	10
Black-headed grosbeak, <i>Pheucticus melanocephalus</i>	10
Black phoebe, <i>Sayornis nigricans</i>	7
Blue grouse, <i>Dendragapus obscurus</i>	10
Blue heron, <i>Ardea herodias</i>	11
Brewer's blackbird, <i>Euphagus cyanocephalus</i>	4A
Broad-tailed hummingbird, <i>Selasphorus platycercus</i>	10
Brown creeper, <i>Certhia americana</i>	10
Brown-headed cowbird, <i>Molothrus ater</i> ¹	10
Bushtit, <i>Psaltiriparus minimus</i>	10
California thrasher, <i>Toxostoma redivivum</i>	4A
California towhee, <i>Pipilo crissalis</i>	4A
California quail, <i>Callipepla californica</i>	2, 7

**Table 7-24. Bear Creek Watershed Assessment 2005
Non-Status Wildlife Species Reported in or Near
the Bear Creek Watershed**

Birds (continued)	
Calliope hummingbird, <i>Stellula calliope</i>	10
Canada goose, <i>Branta canadensis</i>	10
Cedar waxwing, <i>Bombycilla cedrorum</i>	10
Chipping sparrow, <i>Spizella passerine</i>	10
Cinnamon teal, <i>Anas cyanoptera</i>	10
Cliff swallow, <i>Petrochelidon pyrrhonota</i>	4A, 4C
Common egret, <i>Casmerodius albus</i>	10
Common merganser, <i>Mergus merganser</i>	10
Common nighthawk, <i>Chordeiles minor</i>	10
Common poorwill, <i>Phalaenoptilus nuttalli</i>	10
Common raven, <i>Corvus corax</i>	7
Common snipe, <i>Gallinago gallinago</i>	10
Dark-eyed junco, <i>Junco hyemalis</i>	4A, 7
Downy woodpecker, <i>Picoides pubescens</i>	7
European starling, <i>Sturnus vulgaris</i> ¹	3, 4A, 7, 10
Evening grosbeak, <i>coccothraustes vespertinus</i>	10
Fox sparrow, <i>Passerella iliaca</i>	10
Golden crowned kinglet, <i>Regulus satrapa</i>	10
Golden-crowned sparrow, <i>Zonotrichia atricapilla</i>	10
Golden eagle, <i>Aquila chrysaetos</i>	3
Grasshopper sparrow, <i>Ammodramus savannarum</i>	10
Great blue heron, <i>Ardea herodias</i>	10
Great horned owl, <i>Bubo virginianus</i>	2
Greater road-runner, <i>Geococcyx californianus</i>	10
Green-backed heron, <i>Butorides striatus</i>	10
Green-winged teal, <i>Anas crecca</i>	10
Hermit thrush, <i>Catharus guttatus</i>	10
Hermit warbler, <i>Dendroica occidentalis</i>	10
House finch, <i>Carpodacus mexicanus</i>	7
House sparrow, <i>Passer domesticus</i>	10
House wren, <i>Troglodytes aedon</i>	10
Hutton's vireo, <i>Vireo huttoni</i>	10
Killdeer, <i>Charadrius vociferous</i>	4A, 7
Lark sparrow, <i>Chondestes grammacus</i>	10
Lazuli bunting, <i>Passerina amoena</i>	10
Lesser goldfinch, <i>Carduelis psaltria</i>	7, 10
Lewis's woodpecker, <i>Melanerpes lewis</i>	7
Lincoln's sparrow, <i>Melospiza lincolni</i>	7
Mallard, <i>Anas platyrhynchos</i>	10
Mockingbird, <i>Mimus polyglottos</i>	4A
Mountain chickadee, <i>Poecile gambeli</i>	10
Mountain quail, <i>Oreortyx pictus</i>	2
Mourning dove, <i>Zenaida macroura</i>	4A
Northern flicker, <i>Colaptes chrysoides</i>	7
Northern oriole, <i>Icterus galbula</i>	10
Northern saw-whet owl, <i>Aegolius acadicus</i>	10
Nuttall's woodpecker, <i>Picoides scalaris</i>	7
Oak titmouse, <i>Baeolophus inornatus</i>	7
Olive-sided flycatcher, <i>Contopus borealis</i>	10
Peacock, <i>Pavo cristatus</i> ¹	3, 11
Phainopepla, <i>Phainopepla nitens</i>	10
Pileated woodpecker, <i>Dryocopus pileatus</i>	11
Pine siskin, <i>Carduelis pinus</i>	10
Pygmy nuthatch, <i>Sitta pygmaea</i>	10
Red-breasted nuthatch, <i>Sitta canadensis</i>	10

**Table 7-24. Bear Creek Watershed Assessment 2005
Non-Status Wildlife Species Reported in or Near
the Bear Creek Watershed**

Birds (continued)	
Red-breasted sapsucker, <i>Sphyrapicus ruber</i>	10
Red-shouldered hawk, <i>Buteo lineatus</i>	10
Red-tailed hawk, <i>Buteo jamaicensis</i>	2, 4A, 7
Red-winged blackbird, <i>Agelaius phoeniceus</i>	4A, 7
Ring-necked pheasant, <i>Phasianus colchicus</i> ¹	10
Ruby-crowned kinglet, <i>Regulus calendula</i>	7
Rufous-sided towhee, <i>Pipilo erythrophthalmus</i>	4A
Sharp-shinned hawk, <i>Accipiter striatus</i>	2
Snow goose, <i>Chen canagica</i>	7
Solitary vireo, <i>Vireo solitarius</i>	10
Song sparrow, <i>Melospiza melodia</i>	7
Spotted sandpiper, <i>Actitis macularia</i>	7
Steller's jay, <i>Cyanocitta stelleri</i>	10
Three-toed woodpecker, <i>Picoides tridactylus</i>	10
Tree swallow, <i>Tachycineta bicolor</i>	10
Townsend's solitaire, <i>Myadestes townsendi</i>	10
Townsend's warbler, <i>Dendroica townsendi</i>	10
Turkey vulture, <i>Cathartes aura</i>	4A, 7
Varied thrush, <i>Ixoreus naevius</i>	10
Violet-green swallow, <i>Tachycineta thalassina</i>	10
Western bluebird, <i>Sialia mexicana</i>	7
Western flycatcher, <i>Empidonax difficilis</i>	10
Western kingbird, <i>Tyrannus verticalis</i>	10
Western meadowlark, <i>Sturnella neglecta</i>	10
Western screech owl, <i>Otus kennicottii</i>	2
Western scrub jay, <i>Aphelocoma coerulescens</i>	4A, 7
Western tanager, <i>Piranga ludoviciana</i>	10
Western wood pewee, <i>Contopus sordidulus</i>	10
White-breasted nuthatch, <i>Sitta carolinensis</i>	7
White-crowned sparrow, <i>Zonotrichia atricapilla</i>	7
Wild turkey, <i>Meleagris gallopavo</i> ¹	2, 3, 10, 11
Wilson's warbler, <i>Wilsonia pusilla</i>	10
Winter wren, <i>Troglodytes troglodytes</i>	10
Wood duck, <i>Aix sponsa</i>	10
Wren tit, <i>Chamaea fasciata</i>	10
Yellow-billed magpie, <i>Pica nuttalli</i>	4A, 7
Yellow-rumped warbler, <i>Dendroica coronata</i>	7
Mammals	
American beaver, <i>Castor canadensis</i>	10, 12
Big brown bat, <i>Eptesicus fuscus</i>	4A
Black bear, <i>Ursus americanus</i>	2, 11
Black-tailed deer, <i>Odocoileus hemionus</i>	2, 4A
Black-tailed jackrabbit, <i>Lepus californicus</i>	2, 10
Bobcat, <i>Lynx rufus</i>	2
Brazilian free-tailed bat, <i>Tadarida brasiliensis</i>	4A
Brush rabbit, <i>Sylvilagus bachmani</i>	10
California ground squirrel, <i>Otospermophilus beecheyi</i>	2
California mole, <i>Scapanus latimanus</i>	10
California vole, <i>Microtus californicus</i>	10
Douglas's squirrel, <i>Tamiasciurus douglasii</i>	10
Coyote, <i>Canis latrans</i>	2
Deer mouse, <i>Peromyscus californicus</i>	2
Dusky-footed woodrat, <i>Neotoma fuscipes</i>	11
Gray fox, <i>Urocyon cinereoargenteus</i>	2, 4A, 11
Heerman kangaroo rat, <i>Dipodomys heermanni</i>	10

**Table 7-24. Bear Creek Watershed Assessment 2005
Non-Status Wildlife Species Reported in or Near
the Bear Creek Watershed**

Mammals (continued)	
Long-tailed weasel, <i>Mustela frenata</i>	11
Mountain lion, <i>Felis concolor</i>	2, 11
Northern flying squirrel, <i>Glaucomys sabrinus</i>	2, 10
Opossum, <i>Didelphus marsupialis</i> ¹	10
Porcupine, <i>Erethizon dorsatum</i>	10, 12
Raccoon, <i>Procyon lotor</i>	10, 11
River otter, <i>Lutra canadensis</i>	10
Rocky Mountain elk, <i>Cervus elaphus nelsoni</i> ¹	2, 5, 6, 11
Shrew mole, <i>Neurotrichus gibbsi</i>	10
Spotted skunk, <i>Spirogale putorius</i>	2
Striped skunk, <i>Mephitis mephitis</i>	2
Valley pocket gopher, <i>Thomomys bottae</i>	10
Western gray squirrel, <i>Sciurus griseus</i>	10, 11
Western harvest mouse, <i>Reithrodontomys megalotis</i>	10
Wild pig, <i>Sus scrofa</i> ¹	6, 11
Yellow pine chipmunk, <i>Tamias amoenus</i>	10

Other

1 = Introduced species

Source

2 = W.M. Beaty & Associates, Inc.

3 = VESTRA (2002)

4A = ENPLAN (2001a)

4B = ENPLAN (2001b)

4C = ENPLAN

5 = DFG

6 = SHN Consulting Engineers & Geologists, Inc. (2001)

7 = Shasta Land Trust

8 = California Academy of Sciences

9 = University of California at Berkeley's Museum of Vertebrate Zoology

10 = C. Weidert, pers. com.

11 = R. Weidenkeller, pers. com.

12 = G. Aldridge, pers. com.

7.7. Exotic Wildlife

Non-native introduced wildlife species known to occur in the Bear Creek watershed include the bullfrog, brown-headed cowbird (*Molothrus ater*), European starling (*Sturnus vulgaris*), peacock (*Pavo cristatus*), wild turkey (*Meleagris gallopavo*), ring-necked pheasant (*Phasianus colchicus*), opossum (*Didelphus marsupialis*), Rocky Mountain elk (*Cervus elaphus nelsoni*), and wild pig (*Sus scrofa*).

BULLFROG

The bullfrog was introduced into California sometime in the late 1800s or early 1900s to help satisfy the demand for frog legs (Jennings and Hayes, 1985). Bullfrogs prefer warm-water ponds with an abundance of emergent vegetation along the shoreline or dense mats of algae on the water surface. The bullfrog has a high reproductive potential, as each female is capable of laying several thousand eggs in a thin sheet at the water surface. Bullfrog tadpoles remain in aquatic habitats two to three years before transforming into juvenile frogs. The bullfrog is considered a nuisance because of its high reproductive

potential, its indiscriminate appetite for a variety of native wildlife, and because it is difficult to eradicate once established at a site. The bullfrog has been reported at low and middle elevation sites in the watershed (ENPLAN, 2001a; ENPLAN, 2001b; ENPLAN; W.M. Beaty & Associates, Inc.; R. Weidenkeller, pers. com.). Bullfrogs have been observed in a pond on an intermittent tributary of Dickerson Creek (R. Weidenkeller, pers. com.).

BROWN-HEADED COWBIRD

The brown-headed cowbird was introduced into California in the late 1800s. In northern California, brown-headed cowbirds are common in spring and summer, but uncommon during winter. Brown-headed cowbirds are brood parasites, laying their eggs in the nests of other passerine birds (DFG, 2002a). It is known to lay eggs in nests on the ground and on tree branches, but not in tree cavities. Brown-headed cowbirds roost in many habitats, but prefer riparian areas and moist forest edges, where the density of passerine host populations is highest. The breeding season is from April through July. Females lay approximately 30 eggs each breeding season, with one to two eggs deposited in different host nests. Eggs hatch after incubating for 11 to 13 days and young will fledge 10 to 11 days later.

EUROPEAN STARLING

The European starling was introduced into California from Europe in 1939. This bird tends to associate with agricultural lands, such as pastures, orchards, and crops. European starlings feed heavily on seeds, grains, fruits, and nuts (DFG, 2002a). The European starling competes aggressively with native birds for nest holes. It will nest in virtually any hole or crevice; if these are unavailable, it will nest on the ground. It is known to displace native blue birds, titmice, nuthatches, swallows, wrens, and American kestrels, northern flickers, and acorn woodpeckers. The European starling is considered a nuisance because it displaces native species and damages grain crops. The European starling is known to occur along the lower reaches of the main stem of Bear Creek (VESTRA, 2002; ENPLAN, 2001a; Shasta Land Trust).

PEACOCK

The peacock is native to Southeast Asia. The habits of the peacock appear to be similar to that of the wild turkey. Peacock feathers have been found in the Bear Creek watershed on the Fenwood Ranch property (VESTRA, 2002) and have been observed near Dickerson Creek (R. Weidenkeller, pers. com.).

WILD TURKEY

Wild turkey populations were introduced into California in 1877 (DFG, 2002a). They associate with pine-oak woodlands in the foothills along California's Central Valley. Wild turkeys prefer larger trees with low to intermediated canopy, interspersed with grassland, near water. Wild turkeys consume a variety of items, such as seeds, leaves, fruits, nuts, buds, acorns, and arthropods. They roost high in tree groves near water. Nests are generally constructed in slight depressions near a permanent water source. Females typically lay a clutch of 10 to 12 eggs. The effect of introduction of wild turkey on native species is unknown. The DFG is preparing a Wild Turkey Management Plan that is intended to balance the interests of hunters and wildlife enthusiasts, while minimizing

negative impacts that wild turkeys may have in some areas. In the Bear Creek watershed, wild turkeys are known to occur on the Fenwood Ranch property (VESTRA, 2002; W.M. Beaty & Associates, Inc.) and near North Fork Bear Creek and Dickerson Creek (R. Weidenkeller, pers. com.).

RING-NECKED PHEASANT

The ring-necked pheasant, a native of Asia, was introduced into California in the late 1800s. It prefers agricultural lands and grasslands bordered by woodlands. It consumes a variety of seeds and grains. Ring-necked pheasants are known to occur in the Bear Creek watershed (C. Weidert, pers. com.). It is unknown what effect the ring-neck pheasant has had on native wildlife.

OPOSSUM

The opossum was introduced into California around 1900 (Opossum, no date). Opossums are widespread throughout California and are found in a variety of habitats. The opossum is primarily nocturnal and feeds on insects, fish, berries, and carrion. During daytime, opossums occupy tree hollows, logs, ground squirrel burrows, or culverts. Females produce one to two litters per year. Litter sizes are variable, but seldom exceed 18 young. Opossums are known to occur in the Bear Creek watershed (C. Weidert, pers. com.).

ROCKY MOUNTAIN ELK

Rocky Mountain elk from Yellowstone National Park were introduced into California in 1914. Currently, four populations of Rocky Mountain elk occur in California, with a total population of approximately 1,000 to 1,500 animals. In Shasta County, the Rocky Mountain elk herd is comprised of 150 to 200 elk. This herd is reported in the Cow Creek watershed and Bear Creek watershed (SHN Consulting Engineers & Geologists, Inc., 2001; W.M. Beaty & Associates, Inc.; R. Weidenkeller, pers. com.). Rocky Mountain elk have been observed near Dickerson Creek (R. Weidenkeller, pers. com.). The number of Rocky Mountain elk in the Bear Creek watershed is likely small (S. Hill, DFG, pers. comm.). The effect of introduction of Rocky Mountain elk on other wildlife species in the Bear Creek watershed is unknown.

WILD PIG

California's wild pig is a hybrid of the European wild boar and feral pig. It was introduced to California in the 1920s (DFG, 2000d). Wild pigs prefer oak woodlands and grasslands with a permanent water body. A small population of wild pigs is known to occur in the vicinity of Whitmore, several miles north of the Bear Creek watershed. Wild pigs are prolific breeders, as a female is capable of producing 15 piglets each year. Wild pigs are considered a nuisance because of the habitat destruction they cause while rooting for acorns, insects, and roots.

7.8. Managed Big Game Populations

The DFG currently issues hunting tags for three big game animals in the Bear Creek watershed: black bear, black-tailed deer, and wild pig. A small number of Rocky Mountain

elk are known to occur in the Bear Creek watershed, but the DFG does not allow hunting of this herd (S. Hill, DFG, pers. comm.). The mountain lion was classified as a game species in California from 1907 to 1963, and from 1969 to 1972. Across California, more than 12,500 were taken during its first hunting period, while 59 were taken during the second hunting period. No data is available on the number of mountain lions taken in the Bear Creek watershed while this species was legally hunted. The mountain lion is currently classified as a non-game species, therefore, a detailed description of its life history and management will not be included.

BLACK BEAR

Black bears are widespread in California's mountains. Black bears are found in a variety of habitat types, but populations are densest in forested areas that have several seral stages present (DFG, 1998). The current distribution of the black bear in California includes the Klamath Mountains, Cascades, Coast Range, Sierra Nevada, and San Gabriel Mountains.

The black bear was classified as a game animal in California in 1948. In 1998, an estimated 17,000 to 23,000 black bears inhabited California, an increase from the 10,000 to 15,000 black bear population estimate for the early 1980s (DFG, 1998). The DFG allows archery hunting of black bears from August 21 to September 12. The general hunting season begins later and closes on the last Sunday in December, or when 1,700 bears have been reported taken, whichever occurs first. According to DFG records, the number of bears taken annually in Shasta County during the last ten years ranged from a low of 142 in 2003 to a high of 226 in 1994 (Table 7-25). However, no data specific to the number of black bears taken in the Bear Creek watershed is available.

**Table 7-25. Bear Creek Watershed Assessment 2005
Ten-Year Black Bear Take Data for Shasta County**

1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
226	183	219	148	185	208	179	204	178	142

BLACK-TAILED DEER

Black-tailed deer are among the most visible and widespread wildlife species in California. They are important component in food webs. In addition to grazing on many wild-land plants, black-tailed deer are an important source of food for mountain lion, black bear, coyote, and golden eagle. Based on 1998 data, black-tailed deer are the most popular big game mammal, drawing 165,000 to 200,000 hunters into the woodlands annually (Loft et al., 1998).

Black-tailed deer population trends statewide peaked in the 1950s to 1960s, but have since decreased. This statewide decline is attributed mainly to long-term declines in habitat quality, a result of a variety of factors. Predation by mountain lions has also affected the size of black-tail deer populations.

The Bear Creek watershed is part of the Cascade-North Sierra Nevada Deer Assessment Unit (DAU) 4, one of 11 DAUs that the DFG monitors to assess population trends, habitat conditions, habitat issues, and opportunities for change in habitat condition. This DAU encompasses 7,000 square miles, from the Oregon border south to the Lake Almanor and Feather River drainages (DFG, 2002b). Deer population trends in this DAU

have exhibited a significant decline, decreasing from 70,000 animals in 1991 to 40,000 animals in 1996.

The Bear Creek watershed provides suitable habitat in winter and summer habitat for a portion of the Cow Creek deer herd (Smith et al., 1983). The population size of the Cow Creek deer herd peaked in the early 1960s, but has since declined to approximately 6,000 to 8,000 animals (SHN Consulting Engineers & Geologists, Inc., 2001). Estimates of the number of deer from this herd that use the Bear Creek watershed are unavailable.

The DFG manages the Cow Creek deer herd, including the hunting of bucks. Records maintained from 1960 to 1982 show that hunter harvest levels declined in the late 1960s and reached a low in 1974 (Smith et al., 1983). The number of kills reported by hunters declined in the 1970s, partly as a result of a shorter hunting season, early closing dates, and a reduction in the bag limit from two to one in 1970 (Table 7-26).

**Table 7-26. Bear Creek Watershed Assessment 2005
Reported and Adjusted Buck Harvest of the Cow Creek Deer Herd**

(Source: Smith et al., 1983)

<i>Year</i>	<i>Season Dates</i>	<i>Bag Limit</i>	<i>Reported Harvest</i>	<i>Adjusted Harvest¹</i>
1960	9/24 – 11/6	2	1,032	1,720
1961	9/23 – 11/5	2	762	1,270
1962	9/22 – 11/4	2	564	940
1963	9/21 – 11/3	2	957	1,595
1964	9/19 – 11/8	2	1,114	1,857
1965	9/18 – 10/31	2	953 ²	1,588
1966	9/24 – 11/13	2	1,199 ²	1,198
1967	9/23 – 10/29	2	591 ²	1,478
1968	9/21 – 11/3	2	887	1,478
1969	9/20 – 11/2	2	965	1,608
1970	9/26 – 10/25	1	644	1,073
1971	9/25 – 10/25	1	679	1,132
1972	9/23 – 10/23	1	678	1,130
1973	9/22 – 10/22	1	513	855
1974	9/28 – 10/ 20	1	396	660
1975	9/27 – 10/19	1	491	818
1976	9/25 – 10/17	1	501	835
1977	9/24 – 10/16	1	466	777
1978	9/23 – 10/29	1	533	888
1979	9/23 – 10/28	1	672	1,120
1980	9/20 – 10/26	1	600	1,000
1981	9/26 – 10/18	1	551	918
1982	9/25 – 10/17	1	407	678

¹ Adjusted to include 20 percent crippling loss and 25 percent non-tag return, except 50 percent non-tag return in 1967.

² Reported kill estimated by extrapolation from administrative Cow Creek boundary.

The distribution of the Cow Creek deer herd in the Bear Creek watershed varies seasonally. In summer, the herd is found primarily in the Sierran mixed conifer and montane chaparral at higher elevations in the watershed. The herd uses these habitats for foraging and fawning. Cooler temperatures in the fall drive the herd into oak woodlands and grasslands at mid-elevation. During winter, heavy snows force the herd to migrate to oak woodlands and grasslands in the foothills, below 2,000 feet in elevation. The herd winters along Ash Creek just west of its intersection with Highway 44 and along the main stem of Bear Creek from its intersection with Highway 44 to the area where the main stem of Bear

Creek confluences with North Fork Bear Creek and South Fork Bear Creek. The herd returns to summer habits in late April and early May.

The decline in numbers of the Cow Creek deer herd is due to a variety of factors. The suppression of fire is thought to result in overgrown brushfields and dense timber stands. This produces very poor forage conditions and is believed to be the primary factor leading to the decline of this herd (Smith et al., 1983). In addition, livestock compete with the deer herd for forage. Cattle may exclude deer from feeding areas near meadows, streams, and springs. Drought conditions beginning in 1976 and continuing through the 1980s have contributed to the decline of the Cow Creek deer herd. Extended periods of dry weather coupled with very low precipitation prevent the germination and growth of young plants and limit the amount of available water. These conditions cause malnutrition and starvation among members of the herd. Hunting has reduced the deer population, as has predation by mountain lions. The deer population has also been reduced by deaths resulting from impacts with vehicles while crossing roads.

7.9. Historical Wildlife Resources

In addition to the current assemblage of wildlife reported in the Bear Creek watershed, the watershed once supported the grizzly bear (*Ursus horribilis*). This species was identified following a general literature search of wildlife reported in northern California dating back to the early 1800s.

GRIZZLY BEAR

Grizzly bears historically ranged throughout California's Coast Range, Klamath Mountains, Sierra Nevada, and Central Valley. Grizzly bears were reported by early explorers and trappers in Shasta County in the early 1800s (Hunt, 1967; Southern, 1971; Quint, 1985). Their numbers declined steadily as Americans moved west to settle in California during the Gold Rush in the mid-1800s. The grizzly bear was perceived to be a threat to settlers in rural areas throughout California and large numbers were killed during the late 1800s and early 1900s. The last grizzly bear in Shasta County was killed in 1895, in the vicinity of Inwood (Weigart, 1976). The grizzly bear was assumed to be extirpated from California by the 1930s.

7.10. Conclusions

The Bear Creek watershed has a diverse assemblage of wildlife habitats and wildlife species. Several special-status wildlife species are known to occur in the watershed and are protected by State and Federal laws. Wildlife species and their habitats in the Bear Creek watershed have been affected by the introduction of non-native species and by a variety of land uses, such as timber harvesting, road construction, and prescribed burning.

In the preparation of this document, several data gaps were identified. More information is needed regarding the distribution and dispersal requirements of each special-status wildlife species in the watershed. Information regarding the distribution of introduced species is needed to assess potential impacts to wildlife habitats and native species.

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VIII. FISHERIES RESOURCES

8.1. Introduction

The Bear Creek watershed is inhabited by a variety of anadromous fishes, resident native fishes, and introduced fishes. Anadromous fish such as Chinook salmon (*Onchorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss irideus*) are of great interest because of their unique life history as well as their recreational and economic value. Of the different runs of Chinook salmon, only fall-run Chinook salmon return consistently in sizable numbers to spawn. Approximately 300 fall-run Chinook salmon and 200 Central Valley steelhead were estimated to spawn in Bear Creek in 1965 (Potter, 1965). The number of fish that return to spawn each year varies with stream flow, water temperature, ocean conditions, as well as other factors such as the annual degree of disconnectivity between the Sacramento River and Bear Creek due to the presence of a gravel bar barrier at their confluence. These factors are affected by the natural hydrologic regime of the watershed and by human activities, such as ground water pumping and the diversion of water to sustain agricultural operations locally.

8.2. Reference Conditions

The historical diversity of fish in the Bear Creek watershed was very different than the present assemblage of fish species. Several species of fish have been planted in the Bear Creek watershed as well as in adjacent watersheds. These introductions have likely affected the distribution and abundance of native fish species, freshwater invertebrates, and amphibians. Little information is available on the number of anadromous salmonids that historically spawned in the watershed's creeks. However, the number of fish that returned annually to spawn was likely higher than the present number because they were not affected by substantial anthropogenic impacts including water diversions, degraded water quality, habitat loss, and commercial and sport harvest.

8.3. Existing Fisheries Resources

SPECIAL-STATUS FISH SPECIES

Information on special-status fish species occurring in the Bear Creek watershed was obtained from the CNDDDB, University of California at Berkeley's Museum of Vertebrate Zoology, California Academy of Sciences, ENPLAN's records, other environmental consultants, as well as through consultation with biologists from the DFG and USFWS. The CNDDDB reports were reviewed for U.S. Geological Survey 7.5-minute quadrangles that occur entirely or partly in the Bear Creek watershed to develop a list of special-status fish species that occur in or near the watershed.

Four special-status fish species are known to occur in or near the Bear Creek watershed (Table 8-1). Three special-status fish species are known to occur in the Bear Creek watershed: Pacific lamprey (*Lampetra tridentata*), Central Valley steelhead, and four runs (fall-run, late fall-run, winter-run, and spring-run) of Chinook salmon. The green sturgeon (*Acipenser medirostris*) is known to occur in the vicinity of the watershed. The CNDDDB reports for the specified quadrangles are presented in Appendix 6-A (Botanical Section).

Table 8-1. Bear Creek Watershed Assessment 2005
Special-Status Fish Species Reported In or Near the Bear Creek Watershed

SPECIAL STATUS FISH KNOWN TO OCCUR IN THE BEAR CREEK WATERSHED	Status	Source
Central Valley steelhead, <i>Oncorhynchus mykiss irideus</i>	FT	1, 2, 4, 6, 7, 8, 9
Chinook salmon, <i>Oncorhynchus tshawytscha</i>		
Central Valley fall-run Chinook salmon	FC, SSC	1, 2, 5
Central Valley late fall-run Chinook salmon	FC, SSC	1
Winter-run Chinook salmon	FE, SE	1, 2
Central Valley spring-run Chinook salmon	FT, ST	1, 2
Pacific lamprey, <i>Lampetra tridentata</i>	FSC	3
SPECIAL STATUS FISH KNOWN OR EXPECTED TO OCCUR IN THE VICINITY		
Green sturgeon, <i>Acipenser medirostris</i>	CA	10

Source

1 = CNDDB

2 = Potter (1965)

3 = BLM Fisheries Survey(1979)

4 = W.M. Beaty & Associates, Inc.

5 = CalFish (2004)

6 = T. Moore (DFG, pers. memo, March 14, 2003)

7 = T. Moore (DFG, pers. memo, March 18, 2003)

8 = J. Williamson (USFWS, pers. memo, September 2, 2003)

9 = J. Williamson (USFWS, pers. memo, April 14, 2004)

10 = Moyle et al. (1995)

Source

FE = Federal Endangered

FT = Federal Threatened

FSC = Federal Species of Concern

CA = Federal Candidate Species for Listing as Federal Threatened or Federal Endangered

SE = State Endangered

ST = State Threatened

SSC = State Species of Concern

ANADROMOUS FISH

Anadromous fish spend most of their adult life in the ocean or an estuary, but migrate into freshwater rivers and streams to spawn. Representative anadromous fish in California's Sacramento River include sturgeon, lamprey, steelhead, and various runs of Chinook salmon. Chinook salmon and steelhead are important game fish and their populations are monitored by the USFWS and the DFG.

There are four runs of Chinook salmon that spawn in the rivers and streams of California's Central Valley. They include the fall-run, late fall-run, winter-run, and spring-run (Moyle et al., 1995). Each run is distinguished from the other runs by the timing of entry into freshwater from saltwater (Figure 8-1). Fall-run Chinook typically begins its spawning migration in fall and spawns in the low elevation reaches of rivers and streams in the Central Valley. Late fall-run Chinook generally begins its spawning migration in late fall and spawn in the low elevation reaches of rivers and streams in the Central Valley. Winter-run Chinook begins its spawning migration in winter. Historically, winter-run Chinook spawned in the Sacramento River upstream of Shasta Dam. Presently, it spawns almost exclusively in the main stem of the Sacramento River between Red Bluff and Redding. Spring-run Chinook initiate their spawning migration in spring and spawn in the upper and middle reaches of rivers and streams in the Central Valley. The timing of freshwater entry and spawning migration for each is run is closely related to local temperature and water flow regimes. The life history and habitat requirements of special-status anadromous fish are discussed in greater detail below, and their occurrence in streams within the Bear Creek watershed is summarized in Table 8-2.

Table 8-2. Bear Creek Watershed Assessment 2005
Special-Status Anadromous Fish Known to Occur in the Bear Creek Watershed

<i>Stream/ River</i>	<i>Fall-Run Chinook Salmon</i>	<i>Late Fall- Run Chinook Salmon</i>	<i>Winter-Run Chinook Salmon</i>	<i>Spring-Run Chinook Salmon</i>	<i>Central Valley Steelhead</i>	<i>Pacific Lamprey</i>
Ash Creek	1, 5	-	1	1	-	-
Bear Creek – Main Stem	1, 2	-	2	1, 2	2, 7, 8, 9	3
Bear Creek - South Fork	-	-	-	-	-	-
Bear Creek - North Fork	-	-	-	-	2, 6, 7	-
Dickerson Creek	-	-	-	-	-	-
Dry Creek	1	-	1	1	-	-
Lack Creek	-	-	-	-	-	-
Miners Gulch	-	-	-	-	-	-
Rancheria Creek	-	-	-	-	-	-
Sacramento River	4	4	4	4	4	-
Sheridan Creek	-	-	-	-	-	-
Shingle Creek	-	-	-	-	-	-
Snow Creek	-	-	-	-	2	-

Source

1 = Maslin et al. (1998)

2 = Potter (1965)

3 = BLM Fisheries Survey (1979)

4 = CNDDDB

5 = CalFish (2004)

6 = T. Moore (DFG, pers. memo, March 14, 2003)

7 = T. Moore (DFG, pers. memo, March 18, 2003)

8 = J. Williamson (USFWS, pers. memo, September 2, 2003)

9 = J. Williamson (USFWS, pers. memo, April 14, 2004)

Special-Status Anadromous Fish Known to Occur in the Bear Creek Watershed.

Pacific Lamprey. Pacific lamprey, a Federal Species of Concern, is distributed in Pacific slope drainages from Baja California to Alaska (Kimsey and Fisk, 1964). Adults are parasites of salmon and flatfishes while in the ocean (Moyle, 2002). Adults migrate from seawater to freshwater streams in the fall to spawn, and then die. Spawning generally occurs in riffle areas with swift current. The depth of water at the nest sites is usually less than one meter. Most eggs are washed into the crevices of the rocks on the downstream side of the nest. Eggs hatch in approximately two to three weeks. Larval lampreys (ammocoetes) burrow tail-first into substrates and remain in the stream for up to five or seven years (Moyle, 2002). During this time, the ammocoete is a free-living filter feeder, subsisting on algae and organic matter. Downstream migration to the sea begins once the larval lamprey has developed a sucking disc that is suitable for attaching to fish.

In the Bear Creek watershed, Pacific lampreys are known to occur in the Sacramento River and in the main stem of Bear Creek (BLM Fisheries Survey, 1979).

Central Valley Steelhead. Central Valley steelhead, a Federal Threatened species, is an anadromous form of rainbow trout (*O. mykiss*). The historic range of Central Valley steelhead included cold-water tributaries of the Sacramento and San Joaquin rivers, many of which are no longer accessible as a result of dam construction (McEwan and Jackson, 1996). Adults begin their upstream migration into the Sacramento River and its tributaries from August through November with the peak occurring in mid-September (DFG, 1993). Steelhead prefer cold rivers and streams, where the water temperature is 39 to 65°F. Spawning occurs between January and March. Spawning habitat is characterized by loose, clean gravel (0.25 to 3.0 inches in diameter), low water temperature (39 to 55°F), and swift, shallow water. Unlike salmon, not all adults die after spawning (McEwan and Jackson, 1996). Surviving

adults emigrate to sea between April and June. Newly hatched fry remain in the streambed gravel for four to eight weeks. Juveniles typically remain in their natal stream for one to two years before beginning the downstream migration to the sea. However, if unfavorable water conditions develop in their natal stream, they may migrate downstream to better habitat. Juveniles may also migrate to sea as sub-yearlings.

In the Bear Creek watershed, Central Valley steelhead are known to occur in the Sacramento River, the main stem of Bear Creek (Potter, 1965; T. Moore, DFG, pers. memo, March 18, 2003; J. Williamson, USFWS, pers. memo, September 2, 2003; J. Williamson, USFWS, pers. memo, April 14, 2003), North Fork Bear Creek (Potter, 1965; T. Moore, DFG, pers. memo, March 14, 2003; T. Moore, DFG, pers. memo, March 18, 2003), and in Snow Creek (Potter, 1965).

Fall-Run Chinook Salmon. Fall-run Chinook salmon, a Federal Candidate for listing and a State Species of Concern, is currently the most abundant of the Chinook runs in the Sacramento River watershed (DFG, 1993). Much of the habitat where fall-run Chinook historically and presently spawn is downstream of major dams on the Sacramento River and San Joaquin River, thus, this run is not affected by dams to the degree that other Chinook runs are. Fall-run Chinook spawn in the lower reaches (200 to 2,000 feet in elevation) of most rivers and streams in the Central Valley. Adults enter freshwater at an advanced stage of maturity, migrate quickly upstream to spawning sites, and spawn within a few days or weeks of entering freshwater (Moyle, 2002). Spawning migrations occur from July through December. Spawning occurs between October and December, with peak spawning in the Bear Creek watershed occurring in November (D. DuBose, pers. com.). Embryo incubation occurs between October and March. Unlike other Chinook runs, juvenile fall-run emigrate to the ocean three to seven months after they emerge from the spawning gravel. Downstream emigration to the sea by juveniles occurs between January and June.

In the Bear Creek watershed, fall-run Chinook salmon are known to occur in the Sacramento River, the main stem of Bear Creek (Potter, 1965; Maslin et al., 1998), Ash Creek (Maslin, et al., 1998; CalFish, 2004), and in Dry Creek (Maslin et al., 1998).

Late Fall-Run Chinook Salmon. Late fall-run Chinook salmon, a Federal Candidate for listing and a State Species of Concern, is the most recent run recognized by biologists (Moyle et al., 1995). The historic abundance of the late fall-run Chinook in the Sacramento River watershed is not known because it was not recognized as a separate run until the construction of the Red Bluff Diversion Dam in 1966. Like fall-run Chinook, the late fall-run Chinook spawn in the lower reaches (200 to 2,000 feet in elevation) of most rivers and streams in the Central Valley. Similar to the fall-run Chinook, late fall-run Chinook adults enter freshwater at an advanced stage of maturity. However, late fall-run Chinook begin their spawning migration up the Sacramento River from mid-October through mid-April. Adults generally hold in the river for one to three months before spawning (Moyle, 2002). Generally, spawning occurs between January and mid-April (DFG, 1993). In the Sacramento River, most spawning occurs in the reach between Red Bluff and Redding. Additional spawning occurs in tributaries, such as Battle Creek, Cottonwood Creek, Clear Creek, and Mill Creek. Some spawning is reported in the Feather and Yuba Rivers, but the number

of spawners is very small. The embryos hatch after a three to four month incubation period and the fry remain in the gravel for another two to three weeks. Once the yolk sac has been absorbed, the fry emerge (usually by early June) (Moyle et al., 1995). Juveniles remain in the natal stream for approximately one year, if stream conditions are favorable. Juveniles emigrate downstream to the sea between April and mid-October. Adults remain at sea from one to six years, but most will return after two to four years.

Late fall-run Chinook are known to pass through the four-mile reach of the Sacramento River that is included in the Bear Creek watershed because they have been reported to spawn further upstream in the Sacramento River.

Winter-Run Chinook Salmon. The winter-run Chinook salmon is Federal and State Endangered. It historically spawned in the upper reaches (1,500 to 3,000 feet in elevation) of the Sacramento, Pit, McCloud, and Calaveras rivers. The number of winter-run has declined sharply as a result of construction of dams blocking access to historical spawning habitat. Of the current four Chinook salmon runs, the winter-run is the smallest in numbers. Spawning occurs only in the Sacramento River. Winter-run Chinook begin their spawning migration at an immature stage (NMFS, no date). Generally, winter-run Chinook migrate into the Sacramento River from November through May. They swim to the upper reaches of the Sacramento River to spawn. Spawning occurs almost exclusively in the main stem of the river from mid-April through August from Red Bluff to Redding, with most spawning occurring in the Redding area (DFG, 1993). Embryo incubation takes place from mid-April through mid-October. Juveniles are known to rear in tributary streams of the Sacramento River for approximately one year (Maslin, 1998). Juveniles emigrate downstream to the sea between July and March. Adults stay in the ocean from one to six years, but most will return to spawn after two to three years.

Winter-run Chinook are known to occur in the reach of the Sacramento River that is included in the Bear Creek watershed. Juvenile winter-run Chinook have also been detected in Ash Creek (Maslin et al., 1998). Juvenile Chinook salmon of winter-run size have been observed in Dry Creek (Maslin et al., 1998). An unconfirmed report exists of spawning by winter-run Chinook in the main stem of Bear Creek (Potter, 1965). However, due to the proximity of Ash Creek to Bear Creek, it is likely that non-natal rearing of winter-run Chinook salmon occurs in Bear Creek (M. Berry, pers. com.).

Spring-Run Chinook Salmon. The spring-run Chinook salmon is State and Federal Threatened. It historically spawned in the middle and upper reaches (1,500 to 5,300 feet in elevation) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit rivers (DFG, 1993). Prior to the construction of large dams on the Sacramento River and San Joaquin River, spring-run Chinook was the largest run in the Central Valley. It is estimated that the runs in the San Joaquin River exceeded 200,000 fish in the late 1800s. The Sacramento River drainage is estimated to have supported over 100,000 each year between the late 1800s and the early 1940s. Currently, the spring-run Chinook is the second largest of the four Chinook runs. Spring-run Chinook generally spend one to six years in the ocean, but the majority will return to spawn after three years. Spring-run Chinook enter freshwater at an immature stage, migrate far upstream, and spawn in late summer and early autumn (NMFS, no date). Typically, adult spring-run Chinook move into the Sacramento

River and begin their spawning migration from March through May. These adults range in age from two to five years old, but most are three-years old. During the spawning migration, like other Chinook, the adults do not feed, relying instead on stored body fat for energy. In nearby tributary creeks of the Sacramento River, spawning occurs between late August and mid-September. The embryos hatch following a five- to six-month incubation period and the hatchlings remain in the gravel for two to three weeks. Juveniles remain in their natal stream for nine to ten months. Downstream emigration to the sea by juveniles occurs between November and April.

Spring-run Chinook are known to occur in the reach of the Sacramento River that is included in the Bear Creek watershed. Juvenile spring-run Chinook have also been reported in Ash Creek (Maslin et al., 1998), in the main stem of Bear Creek (Potter, 1965; Maslin et al., 1998), and in the lower reach of Dry Creek (Maslin et al., 1998).

Spawning Runs in the Bear Creek Watershed. The historical size of spawning runs of Chinook salmon and Central Valley steelhead in the Bear Creek watershed is unknown. Size estimates for fall-run Chinook salmon spawning runs are available for Bear Creek (Table 8-3) and Ash Creek (Table 8-4). In 1965, the DWR estimated that spawning population of fall-run Chinook salmon in the Bear Creek watershed may total as many as 300 during years of adequate runoff (Potter, 1965; DFG, 1993). The number of Central Valley steelhead that spawn in the watershed is unknown, but it is unlikely to exceed more than 200 (Potter, 1965).

Table 8-3. Bear Creek Watershed Assessment 2005
Estimated Size of Fall-Run Chinook Salmon Spawning Runs in Bear Creek Between 1949 and 2002

Year	Source			
	<i>Azevedo & Parkhurst¹</i>	<i>DFG²</i>	<i>George Eichelberger³</i>	<i>Western Shasta Resource Conservation District⁴</i>
1949	50	-	7,000	-
1950	50	-	3,000	-
1951	140	-	-	-
1952	100	-	-	-
1953	785	800*	-	-
1954	450	500*	-	-
1955	200	200*	-	-
1956	5	5*	-	-
1957	-	30*	-	-
1958	-	200*	-	-
1959	-	10*	-	-
1960	-	50*	-	-
1964	-	50*	-	-
1965	-	350 [▲]	-	-
1966	-	400*	-	-
1967	-	30*	-	-
1968	-	310*	-	-
1969	-	560*	-	-
1976	-	167 [▲]	-	-
1989	-	36 [†]	-	-
1991	-	7 [†]	-	-
1992	-	0 [†]	-	-
2002	-	-	-	62
2004	-	-	-	8

¹ Azevedo and Parkhurst counts were based on the number of redds observed.

² DFG's counts were based on the following count methods: unknown*, carcass count expansion*, redd and carcass

count expansion[▲], and actual physical counts[†].

³ Eichelberger's counts were based on shore-based observations and the accuracy of his counts is uncertain.

⁴ WSRCD counts were based on the number of redds observed and the assumption that two adults build a redd (G. Desselle, WSRCD, pers. com.).

**Table 8-4. Bear Creek Watershed Assessment 2005
Estimated Size of Fall-Run Chinook Salmon
Spawning Runs in Ash Creek**

(Source: CalFish, 2004)

Year	Total Number & Count Method	Source
1957	10 (unknown)	DFG
1960	10 (carcass count expansion)	DFG
1969	320 (carcass count expansion)	DFG

Distribution of Special-Status Anadromous Fish in the Bear Creek Watershed.

Information on the distribution of special-status anadromous fish in creeks in the Bear Creek watershed is not well known. The length of stream available to special-status anadromous fish for spawning is often limited by the presence of barriers. These may include natural barriers, such as waterfalls or dry reaches, or it may include artificial barriers, such as dams, fences, and culverts. The occurrence of special-status anadromous fish in different streams in the Bear Creek watershed can be quickly determined by referring to Table 8-2. The distribution of special-status fish within these streams is depicted in Figure 8-2. This section evaluates each creek in the Bear Creek watershed for potential barriers to special-status anadromous fish during winter and spring when flows are highest.

Sacramento River. There are no barriers to fish passage in the reach of the Sacramento River that is included in the Bear Creek watershed, although the Red Bluff Diversion Dam represents a seasonal barrier to anadromous fish passage and affects their populations in the watershed. Pacific lamprey, Central Valley steelhead, fall-run Chinook salmon, late fall-run Chinook salmon, spring-run Chinook salmon, and winter-run Chinook salmon use this reach. Pacific lamprey, Central Valley steelhead, spring-run Chinook salmon, fall-run Chinook salmon, and winter-run Chinook salmon must use this reach because they have been observed in Bear Creek, Ash Creek, or their tributaries. Late fall-run Chinook salmon are presumed to use this reach because the CNDDDB reports that they spawn further upstream in the Sacramento River near Redding. Green sturgeon may use the reach of the Sacramento River that is included in the Bear Creek watershed.

Ash Creek. Ash Creek is a tributary of the Sacramento River. No known barriers exist in the lower reaches of Ash Creek. However, an earthen dam barrier across Ash Creek near Shingletown has created Woodridge Lake. Fall-run Chinook salmon have been reported in Ash Creek (Maslin et al., 1998; CalFish, 2004). The upstream limit reported for fall-run Chinook salmon in Ash Creek is approximately two miles upstream from its confluence with the Sacramento River (Maslin et al., 1998). In 1998, 40 fall-run Chinook salmon, 10 spring-run Chinook salmon, and 1 winter-run Chinook salmon were detected in Ash Creek (Maslin et al., 1998). Fall-run Chinook salmon were detected at 2.7 miles upstream from its confluence with the Sacramento River. Spring-run Chinook salmon were detected at 0.8 miles upstream

from its confluence with the Sacramento River. Winter-run Chinook salmon were detected at 0.6 miles upstream from its confluence with the Sacramento River.

Rancheria Creek. Rancheria Creek, a tributary of Ash Creek, is low gradient near its confluence with Ash Creek, but becomes very steep further upstream. Given that salmon have only been reported in Ash Creek up to 2.7 miles upstream of its confluence with the Sacramento River, it appears very unlikely that they would be found in Rancheria Creek.

Lack Creek. Lack Creek, a tributary to the main stem of Bear Creek, is low gradient near its mouth, but waterfalls approximately one mile upstream appear to be a barrier to anadromous fish. The Yana historically fished for salmon at the pool below the waterfalls (C. Weidert, pers. com.). However, anadromous fish are not presently known to use Lack Creek.

Dry Creek. Dry Creek, a tributary to the main stem of Bear Creek near its confluence with the Sacramento River. No known barriers exist on Dry Creek that would impeded upstream migration by anadromous fish. Although winter-run Chinook salmon have been reported in Dry Creek near its confluence with the main stem of Bear Creek, it is a small creek and does not support rearing in drier years (Maslin et al., 1998). In 1998, 37 fall-run Chinook salmon and one spring-run Chinook salmon were detected in Dry Creek (Maslin et al., 1998). Fall-run Chinook salmon were detected 1.2 miles upstream from its confluence with the main stem of Bear Creek. Spring-run Chinook salmon were detected one mile upstream from its confluence with the main stem of Bear Creek.

Main Stem Bear Creek. The main stem of Bear Creek, a tributary of the Sacramento River, does not appear to have any known artificial barriers that would prevent the passage of anadromous fish. The reach from the mouth of Bear Creek to the Dersch Road bridge was evaluated in 2003 by the DFG and found to have no barriers to impede anadromous fish. However low to no streamflow in years with below-normal rainfall or heavy water diversions may exclude some runs from entering the stream to spawn (DFG, 1993). During periods of low water releases from Shasta Dam, water flow in the Sacramento River is lowered sufficiently to expose a 40-foot long cobble bar at the mouth of Bear Creek which prevents the passage of anadromous fish. The upstream limit of spawning by the fall-run Chinook salmon in the main stem of Bear Creek is thought to be in the vicinity of its confluence with Sheridan Creek (Potter, 1965). Spring-run Chinook use the main stem of Bear Creek near Parkville Road for non-natal rearing (Potter, 1965), but are not known to spawn (DFG, 1993). Winter-run Chinook have been reported to spawn in the main stem of Bear Creek in the vicinity of the Highway 44 crossing, but this report is unverified (Potter, 1965). Winter-run Chinook are thought to use the main stem of Bear Creek only for non-natal rearing. Central Valley steelhead are known to occur in the main stem of Bear Creek (Potter, 1965; J. Williamson, USFWS, pers. memo, September 2, 2003; J. Williamson, USFWS, pers. memo, April 14, 2004) and presumably occur throughout the entire length of the main stem of Bear Creek. Spawning adult steelhead generally arrive in the main stem of Bear Creek in early

April. Pacific lamprey are also reported in the main stem of Bear Creek (BLM Fisheries Survey, 1979), but their upstream limit is unknown.

South Fork Bear Creek. Bear Creek Falls, near the confluence of South Fork Bear Creek and the main stem of Bear Creek, is a barrier to anadromous fish; thus, anadromous fish do not occur upstream of the falls (Potter, 1965).

North Fork Bear Creek. There are no known barriers on North Fork Bear Creek. The upstream limit of Central Valley steelhead in North Fork Bear Creek is in the vicinity of the Ponderosa Way bridge (T. Moore, DFG, pers. memo, March 14, 2003).

Shingle Creek. Shingle Creek, a tributary to the main stem of Bear Creek, has numerous barriers to anadromous fish passage. Near its confluence with the main stem of Bear Creek, it is very steep and presumably is a barrier to fish passage (Potter, 1965). Those fish that could pass through this steep reach would soon reach an earthen barrier across Shingle Creek that has created an impoundment. Although anadromous fish have not been reported in Shingle Creek, this earthen dam represents the upstream limit for those anadromous fish that may attempt to use Shingle Creek.

Sheridan Creek. Sheridan Creek, a tributary of the main stem of Bear Creek near Inwood, is very steep near its confluence with the main stem of Bear Creek and is presumed to be a barrier to anadromous fish passage (Potter, 1965). There are no reports of anadromous fish in this creek.

Snow Creek. Snow Creek, a tributary of North Fork Bear Creek, has no known barriers that would impede the passage of anadromous fish. Central Valley steelhead have been observed in the lower reaches of Snow Creek during wet years, but no population estimates have been made (Potter, 1965).

Dickerson Creek. Dickerson Creek, a tributary of North Fork Bear Creek, is beyond the upper limit of spawning by Central Valley steelhead and the various runs of Chinook salmon. Anadromous fish have not been reported in this creek. However, rainbow trout have been observed on numerous occasions in Dickerson Creek (R. Weidenkeller, pers. com.). It is unknown if these are Central Valley steelhead, resident rainbow trout, or introduced trout.

Miners Gulch. Miners Gulch, a tributary of Dickerson Creek, is beyond the upper limit of spawning by Central Valley steelhead and the various runs of Chinook salmon. It is an intermittent creek and there are no reports of anadromous fish in Miners Gulch. Rainbow trout have been reported in Miners Gulch (R. Weidenkeller, pers. com.).

Special-Status Anadromous Fish Known to Occur in the Vicinity.

Green Sturgeon. Green sturgeon have been reported in the Sacramento River as far north as the Red Bluff Diversion Dam (Adams et al., 2002; Moyle, 2002). The green sturgeon spawns in the Sacramento River from March through July, with peak spawning from mid-April to mid-June (Moyle et al., 1995). They may spawn as far

upstream as Keswick Dam. Juvenile green sturgeon have been captured in screw traps operating below the Red Bluff Diversion Dam, indicating spawning upstream (F. Sime, pers. com.). The size and structure of green sturgeon eggs indicate that the run is adapted to spawning in cold, low-silt water (Moyle et al., 1995), conditions that exist in the Sacramento River between Keswick Dam and the Red Bluff Diversion Dam. These conditions likely once existed in the upper Sacramento River and other tributary rivers above where Shasta Dam is now located. Thus, it is possible that the green sturgeon may migrate through the reach of the Sacramento River that is included in the Bear Creek watershed to spawn further upstream.

On June 12, 2001, the Center for Biological Diversity, Environmental Protection Information Center, and Waterkeepers Northern California formally petitioned the National Marine Fisheries Service (NMFS), also known as NOAA Fisheries, to protect green sturgeon and its habitat under the Endangered Species Act. The NMFS rejected listing the green sturgeon as Threatened or Endangered, but decided to classify it as a Candidate species (NMFS, January 29, 2003). Subsequently, the NMFS initiated an Endangered Species Act (ESA) status review. The ESA status review recognized two Distinct Population Segments (DPS): a Northern DPS and a Southern DPS. The Northern DPS includes all green sturgeon populations north of the Eel River. The Southern DPS includes all green sturgeon populations south of the Eel River, with the only known population being in the Sacramento River. The Northern DPS and Southern DPS are different because they show high fidelity to their spawning sites and exhibit genetic variation. On April 6, 2005, the NMFS proposed to list the Southern DPS as Threatened (NMFS, April 6, 2005). Presently, no Critical Habitat is designated or proposed for the green sturgeon. In addition, no EFH is designated for the green sturgeon at this time.

NON-STATUS FISH SPECIES

Although no comprehensive surveys for non-status fish have been conducted in the Bear Creek watershed, a number of non-status fish including resident native and introduced species are known to occur in the watershed. All non-status fish species that have been reported in or near the Bear Creek watershed are presented in Table 8-5.

**Table 8-5. Bear Creek Watershed Assessment 2005
Non-Status Fish Species Reported in or Near
The Bear Creek Watershed**

Non-Status Fish Known To Occur In Bear Creek Watershed	Source
Bluegill, <i>Lepomis macrochirus</i> ¹	2
Brown trout, <i>Salmo trutta</i> ¹	3, 6, 11
California roach, <i>Lavinia symmetricus</i>	2, 6, 9
Catfish, (<i>Ictalurus</i> spp.)	2, 11
Eastern brook trout, <i>Salvelinus fontinalis</i> ¹	3
Hardhead, <i>Mylopharodon conocephalus</i>	5, 7
Rainbow trout, <i>Oncorhynchus mykiss</i>	2, 3, 5, 6, 10
Riffle sculpin, <i>Cottus gulosus</i>	6
Sacramento pikeminnow (Sacramento squawfish), <i>Ptychocheilus grandis</i>	5
Sacramento sucker, <i>Catostomus occidentalis</i>	5, 6
Smallmouth bass, <i>Micropterus dolomieu</i> ¹	5, 7, 11
Speckled dace, <i>Rhinichthys osculus</i>	6, 8
Non-Status Fish Known To Occur In The Vicinity	
Bullhead, <i>Ameiurus</i> sp. ¹	4
Carp, <i>Cyprinus carpio</i> ¹	4
Green sunfish, <i>Lepomis cyanellus</i> ¹	4
Largemouth bass, <i>Micropterus salmoides</i> ¹	4

Other

1 = Introduced species

Source

2 = ENPLAN (2001b)
3 = DFG Fish Planting Records at Region 1 Office
4 = SHN Consulting Engineers & Geologists, Inc. (2001)
5 = Potter (1965)
6 = BLM Fisheries Survey (1979)
7 = Maslin et al. (1997)
8 = Maslin et al. (1998)
9 = California Academy of Sciences
10 = T. Moore (DFG, pers. memo, May 2, 2003)
11 = C. Weidert, pers. com.

RESIDENT NATIVE FISH

Resident native fish spend their entire life in the same stream. Records maintained by the DFG for streams in the Bear Creek watershed show that the watershed support a variety of resident native fish such as rainbow trout, Sacramento pikeminnow (*Ptychocheilus grandis*), hardhead (*Mylopharodon conocephalus*), California roach (*Lavinia symmetricus*), speckled dace (*Rhinichthys osculus*), Sacramento sucker (*Catostomus occidentalis*), and riffle sculpin (*Cottus gulosus*). Life history information and habitat associations of resident native fish species are described below, and their occurrence within streams in the Bear Creek watershed is summarized in Table 8-6.

Table 8-6. Bear Creek Watershed Assessment 2005
Resident Native Fish Known to Occur in the Bear Creek Watershed

<i>Stream/ River</i>	<i>Rainbow Trout</i>	<i>Sacramento Pikeminnow</i>	<i>Hardhead</i>	<i>California Roach</i>	<i>Speckled Dace</i>	<i>Sacramento Sucker</i>	<i>Riffle Sculpin</i>
Ash Creek	5	-	-	8	7	-	-
Bear Creek Main Stem	1, 2	3	3, 6	1, 2	1	1, 3	1
Bear Creek South Fork	5	-	-	-	-	-	-
Bear Creek North Fork	3, 4	-	-	-	-	-	-
Dickerson Creek	9	-	-	-	-	-	-
Dry Creek	-	-	-	8	-	-	-
Lack Creek	-	-	-	-	-	-	-
Miners Gulch	9	-	-	-	-	-	-
Rancheria Creek	-	-	-	-	-	-	-
Sacramento River	-	-	-	-	-	-	-
Sheridan Creek	-	-	-	-	-	-	-
Shingle Creek	-	-	-	-	-	-	-
Snow Creek	-	-	-	-	-	-	-

Source

1 = BLM Fisheries Survey (1979)
2 = ENPLAN (2001b)
3 = Potter (1965)
4 = T. Moore (DFG, pers. memo, May 2, 2003)
5 = DFG Fish Planting Records at Region 1 Office
6 = Maslin et al. (1997)
7 = Maslin et al. (1998)
8 = California Academy of Sciences
9 = R. Weidenkeller (pers. com.)

Rainbow Trout. Rainbow trout are abundant in cold-water streams with deep pools, rock bottoms, and abundant cover (Moyle, 2002). Rainbow trout tend to occur in association with other fish such as speckled dace, California roach, and Sacramento sucker. Rainbow trout prefer water temperatures between 54° and 64°F and do well in clear, cool, deep lakes or cool, clear, moderately-flowing streams.

Rainbow trout spawn in the spring in small tributaries of rivers, or in inlets or outlets of lakes. Spawning can also take place in late fall or early winter. Rainbow trout usually return to spawn in the same reach where they hatched. Preferred spawning habitat is shallow riffles with gravel bottoms. The female uses her tail to dig a nest (redd) in the gravel. One or two males will spawn with her in the nest. The fertilized eggs are then buried in the gravel. The embryos hatch in four to seven weeks depending on the temperature. Hatchlings emerge from the interstices in the spawning gravel three to seven days later. Young rainbow trout seek cover. They prefer slow-moving, shallow stream areas where rubble, rocks, in-stream debris, and undercut banks provide shelter. Older trout move into faster and deeper stream waters.

In the Bear Creek watershed, rainbow trout have been observed in the main stem of Bear Creek (BLM Fisheries Survey, 1979; ENPLAN, 2001b), North Fork Bear Creek (Potter, 1965; T. Moore, DFG, May 2, 2003, pers. memo), South Fork Bear Creek (DFG Fish Planting Records at Region 1 Office), Miners Gulch (R. Weidenkeller, pers. com.), Dickerson Creek (R. Weidenkeller, pers. com.), and Ash Creek (DFG Fish Planting Records at Region 1 Office). The DFG planted rainbow trout into Ash Creek from 1946 through 1951, in North Fork Bear Creek from 1950 through 1979, and in South Fork Bear Creek from 1931 through 1979.

Sacramento Pikeminnow. The Sacramento pikeminnow, formerly known as the Sacramento squawfish, is among the largest, native, freshwater minnows in California. It is distributed throughout the Sacramento-San Joaquin river system and is also found in the Pajaro, Salinas, Russian, and upper Pit rivers (Moyle, 2002). Sacramento pikeminnows are found in cold-water streams and often occur with Sacramento sucker, juvenile rainbow trout, and California roach.

Sacramento pikeminnows are reproductively mature in their third or fourth summer (Moyle, 2002). Spawning generally occurs in late spring. Redds are usually built downstream of a pool with running water. Hatchlings remain in the interstices of the spawning gravel until the yolk sac is absorbed. Juveniles school in shallow water in large stream pools. The diet of juveniles includes insect larvae, small insects, small minnows, and juvenile salmon.

In the Bear Creek watershed, Sacramento pikeminnows have been reported in Bear Creek (Potter, 1965). Presumably, they occupy the middle elevation reaches in the main stem of Bear Creek.

Hardhead. Hardhead are bottom-feeding fish that forage for benthic invertebrates and aquatic plant material in quiet water (Moyle, 2002). They are widely distributed in low to mid-elevation streams in the main Sacramento-San Joaquin drainage as well as in the Russian River drainage (DFG, no date – a). In the San Joaquin drainage, populations are scattered in the tributary streams, but are absent from the valley reaches of the San Joaquin River. In the Sacramento River drainage, hardhead are present in the Sacramento River and most of the larger tributary streams. Historically, hardhead were widespread in Central Valley streams. Hardhead are still widespread in foothill streams, but are

threatened by alteration of downstream habitats and the introduction of exotic fish such as smallmouth bass (*Micropterus dolomieu*).

Hardhead generally occur in pristine areas of larger middle- and low-elevation streams, from sea level to approximately 5,000 feet (Moyle et al., 1995). Most streams that support hardhead have water temperatures in excess of 68°F in summer, but the preferred water temperature range is between 63° and 70°F. Hardhead prefer clear, deep (more than three feet) pools with sand-gravel-boulder substrates and slow water velocities (less than 25 cm per second). In streams, adult hardhead tend to remain in the lower half of the water column, occasionally moving into the upper water column, whereas juveniles tend to concentrate in shallow water close to the stream edges. Hardhead are always found in association with Sacramento pikeminnows and usually with Sacramento suckers.

Hardhead mature following their second year and generally spawn during May and June in Central Valley streams (Moyle et al., 1995). However, the spawning season may extend into August in foothill streams of the Sacramento-San Joaquin drainage. Spawning activity has not been documented, but reproductive behavior presumably involves mass spawning in upstream gravel riffles.

In the Bear Creek watershed, hardhead have been reported in Bear Creek (Potter, 1965; Maslin et al., 1997). Given their preference for warm-water habitats, hardhead likely occupy the lower elevation reaches in the main stem of Bear Creek.

California Roach. California roach are found in the Sacramento River and its tributaries (Moyle et al., 1995). Within a watershed, California roach occur in a variety of habitats, from cool headwater streams to the warm-water lower reaches (Moyle, 2002). California roach are tolerant of relatively warm temperatures (86° to 95°F) and low oxygen levels (one to two parts per million). However, it is a habitat generalist, also occurring in cold, well-oxygenated streams, in human-modified habitats, and in the main channels of rivers, such as the Russian and Tuolumne.

California roach are generally sexually mature by about the second year. Reproduction occurs from March to June, but may be extended through late July (Moyle et al., 1995). Spawning is influenced by water temperature, which occurs when water temperature is approximately 60°F. During the spawning season, schools of fish move into shallow areas with moderate flow and gravel/rubble substrate. Females deposit adhesive eggs in the substrate interstices, and males then fertilize the eggs. Typically, each female produces 250 to 900 eggs, and the eggs hatch within two to three days. The fry remain in the substrate interstices until they are free-swimming.

California roach are omnivorous, feeding mostly on filamentous algae, but ingest smaller quantities of crustaceans and aquatic insects, and occasionally consume larval lampreys (Moyle et al., 1996). During winter their diet consists largely of diatoms and other unicellular algae.

In the Bear Creek watershed, California roach have been reported in Bear Creek (BLM Fisheries Survey, 1979; ENPLAN, 2001b), Dry Creek (California Academy of Sciences), and Ash Creek (California Academy of Sciences). Being a habitat generalist, California roach presumably occur throughout the main stem of Bear Creek.

Speckled Dace. The speckled dace is widespread in western North America, ranging from the Columbia River system south to the Colorado River system in southern California (Moyle, 2002). This species lives in a variety of habitats, but normally prefers the shallow, cool and slower moving waters. They spawn in the spring and distribute eggs over

the gravelly bottom. Each female produces from 200 to 500 eggs. This benthic species is an omnivore, feeding on insects, plant material, and zooplankton. Speckled dace likely serve as forage for larger trout and other game species.

In the Bear Creek watershed, speckled dace have been reported in Bear Creek (BLM Fisheries Survey, 1979) and Ash Creek (Maslin et al., 1998). Presumably, they occupy the low elevation reaches in both creeks where water temperatures are warmer.

Sacramento Sucker. Sacramento suckers are widely distributed throughout tributary streams of the Sacramento-San Joaquin river system (Moyle, 2002). They are potamodromous, migrating from large bodies of fresh water or streams to spawn. The spawning period varies. In the low-elevation estuarine tributaries of the Bay Area, spawning occurs from February to June. In foothill streams in the Central Valley, spawning may extend through August. Preferred spawning substrate is gravel. The eggs settle into the gravel and attach on the substrate. The incubation period for embryos ranges from three to four weeks. Hatchlings usually remain on the bottom within the interstices of the gravel until the yolk sac is absorbed. The mouth of the Sacramento sucker is subterminal to inferior, and so they browse on the bottom for detritus, algae, diatoms, and small organisms. Juveniles frequent side pools with moderate, running water. Juveniles remain in the streams during summer and fall, moving to the waters of deep pools or lakes in winter.

In the Bear Creek watershed, Sacramento suckers have been reported in Bear Creek (Potter, 1965; BLM Fisheries Survey, 1979). Due to affinity for cold-water, they likely occur in middle to upper elevation reaches in the main stem of Bear Creek.

Riffle Sculpin. The riffle sculpin is found in the Sacramento-San Joaquin river system, and coastal California streams from Morro Bay to the Noyo River (DFG, no date - a). Riffle sculpins occur in permanent, cold, headwater streams in riffle habitats (Moyle, 2002). Riffle sculpins are reproductively mature at the end of their second year. They spawn from February through April, but the season may extend longer. Females may spawn multiple times during the spawning season. Eggs are generally deposited in small clusters, on the underside of rocks and inside cavities in logs. Preferred spawning habitat is gravel bottoms in riffles. Hatchlings remain in the interstices of the spawning gravel until the yolk sac is absorbed. Juveniles tend to cling to the top or side of small gravel particles, or rest on the sandy bottom, seldom moving. Small juvenile riffle sculpin's major foods are amphipods and other crustaceans. Larger juveniles feed on mayflies, midges, other insect larvae, and fish eggs.

In the Bear Creek watershed, riffle sculpin are known to occur in Bear Creek (BLM Fisheries Survey, 1979). Presumably, they occur in low elevation reaches in the main stem of Bear Creek.

EXOTIC FISH

Records maintained by the DFG and ENPLAN indicate that a variety of exotic fish are present in the Bear Creek watershed including bluegill (*Lepomis macrochirus*), brown trout (*Salmo trutta*), catfish (*Ictalurus* spp.), eastern brook trout (*Salvelinus fontinalis*), and smallmouth bass. However, this list is likely larger, given the number exotic fish in the nearby Cow Creek watershed. Exotic fish in the Cow Creek watershed include carp (*Cyprinus carpio*), green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), and bullhead (*Ameiurus* sp.) (SHN Consulting Engineers & Geologists, Inc., 2001). It is probable that the exotic fish present in the Cow Creek watershed are also

present in the Bear Creek watershed. Life history information and habitat requirements of exotic fish in the Bear Creek watershed, and those that are likely to occur are described below. The occurrence of exotic fish within creeks in the Bear Creek watershed is shown in Table 8-7.

**Table 8-7. Bear Creek Watershed Assessment 2005
Exotic Fish Known to Occur in the Bear Creek Watershed**

<i>Stream/ River</i>	<i>Bluegill</i>	<i>Brown Trout</i>	<i>Catfish</i>	<i>Eastern Brook Trout</i>	<i>Smallmouth Bass</i>
Ash Creek	-	-	-	-	-
Bear Creek – Main Stem	1	2	1, 3	-	3, 5, 6
Bear Creek - South Fork	-	3, 4	-	4	-
Bear Creek - North Fork	-	3	-	-	-
Dickerson Creek	-	-	-	-	-
Dry Creek	-	-	-	-	-
Lack Creek	-	-	-	-	-
Miners Gulch	-	-	-	-	-
Rancheria Creek	-	-	-	-	-
Sacramento River	-	-	-	-	-
Sheridan Creek	-	-	-	-	-
Shingle Creek	-	-	-	-	-
Snow Creek	-	-	-	-	-

Source

1 = ENPLAN (2001b)

2 = BLM Fisheries Survey (1979)

3 = C. Weidert, pers. com.

4 = DFG Fish Planting Records at Region 1 Office

5 = Potter (1965)

6 = Maslin et al. (1997)

Exotic Fish Known to Occur in the Bear Creek Watershed.

Bluegill. The bluegill is a sunfish native to eastern North America. Bluegill were introduced throughout the Western states and were introduced into California in 1874 (Moyle, 2002). They are found in clear waters of ponds and reservoirs, or in sluggish, intermittent streams.

Bluegill are reproductively mature at one to three years of age. They are prolific breeders, capable of spawning numerous times during the summer. Spawning occurs in warm, shallow water between May and August, with peak spawning occurring in June and July. Males excavate nest depressions in sand, gravel, or hard clay. Typically, many nests are concentrated in a small area. Embryos hatch after two to three days (at 68°F). Hatchlings remain in the nest until the yolk is completely absorbed, generally about one week. Juveniles seek cover in small schools near or among plant beds.

In the Bear Creek watershed, bluegill have been reported in the lower reaches in the main stem of Bear Creek (ENPLAN 2001b). In this section of Bear Creek, water temperatures are typically between 70 and 80°F in summer.

Brown Trout. Brown trout were introduced into California in the 1893 (Moyle, 2002). Since then, brown trout have been introduced into numerous streams and lakes throughout the state. Brown trout are often found in rainbow trout habitat. Brown trout may grow to large size, feeding on smaller fish.

In the Bear Creek watershed, brown trout are known to occur in Bear Creek (BLM Fisheries Survey, 1979), North Fork Bear Creek (C. Weidert, pers. com.), and

South Fork Bear Creek (DFG Fish Planting Records at Region 1 Office; C. Weidert, pers.com.). Brown trout were introduced into South Fork Bear Creek in 1940 as a result of fish planting by the DFG. Because of their preference for cold-water habitats, brown trout likely occur in the middle to upper elevation reaches in the main stem of Bear Creek and throughout South Fork Bear Creek.

Catfish. Catfish were introduced into low elevation lakes in California in 1874 (DFG, no date - b). They are very popular among sport fisherman and have been introduced into most reservoirs and some mountain lakes. A large catfish fishery exists in the Sacramento-San Joaquin River Delta.

In the Bear Creek watershed, catfish were reported in 2001 in Bear Creek beneath the Parkville Road bridge (ENPLAN, 2001b) and a large number have been observed in the main stem of Bear Creek near where Dersch Road intersects Highway 44 (C. Weidert, pers. com.). It is uncertain how large this population is and its distribution in the watershed.

Eastern Brook Trout. The eastern brook trout is native to cold-water streams and lakes in eastern North America (Moyle, 2002). Eastern brook trout were introduced into alpine lakes in California's Sierra Nevada in 1872 (Moyle et al., 1996; Moyle, 2002). Eastern brook trout are distributed throughout streams and lakes between 5,000 and 9,000 feet in the Sierra Nevada, Klamath, and Warner Mountains. Eastern brook trout spawn in the fall. Preferred spawning substrate is loose gravels in streams or lakes.

In the Bear Creek watershed, eastern brook trout are known to occur in South Fork Bear Creek (DFG Fish Planting Records at Region 1 Office). This population was introduced as a result of sporadic planting efforts by the DFG from 1932 to 1939.

Smallmouth Bass. Smallmouth bass were introduced into California in 1874 (DFG, no date - b). They thrive in warm-water streams with gravel or rock bottoms, and a slight current. Such streams occur on the valley floor or in the foothills. Smallmouth bass spawn in May and early June when water temperatures range from 55° to 65 F. Nests are built in gravel or hard bottom substrates in 2 to 20 feet of water. Each female lays between 2,000 and 15,000 eggs. The male guards the nest and the fry for a short time. Young smallmouth bass feed on zooplankton and midge larvae. Adults feed on aquatic insects, crayfish, and suitable sized fish.

In the Bear Creek watershed, smallmouth bass have been reported in the main stem of Bear Creek (Potter, 1965; Maslin et al., 1997; C. Weidert, pers. com.). Due to their preference for warm-water habitats, smallmouth bass are likely to be found in the lower reaches in the main stem of Bear Creek.

Exotic Fish Likely to Occur in the Bear Creek Watershed.

Carp. Carp were introduced into California from Asia and Europe in 1872 (Kimsey and Fisk, 1964). This species is now well established throughout the state. It is found in the following warm-water habitats: sluggish streams, irrigation ditches, ponds, and reservoirs.

Peak spawning period for carp is from May through July. During mating, carp congregate in small groups in warm, shallow, weedy waters. The adhesive eggs are

deposited on submerged vegetation and hatch in three to five days at 68°F. Carp may spawn more than once during the breeding season. Juveniles are often found in areas of dense vegetation offering protection from predation. Outside of the spawning season, adults are found in deeper water and form small schools.

With an affinity for warm-water habitats, carp are likely to occur in the lower reaches of the following streams in the Bear Creek watershed: main stem of Bear Creek, Ash Creek, Lack Creek, and Dry Creek.

Green Sunfish. The green sunfish is a freshwater fish native to eastern and central North America. They have been introduced throughout the Western states, including California. They were first introduced in California in 1891 (DFG, no date - b). After introduction, green sunfish expanded their range in the Sacramento-San Joaquin river system. They thrive in warm-water streams that are intermittent in summer. They are likely responsible for the decline of the California roach in some streams.

Spawning occurs between May and August. Males often mate with numerous females in the same or different nests. Eggs are attached to gravel singly or in small clumps. Embryos require three to four days to hatch at 67° to 72°F. Males continue to guard the nest for a short period after hatching. Juveniles are abundant in various habitats such as small ponds with dense vegetation, ditches with filamentous algae, and inshore areas of large reservoirs.

With a preference for warm-water habitats, green sunfish are likely to occur in the lower reaches of the following streams in the Bear Creek watershed: main stem of Bear Creek, Ash Creek, Lack Creek, and Dry Creek.

Largemouth Bass. Largemouth bass were originally distributed in drainages east of the Rockies, with isolated populations in southeastern Canada and northeastern Mexico. Largemouth bass were introduced into California in 1874 (DFG, no date - b). They are a warm-water game fish that have been planted into low elevation ponds, lakes, and streams. This bass is found in a variety of habitats, but prefers calm water with ample vegetation for cover. Largemouth bass tend to nest in calm water with vegetation and any substrate besides soft mud, including submerged logs.

A warm water fish, largemouth bass are likely to occur in the lower reaches of the following streams in the Bear Creek watershed: main stem of Bear Creek, Ash Creek, Lack Creek, and Dry Creek.

Bullhead. Bullhead is a warm-water game fish that was introduced from the Eastern United States into California in 1874 (DFG, no date - b). Since then, it has been introduced into low elevation streams, lakes, ponds, and reservoirs throughout California. The bullhead prefers deep, weedy waters with sand, gravel, or mud substrates in warm-water ponds, lakes, or intermittent streams.

Given its preference for warm-water habitats, bullhead are likely to occur in the lower reaches of the following streams in the Bear Creek watershed: main stem of Bear Creek, Ash Creek, Lack Creek, and Dry Creek.

ANADROMOUS FISH HABITAT RESTORATION

The restoration of anadromous fish habitat has received much attention in California as a result of declining numbers of anadromous fish that return to spawn. In 1992, the

passage of the Central Valley Project Improvement Act mandated that the natural production of anadromous fish in rivers and streams in the Central Valley of California will be sustainable, on a long-term basis, at levels not less than twice the average levels attained from 1967 to 1991 by the year 2002 (USFWS, January 9, 2001). The Anadromous Fish Restoration Program (AFRP) was developed to meet this mandate. The AFRP identified potential restoration actions, that if implemented, would meet the stated goal. The restoration actions identified by the AFRP for Bear Creek are presented in Table 8-8. Although the AFRP does not identify a specific doubling target for Bear Creek, it would likely be included in the category *Miscellaneous Creeks*, which has a target of 1,100 fish. Bear Creek was included in a 1993 study (*Restoring Central Valley Streams – A Plan for Action*) by the DFG to address actions required to restore anadromous fish habitat. These actions, their priority ranking, and costs are presented in Table 8-9.

**Table 8-8. Bear Creek Watershed Assessment 2005
AFRP Restoration Actions Identified for Bear Creek**

<i>Actions</i>	<i>Involved Parties</i>	<i>Priority</i>
Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to allow suitable passage of juvenile and adult Chinook salmon and steelhead during spring and early fall.	Diversers DFG USFWS U.S. Bureau of Reclamation	High
Screen all diversions to protect all life history stages of anadromous fish.	Diversers USFWS U.S. Bureau of Reclamation National Marine Fisheries Service DFG DWR	Medium

**Table 8-9. Bear Creek Watershed Assessment 2005
Priority Ranking and Cost of Implementation Recommendation
to Improve Anadromous Fish Habitat in Bear Creek**

(Source: DFG, 1993)

<i>Priority¹</i>	<i>Anadromous Fish Habitat Restoration Action</i>	<i>Cost</i>
C-1	Install fish screens on all major water diversions.	No Estimate
<i>Priority</i>	<i>Administrative Action to Improve Anadromous Fish Habitat</i>	<i>Agency</i>
C-1	Negotiate for increased streamflows.	DFG
<i>Priority</i>	<i>Evaluation Action to Determine Habitat Needs for Anadromous Fish</i>	<i>Cost</i>
C-2	Conduct annual spawning surveys	No Estimate

¹ The priority rating criteria are as follows: (A) The action principally benefits the habitat of threatened and endangered anadromous fish species or habitat of anadromous fish species and races in decline that may become threatened; (B) The action principally benefits habitat for aquatic communities which can produce large numbers of anadromous fish or provide benefits for multiple species (species diversity); (C) The action principally benefits habitat of relatively small populations of anadromous fish species in categories other than (A) or (B), but which are of sufficient merit to receive consideration. A priority rating followed by a numeric ranking of (1) indicates that evaluation actions are needed prior to implementing a specific habitat restoration or administrative action. A priority rating followed by a numeric ranking of (2) indicates that evaluation actions follow the implementation of a habitat restoration or administrative action.

HABITAT CONDITIONS

Limited information is available on the current habitat conditions of streams in the Bear Creek watershed. Streambeds in the watershed are generally composed of volcanic boulder and cobble at middle to upper elevation, and bedrock at lower elevation. During winter and spring, creeks in the watershed are flowing. Stream flow declines steadily as summer approaches and many creeks become intermittent or completely dry, especially in years of below-average precipitation.

The quality of habitat for fish is a function of the natural hydrologic regime of the watershed as well as human activities, such as diverting water to irrigate crops and pastures.

WATER DIVERSIONS/GROUNDWATER PUMPING AND IMPACTS TO FISHERIES

During summer, natural stream flow conditions are further reduced due to groundwater pumping and extensive diversions of water for agriculture in the lower reaches in the main stem of Bear Creek. Reduced flows result in warmer water temperatures and may hinder the passage of anadromous fish (Chinook salmon and Central Valley steelhead). Significantly reduced flows may discourage or prevent adults from moving into the main stem of Bear Creek to reach spawning habitat upstream.

LEGISLATION TO PROTECT FISH HABITAT

Critical Habitat is a specific geographic area designated by NMFS that is essential for the conservation of a Threatened or Endangered species as Critical Habitat, and may require special management or protection (USFWS, 2002b). The Bear Creek watershed includes Critical Habitat for the winter-run Chinook salmon Evolutionary Significant Unit (ESU) and proposed Critical Habitat for the spring-run Chinook and Central Valley Steelhead (Figure 8-3). An ESU is a sub-portion of a species that is defined by substantial reproductive isolation from other conspecific units and represents an important component of the evolutionary legacy of the species. Critical Habitats for the spring-run Chinook and Central Valley steelhead were designated by the NMFS on February 16, 2000 (NMFS, February 16, 2000). However, these designations were revoked by a Federal court on April 30, 2002 (U.S. District Court for the District of Columbia, April 30, 2002). Critical habitat for spring-run Chinook salmon and Central Valley steelhead was proposed on December 10, 2004, and is currently in the review process (NMFS, December 10, 2004).

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996, established the EFH mandate. This only applies to species managed under a Federal Fishery Management Plan. Essential Fish Habitat is designated only for species regulated under a Federal Fisheries Management Plan. As such, EFH analysis is required for projects that may affect EFH for the fall-run, late fall-run, winter-run, and spring-run Chinook salmon. Because the Central Valley steelhead is not addressed under a Federal Fisheries Management Plan, EFH analysis is not required. Essential Fish Habitat for Pacific Coast salmon consists of “those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem” (NMFS, 2001).

Central Valley Steelhead ESU. The Central Valley steelhead is listed as Threatened by the Federal Government. This ESU includes all naturally produced steelhead in the Sacramento River and San Joaquin River. Existing wild steelhead stocks are confined

mostly to the upper Sacramento River and its tributaries. Critical Habitat was originally designated to include all river reaches accessible to the Central Valley steelhead in the Sacramento River and San Joaquin River, and their tributaries (NMFS, February 16, 2000). On April 30, 2002, the U.S. District Court for the District of Columbia approved a NMFS consent degree, withdrawing a February 2000 Critical Habitat designation for this ESU (U.S. District Court for the District of Columbia, April 30, 2002). Critical habitat was re-proposed for Central Valley steelhead on December 10, 2004, and is currently being reviewed (NMFS, December 10, 2004). Because a Fishery Management Plan does not currently exist for the Central Valley steelhead, no EFH is designated for Central Valley steelhead.

Central Valley Fall-, Late Fall-Run Chinook Salmon ESU. The Central Valley fall- and late fall-run Chinook salmon are State Species of Concern and Candidates for Federal listing. Essential Fish Habitat for fall-run Chinook salmon includes the reach of the Sacramento River included in the Bear Creek watershed, the lower reach of the main stem of Bear Creek, and the lower reach of Ash Creek (NMFS, 2004a). Essential Fish Habitat for the late fall-run Chinook salmon includes the reach of the Sacramento River that is included in the Bear Creek watershed (NMFS, 2004b). The fall-run Chinook is currently the most abundant of the four runs of Chinook salmon in the Sacramento River watershed. Much of the area in which fall-run Chinook historically spawned was downstream from major dam sites. Therefore, this run was not as severely affected by early water project developments as were the spring- and winter-run Chinook which historically spawned at higher elevations (DFG, 1993).

Sacramento River Winter-Run Chinook Salmon ESU. The winter-run Chinook salmon is listed as Endangered by both the State and Federal Government. Though originally listed as Threatened, due to its continued decline and variable run sizes, the Federal status of this population was changed to Endangered in 1994 (NMFS, January 4, 1994). Critical Habitat was established by the National Marine Fisheries Service (NMFS) on June 16, 1993 and includes the Sacramento River from Keswick Dam downstream to the Sacramento-San Joaquin Delta, and out to the Golden Gate Bridge (NMFS, June 16, 1993). Essential Fish Habitat for the winter run Chinook salmon includes the reach of the Sacramento River included in the Bear Creek watershed, the lower reach of Dry Creek, the lower reach of the main stem of Bear Creek, and the lower reach of Ash Creek (NMFS, 2004c).

Central Valley Spring-Run Chinook Salmon ESU. The spring-run Chinook salmon is listed as Threatened by both the State and Federal Government. Critical Habitat was originally designated to include all river reaches accessible to the spring-run Chinook in the Sacramento and San Joaquin Rivers, and their tributaries (NMFS, February 16, 2000). On April 30, 2002, the U.S. District Court for the District of Columbia approved a NMFS consent degree, withdrawing a February 2000 Critical Habitat designation for this ESU (U.S. District Court for the District of Columbia, April 30, 2002). However, this ruling did not affect the EFH designation for the spring-run Chinook, which includes the reach of the Sacramento River included in the Bear Creek watershed, the lower reach of the main stem of Bear Creek, and the lower reach of Ash Creek (NMFS, 2004d). Critical habitat was re-proposed for Central Valley spring-run Chinook salmon on December 10, 2004, and is currently in the review process (NMFS, December 10, 2004).

8.4. Fish Planting in the Bear Creek Watershed

Records of fish planting in the Bear Creek watershed were obtained from the DFG and reviewed to determine which streams have been planted, when they were planted, the fish species planted, and the number of each species planted. Fish planting records exist for South Fork Bear Creek (Table 8-10), North Fork Bear Creek (Table 8-11), and Ash Creek (Table 8-12). The DFG planted rainbow trout and brown trout into the watershed in 1931. Eastern brook trout were introduced into the watershed in 1932. Rainbow trout were planted in all three creeks. Brown trout and eastern brook trout were planted in South Fork Bear Creek.

**Table 8-10. Bear Creek Watershed Assessment 2005
Stocking Records for South Fork Bear Creek**
(Source: DFG Fish Planting Records at Region 1 Office)

<i>Year</i>	<i>Rainbow trout</i>	<i>Brown trout</i>	<i>Eastern brook trout</i>
1931	5,000	5,000	-
1932	5,000	10,000	6,000
1933	-	15,000	-
1934	-	60,000	-
1935	5,000	15,000	-
1936	8,000	5,000	10,000
1937	-	-	10,000
1938	15,000	15,000	-
1939	-	15,000	35,000
1940	-	10,000	-
1941	-	10,000	-
1943	-	5,000	-
1944	-	5,000	-
1945	4,000	-	-
1946	-	5,000	-
1947	-	10,470	-
1948	2,000	-	-
1950	2,680	-	-
1951	522	-	-
1952	351	-	-
1953	281	-	-
1954	330	-	-
1956	662	-	-
1957	526	-	-
1959	653	-	-
1960	627	-	-
1961	1,460	-	-
1962	1,197	-	-
1963	952	-	-
1964	1,278	-	-
1965	1,203	-	-
1966	1,206	-	-
1967	1,197	-	-
1968	1,093	-	-
1969	1,204	-	-
1970	1,199	-	-
1971	1,280	-	-
<i>(continued)</i>			
<i>Year</i>	<i>Rainbow trout</i>	<i>Brown trout</i>	<i>Eastern brook trout</i>
1972	1,201	-	-
1973	1,200	-	-
1974	1,198	-	-

**Table 8-10. Bear Creek Watershed Assessment 2005
Stocking Records for South Fork Bear Creek**
(Source: DFG Fish Planting Records at Region 1 Office)

1975	1,201	-	-
1976	1,208	-	-
1977	1,084	-	-
1978	1,224	-	-
1979	1,197	-	-

**Table 8-11. Bear Creek Watershed Assessment 2005
Rainbow Trout Stocking Records
for North Fork Bear Creek**
(Source: DFG Fish Planting Records at Region 1 Office)

<i>Year</i>	<i>Number</i>
1950	7,000
1951	274
1952	98
1953	231
1954	99
1956	228
1957	499
1958	405
1959	1,128
1960	255
1961	460
1962	482
1963	366
1964	330
1965	327
1966	353
1967	304
1968	300
1971	306
1972	309
1973	299
1974	313
<i>Year</i>	<i>Number</i>
1975	309
1976	312
1979	253

**Table 8-12. Bear Creek Watershed Assessment 2005
Rainbow Trout Stocking Records for Ash Creek**
(Source: DFG Fish Planting Records at Region 1 Office)

<i>Year</i>	<i>Number</i>
1946	1,300
1947	1,350
1950	310
1951	74
1952	166
1953	49
1955	110
1956	200
<i>(continued)</i>	
<i>Year</i>	<i>Number</i>
1957	245
1958	200
1959	220

**Table 8-12. Bear Creek Watershed Assessment 2005
Rainbow Trout Stocking Records for Ash Creek**
(Source: DFG Fish Planting Records at Region 1 Office)

1960	200
1961	220

8.5. Fishing Regulations Applicable to the Bear Creek Watershed

The DFG regulates sport fishing in streams in the Bear Creek watershed. Current fishing regulations applicable to the reach of the Sacramento River included in the Bear Creek watershed are summarized in Table 8-13.

**Table 8-13. Bear Creek Watershed Assessment 2005
Current Fishing Regulations in the Sacramento River
(Deschutes Road Bridge to 500 Feet Upstream From Red Bluff Diversion Dam)**
(Source: DFG, 2004a)

<i>Time Period</i>	<i>Bag Limit¹</i>
Jan. 15 – March 31	One hatchery trout or one hatchery steelhead; no salmon
April 1 – July 31	One hatchery trout or one hatchery steelhead and one wild trout; no salmon
Aug. 1 – Aug. 30	One hatchery trout or one hatchery steelhead and one wild trout; two salmon
Aug. 31 – Jan. 14	One hatchery trout or one hatchery steelhead; two salmon

¹ Hatchery trout or steelhead are those showing a healed adipose fin clip (adipose fin is absent). Unless otherwise provided, all other trout and steelhead must be immediately released. Wild trout or steelhead are those not showing a healed adipose fin clip.

The main stem of Bear Creek (between Ponderosa Way Bridge and the confluence with the Sacramento River) is open to fishing from the last Saturday in April through November 15 (DFG, 2004a). The stream is closed when Chinook salmon and Central Valley steelhead enter the stream to spawn. When the stream is open to fishing, angling pressure in the main stem of Bear Creek is relatively low because suitable fishing areas are remote and difficult to access. The bag limit is zero fish per day in the anadromous reaches and five fish per day and 10 in possession in the non-anadromous reaches (DFG, 2004a). Also, up to 10 brook trout less than 8 inches in length may be kept per day. A smallmouth bass and trout (possibly juvenile steelhead) fishery exists in the lower reaches of the main stem of Bear Creek during summer (Potter, 1965).

8.6. Conclusions

The Bear Creek watershed has a diverse assemblage of fish species, including anadromous fish, resident native fish, and introduced fish. Several species of fish are special-status species, and are protected by State and Federal laws. Bear Creek is the focus of habitat restoration efforts for anadromous fish.

In the preparation of this document several data gaps were identified. The population size and distribution of most fish species in the watershed is not well known. An assessment of fisheries in the watershed could be achieved by comprehensive sampling throughout the watershed to document the relative abundance and distribution of fish species, as well as the habitats that exist in the watershed's creeks. Little information exists about the gravel bar at the mouth of Bear Creek and its effects on anadromous fish passage. The actual amount of water being diverted or pumped from the ground to sustain agricultural operations is unknown. Quantifying how much water is being diverted and

groundwater pumped from the watershed's creeks would enable fisheries biologists to better assess their impacts on populations of anadromous fish that spawn in the watershed.

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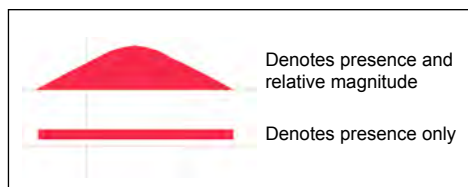
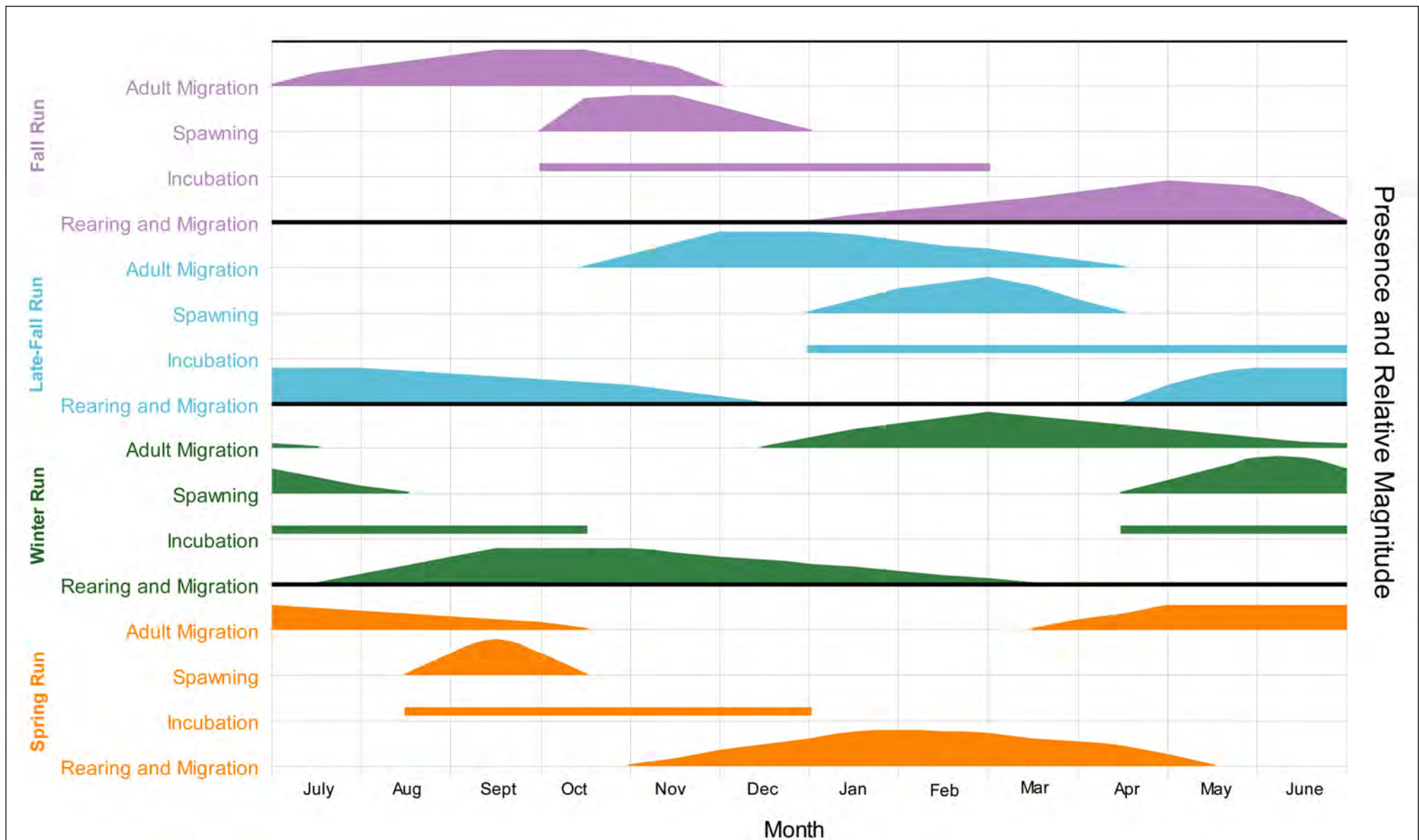


Figure 8-1
General Life History Characteristics of
Upper Sacramento River Chinook Salmon
(Source: CH2M Hill, No Date)

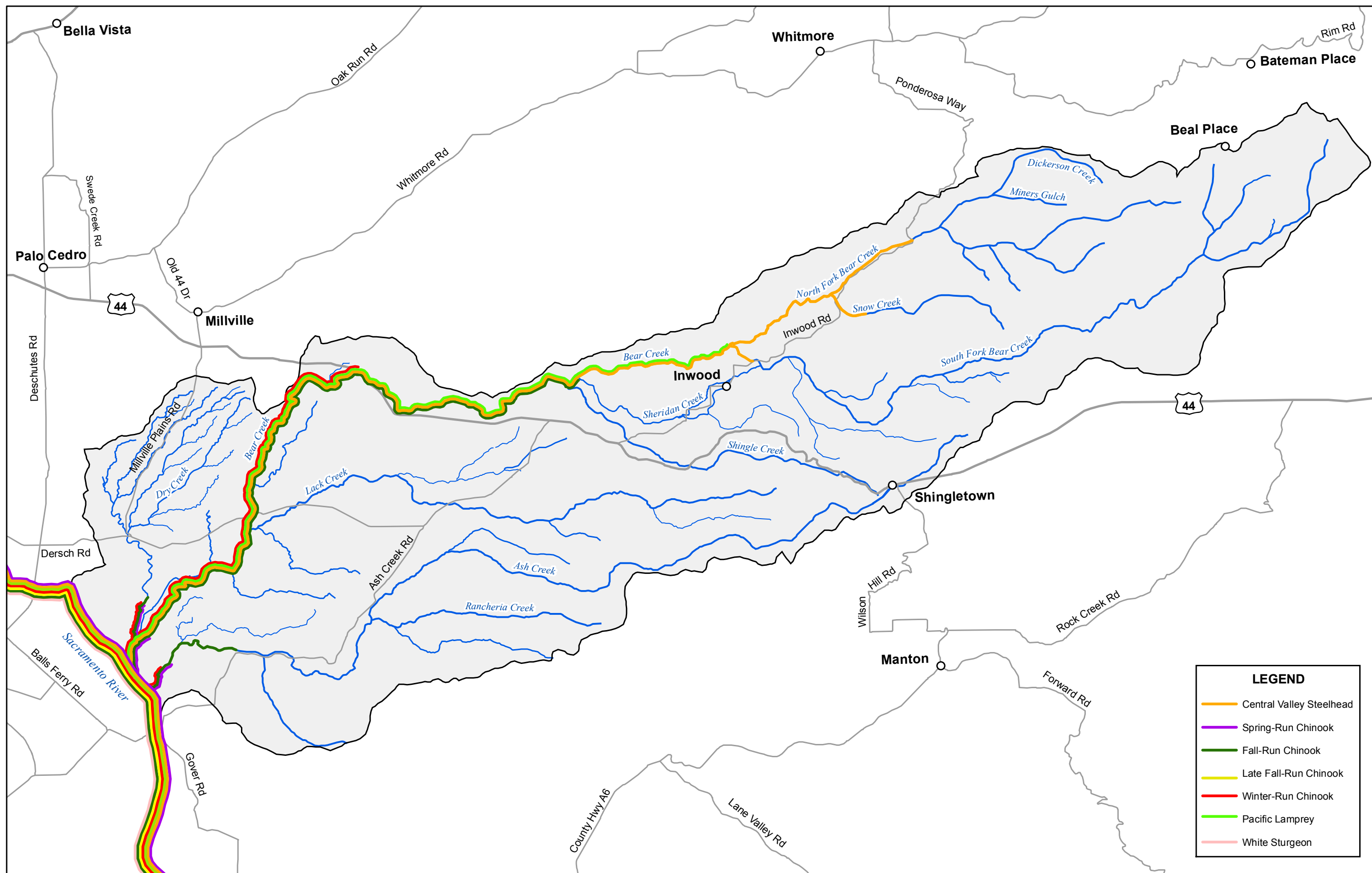


Figure 8-2
Distribution of Special Status Anadromous Fish
Bear Creek Watershed Assessment 2005

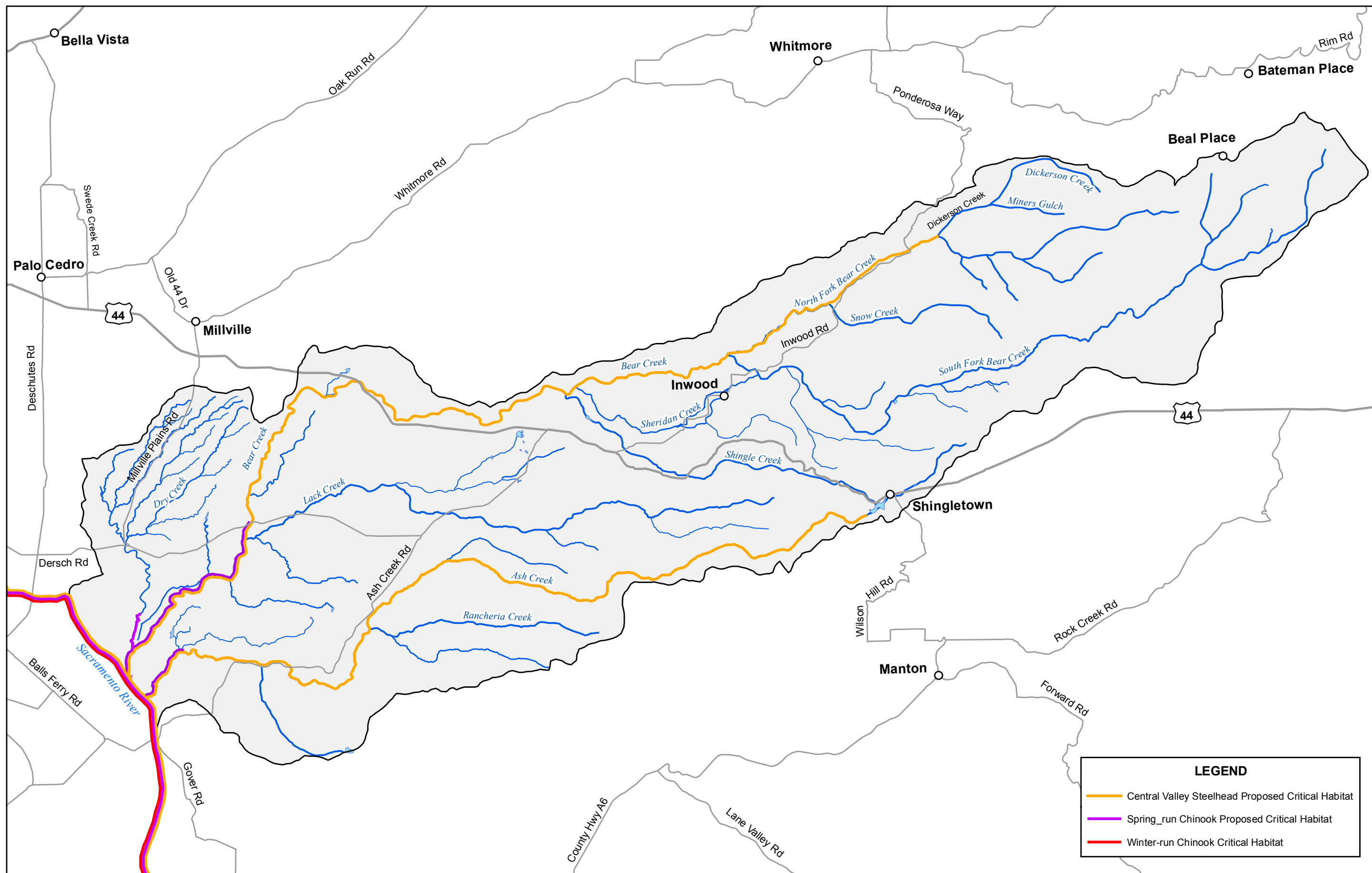


Figure 8-3
Existing and Proposed Critical Habitat for Special-Status Anadromous Fish
Bear Creek Watershed Assessment 2005

IX. LAND USE

9.1. Introduction

Land ownership in the Bear Creek watershed is primarily private, although small, isolated parcels of public lands managed by the Bureau of Land Management (BLM) and California Department of Forestry and Fire Protection (CDF) are scattered throughout the watershed. The management of public lands often varies among government agencies. The primary regulatory agency and policy making body for private land use in Shasta County, including the Bear Creek watershed, is the Shasta County Board of Supervisors. The Shasta County Board of Supervisors makes all decisions regarding land use, resource management, development approvals, environmental impact assessment, and related matters within the context of the Shasta County General Plan, which is described in greater detail below.

9.2. Shasta County General Plan

The Shasta County General Plan is an official document prepared by the Shasta County Board of Supervisors. It establishes long-range policies concerning how Shasta County's future development should occur, addressing both private and publicly owned land resources (Shasta County, 1998). The Shasta County General Plan describes a generalized and non-parcel-specific land use pattern, and it does not represent a particular point in time. Instead, it reflects a 20-year time period and is intended to provide a policy framework that must be reflected in zoning ordinances, specific plans, and other development guidelines. Five major ideas form the conceptual basis of the Shasta County General Plan:

- Growth accommodation as the means of preserving the quality of life, especially in rural areas.
- The geographic distribution and timing of growth, and its relationship to public services.
- Recognition of the Shasta County General Plan as a decision-making tool requiring periodic review and revision.
- Growth accommodation among a variety of living environments.
- Interjurisdictional approach to resolve planning issues.

OBJECTIVES

The Shasta County General Plan objectives are statements of community values regarding future growth, development, and quality of life in Shasta County. These objectives were formulated through broad-based citizen participation efforts, representative of the wide range of perspectives and interests of Shasta County's residents. Inclusion of these objectives in the Shasta County General Plan by the Shasta County Board of Supervisors guides future land use and land use related decisions in Shasta County.

LAND USE DESIGNATIONS

The Shasta County General Plan identifies 11 land use designations in the Bear Creek watershed: Public Land, Agricultural Croplands, Agricultural Grazing, Timberland, Rural Residential A, Rural Residential B, Habitat Resource, Open Space, Mixed Use, Mineral Resource, and General Industrial (Table 9-1). The location of each land use designation in the Bear Creek watershed is shown in Figure 9-1. In the Bear Creek watershed, as well as throughout Shasta County, some of the land use designations identified in the Shasta County General Plan do not reflect existing land uses. This is because the Shasta County General Plan considers not only what the current land use is, but also what the long-range use of the land should be. Thus, land that encompasses the business district of Shingletown is designated as Rural Residential A. Agricultural lands enrolled in the Williamson Act are designated as Agricultural Croplands and Agricultural Grazing. The current use of these lands is for agriculture, and due to their enrollment in the Williamson Act, it is assumed that these lands will retain the same use in the future. This section summarizes each land use designation in the Bear Creek watershed.

**Table 9-1. Bear Creek Watershed Assessment 2005
Land Use Designations in the Bear Creek Watershed**

	Approximate Acreage	Percentage of Watershed
PUBLIC LANDS	3,058	3.04%
LATOUR STATE FOREST	220	0.22%
BLM LANDS	2,838	2.82%
PRIVATE LANDS	97,483	96.96%
Agriculture		
Agricultural Croplands	1,651	1.64%
Agricultural Grazing	8,150	8.11%
Timberland	26,192	26.05%
Residential		
Rural Residential A	2,308	2.29%
Rural Residential B	50,166	49.89%
Habitat resource	8,059	8.01%
Open Space	102	0.10%
Mixed Use	37	0.04%
Mineral Resource	771	0.76%
General Industrial	47	0.05%

PUBLIC LANDS

Public lands are often highly valued for their recreational opportunities. Public lands account for approximately 3,058 acres in the Bear Creek watershed. The BLM manages most public lands in the Bear Creek watershed. However, most of these parcels do not have a management plan (G. Miller, BLM, pers. comm.). Three BLM parcels east of Shingletown are included in a grazing lease that allows up to 29 animals at a time (G. Miller, BLM, pers. comm.). Approximately 220 acres of the Latour Demonstration State Forest is included in the northeastern part of the Bear Creek watershed. The Latour Demonstration State Forest was established in 1949 and encompasses approximately 9,033 acres in eastern Shasta County. The Latour State Demonstration Forest is managed by the CDF. In addition to timber harvesting to fund a variety of the agency's Resource Management Programs, the forest provides research opportunities and demonstration projects on forest

management. In addition, it provides public recreation opportunities, such as hiking, bicycling, snowmobiling, horseback riding, camping, hunting, and fishing.

PRIVATE LANDS

Private lands account for approximately 97,483 acres in the Bear Creek watershed. According to the Shasta County General Plan, privately owned land at low elevation areas is primarily rural residential, but does include some agricultural croplands. However, much of this land is presently used for grazing. Privately owned land at middle elevations is a mixture of rural residential, agricultural grazing, and habitat resource. Sierra Pacific Industries, Inc. and W.M. Beaty & Associates own/ manage much of the timberlands at high elevation areas in the watershed.

Agriculture. Agricultural lands are a significant component of Shasta County's resource land base and are a major element in defining the quality of life available to its residents. These lands confer the rural character and pastoral lifestyle that residents value so much. According to the Shasta County General Plan, this land use designation has three mandatory elements:

- Land Use Element: The proposed general distribution and general location and extent of the use of land for agriculture.
- Conservation Element: The conservation, development, and utilization of natural resources including soils.
- Open Space Element: The managed production of resources, including rangeland, agricultural lands, and areas of economic importance for the production of food or fiber.

The following discussion addresses the historic and current use of agricultural lands in the Bear Creek watershed. In addition, land use designations for agricultural lands and the California Land Conservation Act are described.

Historic Use. The history of ranching and farming in the Bear Creek watershed dates back to the mid-1800s. Historical information presented in this discussion addresses the larger ranches in the watershed and is based on descriptions in Allen (1979). In 1862, William Aldridge acquired 160 acres of property on Snow Creek at the confluence with North Fork Bear Creek. This property was known as the Snow Creek Ranch and later changed its name to the Bonnie Craigs Ranch. The ranch raised pigs, chickens, and rabbits for meat. Dairy cows were raised to provide milk. The ranch grew its own hay to feed the livestock. The ranch also had an apple orchard. In the 1860s, Thomas Armstrong purchased land along Ash Creek which was used as winter range for his cattle. Wally Thatcher owned land along South Fork Bear Creek (presently known as Thatcher Meadow), which provided summer range for his cattle. Ezekial Thatcher purchased the Pine Grove Ranch, located 2.5 miles west of Shingletown in 1870. This ranch raised livestock and grew hay to feed the livestock. The Wengler Ranch, located just east of Inwood, was in operation during the early 1900s.

Current Use. Presently, the vast majority of agricultural lands in the Bear Creek watershed are designated for agricultural grazing. Irrigated pastures are an

important agricultural land used for grazing. Agricultural croplands are found along the lower reaches of the main stem of Bear Creek and Ash Creek. Several vineyards, a winery, and an aviary are known in vicinity of Inwood.

Land Use Designations for Agricultural Lands. In the Bear Creek watershed, agricultural land is classified as either Agricultural Croplands or Agricultural Grazing. As mentioned previously in the Land Use Designation discussion, some agricultural land in the watershed is enrolled in the Williamson Act and is designated as Agricultural Croplands or Agricultural Grazing by the Shasta County General Plan.

Agricultural Croplands. Agricultural lands designated for growing crops account for approximately 1,661 acres of the Bear Creek watershed. As stated in the Shasta County General Plan, cropland is “land capable of producing agricultural products which are planted, cultivated, and harvested by either mechanical means or by hand, or both.” Cropland types include field and row crops, orchards, vineyards, nursery crops, and other related food and fiber crops. Shasta County does not specify a minimum parcel size for agricultural croplands operated by full or part-time operators in the Bear Creek watershed.

Agricultural Grazing. Agricultural lands designated for grazing account for approximately 8,150 acres of the Bear Creek watershed. As stated in the Shasta County General Plan, grazing land is “land used primarily for grazing and occasional haymaking, which is irrigated by surface or subsurface means according to generally accepted practices.” Agriculturally fallow land is also considered grazing land if left fallow under the definition of “current primary uses.” Shasta County has established a minimum parcel size of 760 acres for full-time operators of grazing land in the Bear Creek watershed.

California Land Conservation Act (Williamson Act). The California Land Conservation Act, better known as the Williamson Act, was passed in 1965. It is intended to protect agricultural and open space lands by discouraging the premature and unnecessary conversion to urban uses (California Department of Conservation, 2004). The Act enables land owners to contract with cities and counties to voluntarily restrict land to agricultural and open space use for a period of 10 years, although some jurisdictions require a minimum of 20 years. When the contract expires, the landowner can decide whether to renew the contract. Parcels of land protected under the Williamson Act are assessed for property tax purposes at a rate consistent with their actual use, rather than their potential market value. In general, the Williamson Act is estimated to save agricultural landowners from 20 to 75 percent in property tax liability each year. Only land located in an agricultural preserve that encompasses at least 100 acres is eligible for a Williamson contract. In the event that ownership of a parcel of land subject to the Williamson Act is transferred to a new landowner, the new owner is legally obligated to maintain the parcel as specified under the terms of the contract. The California Department of Conservation is responsible for interpretation of the Williamson Act, research of related issues and policies, and enforcement of Williamson Act provisions and restrictions.

Approximately 8,989 acres of agricultural land in the Bear Creek watershed is enrolled under the Williamson Act. Table 9-2 shows the landowners in the Bear

Creek watershed with agricultural lands enrolled under the Williamson Act and Figure 9-2 shows the locations of these lands. The majority of land enrolled in the Williamson Act within the Bear Creek watershed is designated Agricultural Grazing and Agricultural Cropland.

Table 9-2. Bear Creek Watershed Assessment 2005
Landowners in the Bear Creek Watershed With Agricultural Lands Enrolled Under the Williamson Act
 (Source: Shasta County, 2003)

Owner	Map No.	Location by Blocks	No. Parcels	Total Acreage	Homesite Acreage	Contract Acreage	Prime Acreage	Non-Prime Acreage	Acres in Bear Creek Watershed
Abbott, Arthur	114	93	4	1,278		1,278	0	1,278	350
Aldridge, Glenn	15 por	93,95	11	3,457	1	3,456		3,456	3,300
Aldridge, Glenn	15 por	93	4	1,800		1,800		1,800	3,300
Boehme, Richard	182	57	4	381	1	380	55	325	381
Crowe Hereford Ranch	79	93,99	3	2,289	5	4,910	159	4,751	95
Dubose, Clyde	130	57	3	272	1	271	164	107	272
Farrell, Virgil	98	93	4	2,270	1.4	2,269	68	2,201	270
Fisher, Edith & Others	167	14,15	2	203		203	0	203	203
Morelli, Virginia	141	95,99	4	2,280	1	2,279	6	2,273	336
Myers Family Ranch	172	93,95	3	482	1	481	50	431	482
									8,989

Timberlands. Among the most important of Shasta County's resources are its timberlands. The timber industry has a rich heritage in Shasta County and continues to provide many jobs for Shasta County residents. Private landowners, as well as both state and federal agencies, own timberlands in Shasta County. According to the Shasta County General Plan, this land use designation has three mandatory elements:

- Land Use Element: The proposed general distribution and general location and extent of the use of land for agriculture.
- Conservation Element: The conservation, development, and utilization of natural resources including soils.
- Open Space Element: The managed production of resources, including rangeland, agricultural lands, and areas of economic importance for the production of food or fiber.

The following is a brief discussion of historic and current timberlands uses.

Historic Use. The history of timber harvesting in the Bear Creek watershed dates back to the mid-1800s when Fritz Bechtel and Joe Turner operated a sawmill along Snow Creek (Allen, 1979). In 1870, Sylvanus Leach and Rudolph Klotz operated the Dry Mill, which was located about ½ mile west of Shingletown (Allen, 1979). Lumber from this mill was placed onto wagons and pulled by a team of horses, mules, or oxen to Logan's Ferry, on the Sacramento River below the mouth of Bear Creek, from where it was rafted downstream to Sacramento (Klotz, 1958). In 1894, Alex and Markham Thatcher operated a mill at Pine Grove, but moved the mill to the head of South Fork Bear Creek in 1900 (Allen, 1979).

Current Use. Timber harvesting has been an important industry in the Bear Creek watershed since the mid-1800s and continues to provide large quantities of timber

annually. Presently, timberlands account for approximately 26,192 acres in the Bear Creek watershed and are found predominantly northeast of Shingletown. Much of this (approximately 19,300 acres) is privately owned, and managed by W.M. Beaty & Associates. The locations of timberlands managed by W.M. Beaty & Associates in the Bear Creek watershed is shown in Figure 9-3. Sierra Pacific Industries, Inc. manages most of the remaining timberlands. W.M. Beary & Associates manages its timberlands using uneven-age silvicultural practices that result in a wide range of tree size, age, and density.

Timberlands in the Bear Creek watershed range in value from low to high. In the vicinity of Inwood, medium value timberlands dominate the Shingletown Ridge. High value timber is located predominantly along South Fork Bear Creek (Mallory et al., 1952). Low value timberlands have a patchy distribution and are interspersed among high and medium value timberlands.

Timber harvesting on private land in California is closely regulated. Timber companies must adhere to the Forest Practice Act and Forest Rules Act, prepare a timber harvest plan (THP), and enter into a review process with various State and Federal agencies. The THP process is a certified program under the California Environmental Quality Act and involves the preparation of a THP (CNPS, no date). The THP identifies the scope of the proposed timber harvest and addresses potential concerns related to the proposed timber harvest.

Within 10 days after submitting a THP to the CDF, copies are distributed to all reviewing agencies and a notice of intent is submitted to all landowners within 300 feet of the THP, the office of the County Clerk, and the local CDF unit headquarters (CDF, no date). In addition, a Notice of Submission is sent to anyone who has requested in writing, notification when a THP is submitted to the CDF. A preliminary review of the THP is done by a multi-agency team that includes the CDF, California Department of Fish and Game (DFG), California Regional Water Quality Control Board, California Division of Mines and Geology, and any other agencies that may be interested. The purpose of the preliminary review is to assess whether the THP meets the guidelines established by the State Board of Forestry and Fire Protection. After the multi-agency review team is satisfied that the THP meets these guidelines, a Notice of Filing is sent to the person who submitted the THP, the office of the County Clerk, and to anyone else who has requested in writing. Within 10 days of submitting the Notice of Filing, the multi-agency review team will conduct a pre-harvest inspection at the site. Within 20 days of conducting the pre-harvest inspection, the multi-agency review team will meet to discuss the pre-harvest inspection and to finalize any recommendations or changes needed for the THP. Up to 30 days after conducting the pre-harvest inspection, the public may comment on a THP that has been filed. All comments must be in writing and addressed to the Director at the regional office where the plan is filed. Final recommendations are sent to the Registered Professional Forester (RPF) for response. After the RPF's response is received and the public comment period ends, the THP is forwarded to the CDF Director, or his/ her representative, who has 15 days to approve or deny the THP. Once a THP is approved, the CDF will occasionally inspect the timber harvest to ensure it is compliant with the approved THP and all laws and regulations. After the timber has been harvested, the timber company must submit a completion report to the CDF.

Residential. Land designated Residential is zoned for housing construction. Residential land in the Bear Creek watershed is designated as Rural Residential A and Rural Residential B. These designations are described below.

Rural Residential A. A designation of Rural Residential A characterizes a living environment receiving no, or only some urban services, usually within or near a Rural Community Center. The maximum residential density is one dwelling per two acres.

In the Bear Creek watershed, Rural Residential A accounts for approximately 2,308 acres and is found in the vicinity of Shingletown. It is unknown what the realistic potential for the number of homes is in Rural Residential A, or what the effects would be.

Rural Residential B. A designation of Rural Residential B characterizes living environments receiving no urban services located in areas of Shasta County characterized by one or more of the following conditions: (1) severe limitations on septic tanks, (2) uncertain long-term availability of water, (3) proximity to lands categorized as timber, grazing, or croplands, (4) remoteness from urban, town, and rural community centers, (5) extreme wildland fire hazard, and (6) inaccessibility via County maintained roads. The maximum residential density is one dwelling per five acres.

In the Bear Creek watershed, Rural Residential B accounts for approximately 50,166 acres and is the predominant land use designation west of Shingletown. Similar to Rural Residential A, it is unknown what the realistic potential for the number of homes is in Rural Residential B, or what the effects would be.

Habitat Resource. The natural resources of the Bear Creek watershed have been used by humans for hundreds of years. Native Americans subsisted on the abundant wildlife in the watershed and used its trees for a variety of purposes. They hunted deer, beaver, squirrels, rabbits, mountain quail, ducks, and ate fish (Allen, 1979). In addition, they foraged on a variety of grasses, forbs, and berries and used the bark from cedar trees to cover their dwellings.

The relatively undeveloped nature of the Bear Creek watershed lends to its use by fish and wildlife both seasonally and year round. Seasonal visitors to the Bear Creek watershed include anadromous fish and various species of migratory birds. In addition to seasonal visitors, many other wildlife species inhabit the Bear Creek watershed year-round.

In the Bear Creek watershed, land designated as Habitat Resource accounts for approximately 8,059 acres. Habitat Resource lands are located atop the ridge just south of Rancheria Creek, on Shingletown Ridge in the vicinity of Ash Creek and Lack Creek, and in the vicinity of the confluence of Dickerson Creek and Miners Gulch.

Open Space. The economy of Shasta County is dominated by five major industries: timber, tourism, healthcare, Government, and agriculture. Each industry requires substantial open space resources. Significant open space resources in Shasta County include rivers, streams, and their associated riparian corridors, floodplains, and critical wildlife habitats. Potential uses include riparian and other habitat protection, floodplain management, community design, and recreation. Open space resources are highly valued because of this competition.

The Open Space Element is the broadest in scope, except for the Land Use Element, in the Shasta County General Plan. As defined by Government Code Section 65560(b), Open Space includes any parcel or area of land or water which is essentially unimproved and designated as such for any one of the following reasons:

- Natural resource protection, such as fish and wildlife habitats, rivers, streams, and riparian corridors.
- Managed production of natural resources, including agricultural and timberlands, recharge of groundwater basins, mineral extraction areas, and fish hatcheries.
- Provision of outdoor recreation, such as camping, hiking, and boating.
- Assurance of public health and safety, such as open space along floodplains, steep slopes, or any other such area which threatens the safety of structural development.

The objectives of the open space element are identified by the State Legislature and are included in Government Code Section 65561: "... (a) That the preservation of open space land ...is necessary not only for the maintenance of the economy of the state, but also for the assurance of the continued availability of land for the production of food and fiber, for the enjoyment of scenic beauty, for recreation and for the use of natural resources; and (b) That discouraging premature and unnecessary conversion of open space land to urban uses is a matter of public interest and will be of benefit to urban dwellers because it will discourage noncontiguous development patterns which unnecessarily increase the cost of community services to community residents."

In the Bear Creek watershed, land designated as Open Space accounts for approximately 102 acres and is found in three locations in the watershed. A small parcel is located just southeast of Ash Creek, near its confluence with the Sacramento River. A small parcel is found several miles west of the Parkville Cemetery and another parcel occurs several miles east of Inwood.

Mixed Use. This designation, which allows a variety of land uses, recognizes that in a rural setting, segregation of different land uses typical to urban environments is unnecessary and impractical (Shasta County, 1998). At this scale, conflicts arising from intermixing land uses are resolved via screening setbacks and architectural design standards set in County zoning guidelines. Mixed Use designation may be assigned to rural community centers when commercial or light industrial uses existed there before January 10, 1984.

The Mixed Use designation permits a variety of land uses, such as commercial, light industrial, and residential. Commercial uses include local and tourist oriented retailers and professional offices. Light industrial uses are permitted so long as they do not cause odors, noise, visual, or other adverse impacts. Residential uses are permitted at a maximum density of one dwelling per acre if the site is within a rural community center, and one dwelling per two acres if not within a rural community center. A residence and commercial require two acres in a rural community center, or four acres for a residence and commercial outside of a rural community center.

In the Bear Creek watershed, Mixed Use land accounts for approximately 37 acres. Mixed Use land is found near the intersection of Black Butte Road and Highway 44, and a small parcel exists along the north side of Highway 44 several miles to the east of the intersection of Black Butte Road and Highway 44.

Mineral Resource. Mining and mineral resources are important to the economy of Shasta County and also to the daily lives of its citizens. The history of mining in Shasta County dates to 1849 when gold was discovered by Pearson B. Reading in Clear Creek. Prospectors mined placer deposits in streams and dug hundreds of mines into hillsides in search of gold and silver. During the late 1800s and early 1900s Shasta County was one of California's most important copper producing areas. Between 1874 and 1929, coal was mined from the Montgomery Creek Formation east of Redding. Presently, six mineral resources are mined in Shasta County and include alluvial sand and gravel, crushed stone, volcanic cinders, limestone, diatomite, and gold (Shasta County, 1998).

Mining is a temporary land use, and when the mineral resource is depleted, these mine sites will revert to a different land use. The mining of mineral resources in California is governed by the Surface Mining and Reclamation Act (SMARA) of 1975. The SMARA states that the extraction of minerals is essential to the continued economic well-being of the State and to the needs of society, and the reclamation of mined lands is necessary to prevent or minimize adverse effects on the environment, and to protect the public health and safety.

In the Bear Creek watershed, land designated as Mineral Resource accounts for approximately 771 acres. This land is located around Black Butte. However, Dupras (1997) indicated three mining operations in the watershed. These include the Millville Plains borrow pit, the Taylor Quarry along Lack Creek, and the Black Butte Cinder Pit. The Millville Plains borrow pit extracts fill materials, while the Taylor Quarry and Cinder Pit operations extract base aggregates.

General Industrial. Land designated as General Industrial provides for the intermixing of industrial uses with varying degrees of impacts, scales of operation, and service requirements, including rail access (Shasta County, 1998). This designation allows the inclusion of non-industrial uses, providing materials and services are primarily used by industry. Other non-industrial uses may be permitted on an interim basis, with conditions providing for reversion to industrial uses. Such lands should be located along a freeway, highway, or other main road.

In the Bear Creek watershed, land designated as General Industrial accounts for approximately 47 acres. This land is located several miles east of Shingletown near the Shingletown airport.

9.3. Population Growth and Land Use

This discussion on population growth and land use focuses primarily on current and projected population densities in the Bear Creek watershed and the potential impacts associated with increased population growth.

According to the U.S. Census Bureau (2003), Shasta County's estimated population in 2003 was 175,650. Much of this population is concentrated in and around Redding. No population estimates are available for individuals living within the Bear Creek watershed. However, a large section of land in the Bear Creek watershed is designated as Rural Residential B, indicating that the number of people living in the watershed is expected to increase. The largest community in the Bear Creek watershed is Shingletown, which had a population of 2,222 in 2000 (U.S. Census Bureau, 2000).

Population growth in the Bear Creek watershed will place additional demands on Shasta County's emergency response services and will result in habitat loss for wildlife.

The task of protecting life and property will become increasingly more difficult as more homes are built in the watershed. Population growth in the Bear Creek watershed is also expected to have adverse impacts on the watershed's wildlife. As more people move into the area, land will be cleared to make room for homes, surrounding vegetation will be removed to improve fire safety, and demand for surface and ground water will increase.

9.4. Conservation Easements in the Bear Creek Watershed

A conservation easement is a voluntary agreement that enables a landowner to restrict the type or amount of development on their property while retaining private ownership of the land (The Nature Conservancy, 2004). The easement is a legal contract between the landowner and the Trust. The Trust accepts the easement with the understanding that it must enforce the terms of the easement in perpetuity. By granting a conservation easement, a landowner is assured that the current and future use of the property will adhere to the terms specified in the conservation easement, regardless of who owns the land in the future. The activities allowed by a conservation easement depend on the wishes of the landowner. Some conservation easements specify that no further development shall occur on the land, whereas other conservation easements allow limited development.

The Fenwood Ranch conservation easement includes land in the Bear Creek watershed and several other conservation easements are proposed on private lands on the Millville Plains to protect vernal pool tadpole shrimp. These conservation easements are discussed in greater detail below.

FENWOOD RANCH CONSERVATION EASEMENT

The Trust for Public Land and the Shasta Land Trust acquired a conservation easement on the 2,241-acre Fenwood Ranch, which is located between Bear Creek and Cow Creek in Shasta County (VESTRA, 2002). The purpose of the easement is to protect the landscape and natural resources of the property from development and other uses that would degrade these resource values. This undeveloped property, approximately 14 miles southeast of Redding is currently managed as a winter cattle range. The Shasta Land Trust will manage and enforce the provisions on this property. The Fenwood Ranch conservation easement includes approximately 2,100 acres in the Bear Creek watershed.

MILLVILLE PLAINS CONSERVATION EASEMENTS

The Millville Plains is known to support approximately 1,200 acres of vernal pool habitat, of which, 40 acres are protected by the BLM. The Department of Fish and Game plans to protect an additional 250 acres of vernal pool habitat using federal grant money and may seek to protect another 230 acres using other grant money (Breitler, 2004). This grant money will be used by the DFG to establish conservation easements with private landowners to ensure that these vernal pool habitats, which are inhabited by vernal pool tadpole shrimp, are protected in perpetuity. The Bear Creek watershed has vernal pool habitat on the Millville Plains. However, it is not known how many (if any) of the proposed conservation easements will include land in the Bear Creek watershed.

9.5. Electrical Power Lines and Natural Gas Pipelines

The Bear Creek watershed is traversed by two significant electrical power lines and one natural gas pipeline. One electrical power line runs north-south just east of Shingletown. The other electrical power line runs north-south through the Millville Plains. The natural gas pipeline runs northeast to southwest through the watershed in the vicinity of Shingletown. Exact locations of these structures are unavailable.

9.6. Conclusions

Land use in the Bear Creek watershed has and will continue to emphasize agriculture and timber resources as the predominant focus. Most of the land in the watershed is designated for Rural Residential B and Timberland. Conservation easements have protected a very small proportion of land in the watershed and proposed conservation easements may protect additional land. Agricultural lands enrolled in the Williamson Act are also expected to be preserved. Future population growth in the watershed is expected to place additional demands on Shasta County's emergency response services and has the potential to adversely affect many fish and wildlife species in the watershed.

Land use in the Bear Creek watershed affects the natural resources in the watershed and in adjacent watersheds. Agricultural operations in the Bear Creek watershed sustained by groundwater pumping or water diversions affects fisheries resources. Land development and timber harvesting can eliminate, degrade, or fragment wildlife habitats. In addition, they can potentially impact water quality if they introduce sediments into nearby creeks.

Two data gaps were identified in the preparation of this document. A digital layer showing the location of the two electrical power lines and the natural gas pipeline is needed for use with a geographic information system (GIS) data base. In addition, a digital layer depicting Timber Preserve Zones in the watershed is needed for use with a GIS data base.

9.7. References

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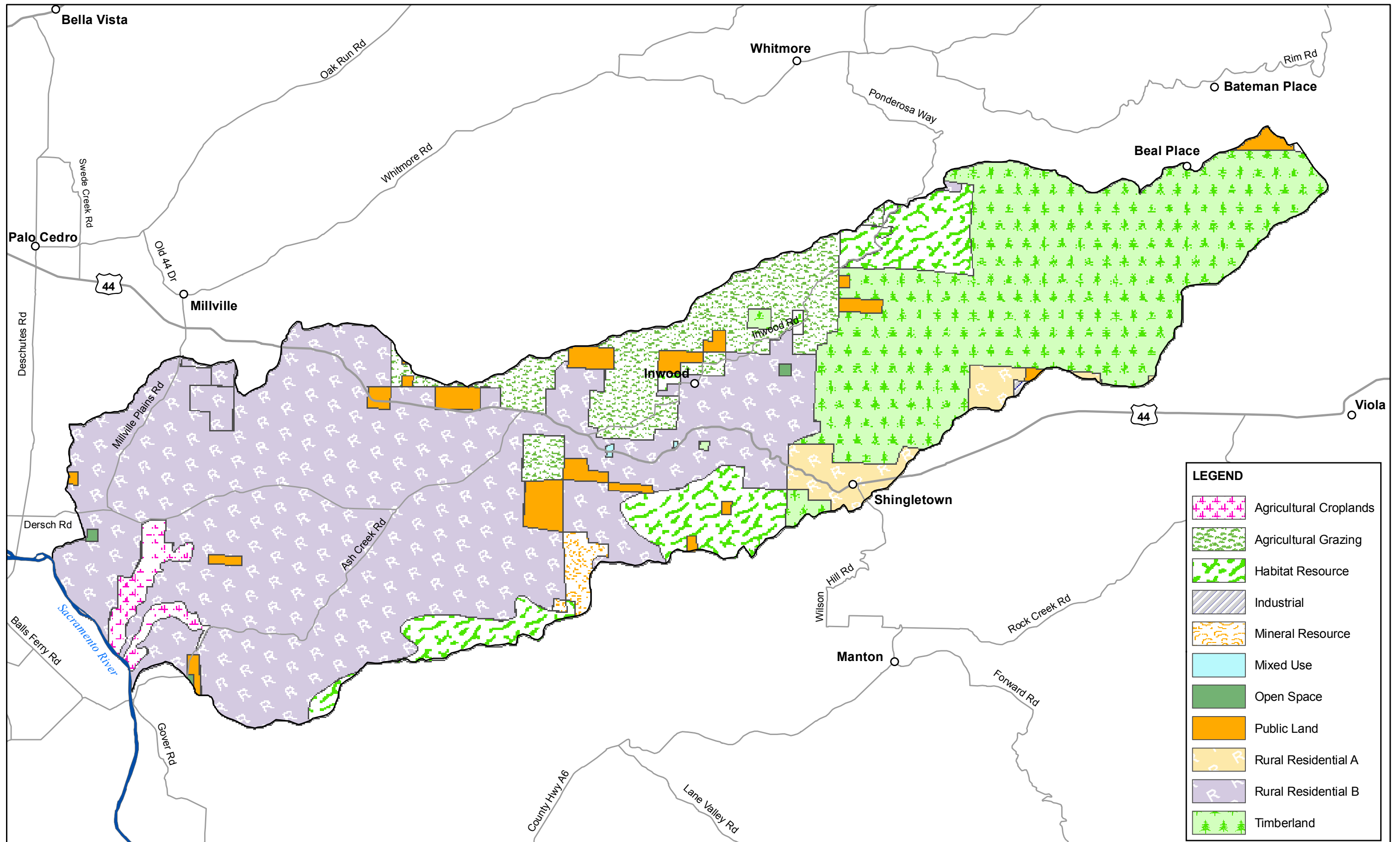
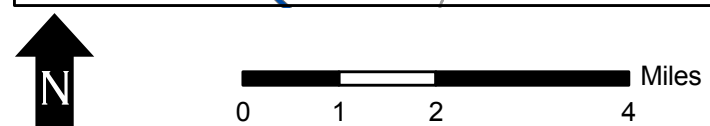


Figure 9-1
Shasta County General Plan Land Use Classification
Bear Creek Watershed Assessment 2005



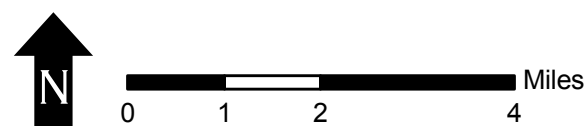
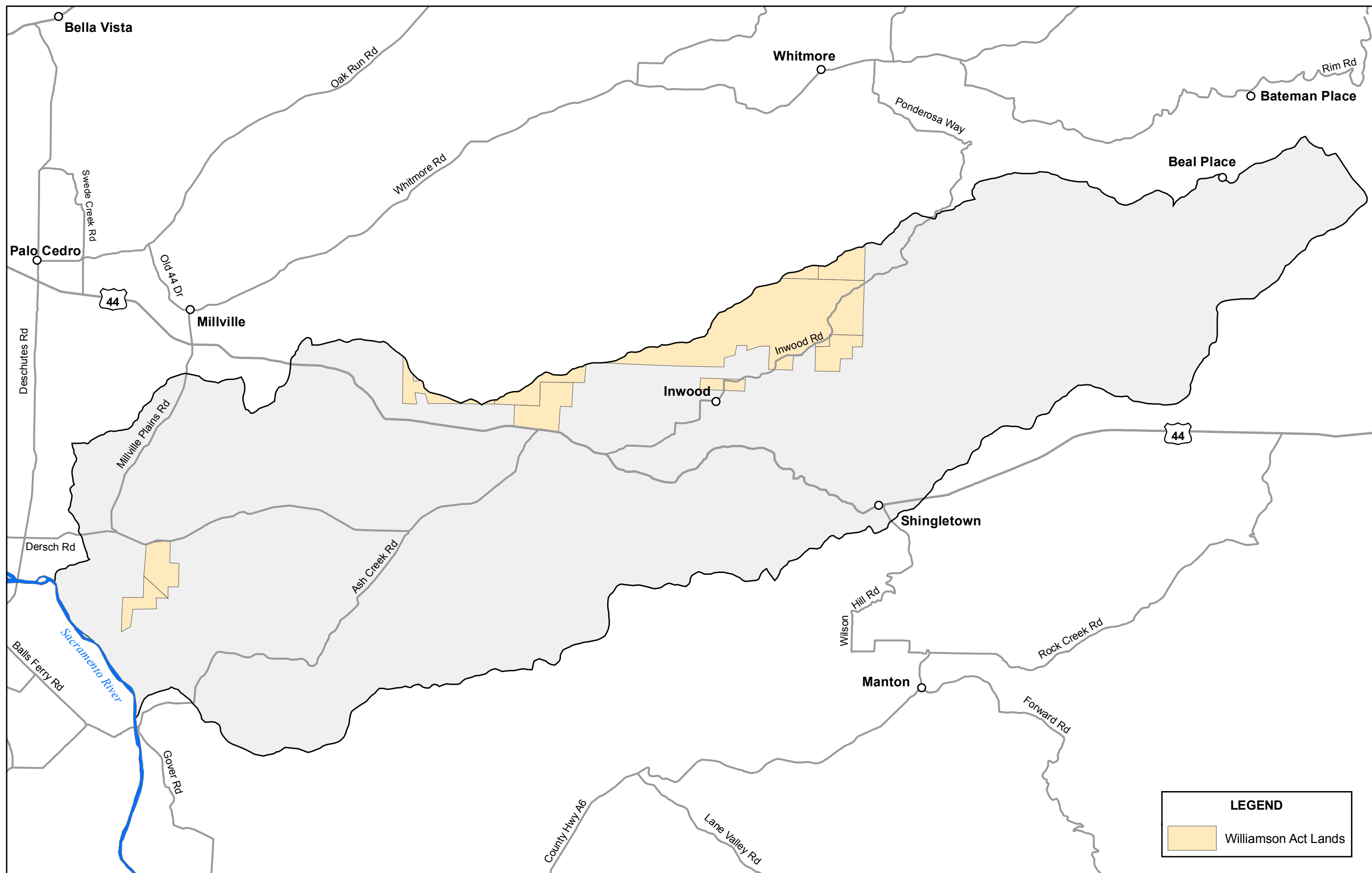


Figure 9-2
Williamson Act Lands
Bear Creek Watershed Assessment 2005

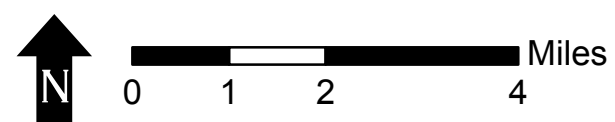
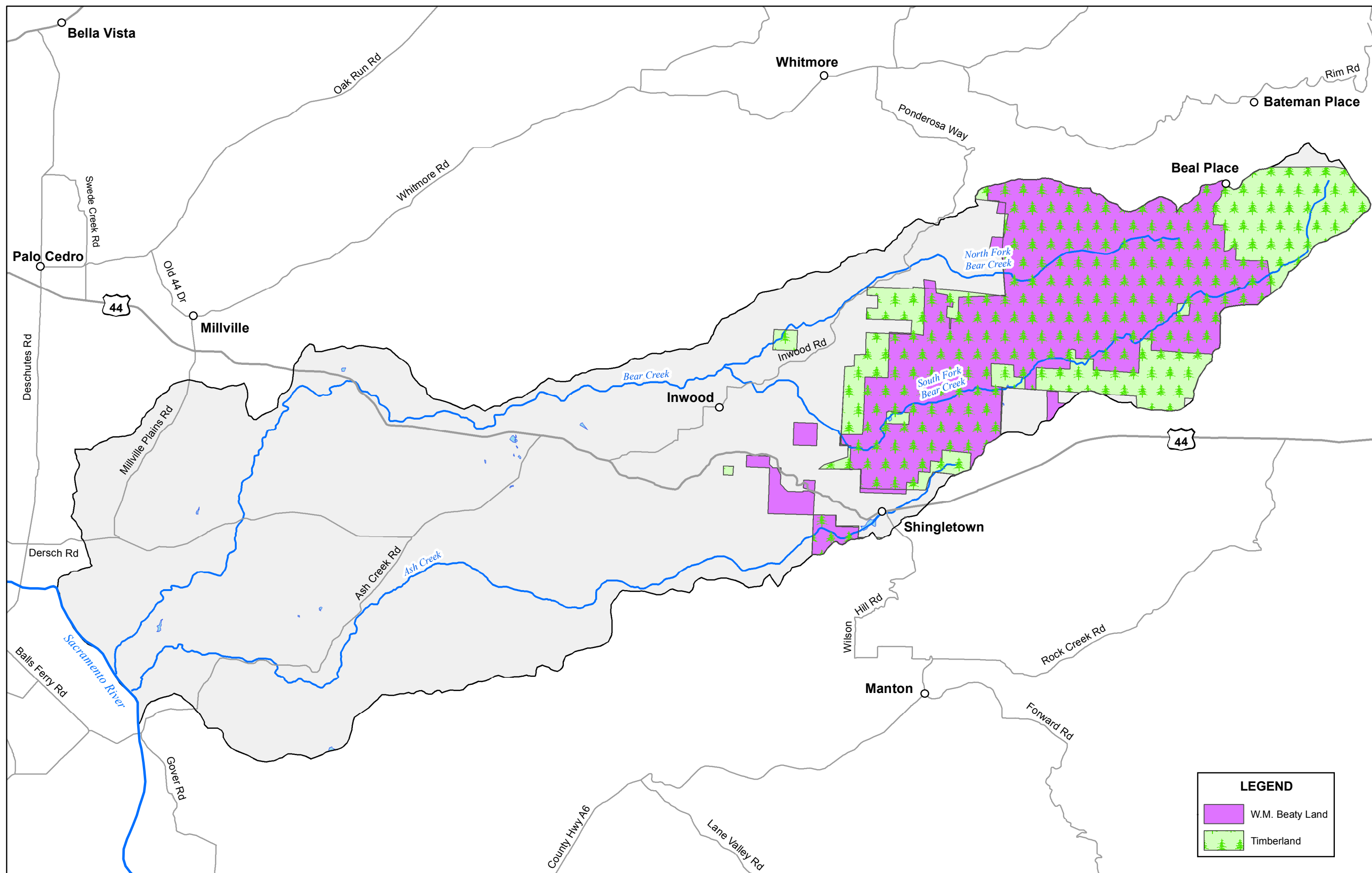


Figure 9-3
Timberlands Managed by W.M. Beaty & Associates
Bear Creek Watershed Assessment 2005

X. FIRE AND FUELS MANAGEMENT IN CALIFORNIA

10.1. Overview

Fire has played an important role in shaping the structure and composition of natural communities in California. California's Mediterranean climate does provide cool, wet winters; hot, dry summers, punctuated by occasional thunderstorms with lightning, provide suitable conditions for burning. Lightning-caused wildfires were so frequent over thousands of years that many chaparral plant species exhibit fire-adapted traits, such as thick bark or thick seed coats that rupture during high temperatures (McKelvey et al., 1996).

Fire has also been used as a tool by humans. For several thousand years, Native American tribes in California used fire for a variety of purposes. Numerous accounts by early Spanish and American explorers cite the use of fire by Native Americans in California's central and southern Coast Range mountains. While there is much documentation on the use of fire by Native Americans in California, there is much debate on what impact the use of fire has had on California's landscape (Keeley, 2002).

Fire suppression efforts over the past 100 years have resulted in an accumulation of fuels on the forest floor which pose a severe fire hazard to residents in California's rural areas. The California Gold Rush in the late 1840s brought thousands of people into the foothills of the Sierra Nevada and into the mountains of California in search of gold. As communities became established in the foothills and mountains, the need for fire protection became increasingly important. Following a series of disastrous wildfires in the northern Rocky Mountains that burned 2.5 million acres and claimed 85 lives in 1910, the issue of fire suppression received national attention (Husari and McKelvey, 1996). In response, the United States Forest Service adopted a wildfire suppression policy in 1926 which has been modified several times since its inception. Currently, four agencies have adopted wildfire suppression policies and are responsible for fire suppression in California: U.S. Forest Service (USFS), Bureau of Land Management (BLM), National Park Service, and the California Department of Forestry and Fire Protection (CDF). While protecting life and property, these fire suppression policies adopted by state and federal agencies have resulted in an increase in fuels on private and public lands in California.

Timber harvest practices over the past 150 years have also altered the structure of California's forests and contribute to the fire hazard that residents in rural areas currently face. Decades of selectively logging old-growth conifers left behind large amounts of slash and dense stands of small and medium size classes of shade-tolerant trees (McKelvey, 1996). Forest thinning operations also affect the microclimate. Thinning allows more solar radiation and wind to reach the forest floor. This reduces the moisture content in the soil and the relative humidity at the site. W.M. Beaty & Associates employs silvicultural techniques intended to maintain a large tree component while at the same time thinning dense stands of small and medium size classes of trees on timberlands in the Bear Creek watershed.

In the Bear Creek watershed, mechanical removal is the predominant technique used to reduce fuel loads that have accumulated as a result of fire suppression efforts and timber harvest practices over the past 150 years. Fire is also used to reduce fuel loads in the watershed. Prescribed burns are generally conducted under the guidance of a state or federal agency to meet specific objectives related to hazardous fuels reduction or wildlife habitat improvement.

10.2. Fire History in the Bear Creek Watershed

The climate, topography, and vegetation of the Bear Creek Watershed pose significant fire hazards to residents living within the watershed. At low and mid-elevation sites in the watershed, the summer climate is often hot and dry with occasionally gusts of wind. The topography of the watershed is variable, with rolling grasslands in low elevation areas and steep stream canyons at mid-elevation areas. The landscape is dominated by annual grassland and oak woodlands at lower elevations and conifers at higher elevations. Altogether, these factors pose a significant fire hazard to residents living in the watershed. This section summarizes the history of wildfire and prescribed fires in the Bear Creek watershed.

WILDFIRE

Prior to settlement of California by Native Americans, estimates put the frequency of wildfires caused by lightning in the Sierra Nevada foothills at less than every 20 years (McKelvey et al., 1996). Fire records maintained by the CDF for the Bear Creek watershed indicate that wildfires have a more frequent occurrence in the 20th century (Table 10-1). Wildfires have occurred at low, middle, and high elevations sites in the watershed. The largest of these fires burned approximately 13,700 acres in 1965.

Table 10-1. Bear Creek Watershed Assessment 2005
Wildfires in the Bear Creek Watershed
 (Source: CDF)

<i>Year</i>	<i>Fire Name</i>	<i>Lead Agency</i>	<i>Cause</i>	<i>Total Size (Acres)</i>	<i>Acres Within Bear Creek Watershed</i>
1911	-	USFS	Unknown	1,458	736
1917	-	USFS	Miscellaneous	540	540
1917	-	USFS	Unknown	2,194	386
1931	-	USFS	Miscellaneous	122	122
1931	-	USFS	Unknown	286	260
1946	-	USFS	Lightning	292	292
1950	Armstrong-Dersch	CDF	Unknown	3,669	3,667
1950	Bear Creek	CDF	Unknown	378	229
1958	Blue Mountain Escape	CDF	Unknown	5,365	1,594
1958	Lightning #29	CDF	Unknown	263	263
1958	Blue Mountain Escape	CDF	Unknown	1,366	34
1963	Coleman Forebay	CDF	Unknown	664	160
1965	Highway 44	CDF	Unknown	13,707	13,699
1966	Lightning #13	CDF	Unknown	3,750	348
1980	Dersch Road	CDF	Unknown	145	145
1990	Black #481	CDF	Powerline	281	279
2003	Wildcat	CDF	Equipment use	13	13
2003	Ridge	CDF	Unknown	49	41
2003	Butte	CDF	Unknown	36	36
1999	SHU Coleman	BLM	Equipment use	18	< 1
				Total: 34,596	Total: 22,845

PRESCRIBED FIRE

Several thousand years ago, Native American tribes introduced fire to the California landscape as a management tool. Early Spanish explorers and missionaries documented Native Americans tribes in the Coast Range mountains of southern and central California using fire to enhance acorn production and to maintain productive grasslands for hunting

(Ainsworth and Doss, 1995; Keeley, 2002). Considerable evidence exists that Native Americans tribes in the Sierra Nevada foothills conducted burns in late summer and fall (Skinner and Chang, 1996).

Several Native American tribes were known to occur in the vicinity of the Bear Creek watershed, including the Asagewis, Yana, and Wintu (California Board of Forestry, 1996). The Wintu were known to use fire to collect grasshoppers. Although there is no direct evidence that the Asagewis and Yana used fire, they may have used fire just as many other tribes in northern California did.

In contrast to wildfire, a prescribed fire, also known as a controlled burn, is an intentionally ignited fire under predetermined conditions to meet specific objectives related to hazardous fuels reduction or wildlife habitat improvement. Numerous prescribed fires have been set in the Bear Creek watershed by private landowners and by the CDF (Table 10-2). The locations of prescribed fires and historic fires are shown in Figure 10-1.

**Table 10-2. Bear Creek Watershed Assessment 2005
Prescribed Fires in the Bear Creek Watershed**

(Source: CDF)

<i>Year</i>	<i>Fire Name</i>	<i>Agency</i>	<i>Total Size (Acres)</i>	<i>Acres Within Bear Creek Watershed</i>
1950	Aldridge	-	10,000	-
1957	Aldridge	-	9,800	-
1957	Aldridge	-	-	-
1969	Aldridge	-	-	-
1970	Aldridge	-	5,160	-
1972	Aldridge	-	-	-
1972	Aldridge	-	-	-
1983	Blue Mountain	CDF	3,144	1,483
1985	Blue Mountain West	CDF	3,997	8
1989	Aldridge	CDF	684	678
1993	Aldridge	CDF	284	272
1996	Khoromov	CDF	448	448
			Total: 8,557	Total: 2,889

Ranchers in the Bear Creek watershed have used prescribed fires to clear brush and improve rangelands for cattle. Seven prescribed fires were set at the Bonnie Craigs Ranch near Inwood between 1950 and 1972 (Aldridge, 1977). The first prescribed fire was set in 1950. This fire burned approximately 10,000 acres (it is unknown how many acres burned in the Bear Creek watershed). In 1957, a 9,800 acre prescribed fire was set at the Bonnie Craigs ranch (it is unknown how many acres burned in the Bear Creek watershed). The area that did not burn was burned at a later date that year. In 1969, a smaller prescribed fire was set in the same area that was burned in 1950. In 1970, a prescribed fire burned 5,160 acres in the vicinity of the Bonnie Craigs Ranch (it is unknown how many acres burned in the Bear Creek watershed). In 1972, prescribed fires were set again in the area that was burned in 1950 and in the area that was burned in 1957.

Since the 1980s, the CDF has been involved with private landowners and communities in setting prescribed fires to reduce the fire hazard to rural communities. The largest known prescribed fire in the Bear Creek watershed was conducted by the CDF and burned 1,483 acres in 1983.

10.3. Environmental Consequences of Wildfire

Wildfires adversely affect a variety of important assets in wildland areas, including soils, water, air quality, wildlife, resources used for economic and recreational benefit by humans. This section describes the environmental consequences associated with wildfire.

SOIL

Wildfires tend to denude the landscape of vegetation and expose the topsoil to weathering and erosion. The rate of erosion is a function of fire severity, soil erodibility, topography, and the amount and intensity of precipitation that falls. Wildfires that reach moderate to high temperatures are capable of altering the chemical and physical properties of soils. Such wildfires cause organic material in the soil to coalesce and become water-repellant for up to one year following the burn (MacDonald and Huffman, 2004). The repellent properties of the soil during this time will result in less water retained in the soil, higher rates of water run-off, and higher peak flows in nearby streams.

WATER

Water quality in streams can be significantly degraded as a result of nearby wildfires. The magnitude of these impacts is a function of the type and condition of vegetation, type of soil and its moisture content, amount of heat generated by the wildfire, slope, aspect, proximity to a water body, and the timing and amount of post-fire rainfall (USFS, 1979a). Without vegetative cover, the exposed topsoil is easily eroded by rainfall. Run-off containing ash and eroded topsoil delivers high concentrations of suspended materials to streams. This increases turbidity as well as the amount of dissolved chemical constituents, such as nitrates and phosphates.

Rainfall following a wildfire can deliver a large amount of water and sediment into streams which often results in flooding. Without vegetation to hold it, water that would normally be used by plants and held in the topsoil is available to streams. Sediments deposited into streams by run-off also alter the stream's form and function. As the stream channel fills with sediment, the stream is prone to flooding during subsequent storms.

Wildfire may also increase the recharge of natural springs, as there is less vegetation present to capture groundwater. Aldridge (1977) reported that following a prescribed burn on his property, water flow from springs within the prescribed burn increased, while water flow from springs outside the prescribed burn remained constant.

AIR QUALITY

Wildfires are a significant source of air pollution in California. Grass and woodland fires emit approximately 23 pounds of particulate per acre, whereas timber and brush fires emit 630 pounds per acre (California Board of Forestry, 1996). The primary pollutants produced in a wildfire are carbon monoxide, nitrogen oxides, organic gases, and suspended particulates. These pollutants adversely affect visibility and human health. In terms of general human health, suspended particulates are of greatest concern. Short-term effects of smoke produced in a wildfire include irritation of the eyes, mucous membranes, respiratory tract, aggravation of chronic respiratory and cardiac diseases, and generally reduced lung function (Reinhardt et al., 1994; RERI, 1994; Sandburg et al., 2002). The long-term effects of chronic exposure to smoke produced by wildfires is unknown, but is presumed to be detrimental to human health.

WILDLIFE

The effects of wildfires on wildlife habitat vary, depending on the intensity and uniformity of the burn. Large fires do not burn evenly and as a result produce a mosaic of intact vegetation and post-fire plant community succession. However, an intense stand-replacing fire can reduce habitat heterogeneity and foster a uniformity of food and cover values, particularly in areas of similar slope, aspect, and soil type (California Board of Forestry, 1996). Following a wildfire, the recovery time varies for different natural communities. Whereas coniferous forests require hundreds of years to return to their pre-fire state, chaparral and grassland communities may recover in several years (Ainsworth and Doss, 1995).

Wildfires have many adverse affects on fish and wildlife. Wildfires remove most vegetation and eliminate browse, forage, and shelter habitat for many species. Consequently, most sites that have been burned in a wildfire exhibit a decline in species diversity (Chang, 1996). Large amounts of ash-fall or sediment contained in run-off degrade spawning habitat for fish. In wildfires that burn through riparian areas, the removal of riparian vegetation and coarse woody debris in the stream channel exposes the stream to more hours of sunlight, which in turn, elevates water temperatures.

Wildfire also has many potential benefits to wildlife. Following a wildfire, there is generally an abundance of forbs for deer to browse, especially in chaparral. Open areas may enable many species of owls and raptors to better hunt small mammals and snakes.

Fire is also important for the regeneration of plants. For certain plants in the Bear Creek watershed, such as the McNab cypress, western redbud, and knobcone pine, fire plays an important role in their life cycle. These species require high temperatures produced by fire to rupture their seed coats which allows the seed to germinate. The burning of trees and shrubs creates open areas which promote the germination of seeds in the soil. Intense stand-replacing fire can reduce habitat heterogeneity if not reforested soon after burning.

RANGELAND

Rangelands in the Bear Creek watershed play an important role in the productivity of California's livestock industry. Large expanses of annual grassland in the Millville Plains as well as grasslands created from the removal of oak woodlands and chaparral at higher elevation sites provide important range for cattle. The effects of wildfires on these rangelands depends on a variety of factors, including whether the land is currently being grazed, the time of year the fire occurs, the amount of the year's forage that has already been grazed, and the intensity of the fire (California Board of Forestry, 1996). In general, the capacity for the rangelands to produce forage for the next several years is impaired following a large wildfire. Therefore, livestock owners must provide livestock with alternative foods, range mix, or liquid supplements.

RECREATION

Due to the high percentage of privately owned land, the opportunities for recreation in the Bear Creek watershed are relatively limited. Recreational opportunities in the Bear Creek watershed include deer hunting, fishing, hiking, viewing scenic landscapes, and visiting historical sites. Wildfire impacts recreational values through the loss of use, reduced wildlife habitat and change in the mix of species comprising the vegetation. Deer

hunting success is likely to increase in burned areas because deer will return in large numbers to browse on forbs and grasses.

TIMBERLANDS

Timberland losses caused by a wildfire are measured in terms of economic and aesthetic value. Large wildfires incinerate most smaller trees and those that remain can be recovered if salvage harvest is conducted in a timely manner. What remains following a wildfire is generally a scene of devastation that requires many years to recover. Reforestation costs are expensive with no economic returns for many decades.

HUMAN RESOURCES

Wildfire poses a significant risk to human health and property. Injuries suffered during a wildfire may include lung damage from smoke inhalation, broken bones from falling trees or limbs, skin burns, and even death. Despite the risk, people continue to build homes in the Bear Creek watershed.

10.4. Fire Behavior and Fuel Models to Predict Fire Behavior

FIRE BEHAVIOR

Fire behavior is a function of fuels, weather, and topography (National Wildfire Coordination Group, 1994). This section describes each variable and how it could influence fire behavior in the Bear Creek watershed.

FUELS

Fuels include various components of vegetation, living and non-living that occur at a particular site. Fuels are classified into four groups: grasses, brush, timber, and slash (Anderson, 1982). The differences in fire behavior among these groups are a function of the fuel load and its distribution among the fuel particle size classes. Fuels generally exist at three fairly distinct strata: ground, surface, and aerial (National Wildfire Coordinating Group, 1994). Ground fuels are combustible materials below the subsurface litter layer. Examples of ground fuels are duff, dead moss and lichens, peat, and tree roots. Surface fuels are found above ground fuels and include leaf and needle litter, dead branches, bark, cones, and logs. Aerial fuels occur above the surface fuels and include needles, leaves, twigs, branches, stems, bark, vines, moss, and lichens. Ladder fuels form the link between surface and aerial fuels. That is, they provide connectivity between a fire burning low on the forest floor and branches higher up in trees. Fuel factors that influence fire behavior are fuel moisture, fuel loading, size, compactness, horizontal and vertical continuity, and chemical content.

The rate of change of the moisture content in woody materials is proportional to the diameter. Historically, woody materials have been classified according to their "time lag", which is the amount of time required to reach 63 percent of the total expected change (Anderson, 1982). In general, the larger the diameter of the woody material, the longer the time lag. The time lag classes traditionally used for fire behavior and fire danger ratings are specified as: 1 hour (<1/4 inch diameter), 10 hour (1/4 to one inch diameter), 100 hour (one to three inches diameter), and 1,000 hour (greater than three inches diameter).

A variety of surface fuels exist in the Bear Creek watershed and are shown in Figure 10-2.

WEATHER

Weather has a profound influence on the fuel conditions and the direction that a fire will burn. Summer weather conditions in the Bear Creek watershed are hot (often above 100°F) with an occasional afternoon wind blowing from the north or the south (WSRCD, 2003). During these conditions, relative humidity is often very low and fire danger is very high.

TOPOGRAPHY

The topography of the landscape is an important determinant in the direction and rate of spread of a fire (WSRCD, 2003). Topographic factors important to fire behavior include elevation, aspect, and slope (National Wildfire Coordinating Group, 1994). Surface fires tend to move more quickly upslope than downslope. This is because the flames of a fire burning upslope are positioned closer to fuels ahead of the fire and preheats the fuels at a greater rate than if they were on flat land.

The topography in the Bear Creek watershed consists of rolling grasslands at lower elevation and steep canyons at middle elevation sites. Thus, fires that start at low elevation sites have the potential of being driven in a northeasterly direction into the steep canyons which have high fuel loads.

FUEL MODELS FOR PREDICTING FIRE BEHAVIOR

The U.S. Forest Service developed a National Fire Defense Rating System (NFDRS) that is based on fuel models. This rating system has progressed from two fuel models in 1964 (USFS, 1964), to nine fuel models in 1972 (Deeming et al., 1972), and to 20 fuel models in 1978 (Deeming et al., 1977). While the number of fuel models for rating fire danger has grown to 20, the fuel models used to predict fire behavior are based on the 13 fuel models developed by Albini (1976) and Anderson (1982). The fuel models developed by Albini (1976) and Anderson (1982) for predicting fire behavior are very general and are used to predict fire behavior are based on conditions present in four different fuel environments: grasslands, shrublands, timberlands, and slash. The 13 fuel models developed by Albini (1976) are summarized in Table 10-3 and the fuel models developed by Anderson (1982) are summarized in Table 10-4. This section describes the 13 fuel models for predicting fire behavior, as outlined in Anderson (1982).

Table 10-3. Bear Creek Watershed Assessment 2005
Description of Fuel Models Used in Predicting Fire Behavior
 (Source: Albini, 1976)

Fuel Model	Typical Fuel Complex	Time Lag Classes (Tons/ Acre)				Fuel Bed Depth (Feet)	Moisture of Extinction Dead Fuels (Percent)
		1 Hr.	10 Hrs.	100 Hrs.	Live		
GRASS & GRASS DOMINATED							
1	Short grass (1 foot)	0.74	0.00	0.00	0.00	1.0	12
2	Timber (grass & understory)	2.00	1.00	0.50	0.50	1.0	15
3	Tall grass (2.5 feet)	3.01	0.00	0.00	0.00	2.5	25
CHAPARRAL & SHRUB FIELDS							
4	Chaparral (6 feet)	5.01	4.01	2.00	5.01	6.0	20
5	Brush (2 feet)	1.00	0.50	0.00	2.00	2.0	20
6	Dormant brush, hardwood ash	1.50	2.50	2.00	0.00	2.5	25
7	Southern rough	1.13	1.87	1.50	0.37	2.5	40
TIMBER LITTER							
8	Closed timber litter	1.50	1.00	2.50	0.00	0.2	30
9	Hardwood litter	2.92	41	0.15	0.00	0.2	25
10	Timber (litter & understory)	3.01	2.00	5.01	2.00	1.0	25
SLASH							
11	Light logging slash	1.50	4.51	5.51	0.00	1.0	15
12	Medium logging slash	4.01	14.03	16.53	0.00	2.3	20
13	Heavy logging slash	7.01	23.04	28.05	0.00	3.0	25

Table 10-4. Bear Creek Watershed Assessment 2005
Description of Fuel Models Used in Predicting Fire Behavior
 (Source: Anderson, 1982)

<i>Fire Behavior Fuel Model</i>	<i>Total Fuel Load, <3-inch Dead and Live (Tons/ Acre)</i>	<i>Dead Fuel Load, ¼-inch (Tons/ Acre)</i>	<i>Live Fuel Load, Foliage (Tons/ Acre)</i>	<i>Fuel Bed Depth (Feet)</i>	<i>Rate of Spread (Chains/ hour)</i>	<i>Flame Length</i>	<i>Corresponding 1978 NFDRS Fuel Model</i>
GRASS GROUP							
Fire Behavior Fuel Model 1	0.74	0.74	0	1.0	78	4	A, L, S
Fire Behavior Fuel Model 2	4.0	2.0	0.5	1.0	35	6	C, T
Fire Behavior Fuel Model 3	3.0	3.0	0	2.5	104	12	N
SHRUB GROUP							
Fire Behavior Fuel Model 4	13.0	5.0	5.0	6.0	75	19	B, O
Fire Behavior Fuel Model 5	3.5	1.0	2.0	2.0	18	4	None
Fire Behavior Fuel Model 6	6.0	1.5	0	2.5	32	6	F, Q
Fire Behavior Fuel Model 7	4.9	1.1	0.4	2.5	20	5	D
TIMBER GROUP							
Fire Behavior Fuel Model 8	5.0	1.5	0	0.2	1.6	1.0	H, R
Fire Behavior Fuel Model 9	3.5	2.9	0	0.2	7.5	2.6	E, P, U
Fire Behavior Fuel Model 10	12.0	3.0	2.0	1.0	7.9	4.8	G
LOGGING SLASH GROUP							
Fire Behavior Fuel Model 11	11.5	1.5	0	1.0	6.0	3.5	K
Fire Behavior Fuel Model 12	34.6	4.0	0	2.3	13.0	8.0	J
Fire Behavior Fuel Model 13	58.1	7.0	0	3.0	13.5	10.5	I

GRASSES GROUP

Fuel Model 1. Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than 1/3 of the area. Fuel Model 1 corresponds to 1978 NFDRS Fuel Models A, L, and S.

Fuel Model 2. Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to leaf litter and dead down-stemwood, contributes to the fire intensity. Open shrub lands, pine stands, or scrub oak stands that cover 1/3 to 2/3 of the area may generally fit this model; such stands may include clumps of fuels that generate higher intensities and that may produce fire brands. Some pinyon-juniper may be included in this model. Fuel Model 2 corresponds to 1978 NFDRS Fuel Models C and T.

Fuel Model 3. Fires in this fuel model are the most intense of the grasslands and exhibit the rapid rates of spreading under the influence of winds. Winds may drive fires into the upper heights of the grass and across standing water. Stands are tall, averaging about three feet in height. Approximately 1/3 or more of the stand is dead or cured and maintains the fire. Fuel Model 3 corresponds to 1978 NFDRS Fuel Model N.

SHRUB GROUP

Fuel Model 4. The fire's intensity and rapid rate of spread involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Stands of mature shrubs greater than six feet tall, such as mixed chaparral, are representative. In addition to flammable foliage, dead woody material in the stands significantly contributes to the fire intensity. A deep litter layer may hamper fire suppression efforts. Fuel Model 4 corresponds to 1978 NFDRS Fuel Models B and O.

Fuel Model 5. Surface fuels that are made up of litter from shrubs and grasses, or forbs in the understory generally carry fire. Fires are generally not very intense because surface fuel loads are light, shrubs are young with little dead material, and the foliage contains little volatile material. In general, shrubs are short and nearly cover the entire area. Green, low shrub fields within timber stands or without overstory are typical. Fuel Model 5 has no corresponding 1978 NFDRS Fuel Model.

Fuel Model 6. Fires carry through the shrub layer where the foliage is more flammable than Fuel Model 5, but this requires moderate winds, exceeding eight miles per hour at mid-flame height. Fire will drop to the ground at lower wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of Model 4, nor do they contain as much fuel as Model 4. Fuel Model 6 covers a broad range of shrub conditions, including intermediate stands of chamise, chaparral, and oak brush. This fuel model may also represent hardwood slash that has been cured. This fuel model may also apply to pinyon-juniper shrublands, but may overestimate the rate of spread, except when winds exceed 20 miles per hour at the 20-foot level. Fuel Model 6 corresponds to 1978 NFDRS Fuel Models F and Q.

Fuel Model 7. Fires burn through the surface and shrublands with equal ease and can occur higher dead fuel moisture contents because of the flammability of live foliage and

other living material. Shrublands are typically two to six feet tall. Fuel Model 7 corresponds to 1978 NFDRS Fuel Model D.

TIMBER GROUP

Fuel Model 8. This fuel model is characterized by slow-burning ground fires with low flame lengths, although the fire may encounter an occasional area of heavy fuel concentration resulting in a flare up. Only under severe weather conditions involving high temperature, low humidity, and high winds do the fuels pose a fire hazard. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly comprised of needles, leaves, and occasional twigs. Representative conifer stands include white pine, lodgepole pine, spruce, Douglas fir, and larch. Fuel Model 8 corresponds to 1978 NFDRS Fuel Models H and R.

Fuel Model 9. Fires spread through the surface litter faster than in Fuel Model 8 and have taller flames. This fuel model is represented by hardwoods and by closed stands of long-needle pines, such as ponderosa pine and Jeffrey pine. Concentrations of dead-down woody material contribute to possible torching out of trees, spotting, and crowning. Fuel Model 9 corresponds to 1978 NFDRS Fuel Models E, P, and U.

Fuel Model 10. Fires burn in the surface and ground fuels with greater fire intensity than the other timber models. Dead-down fuels include greater quantities of 3-inch or larger limbwood resulting from over-maturity or natural events that create a large load of dead material on the forest floor. Crowning out, torching, and spotting of individual trees are more common in this fuel situation, making fires difficult to control. This fuel model may be representative of any vegetation type if heavy down material is present. Examples include insect/ disease-ridden stands, wind-thrown stands, over-mature situations with deadfall, and aged light thinning or partial-cut stands. Fuel Model 10 corresponds to 1978 NFDRS Fuel Model G.

LOGGING SLASH GROUP

Fuel Model 11. Fires are active in areas where slash and herbaceous material are intermixed. The spacing of the light fuel load, shading from the overstory, or the age of fine fuels can control fire spread. Representative areas include light, partial cuts or thinning operations in mixed conifer and hardwood stands. Fuel Model 11 corresponds to 1978 NFDRS Fuel Model K.

Fuel Model 12. Rapidly spreading, high-intensity fires capable of generating firebrands characterize this fuel model. Once a fire has started, it is generally sustained until it reaches a fuel break or a change in fuel category. Representative areas include heavily thinned conifer stands, clear-cuts, and medium or heavy partial cuts. Fuel Model 12 corresponds to 1978 NFDRS Fuel Model J.

Fuel Model 13. In this fuel model, fires are generally spread by a continuous layer of slash. Typically, large quantities of material greater than three inches in diameter are present. Fires typically spread rapidly through the fine fuels and intensity builds up more slowly as larger fuels combust. Active flaming is sustained for long periods and a wide variety of firebrands are generated. These conditions contribute to spotting problems when weather is more severe. In this type of fuel environment, the slash load is dominated by

material greater than three inches in diameter. The total load may exceed 200 tons per acre. Fuel Model 13 corresponds to 1978 NFDRS Fuel Model I.

FIRE THREAT

Fire threat is a combination of two factors: fire frequency and potential fire hazard. These two factors are combined to create five fire threat classes: Little or No Threat, Moderate Threat, High Threat, Very High Threat, and Extreme Threat. In the Bear Creek watershed, fire threat is most severe between the Millville Plains and Shingletown (Figure 10-3). This area is predominantly oak woodland and chaparral. These communities are very dry in summer and are highly susceptible to fire.

10.5. Fire Protection

Fire protection involves prevention, pre-suppression, detection/suppression, and fuel reduction. This section summarizes each program, as it applies to the Bear Creek watershed.

PREVENTION

Prevention includes local and state laws protecting life and structures from wildfire, public education programs to increase awareness about the dangers of wildfire, and the preparation of community fire plans.

FIRE PROTECTION LAWS

Following a series of disastrous wildfires in southern California in 2003, in which a lack of defensible space was blamed for the swift spread, the California Legislature passed Senate Bill 1369, which became effective in 2005. This law requires Californians living in areas designated as a “very high fire hazard severity zone” to remove “all brush, flammable vegetation, or combustible growth” within 100 feet of their home, or up to the property line, whichever is closer (Breitler, 2004). Shasta County already requires residents to maintain a 100-foot buffer around their homes. However, the CDF suggests that the new law may affect some residents who live in a “very high fire hazard severity zone” and are not in compliance with existing fire protection laws.

COMMUNITY FIRE EDUCATION PROGRAMS

Wildfires have increased in the number, size, and degree of devastation over the past decade. This has resulted in the creation of a National Fire Plan for the U.S. Departments of Agriculture and Interior. The National Fire Plan provides funding to rural communities and watershed groups for identifying, planning, and implementing fuel reduction projects. Residents of Shingletown, the largest community in the Bear Creek watershed, have worked together with county, state, and federal agencies to form their own fire awareness programs, which are described below.

Shingletown Community Fire Safe Program. The Shingletown Community Fire Safe Program was formed in 1993 as part of a state-wide effort to educate and encourage communities to prepare for wildfires before they occur. The Shingletown Community Fire Safe Program was a collaborative effort among the CDF, Shasta County Fire Department,

DFG, professional resource managers, and local residents to prepare a comprehensive plan to evaluate and reduce the danger of wildfire.

Shingletown Fire Safe Council. The Shingletown Fire Safe Council was formed in 2003 and works in conjunction with the Shasta County Fire Safe Council, which was established in 2002.

COMMUNITY FIRE PLANS

Community fire plans for residents in the Shingletown area were prepared by local and state agencies in 1995 and 2001. The following discussion describes each community fire plan in greater detail.

Shingletown Wildfire Defense Plan. The *Shingletown Wildfire Defense Plan* was prepared in 1995 by Ralph Minnich, CDF Battalion Chief, Mark Lancaster, Registered Professional Forester, and Ron Hodgson, a retired professor at California State University, Chico. The plan encompassed approximately 40,000 acres and was intended to be a general organizing effort. It discussed the goals and values relating to the forest, a physical description of the forest on Shingletown Ridge, the resource management history and present land uses, the health of the forest, a description of the wildfire threat to human life and property, the predicted behavior of wildfires during extreme fire danger conditions, and recommendations to reduce fire hazards along Shingletown Ridge.

Fire Safe Plan for the Shingletown Community. The *Fire Safe Plan for the Shingletown Community*, prepared by the Western Shasta Resource Conservation District in 2003 under a grant from the U.S. Forest Service's National Fire Plan Community and Private Land Fire Assistance Program, is an update of the 1995 *Shingletown Wildfire Defense Plan*. The boundary of the *Fire Safe Plan for the Shingletown Community* encompasses 112,100 acres and services approximately 2,600 residents living in the communities of Shingletown, Viola, and Manton. This plan encompasses approximately 52,430 acres and includes about 65 percent of the Bear Creek watershed. It identifies values at risk, evacuation routes, potential sources of funding, and fuel reduction guidelines for homeowners. The recommendations include defining the boundary of the planning area in order to maximize coordination with other groups performing similar work in the area, making the community evacuation plan more publicized and accessible through posting on the Western Shasta Resource Conservation District website, continuing annual neighborhood-based fuels reduction work, establishing a locally-based Fire Safe Council to participate in the Shasta County Fire Safe Council, and placing shaded fuel breaks along key roadways and bridges.

PRE-SUPPRESSION

Pre-suppression involves training firefighters and maintaining equipment and structures so that they are ready when needed to suppress a wildfire.

DETECTION AND SUPPRESSION

Fire detection in the Bear Creek watershed is provided intermittently by the Latour Butte Lookout, operated by CDF. This lookout was closed several years ago due budget cuts. However, when strong winds or thunderstorms are expected during the fire season,

the CDF will attempt to staff the lookout (R. Hartley, pers. comm.). Fire suppression is provided by a CDF fire station in Shingletown. In addition, the Shasta County Fire Department maintains two volunteer fire stations in the Shingletown area. The locations of these fire stations are shown in Figure 10-4. The Northern California Fire Association Air Patrol Program, a cooperative representing timberland companies in northeastern California, conducts daily flights in the region to monitor timber harvest activities and may provide some degree of fire detection.

FUELS REDUCTION

Reducing fuel loads is an important element of any fire prevention and protection program. Combustible fuels posing a fire hazard can be reduced in a variety of ways including: prescribed fire, mechanical treatment, shaded fuel break, and maintenance treatment. This section summarizes each technique and includes a discussion on the California Vegetation Management Plan.

PRESCRIBED FIRE

A prescribed fire is any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. Prescribed fires are set for a variety of purposes, but are more commonly used to reduce fuel loads and to mimic natural fire regimes that maintained healthy forests for thousands of years (Husari and McKelvey, 1996). In contrast to wildfires, prescribed fires generally burn at lower temperatures, are limited to the shrub layer and small trees, and cause little or no damage to the soil. However, the use of prescribed fire is controversial, is inappropriate in some circumstances, and has many risks. A prescribed fire can escape containment, causing damage to watersheds, wildlife habitat, structures, and even the loss of life (WSRCD, 2003).

MECHANICAL TREATMENT

Mechanical treatment involves using machines to reduce fuels loads. Machines used include bulldozers, excavators, falling machines, masticators, chippers, and grinders. Mechanical removal of fuels enables the landowner to market the fuel for power generation or as mulch. In contrast to prescribed fire, mechanical treatment is becoming increasingly popular because it involves less risk, produces less air pollutants, is more aesthetically pleasing, and provides landowners more control over vegetation removal (WSRCD, 2003). The drawback to using mechanical treatments is that it is expensive.

SHADED FUEL BREAK

A shaded fuel break is constructed as a way to create a defensible space in which firefighters can safely conduct fire suppression efforts. In addition, it is also useful in slowing a fire's progress because it breaks up fuel continuity, preventing a ground fire from reaching the canopy layer. The WSRCD has adopted the following fuel break standards:

- The minimum width is typically 100 feet, but may be up to 300 feet wide.
- Fuel breaks should be easily accessible by fire crews and equipment at several points.
- The edges of a fuel break should be varied to create a mosaic or natural appearance.

- A maintenance plan should be prepared before construction of the fuel break.
- Low ground cover should be present in the fuel break to prevent erosion.
- The fuel break should consist of well-spaced vegetation with little or no ground fuels and no understory brush.

Shaded fuel breaks have been constructed in the Bear Creek watershed in the vicinity of the intersection of Dersch Road and Highway 44, and to the west and north of the Shasta Forest Village subdivision in Shingletown. The fuel breaks around the subdivision were designed to prevent wildfire movement upslope on Shingletown Ridge from threatening the subdivision. In addition to the shaded fuel breaks, an understory thinning operation on W.M. Beaty & Associates lands to the east of the subdivision provides additional protection. The maintenance of these shaded fuel breaks is essential for them to maintain their effectiveness.

MAINTENANCE TREATMENT

A variety of maintenance treatments are commonly used to control vegetation on shaded fuel breaks. Methods of treatment include herbicides, manual treatment, and herbivores (WSRCD, 2003). Herbicides are an effective and inexpensive method of eliminating vegetation. Manual treatment is an effective method of removing vegetation, but is labor intensive. Goats are quite effective at removing vegetation from a shaded fuel break. However, the use of goats requires that a fence be placed around the perimeter of the shaded fuel break. One concern associated with using goats is that over-grazing may cause erosion. A drawback to maintenance treatment is that it requires periodic maintenance for effectiveness beyond five years. As a result, prescribed fire under-burns may be considered as an alternative to maintenance treatment.

CALIFORNIA VEGETATION MANAGEMENT PROGRAM

The California Vegetation Management Program (CVMP) was created in 1981 and is a cost-sharing program focusing on the use of prescribed fire and mechanical means to address wildland fire fuel hazards and other resource management issues on State Responsibility Area lands (CDF, 2004). The use of prescribed fire mimics natural processes, restores fire to its historic role in wildland ecosystems, and provides significant fire hazard reduction benefits, thereby enhancing public and firefighter safety.

The CVMP enables private landowners to enter into a contract with the CDF to use prescribed fire to accomplish a combination of fire protection and resource management goals. Implementation of CVMP projects is by the CDF units. Projects fitting within a unit's priority areas (e.g., those identified through the Fire Plan) and those considered to be of most value to the unit will be completed. The CVMP has been in existence since 1981 and has averaged approximately 35,000 acres per year since its inception.

10.6. Conclusions

Prescribed fires, fire suppression policies, and timber harvest practices over the past 150 years have greatly influenced the character of forests in the Bear Creek watershed. Fire suppression policies over the past 100 years have resulted in significant fuel loading and potential for catastrophic wildfire. Fuel reduction efforts in the watershed include the use of prescribed fire, mechanical treatments, shaded fuel breaks, and maintenance

treatments. Residents in the Shingletown area have prepared community fire education programs (e.g., Shingletown Community Fire Safe Program and the Shingletown Fire Safe Council) and community fire plans (e.g., Shingletown Wildfire Defense Plan and the Fire Safe Plan for the Shingletown Community). The mixed chaparral community in the watershed has a high potential for wildfire. In addition, high fuel loads in the watershed add to the fire danger that residents face. Consequently, fuel reduction efforts in the watershed will likely continue.

Wildfire and fuels management programs in the Bear Creek watershed can potentially affect vegetation types and natural communities, wildlife and their habitats, and water quality. Wildfire and fuels management programs expose soils to erosion which can potentially enter streams and affect fisheries and water quality.

More information is needed about historical fires in the Bear Creek watershed. This knowledge can help foresters and biologists better understand how fire has affected vegetation in the watershed. Quantifying and qualifying fuel hazards in the watershed is needed to help residents better understand fuel conditions and how it affects them.

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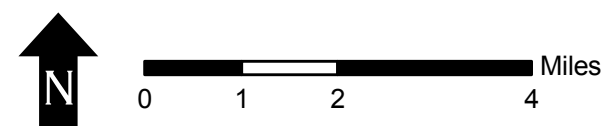
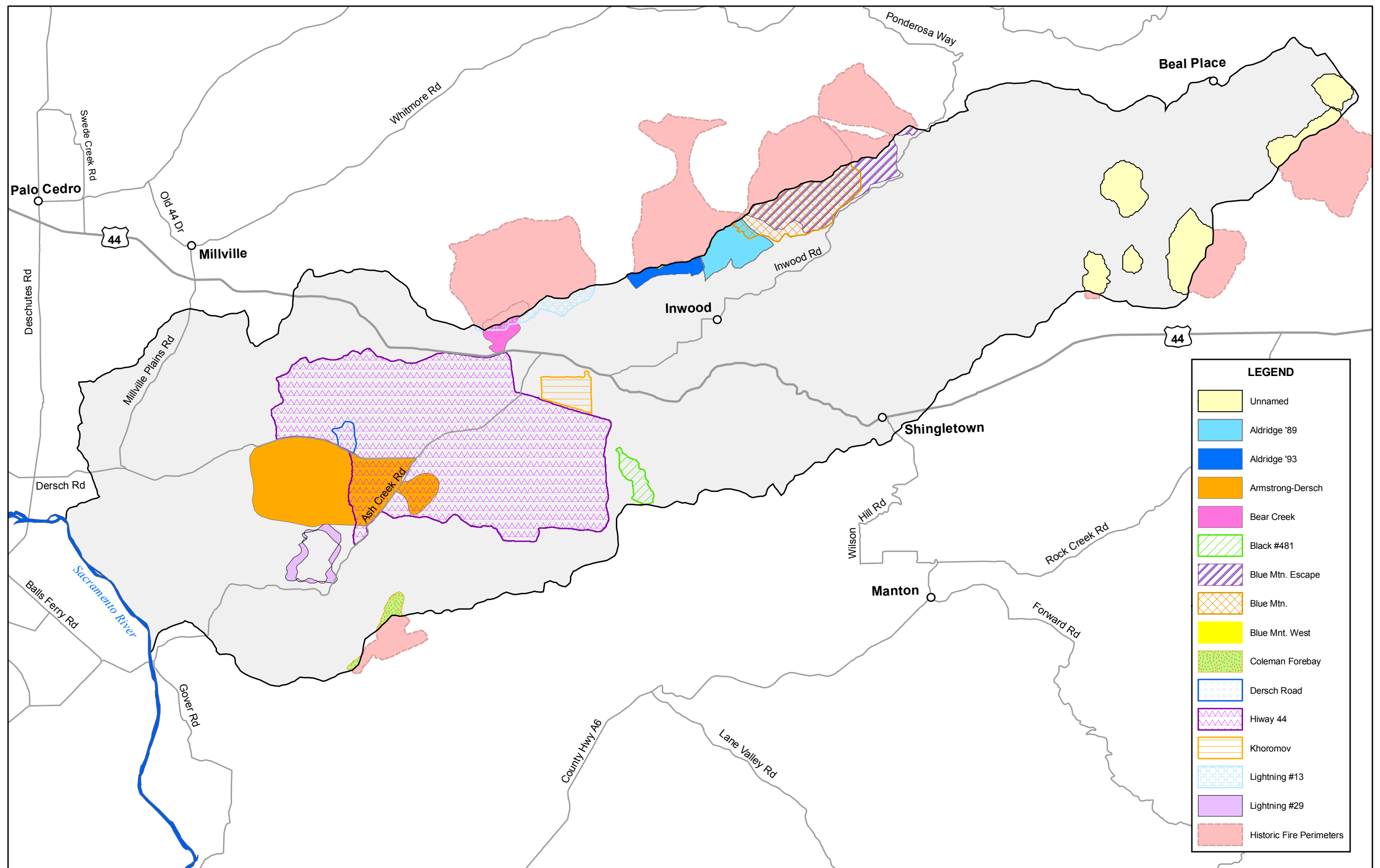


Figure 10-1
Fire History Map
Bear Creek Watershed Assessment 2005

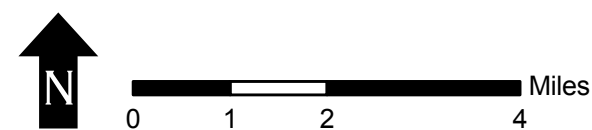
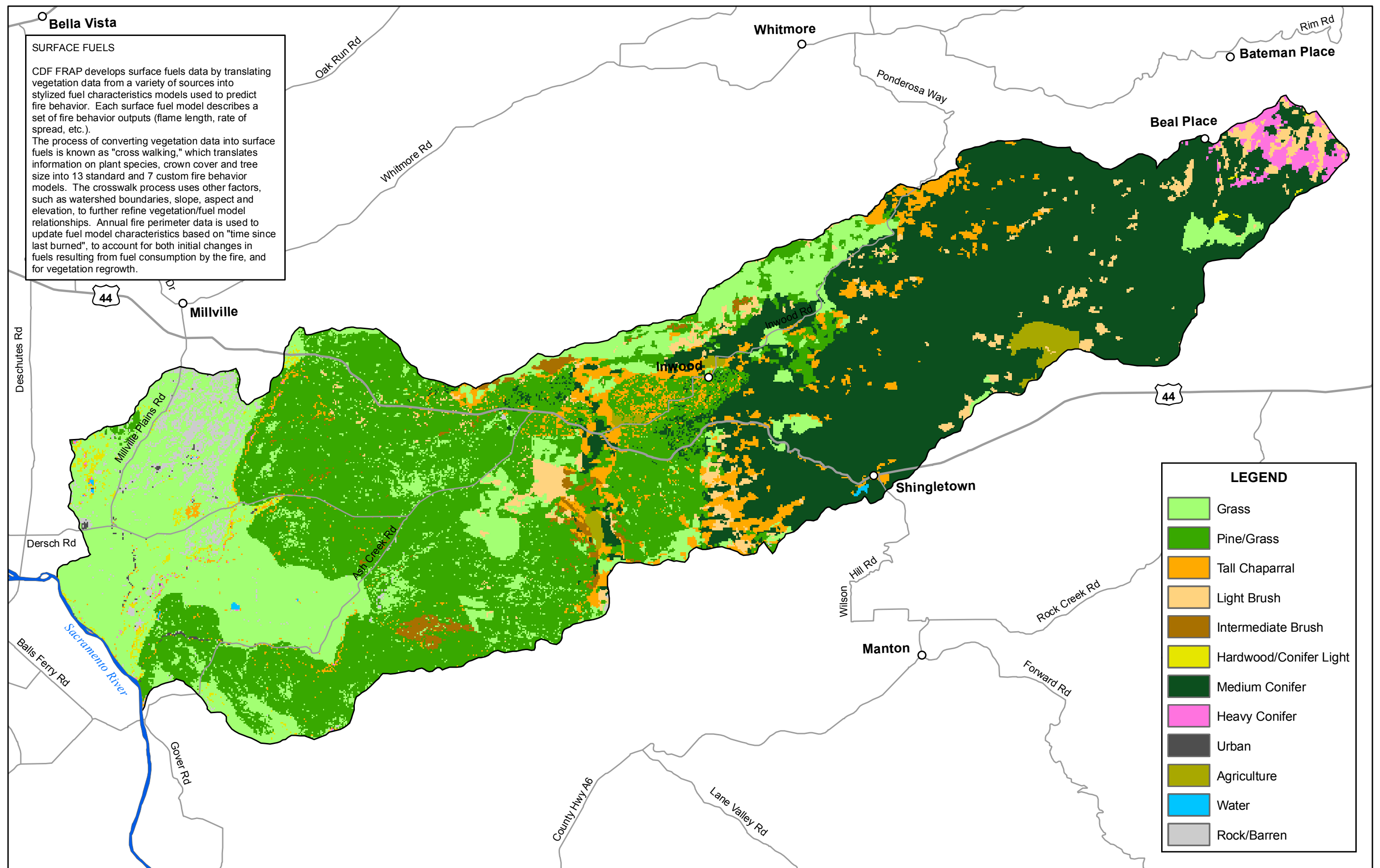


Figure 10-2
California Department of Forestry and Fire Protection Surface Fuels Classification 2004
Bear Creek Watershed Assessment 2005

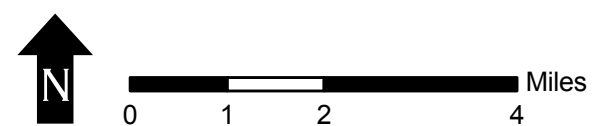
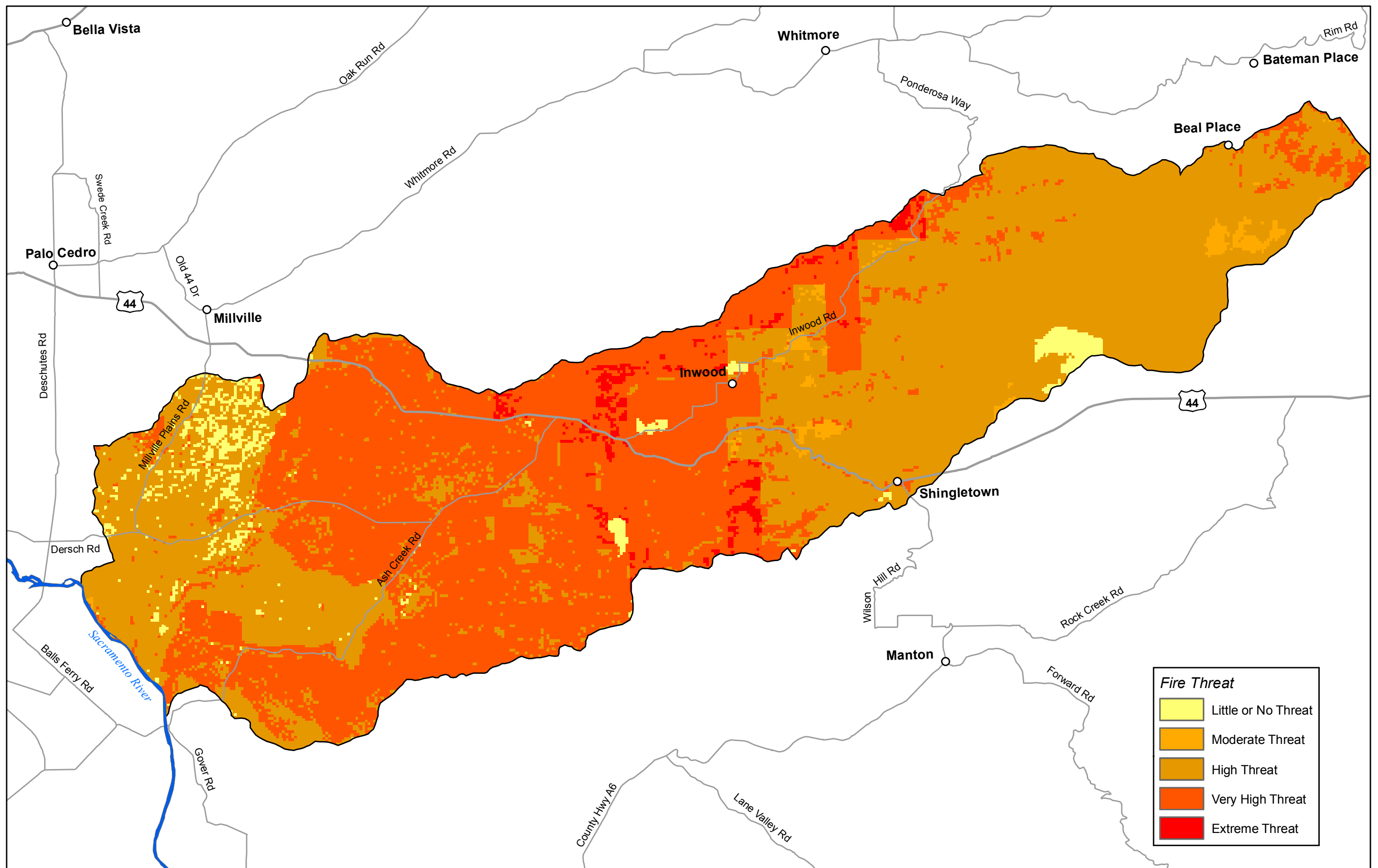


Figure 10-3
California Department of Forestry and Fire Protection Fire Threat Rating 2003
Bear Creek Watershed Assessment 2005

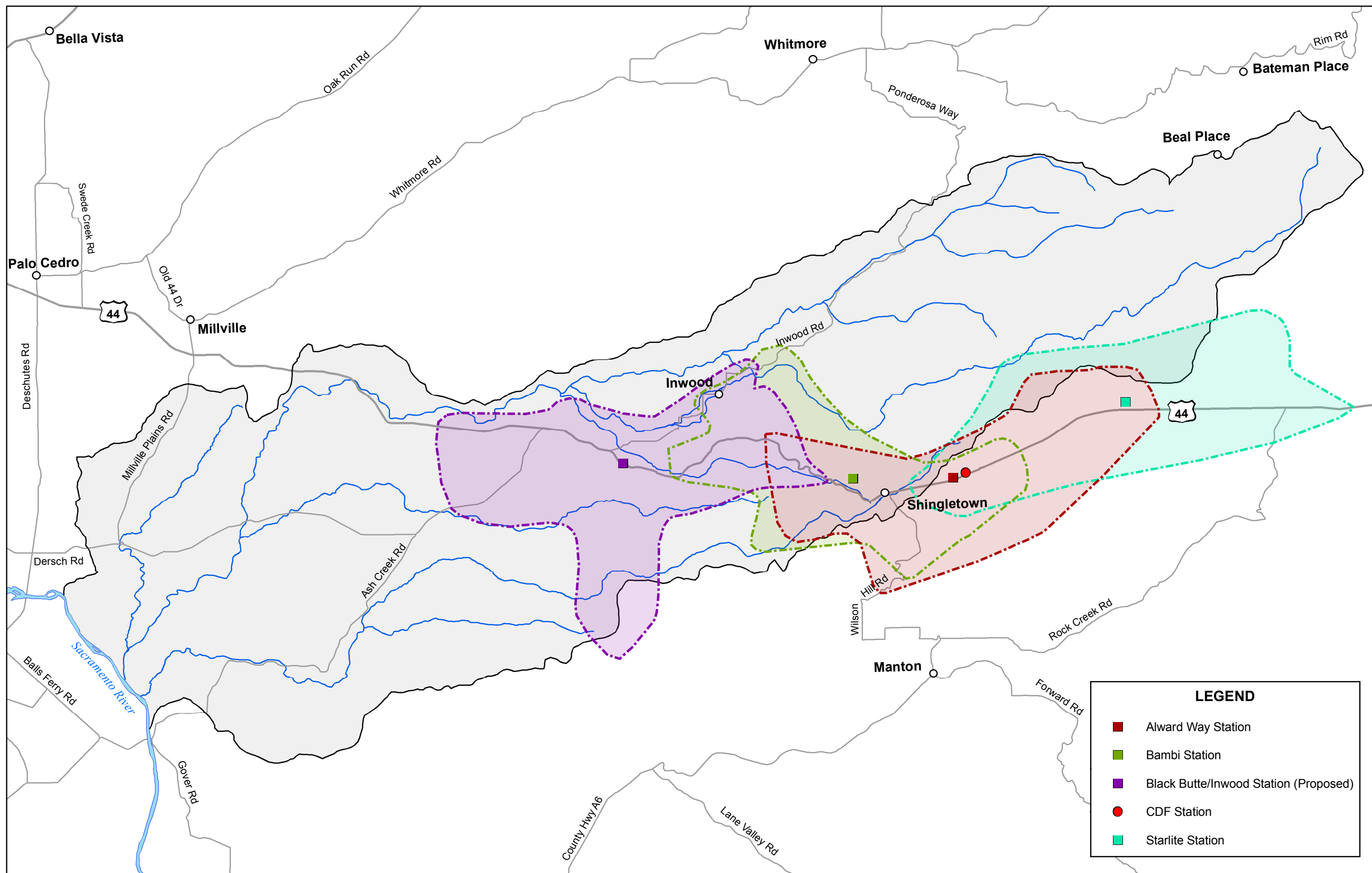


Figure 10-4
Shingletown Volunteer Fire Station Company Response Areas
Bear Creek Watershed Assessment 2005

XI. CULTURAL CHARACTERISTICS

11.1. Introduction

The Bear Creek watershed includes a diverse range of biotic communities and physiographic characteristics within its grassland, oak-woodland, and coniferous forest that are favorable for human occupation and utilization. Resources within the Bear Creek watershed have been utilized by humans in a variety of ways for at least 5,000 to 7,000 years resulting in various imprints upon the landscape. By use of historical and archaeological discourse, these imprints can be studied in order to provide insight into how the watershed contributes to shaping cultural characteristics, and how cultural characteristics contribute to environmental manipulation of watershed resources.

Humans utilize resources and manage their landscape in order to fulfill specific needs, resulting in impacts to the environment. These environmental impacts vary according to the nature and extent to which the environment is modified; the nature and extent of this environmental modification is determined by particular cultural characteristics, and the frequency in which various types and quantities of resources are exploited. At the same time, the environment with its limited and native resources plays a role in shaping particular cultural characteristics, especially in the absence of transportation, intensive trade, and the introduction of exotic floral and faunal resources.

Prehistoric inhabitation and cultural characteristics within the vicinity of the Bear Creek watershed began at least 5000 years ago and continued into the middle 19th century. In general, prehistoric inhabitants of the watershed were complex hunter-gatherers who practiced a transhumance subsistence strategy consisting of the exploitation of various native resources for use within the local economy and in limited trade. Seasonal and intermittent resource exploitation allowed for specific faunal and floral communities to regenerate prior to further exploitation. Throughout California, surplus resources and/or resources that were bound to particular geographic environments or cultures (such as acorns, obsidian, shell, salt, baskets, ceramics, asphaltum, dogs...etc.) were commodities distributed throughout California and the Great Basin by means of sophisticated exchange systems and networks. Prehistoric population densities did not grow beyond that which the immediate environment could sustain because populations did not rely on agriculture and were interdependent on territorial resources. The most significant environmental modification made by prehistoric inhabitants of the Bear Creek watershed may have been systematic burning in order to manage the ecosystem they inhabited.

European-American use and inhabitation within the vicinity of the Bear Creek watershed began in the 1830s. In general, early European-American inhabitants within the Bear Creek watershed practiced a sedentary agricultural/ranching subsistence strategy which consisted of the exploitation of land in order to produce and maintain native and non-native resources for use in the local, state, and national economies. Indeed, their culture and mobility provided them with the ability to travel thousands of miles with the necessity and means to construct dams, ditches, fences, mills, mines, and permanent structures, in addition to introducing non-native plants, seeds and animals into their environment. Population densities could exceed that which the immediate environment could sustain because of advanced storage techniques and exportation/importation of resources by means of horse, wagon, train, boat/ship, and automobile/truck. European-Americans' most significant and lasting impacts to the watershed environment are related to the exclusion of

fire, the introduction of exotic plant and animal species, logging, mining, water diversion and management, and stock grazing.

Cultural traits of Californians have changed in recent times due to the realization that natural and cultural resources are disappearing at an alarming rate as a result of mismanagement and over-utilization of those resources. These changes have resulted in placing higher economical values on identifying, managing, sustaining, and/or protecting renewable and non-renewable natural and cultural resources. As such, it is imperative to gain a broad understanding of the natural and cultural resources present within the Bear Creek watershed in order to access the ways by which to better manage them.

This document will provide a cultural context for the Bear Creek watershed. The objective of this document is to provide a centralized database of information as it relates to the culture and history of the watershed. Cultural contexts will be presented separately for prehistoric (up to 1830) and historic time (1830 to 1955), and will provide data that illustrates the various interactions and relationships of humans and the Bear Creek watershed environment over the past 5,000 to 7,000 years. The final portion of this document deals with more modern issues relating to Census 2000 information and statistics for the Bear Creek watershed.

11.2. Prehistoric Cultural Context

ETHNOGRAPHIC CONTEXT

Ethnographic descriptions are derived primarily from ethnographic and linguistic studies conducted during the late 19th and early 20th centuries. During this time, anthropologists collected data during field studies and through interviews with primary and/or secondary informants. Ethnographic descriptions provide insight into the cultural characteristics and territorial boundaries of native Californians at the time of European-American contact (1830s). The data also provides a foundation by which to test ethnographic assertions through archaeological discourse.

At the time of European-American contact (1830-1840), the Bear Creek watershed was inhabited by the Central Yana, Southern Yana, and *Dau-nom* Wintu, also referred to as the Bald Hills Wintu (Johnson 1978; LaPena 1978). The Central Yana inhabited a majority of the watershed, with a small portion of the watershed (near Ash Creek) inhabited by the Southern Yana. The Bald Hill Wintu territory included the western portion of the entire watershed at its border with the Sacramento River Valley. In addition, the Atsuge branch of the Atsugewi territorial boundary was located about five miles east of the headwaters of Bear Creek, however because of their location outside of the watershed, they will not be discussed here. It must be noted that discrepancies exist among various ethnographers and archaeologists regarding exact territorial boundaries, especially between the Yana and Wintu. Hamusek (1988) notes that these discrepancies may reflect the unsettled conditions that existed between the Yana and Wintu prior to European-American contact.

THE YANA

Knowledge of the Yahi Yana is extensive as a result of detailed anthropological studies of Ishi. In 1911, Ishi was found near Oroville. He had been in hiding since the mass genocide of his people during the middle to late 1800s. Much of what is known of the Northern and Central Yana is inferred through studies of Ishi, or was obtained through informants of surrounding tribes, who were usually not on good terms with the Yana. The

following description of the Yana is derived primarily from the summary work of Johnson (1978) and Baumhoff (1957) unless otherwise indicated.

The Yana belong to the family of Hokan speakers, a linguistic stock whose members are found sporadically from California to Central America. Based upon linguistic differences, four divisions of Yana are recognized and include the Northern, Central, Southern, and Yahi Yana. In general, the Yana inhabited the upper Sacramento River Valley foothills and mountains east of the river.

Yana political organization consisted of numerous tribelets, which included a major village with a chief and several smaller allied villages. Territories were claimed by each tribelet, and there was private ownership of land, seed tracts, and fishing places among some Yana. The Central Yana built earth-covered multi-family dwellings and assembly houses. Conical bark houses were also constructed.

The Yana practiced a semi-sedentary subsistence/settlement pattern. Main villages consisting of earth-covered multi-family dwellings, assembly houses, and/or conical bark house were occupied during all months except summer, at which time the Yana migrated to elevations above 2,500 feet in order to find food and escape the heat. Throughout the year, various ecological zones were exploited in seasonal rounds at the peak of their output. The main staples of the Yana diet included acorns, deer, and fish. In addition, a variety of other floral and faunal resources were utilized. Acorns (the most important food source), were gathered in late September and October, and during good years the supply would last until the next harvest.

The Yana utilized a wide variety of resources in the production of tools and other utilitarian items. Textiles such as basketry, cords, ropes, and nets required a variety of plant materials including hazel, willow, pine roots, sedge, milkweed fiber, Indian hemp, and bark. Clothing was made from buck, elk, and deer skin, in addition to bark and tules. Blankets were made from skins of rabbit, deer, wild cat, coyote and bear. Mahogany, juniper, hazel, and yew were utilized in bow production, oak was used for digging sticks, and a variety of other woods were utilized for arrow shafts and fire drills. Projectile points were made from locally available basalt, in addition to obsidian, and glass. Obsidian was acquired through trade, and glass was available post-European-American contact. Grinding tools such as hopper mortars, manos, metates, and pestles were used; bedrock mortars were apparently not used.

THE WINTU

A great deal is known about the Wintu as a result of detailed ethnographic studies and the group's survival. The following descriptions of the Wintu are derived primarily from the summary work of LaPena (1978) unless otherwise indicated.

The Wintu belong to the family of Penutian speakers, a linguistic stock whose members are found throughout California within four main language families including Wintuan, Maiduan, Yokutsan, and Utian (Moratto 1984). Wintuan language subgroups consist of Wintu (Northern Wintun), Nomlaki (Central Wintun) and Patwin (Southern Wintun) (Kroeber 1925). The Wintu are further divided into nine major groups based upon their geographic location, one of which includes the *Dau-nom* Wintu, also referred to as the Bald Hills Wintu (DuBois 1935). In general, Wintu territory covered parts of what are now Trinity, Shasta, Siskiyou and Tehama Counties. The western portion of the Bear Creek watershed was inhabited by the Bald Hills Wintu.

The basic unit of Wintu life was the family, while the village, or tribelet, was considered the social, political and economic unit. A chief headed each village (LaPena

1978). "Flats on the banks of streams were the favorite site for a village, which consisted of bark houses numbering from four to five to several dozen" occupied by 20 to 250 people. Houses were occupied by three to seven family members, and villages containing 12 to 15 dwellings or more (ca. 50-70 persons) also had an earth lodge. Earth lodges were circular, 15 to 20 feet in diameter with a center post and served as a gathering place for men (DuBois 1935).

The Wintu subsistence/settlement strategy was similar to many other California groups, and was based on seasonal transhumance and the exploitation of vegetal resources, fish and game. The Wintu lived in permanent villages during the winter, subsisting mainly on stored foods. In the spring and summer months they occupied resource procurement camps (in brush shelters) usually located no more than three to four days walk from the main village. Resource procurement activities consisted of the collection of plant foods, fishing and hunting (La Pena 1978). Food resources were periodically returned to the base camp for storage, which was guarded by old people unable to participate in the gathering rounds (DuBois 1935:29-29; Moratto et al. 1994).

Wintu diet/subsistence focused on three predictable resources — acorns, deer and salmon — which were of high nutritional value, easily stored, and dependably available on a seasonal basis. Acorns and seeds were prepared using a hopper mortar to grind them into flour which was then used in soups, mush and bread. Other plant foods included manzanita and other berries, grass seeds, tubers, fungi, nuts, buckeye and a variety of herbs, some also used for medicinal and religious purposes. Meat supplemented the diet and consisted of deer, bear, rabbit, quail and small game such as gophers, rodents and squirrels which were hunted both communally and individually. Salmon, trout, suckers and other fish were caught from the Sacramento River and its tributaries, depending on the season (LaPena 1978). The fall salmon catch (September) was a community event in which the salmon was dried for winter use. The spring run in March was a family, rather than communal event, and salmon were often harpooned by fishermen sitting atop a salmon house constructed over the river (DuBois 1935:122). Grasshoppers were obtained by encircling a grassy area, driving the grasshoppers into the center, and then setting the grass afire. After the blaze subsided, the wingless grasshoppers were collected.

Woodland, grassland, and riverine environments provided the Wintu with a variety of materials suitable to a wide range of economic activities. The Wintu manufactured many implements for their own use as well as for trade including bows, arrows, spears, clubs, slings, ropes, nets, rafts, basketry, clothing of hides and pelts, pipes, and a variety of other utilitarian and non-utilitarian items. Local toolstones included basalt, mottled chert, granite and various meta-igneous and mafic rocks. Obsidian was obtained from Glass Mountain approximately 60 miles northeast in the Modoc territory, and through trade from the Shastans near Mount Shasta. Extensive trade existed within and between various Wintu villages and tribelets, and limited trade existed with the Shasta, Pomo and Chimariko people residing in areas adjacent to Wintu territory. Merriam (1967:265) indicates that food exchanges were frequent between the Wintu of the McCloud area and those of the Trinity. Silver (1978) reports that the Wintu traded beads, deer hides, and woodpecker scalps for obsidian and dentalia shells with the Shasta. The clam disk money utilized by the Wintu was obtained from the south; the farther north clam disks moved, the more valuable they became.

ARCHAEOLOGICAL CONTEXT

Systematic archaeological investigations conducted in Shasta County over the last 60 years are beginning to provide a picture of the complex prehistory of the region. Most archaeological work within the Bear Creek watershed has been conducted in association with development projects and timber harvesting. Work related to development projects are conducted by qualified archaeologists as required by state and/or federal permitting agencies. Within the last five to ten years, archaeological training has been provided to timber harvest personnel in order to improve their ability to identify and manage/avoid archaeological sites on lands they own and/or lease.

Current records at the Northeast Center of the California Historical Resources Information System at California State University, Chico indicate that roughly 19 percent (about 19,200 of 100,583 acres) of the watershed has been subjected to archaeological pedestrian surveys. Over 100 prehistoric and historic archaeological sites and features have been recorded as a result of those surveys, in addition to a number of unrecorded reported sites and resources. The prehistoric sites include villages, temporary/seasonal camps, tool procurement/manufacturing sites and debris, petroglyphs, and other cultural resources. The historic sites include homesteads, hydraulic power plants, foundations, trash pits, ditches, trails, roads, rock walls, barbed wire fences and other resources related to historic settlement, ranching, milling, and development. Very few of these sites have been subjected to systematic archaeological investigations. As such, there is a great potential that these, and yet to be identified sites can provide valuable research information that can address local and regional questions relating to subsistence patterns, trade, technology, social structure, economic activities, and population densities within the watershed over the past many millennia.

Systematic archaeological investigations began in Shasta County during the 1930s and 1940s with the construction of Shasta Dam. A large number of sites were recorded along the Sacramento, Pit and McCloud Rivers, and Squaw Creek (Smith and Weymouth 1952). The majority of these sites were midden deposits. The Wintu occupation of the area, believed to begin by 1000 years ago, is characterized by tool assemblages from three sites recorded along the McCloud River (Sundahl 1992), and is identified as the Shasta Complex, also referred to as the Redding Aspect of the Augustine Pattern (Meighan 1955).

Baumhoff (1957) proposed a temporal sequence for the Yana based upon his work at Kingsley Cave in 1954 and Payne Cave in 1957, and identified the prehistoric period Kingsley Complex and the proto-historic period Mill Creek Complex. His work showed that the Yana had been present locally for as long as 3000 to 4000 years (Moratto 1984:559).

Investigations by Shasta College (Clewitt and Sundahl 1980, 1981, 1982) along the Clikapudi drainage identified four prehistoric assemblages (three preceding the Shasta Complex) indicating human occupation approximately to 4000 years before present (B.P.). The Yana occupied the site from 1740 to 860 years B.P.; the Wintu occupied the site thereafter.

Work by Vaughan, Sundahl and Tyree (1994) at a prehistoric site located on Dry Creek suggests the site was continuously occupied for approximately 3,500 years, with the possibility of an earlier occupation circa 4,500 years B.P. Analysis of groundstone from the site indicates that site inhabitants were probably Yana. The site was defined as a temporary hunting camp utilized by the Yana and their predecessors.

Hamusek (1988) evaluated a prehistoric site located in the foothills near Manton in Tehama County. The site is associated with the late Kingsley (1,500 to 2,000 years B.P.) and middle Dye Creek (700 to 1,500 year B.P.) periods identified for the Southern Yana and

Yahi Yana, with the possibility of an earlier occupation. The site is defined as a temporary hunting camp that was occupied yearly during the seasonal round.

Archaeological and ethnographic evidence suggests that people of proto-Hokan language groups were present in the Sacramento Valley as early as 6,000-8,000 years ago and were slowly displaced upon the arrival of Penutian speakers from the north, northeast, and south (Moratto 1984:543-564).

Additional archaeological investigations have been conducted in the Redding area and the Northern Sacramento Valley by Basgall and Hildebrandt (1989), Clewitt (1977), Tyree (1992), and Tyree and Sundahl (2002). The results of their studies classify cultural remains into several different temporal/cultural taxonomic systems and demonstrate human occupation within Shasta County as early as 6,000-8,000 years ago.

PREHISTORIC LAND MANAGEMENT

Many of California's hunter-gatherers achieved a status of "proto-agriculturalists": they sowed wild seeds, planted and/or tended native root crops, greens, and tobacco; pruned plants to stimulate growth; planted wild grapes; irrigated desired plants; and used "quasi-agricultural" techniques to harvest (and store) acorns, grass seeds, mesquite and pine nuts (Bean and Lawton 1973). Wild tobacco was planted and grown by the Wintu, Maidu, and other tribes in the region, and Native Californians managed fish resources in various ways. Within Northwestern California the anadromous fishery was the most important and probably most intensely manipulated food resource (Moratto 1984).

There is scant ethnographic evidence that fire was used specifically among the Wintu or the Yana. Only one reference is made to the Wintu using fire in order to trap and harvest grasshoppers (DuBois 1935). However, there is ample ethnographic evidence that fire was used by surrounding tribes of the Wintu and Yana, such as the Shasta, Maidu, Karuk, Hupa, and Miwok. These groups practiced advanced basket making techniques, as did the Wintu and Yana, and the Karuk and Shasta were known to have systematically burned vegetation to increase the quality and quantity of raw materials necessary for basket making. Fire was used extensively across California to increase the yield of edible seeds, encourage growth of desired plants, flush and drive game, provide forage for deer and elk, and clear ground below oaks and pines to facilitate nut harvests (Lewis 1973). Systematic burning was the single most important environmental modification by the California Indians, allowing them to control plant successions and, locally, to maintain biotic communities such as grasslands and oak savannas (Moratto 1984). Bean and Lawton (1973) indicate that 15 of 19 groups within the Great Basin burned vegetation; and that seven of 19 groups sowed wild seeds after burning.

Field research on the ecology of fire has been carried out on grass, brush and forest land. Some of the studies offer conclusions which make it possible to understand the broader ecological features of Native American burning patterns (Lewis 1973). Studies by Blackburn and Anderson (1993) indicate that Native American burning practices may have played a fundamental role in the evolution of California's chaparral. Spanish accounts describe not only Indian burning practices, but also certain edible seeds of grasses that may no longer exist. The historic cessation of burning, along with the spread of exotic plants and livestock, may have brought to extinction some floral species once important to California Indians (Moratto 1984). Ethnobotanical studies at archaeological sites in the Sacramento Valley could provide significant data to test this claim.

Historical accounts by pioneers and early settlers indicate that the Wintu sometimes used torches in communal fish drives, and trout from Hat Creek were planted in Manzanita Lake by Chief "Bob" Shave Head of the Pit River Tribe (Smith 2004).

Systematic burning and resource management by the Wintu and Yana can only be inferred based upon the practices of surrounding tribes, and our knowledge that surrounding tribes exchanged commodities, and cultural characteristics diffuse. However, additional archaeological data is still needed in order to determine to what extent Native Californians manipulated the environment within the Bear Creek watershed.

11.3. Historic Cultural Context

Historic use within the vicinity of the Bear Creek watershed by European-Americans began during the late 1820s when the expeditions of Jedediah Strong Smith and Peter Skene Ogden traveled through the Sacramento Valley. Permanent European-American settlement in Shasta County occurred and expanded as a result of the acquisition of the Rancho Buenaventura land grant by Pearson B. Reading in 1844, gold mining in 1849, the Homestead Act of 1862, the arrival of the Central Pacific Railroad in 1872, the copper boom of the 1890s, and the Central Valley Project of 1935. Early settlers of Shasta County were generally of European descent and consisted of miners, and businesses/industries serving the needs of miners.

The *History and Business Directory of Shasta County* (Franks and Chappell 1881) advertises the Bear Creek Valley as a place which provides perfect land for agriculture, horticulture, and stock raising, due to access of free pasturelands and unoccupied lands. The directory was targeted towards emigrants and immigrants. Indeed, timber, stock, and agricultural products of the watershed played an integral role in allowing Shasta County to support the mass migrations of people onto its lands.

European-American population increases and development of the Bear Creek watershed brought to light the gap between California Indian and European-American cultures. The Yana and Wintu of the watershed quickly became a minority among a new dominating culture with a completely different set of subsistence patterns, technologies, beliefs, and values. Within a 14 year period, from 1849 to 1863, the Yana and Wintu were completely deprived of the means to live as they had centuries before.

ETHNOHISTORY

The following descriptions are provided in order to represent the historical context of the area from the perspective of the native inhabitants. In general, this section provides information relative to relations between the native inhabitants (the Yana and Wintu) and European-Americans from date of contact (during the 1830s) to the early 20th century. Descriptions are derived from works of LaPena (1978), Johnson (1978) and Smith (1999), unless otherwise indicated.

The Wintu's first extended encounter with European-Americans occurred in 1826 and 1827 when fur trappers led by Smith and Ogden appeared within the Pit and Sacramento River Basin. Oregon trappers unintentionally introduced malaria to the area, and epidemics between 1830 and 1833 are known to have decimated the California Indian population living along the Sacramento River, including the Wintu, by 75 percent. This disaster prevented the Wintu from effectively meeting the challenge of European-American occupation (LaPena 1978). The Yana's first encounter with European-Americans was limited prior to 1845. Due to their remoteness from the centers of Spanish and Mexican

missions and regimes, the Yana had managed to escape the initial decimation that affected many California Indian tribes (Vaughan, Sundahl, Tyree 1994).

European-American settlement and cultural patterns began to excessively interrupt the lives of the Wintu and Yana in the mid 1840s when two land grants were issued in Shasta County (then under Mexican ownership) along the Sacramento River. Many Indians worked as laborers on the ranchos and were exposed to agricultural practices, in addition to exotic plants, animals, and diseases. In 1846, Captain J.C. Fremont slaughtered 175 Wintu and Yana near Battle Creek. In 1848, more intensive contact between European-Americans and the Yana began with the opening of the California-Oregon Trail, which crossed Northern and Southern Yana territory, and the Lassen Trail which ran through Yahi territory (Vaughan, Sundahl, Tyree 1994).

In 1849, the Gold Rush served as the catalyst for mass European-American migration into Shasta and other surrounding counties via the California-Oregon and Lassen Trails. Most of the emigrants from Oregon and the eastern United States brought with them the cultural disposition of despising, fearing, and dominating Indians. Many fears were justified due to harrowing experiences of emigrants that occurred on the trails joining the western and eastern United States. The placer gold deposits that miners sought were located along the confluence of streams tributary to the western side of the Sacramento River; Wintu villages were generally located in these same areas. Miners, consisting mostly of independent desperate men, soon flocked into these streams in search of gold, thus, displacing the Wintu. Some Wintu were used as laborers by the miners, and some retreated into the foothills of the eastern Sacramento River Valley. There are more than a handful of accounts in which miners befriend Indians so that Indians would show them where rich gold deposits were located. The Indenture Act of 1850 was a human slavery indenture law giving European-Americans additional opportunities to exploit the Wintu and other Indians. The Act allowed Indians to be seized, sold, or held as virtual slaves on a charge of vagrancy. Exploitation of the Act ran rampant. It was the closest California ever came to emulating the slave economy of the south. The Act was repealed in 1863, but the practice continued.

In 1851, the Nobles' Emigrant Trail became the preferred route into the northern Californian gold fields. The trail followed the ridgeline between the south fork of Cow Creek and the north fork of Battle Creek, the approximate border between Central and Southern Yahi territories, then descended into the Sacramento River Valley (Vaughan, Sundahl, Tyree 1994). By this time, woodlands and forests within Yana and Wintu territory were being altered through European-American activities associated with cattle grazing, mining, logging, and population growth. Wintu and Yana lands were being overrun and over-grazed by cattle and sheep, destroying resourceful grasslands and woodlands; streams were being over-fished and polluted by mining activities, especially with the introduction of hydraulic mining after 1855; forests of giant sugar pines were completely clear cut; fences were erected, which altered the migration patterns of game and the exploitation patterns the Wintu and Yana; and game became scarce due to over-hunting. As a result, it became extremely difficult for the Yana and Wintu to obtain adequate food supplies through their traditional subsistence strategies. It was at this time the Yana began raiding white settlements for food, resulting in intense conflicts.

Two verbal treaties and one written treaty are known to have taken place between Indians and settlers in Shasta County. The written treaty was known as the Cottonwood Treaty, and was drawn up in 1851 by an agent of the federal government and a group of Shasta County Indians; however, not all tribes participated. The treaty was signed in good

faith by the Indians and the agent, and called for the establishment of reservation lands extending from Ash Creek east to the Pit River, and from the Pit to its confluence with the Sacramento River. The treaty, along with 18 others that were drawn up in California during 1852 was never ratified because the California legislature buckled under pressure levied against legislatures to remove Indians from the lands. When settlers began settling in the reservation lands in that same year, it was obvious to the Indians that European-American settlers and the U.S. government could not be trusted (Smith 1999).

In 1852, Fort Reading was established as a military post/reservation in the interest of the Indians, but did little to protect the Wintu and Yana. In 1854, the Nomi Lackee Indian Reservation was established in Tehama County. Many Yana and Wintu from Shasta County were forced onto this reservation which held between 300 and 2,500 Indians. Between 1852 and 1860, various campaigns were launched against the Wintu and Yana by miners and settlers. Army and civilian troops hunted down the Trinity and Bald Hill Wintu in an official "Wintoon War" lasting six months between 1858 and 1859. Wintus were either killed, or captured and marched to reservations.

The Homestead Act of 1862 brought more settlers into Shasta County. In addition to homestead patents made by individuals, large plots of land were monopolized for grazing resulting in the introduction non-native seeds, grasses and plants. Ruminates also tended to graze on many of the same floral resources utilized by the Yana and Wintu. This put additional pressure on Yana and Wintu subsistence patterns. With little other option, the Yana continued raiding white settlements.

In 1864, the William Allen Family homestead was raided resulting in the deaths of all but William Allen and one son. On the following day, Mrs. Jones was shot and killed by Indians in Bear Valley. A posse of friends and family from Millville, Oak Run, and Ball's Ferry pursued and retaliated with the death of 80 to 100 Yana and Wintu, most or all of whom were innocent. On October 8, 1865, the Millville Resolution resolved the intent of settlers that all Indians were to be exterminated or expelled from the east side of Sacramento River. In 1866, all Indians from the Nomi Lackee Reservation and subsequently captured Indians, were forcibly marched to the Round Valley Reservation on the Mendocino coast. Reservation conditions were disparaging, and neighboring tribes who were traditional enemies were forced to live amongst each other. Also in 1866, fifteen Indians raided the Dersch ranch, resulting in the death of 35 year old Marie Dersch. Following this incident, the Millville Volunteers reorganized under the command of Captain John Boyes and Supervisor Demarcus Lack Sr., and raised money to "defray the expenses of the volunteers while they hunted and killed Indians". The Pine Grove Volunteers also organized at this time under the direction of Captain George Schuler. Both groups hunted and killed numerous innocent Wintu and Yana peoples.

Pre-European-American contact population estimates are 300-500 Central Yana and 300-500 Southern Yana in 1848, among a total Yana population of 1,100-1,800. By 1884, only 35 Yana could be accounted for. By 1928, only three Yana remained among the total population. Although a malaria epidemic introduced by trappers was responsible for the deaths of approximately 75 percent of Indians living in the Sacramento Valley between 1830 and 1833, Yana population estimates indicate that the largest population reductions occurred between 1852 and 1884. The reductions and eventual loss of the Yana people and culture was the direct result of various European-American massacres and forced settlement of Indians onto reservations.

Pre-European-American contact population estimates for the entire Wintu population are estimated at 14,250. In 1852, their population was estimated at 3,500. By 1910, only

395 Wintu remained. Population reductions were the result of disease, various massacres and the forced settlement of the Wintu onto reservations. Since 1910, Wintu population has grown with the largest increases occurring over the last 30 years.

During the late 19th century, the Wintu underwent a period of religious revival, and many of their older practices were modified or replaced. In 1892, Indians were finally allowed to receive either an 80-acre or a 160-acre land allotment; the better land was limited to the 80-acre option. Much of this land was claimed by members of the Wintu Tribe, but is now located beneath Shasta Lake, the Mc Cloud and the Pit River. In 1889, a petition by the Wintu and Yana was given to President Benjamin Harrison, who declared there was land for the Indian, but he did nothing to establish boundaries or offer protection of land rights. 1915 marked the first year in which the Wintu population increased, from 395 to 701; however, it declined to 380 in 1930. It was not until 1924 that Indians could become US citizens and receive voting privileges; in 1928 they could attend public schools. Wintu population was estimated at 900 in 1971.

MEXICAN LAND GRANTS

The following descriptions are summarized from Petersen (1965) and Smith (1999, 2004).

On July 26, 1844, the first Mexican land grant in Shasta County was issued within a portion of the Bear Creek watershed. The 22,000-acre Rancho de Briesgau was located on the east side of the Sacramento River, and included the western margins of Battle, Ash and Bear Creeks, as well as Bloody Island. John Sutter visited the grant under the authority of the Mexican government with would-be owner William Bennitz, suggested the name, helped determine boundary lines, select a home site, draw up a map, and left Julian in charge (Julian later stayed at Pierson B. Reading's grant across the Sacramento River). The land was officially granted on July 26, 1844, to Bennitz by Mexican Governor Manuel Micheltorena, however it was never confirmed because Bennitz never took possession. Because Bennitz never returned to claim the grant, others settled and farmed it including Pierson B. Reading who planted crops on a portion. As a result, Rancho de Briesgau is sometimes confused with Rancho Buena Ventura. Bennitz had sold interests to the land by 1856 to G. W. Beckh, Charles Carrens and Ernest Rufus who took in Jeremiah Clark as a partner. These four men dealt with 12 different men who lived on the grant and filed squatter's rights. An agreement was made in 1856 whereby each paid 62 cents for each acre claimed.

Pierson B. Reading's Rancho Buena Ventura, located on the west side of the Sacramento River across from the Rancho de Briesgau, was granted in December 1844. The 26,632-acre grant bordered 19 miles on the western side of the Sacramento River from Cottonwood Creek to just south of Salt Creek. By 1847, 40 acres of the land grant had been cultivated with pear and olive trees, grapes, cotton, grains, vegetables, and shade trees. Ranch work was performed by Indians who lived on the rancho. The rancho housed considerable military forces for use as a stronghold against Indians until 1852.

MINING

The following is summarized from Petersen (1965), Vaughan (1996), and Smith (1999, 2004), unless otherwise indicated.

No intensive gold, silver, or copper mining has taken place within the Bear Creek watershed. Low quality coal deposits were found north of the Bear Creek watershed at the

head of Little Cow Creek in 1882, and low-quality coal mined by the Shasta Coal Mining Company was used by pioneer blacksmiths. In addition, a Shasta Courier newspaper article from June 5, 1875, stated that interest in the Bear Creek area mines remains unabated. It further stated, "...though there is a temporary cessation of labor thereon, from the specimens of rock shown me, they have very good indications of striking a rich silver bearing quartz, of a bluish gray color similar to the rock taken from the rich lodes of Nevada. A great amount of labor will be required to develop these mines and he who expects pay from the start, had best seek some other occupation" (Smith 2004).

According to an interview with Alex Thatcher in 1930 (Southern 1971), Ezekial Thatcher and Bill Asbury hauled rock from a quarry on Dry Creek for the foundations of the buildings at Fort Reading. Other quarry mining probably took place at many of the stream heads within the watershed.

Historically, mining was Shasta County's largest industry. Although little to no mining took place within the watershed, activities associated with the mining industry, and concomitant population increases within Shasta County played a direct role in affecting resources and cultural characteristics within the watershed. Timber from the Bear Creek watershed, both plentiful and of high quality, provided the means by which towns could develop, mining equipment could be manufactured and ore could be processed; cattle and agricultural products from the watershed also provided goods to the growing county.

The California Gold Rush began in Shasta County following the discovery of gold by P. B. Reading on Clear Creek in the spring of 1848. Within a few months of the find, camps sprang up all along the creeks in western Shasta County. Boom towns such as Shasta, Horsetown, Texas Springs, Whiskeytown, French Gulch and Gas Point flourished for a few years, and regressed into the status of ghost towns or into small agricultural communities. The success of the first rush of mining lasted about 10 years until 1860. During this time, gold was extracted through two primary methods: (1) placer mining, which involved the removal of gold from sediment through gravitation, and (2) lode mining, which involved the use of adits and drifts to reach gold bearing ore. Wood was required to construct boom towns and a majority of the equipment used in traditional, drift, and dredge mining operations.

By 1860, a large crescent-shaped mineral belt was discovered in Shasta County that extended north, east, and west of Redding. Minerals in the belt consisted mainly of copper, but also included clay products, silver, iron ore, pyrite, zinc and some gold. Extensive copper mining began near the town of Keswick in 1896. By 1897, copper mining became Shasta County's leading exported mineral. Zenith years for copper mining were 1906-1907 when Shasta County produced and processed more copper than any other county in the United States. Thousands of men were employed in the copper mines, smelters, and other related businesses.

Five copper smelters were located in Shasta County and operated at Kennett, Keswick, Bully Hill, Coram, and Ingot. Copper smelters were required to extract copper from heated ore. Heating ore required massive amounts of timber. Ore was burned or heap roasted at the smelters, creating airborne poisonous sulfuric dioxide fumes that were transported by wind, killing vegetation and animals. The fumes damaged or eliminated vegetation over an area greater than 153,000 acres, extending from the Sacramento Canyon to Red Bluff. The last smelter terminated operation in 1919 as the result of legal action brought against the smelters by Shasta County citizens.

The Bear Creek watershed has not been directly subjected to the devastating mining-related environmental modification that occurred within many of Shasta County's

watersheds. However, mining did have an indirect negative affect on faunal and floral resources within the watershed, as plants and animals within the watershed would have been affected by smelter fumes.

LUMBER INDUSTRY

The following is derived from Allen (1979), McNamar (1952), Petersen (1965), and Smith (1999, 2004), unless otherwise indicated.

Historically, the lumber industry was the second largest industry in Shasta County. Early timber production in eastern Shasta County played an integral role in supplying goods to the rapidly expanding populations of Northern California counties. Beginning in the early 1850's and continuing into the 20th century, logging and milling in the Shingletown area provided wood for structures, ferries/boats and docks, wagons, mining equipment, ore processing, and steam production. Once the railroad arrived at Anderson in 1872, timber goods from eastern Shasta County were easily exported to support California's growing populations, in addition to supplying wood for rebuilding San Francisco following the earthquake and fires of 1906.

The beginning of the lumber business in Shasta County dates back to 1844 when P. B. Reading's friend, Sam Hensley, was using the Ball's Ferry area as a launching point for logs he had cut down in eastern Shasta County and was sending down the Sacramento River to Sutters Fort. Permanent lumbering coincided with the Gold Rush, and its demands for buildings and mining equipment. The first mills were the McCumber and the Old Dry Mills in the Shingletown area. In 1856, Rudolph Klotz bought a sawmill in Shingletown near present-day Nora Lake. By 1870, he had acquired the Eureka and Dry Creek mills. Lumber from the Eureka mill was sent to Red Bluff by flumes. Other mills hauled lumber by oxen or horse to Logan's Ferry and the Sacramento River near Bear Creek, and there it was made into rafts and sent down the river as far as Sacramento (Klotz 1958).

Upon the arrival of the railroad in 1872, Anderson and Cottonwood served as shipping points for the lumber from northeastern Shasta County. The Shingletown area was Shasta County's primary timber supply section from 1860 to 1910. By 1882, a rush was on to purchase timber land for \$2.50 per acre. By 1885, there were eight sawmills in the area producing lumber, shakes and shingles.

Yellow and sugar pine provided the bulk of the timber supply. Only the finest, most mature trees were secured by sawmills, because timber was cheap and available for the cutting to anyone. After being fallen and skidded from the fall area via pack teams, and later with the aid of big wheels, timber was sent to the mill by horse and/or oxen teams, or traction engines. The boards were sent to shipping points via flumes, traction engines or teamsters. Traction engines were introduced in the 1890s and could pull several wagons. Over 300 teamsters hauled lumber to Cottonwood and Anderson during the latter half of the 19th century for wages up to \$65 per month, which was good pay at the time. From four to 16 horses would haul a wagon loaded with nearly 8,000 board feet of lumber. A one-way haul took one to three days, and teamsters would stop overnight at ranches along the way, including the Dersches and Hawes. It is estimated that 3.5 million feet of lumber was cut in a single seven month season by the Shingletown mills. In addition, rail connections with Anderson were established by the Terry Lumber Company of Bella Vista in 1897.

After 1912, the lumber industry came to a standstill in Shasta County. The principal cause of this decline was the purchase of a majority of the northeastern Shasta County timberland by the Red River Lumber Company; they also bought out most of the timber holdings and equipment of smaller firms that had been shipping to Anderson and

Cottonwood. Since Red River Lumber could not transport its timber supply across the mountains to their facilities in Westwood, vast holdings in Shasta County became inactive until the World War II period.

Lumbering in Shasta County rose again during World War II. In 1925 total lumber production was approximately 12.5 million board feet. By 1939, the figure was 45 million board feet; a year later it had increased to 73 million, and by 1948 had reached 203 million board feet. By 1955, an estimated 420 million board feet of wood was processed by the major mills of Shasta County.

SHINGLETOWN RIDGE LUMBER MILLS

The intensity of timber harvesting and milling within the vicinity of Shingletown Ridge was determined by a combination of supply, demand, and manufacturing technologies. McNamar (1952) recognizes four distinct harvesting phases as noted below by Smith (2004):

- Only the best logs were milled during this time and tree trunks above the first branches were left on the ground to rot.
- Timber shortages were beginning to be felt. Up to this time, only the best was milled and practically all the tree trunks above the first branches had been left on the ground to rot. Settlers were now selling their land for mere pittance or allowing timber to be taken off their land for 50 or 75 cents per 1,000 feet.
- Timber was by this time less easy to find. People who owned small acreage's began setting up their own mills and cutting timber from their land. Second and third class timber was now being cut. Red fir trees were being cut and sold for the first time. But waste was still going on; much of the tree was being left on the ground.
- The closing of the Ritts Mill marked the close of the 3rd Period. This was a complete close. No buzz saws broke the silence of the ridge. But Mother Nature was restoring her own order in the woods and a new dense growth of trees was being born.

A number of sawmills have been documented within the Bear Creek watershed and lands adjacent to it within the Shingletown Ridge area, including mills operating in the Battle Creek watershed. The following list of sawmills, and accompanying descriptions (Table 11-1) is provided by Smith (2004) with a majority of her information being derived from McNamar (1952) and Smith (1999).

**Table 11-1. Bear Creek Watershed Assessment 2005
Sawmills Documented within the Bear Creek Watershed**

Abbott Mill	Built by a Mr. Abbott on the east bank of Mill Creek on the south side of the highway near Big Wheels sometime after 1900. The mill was built on PG&E land and its purpose was to take off timber killed by the fire. Was a 1 st class mill with steam power and new logging trucks. Destroyed by fire a few years later and not rebuilt. This mill was the beginning of the community of Big Wheels and was the 5 th mill that dominated the banks of Mill Creek in less than an area of two miles downstream from the highway – the McCumber-Vilas, Klotz, Coyoner, Welch, and Abbott Mills.
Betts-Benton Mill	Thomas Hart Benton built a sawmill on Battle Creek in Shingletown (date unknown). He purchased the Betts Sawmill at Plateau in 1895. Purchased the holdings of Bass, Buick and Wengler at Turtle Bay in 1908. Rebuilt the sawmill in 1910 after it burned. Closed the mill in 1916 and moved to Siskiyou County after a flood took a season's worth of logs.

Table 11-1. Bear Creek Watershed Assessment 2005
Sawmills Documented within the Bear Creek Watershed
(continued)

Billy Smith Mill	Owned by William Worthington Lassengree Smith who was known as Billy. Billy traveled to California by wagon train in 1853 and settled at Shingletown. Purchased the Dry Mill (later called the Old Dry Mill) at Shingletown in 1853. Sold the mill in 1856 to George C. Woodall. Built and established the Wayside Inn aka Foot of the Mountain Station beside Nobles' Emigrant Trail in 1858. Settled in Parkville and raised cattle.
Coyoner Mill	Built by a man named Coyoner in 1902 on Mill Creek a short distance downstream from the highway crossing at Big Wheels. Was a small bolt water powered mill with circular saws. Operated for five or six years and cut trees on the land almost logged off by the Vilas and Klotz mills. Sold for its water rights to the Northern California Power Company.
Darrah Mill	Joseph Darrah was affiliated in 1881 with the business of J. S. Darrah & Bros. who manufactured and sold sugar pine lumber three miles north of Shingletown.
Dry Mill	Became known as the Old Dry Mill. Built in 1853 by John Dinsmore in a ravine west of the original Shingletown Store. Was possibly the first sawmill in the Shingletown area. William Smith purchased the mill soon after it was built and sold to George C. Woodall. In 1867 the Dry Mill and Lumber Company was formed with the help of Mr. Dry (first name unknown), millwright; the mill is named for him. Rudolph Klotz and Sylvanus Leach purchased the mill in 1870, greatly improved it and moved part of the machinery to their Eureka Mill.
Moore-Edwards Mill	Built by Ross Edwards and Erwin Moore in the early 1940s along Ponderosa Way, about one mile north of Highway 44. Turned out lumber until 1948.
Eureka Mill	Built in 1868 by Rudolph Klotz and Sylvanus Leach on Battle Creek approximately 1.5 miles above the present Highway 44 crossing at Battle Creek. Built with machinery from the Dry Mill. Was a combination steam and water-powered mill and possibly the first of its kind in Shasta County. Operated a small railroad/ tramway system on a track built of timbers with iron strips on which narrow log cars were pulled to the head rig by mules or horses; each car had the capacity to carry approximately one log. Was one of the four starting points of the Blue Ridge Flume
Fritz-Turner Mill	Located on south fork of Bear Creek about four miles north of Big Wheels. Operated through the 1890s to 1905 by a Mr. Fritz and a Mr. Turner. Was a small capacity mill operated by water power and circular saws. This was the most northerly mill in the Shingletown country. Was sold to the Red River Lumber Company.
Johnson Mill	Built by Herbert Johnson about 1947 on what had been the pioneer Ogburn family place about four miles west of Shingletown. The mill was located somewhat off the highway on the old wagon road that skirted the meadow on the north –the Emigrant Road of 1853. The mill was powered by gasoline and had a capacity of 15,000 feet per day. It had up-to-date logging equipment, lifts, etc. Was destroyed by fire in 1949.
Joseph Dailey Mill	Built by Joseph Dailey in 1896 on his farm four miles east of Shingletown. Was a water power mill, cross cut saw with vertical stroke, and a capacity of 3,000 feet per day. Joseph Dailey and his son Perry were the sole owners and many times the lone operators. The mill and its timberland, the water rights and the farm were sold to Northern California Power Company in 1906.
Klotz Mill aka Klotz Mill and The Factory	Established in 1856 by Rudolph Klotz at Shingletown near present location of Nora Lake. Was a sash and door factory and a planing mill. Sashes, doors, moldings, blinds, brackets, rustics, and dressed lumber were manufactured here. It was the only mill of its kind at the time. Many old Shasta County homes contain windows and doors made at this factory. Lumber and finished products were first hauled to Logan's Ferry on the Sacramento River by either ox or horse team, transferred to rafts and floated downriver by Dan Klotz. Klotz Dump Spur, a spur railroad line, built in 1872 from Sacramento River to Panorama Point at Cottonwood allowing the company to more easily ship its products. Burned in 1917 or 1918.
Loomis Mill	Benjamin Franklin Loomis purchased the Vilas Mill in 1906 plus considerable timberlands, and began logging. Some of the logs were so large that holes were drilled in them to blast them in half. Loomis Peak is named for him.

Table 11-1. Bear Creek Watershed Assessment 2005
Sawmills Documented within the Bear Creek Watershed
(continued)

McCumber Mill. aka McCumber- Vilas Mill and the McComber Mill	Located two miles east of Shingletown beside Mill Creek. Was one of the first mills built in the Shingletown country. Built by a Mr. Wiemer in 1851 who soon sold. Continued to operate for 45 years. It was a popular stopping place and the first white settlement on Nobles' Emigrant Trail. Was located beside Mill Creek; today's location is 0.2 mile on Sutters Lane off Mill Creek Road. Was considered the granddaddy of all the lumber mills. Was dismantled in 1896 and the machinery was moved to the site of M. B. Vilas' second mill at Viola. In 1905 the mill was sold to the Red River Lumbering Company. Mill workers lived here.
Ogburn Mill	In approximately 1891 Jefferson and John Ogburn built this mill at the west end of the Ogburn place, four miles west of Shingletown. It stood southwest of Midway and a few hundred yards north of the Shingle Creek Bridge. Was a well-equipped steam mill. Closed in 1909. This was supposedly the last mill to use oxen.
Phelps Mill	Robert E. Phelps settled at Shingletown in 1895 to make shakes. Purchased a sawmill located approximately 1.5 miles east of Shingletown beside Baldwin Creek in 1909 and operated it until 1914. Moved to Anderson in 1910 for better schooling for his children; moved permanently in 1915. Was on top of Lassen with his mill crew when it erupted in 1914. Purchased a second mill at Whitmore in 1916.
Rains Mill	Built on almost the exact site of the McCarley-Smith Mill on Bridge Creek east of LaTour Meadows, 12 miles east of Shingletown in 1947. Cut perhaps 50 or 60 thousand feet per day with two sets of large sized circular saws in two buildings. It was located in the midst of a virgin forest of red fir and 2 nd class timber. Lumber hauled out by motor truck via a well graveled road straight to the highway via the west end of Deer Flat.
ReQue Mill	Established in 1945 by Roth E. ReQue on Bailey Creek about three miles east of Plateau on the old William Asbury place. Was a steam powered mill with a capacity of 20,000 feet per day.
Reynolds Mill	Established in 1902 by L. C. Reynolds after he dissolved his partnership with William Smith. It was located at the west end of the Bailey place three miles west of Viola. Per Benjamin Loomis: "Here Reynolds hauled his bolts and logs to the mill with a pair of big wheels. Later he built a railroad and hauled logs and bolts to the railroad with the big wheels. His mill had a capacity of perhaps 35,000 feet per day. He cut short door stock. This was the only logging railroad ever built in this part of the country...The Reynolds Mill had about the greatest capacity of any in this section and next to Klotz Mill and sash and door factory, was the best equipped."
Reynolds-Al Smith Mill	Located three miles west of Viola beside Bailey Creek. Established in 1902 by L. C. Reynolds. Cut 35,000 feet per day and considered a "well-equipped" mill. Included small logging railroad complete with small locomotive and steel rails. The railroad was a three-mile-long narrow-gauge railroad located on the Shingletown Ridge. It connected the Reynolds Mill to the woods operation at the Nunes Ranch. Tracks consisted of steel rails attached to fallen logs (tree trunks) placed end to end and hewn flat on top to hold the rails. The locomotive was a wood-burning saddle back hauled to Shingletown from Cottonwood by William Delaney on a wagon pulled by 16 mules. Albert F. Smith was known as Al and Al the Shingletown Banker. He established McCarley & Smith General Merchandise, Trading Post and Hotel in 1871 at Shingletown with partner John McCarley. He also owned the Al Smith Sawmill. Al Smith Gulch in French Gulch is possibly named for him.
Ritts Mill	Built in 1920 by Collin Ritts about eight miles northeast of Shingletown and somewhat northwest of McCumber Lake. Was a steam mill with about 1,000,000 feet annual capacity. A Best steam traction engine was used in the woods and motor trucks hauled the lumber to the valley. Was the only operating mill on the Shingletown Ridge during the 1930s. Closed in 1939.
Thatcher Mill	Established in the 1850s. Ezekial Thomas Thatcher settled on Bear Creek in The Thatcher Lumber Company was established in the 1850s. The first mill was near Millville, others were at Viola. Settled on Bear Creek in 1853 approximately two miles up-creek from Parkville and engaged in farming, stockraising, teaming and lumbering. Was continually involved in the lumber business throughout his life although sons were more involved. Hauled the first load of lumber out of the mountains with three yoke of oxen from Shingletown to the Baker Place on Bear Creek. Provided blacksmith services and oversaw the cutting of millions of feet of lumber at the ranch sawmill. Used three or four traction engines to haul lumber on Dersh Road to the Hawes' Place for shipment on the railroad.

**Table 11-1. Bear Creek Watershed Assessment 2005
Sawmills Documented within the Bear Creek Watershed**
(continued)

Thatcher-Montgomery Mill	Established by Arthur Thatcher, son of pioneer Ezekial, on the north side of the highway about one mile east of Shingletown. Was originally a mill of medium capacity and cut rough lumber only. After a few years it was sold to the Montgomery brothers who enlarged and improved it and installed electric power. The capacity of the new mill was far greater than any other mill operated in this section of the country and it was the only mill that ever ran more than one shift per day. It was destroyed by fire in 1949 and was immediately rebuilt. It was also known as the Thatcher Mill, the Montgomery Mill, the Viola Mill, the Fremont Mill, and the Shingletown Mill.
The Electric Mill	Built in 1906 by the Northern California Power Company west of Grace Lake on the south side of the road. Built and operated as an electric power mill. Used to make staves for a wooden pipe which conveyed water from Grace Lake to the bow of the hill near Lake Nora. Closed when the pipe was completed.
Watts Mill	Established by a Mr. Watts in 1933 after the forest fire. Watts bought the dead timber on PG&E's land north of Big Wheels. The mill was powered by a gas engine and equipped with a circular saw and an edger. Operated only two seasons.
Welch Mill	This was a shingle mill built and owned by Lincoln Welch. Stood a few hundred yards downstream from the Coyoner Mill. This was a water powered mill with circular saws, set horizontal, edger, cut-off, and all necessary machinery for 1 st class work. Box and crate materials were also manufactured here and sold to the fruit growers of Happy Valley and Anderson. Sold to the Northern California Power Company in 1906
Wells Mill	James Wells, a minister, purchased Plateau property in 1891. He and his son Ernest Wells erected a small steam powered mill on their homesite and cut timber from their own property plus on land already cut by M. B. Vilas and Rudolph Klotz and T. H. Benton. The mill stood directly at the south side of the Plateau-Manton Road at the first bend about 200 yards south of the top of Battle Creek Hill. Mill had circular saws and cut bolt timber only. Had a capacity of 5,000 feet per day. Water rights of the mill were sold to Northern California Power Company in 1911 and soon after most of the land passed to the Red River Lumber Company. He financed the building of several sawmills in the area. He also built a general merchandise store; the Plateau Post Office was located inside the store and Wells was the postmaster.

AGRICULTURE

Herds of sheep and cattle were introduced into Shasta County during the 1840s and 1850s. During this time, California was the largest sheep producing state in the nation (WSRCD 2000). Most of the early ranches in California ran herds of sheep, cattle, and horses.

By the early 20th century, ranches in the Bear Creek watershed area primarily produced cattle. In the spring, cattle was herded into higher elevation summer pastures, and returned to the Shingletown and Inwood area ranches during the fall. The routes of various cattle drives in portions of Shasta County, including the Bear Creek watershed, are currently being mapped by Dave Dubose, and should be on file at the Shasta Historical Society at the time of this printing (Dottie Smith, personal communication). Most ranches also produced a variety of other agricultural products including garden produce, hay, milk, chickens, eggs, and hogs. The lush grasslands in most of the area provided perfect grazing/ranching conditions.

Although the soil was not favorable for growing row crops in higher elevation areas, orchardry was practiced by residents in the Bear Creek watershed. Apples, wine grapes and cherries were known to have been produced in the Inwood Valley, and Inwood was renown for its cherries. Apple and cherry trees over 100 years old are still present in the Inwood Valley (Jane Arnett, Shingletown Historical Society, personal communication 2004). Additionally, peaches were grown by Charles Ogburn (Smith 2004).

The Chinese were excellent gardeners and planted many large gardens in the Redding and Anderson areas. As noted in the 1900 census data that follows, 12 gardeners of Chinese descent were noted to reside in the Shingletown area. The vegetables from Chinese gardens were highly sought after by the whites and were sold almost as fast as they ripened on the vine. The gardens were commonly known as China Gardens. The Chinese usually transported their vegetables in peddling wagons into the nearby white settlements and towns where they had no trouble selling the produce. Balls Ferry Chinese Gardens were located at two separate locations at separate times. During the 1860s a garden was located on the east side of the Sacramento River between Ash and Bear Creeks. In 1883, William Wilcox leased 60 acres of land, also on the east side of the Sacramento River, south of the aforementioned garden, to various Chinese individuals who continued to cultivate it until 1923. Produce from this garden was hauled to Cottonwood and Anderson and sold (Smith 1999, 2004).

POWER PRODUCTION

Power production along streams in Eastern Shasta County and the Bear Creek watershed progressed from water-driven mills to hydroelectric generation. Power generation was successful in these areas due to a plentiful supply of water and steep grades. A majority of hydroelectric power houses were located within the Battle Creek Watershed, such as the Battle Creek Hydroelectric System that included the Volta (built in 1901), South (1910), Inskip (1910), and Coleman (1911) powerhouses. Volta (listed on the National Register of Historic Places) was one of the first high-head long-distance power developments established in the West, one of the first Shasta County powerhouses, and built to deliver power to the Mountain Copper Company smelter at Keswick and their mine at Iron Mountain. The Battle Creek Hydroelectric System was established by H. H. Noble as the Keswick Electric Power Company in 1900. Noble reorganized the company in 1902 as the Northern California Power Company, and sold the company to Pacific Gas and Electric Company in 1919 (Smith 1999).

In 1904, the Shasta Power and Light Company built the Snow Creek powerhouse on Snow Creek near Inwood. Water for the plant was to be brought from Hat Creek at the foot of Mount Lassen. William Klotz was in charge of the project. He supervised the digging of 20 miles of ditch, as well as several miles of flume around the mountain from Hat Creek to the ditch. The camp headquarters was at Sunflower Hill, on a portion of Nobles' Emigrant Trail. Many months were spent working with picks, shovels, and horse-drawn Fresno scrapers by Italian laborers brought in from San Francisco. Men and materials were transported to the work sites by team and wagon. The powerhouse and other buildings were built at the plant site. A large clubhouse/dormitory was built for visitors and unmarried men. This plant furnished power and lights to Redding. A few years later the Northern California Power Company bought the water rights and dismantled the plant (Smith 2004).

One other hydroelectric facility exists in the watershed on South Fork Bear Creek near Inwood. This facility is operated by CHI West, Inc. of Burney under a water right acquired in 1981 by Bear Creek Hydro.

TRANSPORTATION

TRAILS

The following is derived from Smith (1999, 2004), unless otherwise indicated. During the height of the Gold Rush, overland travel into Shasta County was accomplished

by way of the Lassen Trail. The trail was also known as Death Trail, the Lassen Route, Lassen's Cut-Off, and Greenhorn Trail. It was established by Peter Lassen in 1849 on the east side of Mount Lassen, followed the various ridges between the south fork of Cow Creek and the north fork of Battle Creek, and arrived in the Sacramento Valley at Lassen's ranch on Deer Creek in Tehama County. The trail was extremely rugged and dangerous, and was abandoned by 1852.

In 1852, Nobles' Emigrant Trail replaced Lassen Trail as the best route into Shasta County. The trail is listed on the National Register of Historic Places, and is also known as Noble Overland Emigrant Route, Noble Route, Nobles' Pass Road, Nobles' Trail Road and the Emigrant Trail. The trail was established in 1852 by William H. Nobles, and linked the Applegate Trail in Nevada to the northern Sacramento Valley, ending at Fort Reading beside Cow Creek; from there emigrants traveled to places such as Shasta. Eighteen miles of the trail traveled through present day Lassen Volcanic National Park where remnants still remain. The trail was the most popular route into Shasta County from the east; several thousand emigrants used it in the 1850s and 1860s. The trail cut several days travel from the previously used Lassen Trail and was considered the best road through the Sierra Nevada because it was abundantly supplied with grass, water, and wood the entire length. The greatest distance between watering places was only 25 miles. Present-day Dersch Road was built on a portion of the trail, and Nobles' Trail Road retains the name. Ezekiel Thatcher hauled the first load of lumber in 1852 from Shingletown to Shasta by ox team on Nobles' Emigrant Trail. The trail was practically abandoned when the railroad was built in 1872, but was still used until approximately 1900 when modern highways were built. The trail enters the Bear Creek watershed from the east in the Shingletown area, follows portions of present-day Highway 44, before descending into the Sacramento Valley.

The Nobles' Trail Committee has recently concluded a four-year project resulting in the most accurate mapping of the trail, and it has been determined that no one trail existed, especially within the Shingletown area. A detailed map based upon GPS coordinates of the trail is in the process of being produced by Richard Silva (Richard Jenkins, USFS Archaeologist, personal communication, October 2004). Richard Silva can be contacted through the Siskiyou County Museum.

ROADS

Around 1880 there were three main routes from the Sacramento Valley to the Burney Valley and eastern Shasta County. One of the roads followed the county road from Balls Ferry to the Shingletown area, joined the Nobles' Road from there to where it crossed Hat Creek, and from there the Pit River or Lockhart Road could be taken to Fall River Mills (Colby 1982). Butte Road (which later became Ash Creek Road)/Balls Ferry-Shingletown Road was associated with the early lumbering industry in the Shingletown Ridge area. When Nobles' Trail reached McCumber Mill on Mill Creek, it continued on using the already established road to the Sacramento River. Its route passed Grace Lake, joined the Shingletown-Manton Road and passed where the Shingletown Store stands, following along present Highway 44 until it branched off to cross Shingle Creek. It then passed the Rancho del Encino and closely followed the Cottonwood Road to a meadow where the Payne and Smith place was located. From there it followed the south side of the ridge along Lack Creek to the Dersch Place on Bear Creek. From the Dersch Place it went almost due west to cross Cow Creek just south of the site of old Fort Reading and crossed the Sacramento River about where the Deschutes River Bridge now stands (Colby 1982).

In the 1880s, boards were transported down these roads to the valley shipping points by horse-drawn wagons, and in the 1890s traction engines were able to haul several wagons of cut lumber at a time to the valley. In 1899 a group of Shingletown mill operators asked for a franchise to operate traction engines and horseless carriages over a 20-year period on Shasta County highways. The proposed route ran from Cottonwood by way of Balls Ferry to the Shingletown area mills. It was not approved.

FERRIES

In March 1850, the California State Senate approved an act creating and regulating public ferries on the Sacramento River. As part of the act, ferries were required to be spaced at least a mile apart. Table 11-2 is a list of ferries known to have operated within and near the Bear Creek watershed. The information was obtained from Smith (1999, 2004) unless otherwise indicated.

Table 11-2. Bear Creek Watershed Assessment 2005
Ferries Known to Have Been Operated Within and Near the Bear Creek Watershed

Adams Ferry	Was purchased by G. W. Adams and Bragg (first name unknown) in 1861 and renamed the Adams Ferry. It operated across the Sacramento River just south of the mouth of Bear Creek.
Logan's Ferry	Was originally the Slack & Daingerfield Ferry. Had many owners. Last owner was Pleasant Logan who purchased from Braggs in 1878. The ferry operated across the Sacramento River just south of Bear Creek and connected with present-day Blue Jay Lane on the west side of the river. The earliest known freight road from Red Bluff to Yreka crossed at this ferry crossing. Lumber and many types of finished mill products were hauled to the ferry landing originally by ox-team from the Klotz Mill at Shingletown, placed on rafts, and floated downriver to places as far south as Sacramento. Destroyed in the flood of 1890.
Daingerfield Ferry	Was also spelled as Dangerfield. First known as the Slack & Daingerfield Ferry. Established in 1853 by owners Leroy P. Daingerfield and R. N. Slack. Operated across the Sacramento River at the mouth of Bear Creek to the present Blue Jay Lane on the west side of the river. Sold to Judge George W. McMurtry in 1855, to Haycraft (first name unknown) and Fountain Lafferty in 1858, to G. W. Adams and Braggs (first name unknown) in 1861, to Braggs in 1863, and lastly to Pleasant Logan in 1878 who established Logan's Ferry, the last ferry. Destroyed in the flood of 1890.
Ball's Ferry	Is California Historical Landmark No. 4. The ferry was purchased by William Ball in 1868 from William Wilcox who quite probably purchased the same ferry from the estate of Pierson B. Reading. The ferry operated across the Sacramento River approximately 100 feet downstream from the present bridge and carried wagons, buggies, and stock of all kinds across the river. An 1881 newspaper advertisement claimed it was the only river ferry never failing to cross daily. The ferry site was also a popular embarkation point for logs and lumber (see Ball's Ferry - the townsite). The ferry operated until 1897 when Shasta County built a bridge across the river at the site. Was always operated by a member of the Ball family.
Wilcox Ferry	William Sample Wilcox purchased a ferry and the use of one acre of land from the Pierson B. Reading estate in 1868. This is quite possibly the same ferry that became Ball's Ferry later that year.
Emigrant Ferry	AKA Immigrant Ferry. Established by Samuel Francis, Drury D. Harrill and Charles Smith in 1852 across the Sacramento River near the mouth of Cow Creek and a stone's throw from the U.S. Government Ferry. Established to serve travelers arriving on Nobles' Emigrant Trail on the east side of the river. Re-licensed in 1853 to A. S. Wells and Harrill, thereafter only to Wells, becoming known as the Wells Ferry.
U.S. Government Ferry	Built in 1853. Known as the Government Ferry. Was larger than most ferries and required two men to operate. Was operated by U. S. Army soldiers across the Sacramento River within a stone's throw of the Emigrant Ferry. According to General Wright who commanded Fort Reading in 1853, the ferry was the best on the river and worth double the value of the nearby Emigrant Ferry. Sold in 1858.
Ferry (unnamed)	In 1908 a special ferry had to be constructed at Balls Ferry to transport hundreds of sheets of steel for the 7 feet thick Coleman Forebay penstock walls across the Sacramento River. The sheets arrived by train at the Cottonwood Railroad Depot and were hauled on flat wagonbeds by four and six horse teams to Coleman forebay (Smith 1994)

RAILROADS

The transcontinental railroad was completed in 1869 when Central Pacific's western termination point in Sacramento joined Union Pacific's connection in Utah. The first train arrived to Cottonwood in 1872. By 1874, the railroad extended into Anderson and ended in Redding. Redding served as the northern railhead until 1884 when tracks were laid to Delta (railhead town located on Dog Creek), followed by the track's completion at Ashland in 1887. In addition to providing the means by which settlers could easily travel to Shasta County, the railroad also provided a means to import and export large quantities of economic goods.

The Reynolds Mill Logging Railroad was a three-mile-long, narrow-gauge railroad located on Shingletown Ridge that connected the Reynolds Mill to the woods operation at the Nunes Ranch. Tracks consisted of steel rails attached to fallen logs (tree trunks) placed end to end and hewn flat on top to hold the rails. The locomotive was a wood burning saddle back hauled to Shingletown from Cottonwood by William Delaney on a wagon pulled by 16 mules (Smith 1999, 2004).

THE HOMESTEAD ACT

"The scale of post-Civil War migration to the American West dwarfed everything that had preceded it. In previous decades, the settlers had come in thousands. Due to the Homestead Act, they came in millions, spreading through the vast western territories - into empty and inhabited lands alike. Most of the new settlers were from the established Anglo-American societies of the eastern United States, but substantial numbers - over two million between 1870 and 1900 - were foreign-born immigrants from Europe: Scandinavians, Germans, Irish, Russians, Czechs, and others." (Brinkley 2000)

The Homestead Act of 1862 provided any citizen or first paper alien (except Indians) the right to claim 160 acres for \$10 on the condition he or she lived on, made improvements to, and cultivated the land for five years, were the head of the family, and over 21 years of age (Smith 1999). Land could also be purchased outright under Cash Entry Patents, and military veterans of the Spanish-American and Civil wars could claim lands under scripts received from the US Government. In addition, the United States granted large amounts of western lands to railroad companies so the companies could sell/develop the lands in order to finance construction of the Transcontinental Railroad.

A number of Homestead, Military Scrip, Cash-Entry, Railroad, Agricultural, Stock Raising, Stock Grazing, and other land patents were issued by the General Land Office (GLO) for lands within the Bear Creek watershed. Extensive research and time would be required to discern the amount of acreage acquired through any of the above. However, detailed land patent information is available to the public and can be obtained through the Bureau of Land Management's website of GLO records at <http://www.glorerecords.blm.gov>, or by visiting the BLM, Redding office.

SETTLEMENTS

Shasta County was created in 1850 as one of the original 27 counties in California. At that time, the county included all lands in present-day Shasta, Modoc, Lassen, Siskiyou, and parts of Plumas and Tehama Counties. The county borders were modified many times, but by 1870, Shasta County's borders were generally drawn as they are today (Smith 1999).

Most early settlement within western and central Shasta County consisted of temporary stays in mining towns and districts. A majority of those towns disappeared as quickly as they were created once placer deposits were depleted. However, early settlement within the Bear Creek watershed tended to be more permanent, primarily because large amounts of capital were necessary for logging, milling, ranching and stock-raising, requiring that investments of time and labor be concentrated on goods produced. The goods could be exported, were plentiful, and for the most part, renewable (aside from the old-growth sugar pines lost early to logging). In addition, settlements within the watershed sprang up in response to transportation demands (ferries) and boarding needs of travelers and teamsters. As such, many early settlements within and immediately adjacent to the Bear Creek watershed survived as long as the economic demands and outputs of their particular industry sustained. Watershed settlements and associated descriptions, provided by Dubose (1998) and Smith (1999, 2004), are listed in Table 11-3.

**Table 11-3. Bear Creek Watershed Assessment 2005
Settlements Within and Immediately Adjacent to the Bear Creek Watershed**

Balls Ferry	The townsite is California Historical Landmark No. 4. The settlement began growing up around the ferry site on the east side of the Sacramento River in 1868. The settlement included the Ball's Ferry Hotel, houses on the hill behind the hotel to the east, a flour mill, the ferry, a merchandise and grocery store, a post office, and a saloon. The 1 st hotel was located approximately 100 yards north of the end of the present bridge on the east side of the road. It burned (date unknown) and was replaced with a 2-story hotel directly across the road on the west side beside the Sacramento River (presently the site of Rooster's Landing). Another building was built beside the road directly opposite the end of where the present-day bridge is now located and contained a general merchandise and grocery store, post office, and a large porch in the front with a hitching rail for the stockmen's saddle horses. Two large barns were located north of the bridge on the east side of the road with large wooden corrals and outside mangers for the teamsters who made that their stopping place between the Shingletown lumber mills and the railroad. The Parkville Post Office moved into the Ball's Ferry Hotel in 1875 and re-established itself as the Ball's Ferry Post Office. William Ball was the first postmaster. Lumber rafting eventually made Ball's Ferry the chief shipping point on the river. Lumber was hauled here beginning in the 1850s by oxen and later horses from the Shingletown area sawmills, bolted together into rafts, and floated downriver sometimes as far as Sacramento. Ball's Ferry was strategically located on the main road from Cottonwood and all points leading to Millville, Shingletown, Burney Valley, Hat Creek Valley, Adin, Alturas, and all points in southeast Oregon. Was a popular relay point and was located on the most direct route from Shingletown and Millville to Red Bluff. Business at Balls Ferry began fading away in 1910 when lumber hauling folded up (Ritter 1995).
Parkville	Established in the early 1870s beside Bear Creek approximately four miles north of Balls Ferry adjacent to the only road at the time that went from Cottonwood to Shingletown. First historic activity in the area consisted of Rudolf Klotz hauling lumber to the mouth of Bear Creek and rafting the lumber down the Sacramento River from a point near Parkville. Steven Park filed for squatter's rights on the land in 1856. The Parkville area was apparently named for Stephen Park, however a John W. Park owned property in the area as well. The Parkville School District was established in 1861, and the first schoolhouse was located about 200 yards north of the Bear Creek Bridge, though it was moved north about two miles to the intersection of Dersch and Parkville roads in 1916, and closed in 1958. Parkville Post office was established in 1871, and was the first post office established in the Shingletown territory; mail was brought to Parkville from Millville twice a week. The post office but was relocated to Ball's Ferry in 1871. Parkville was a small agricultural community that contained a cemetery, school, at least one boarding house/hotel and a stable or two. It was referred to as "Greaseville" or "Greasyville" because the workers, primarily men who worked the log and timber industry, were not the cleanest people around. Parkville faded out of existence by the turn of the century as a result of the railroad alleviating the need for lumber to be floated down the Sacramento River. Parkville was known for its wildlife and agricultural interests, and is still an important deer winter range and agricultural area today. (Dubose 1998; Petersen 1965; Smith 1999; Southern 1971:27-29).

Table 11-3. Bear Creek Watershed Assessment 2005
Settlements Within and Immediately Adjacent to the Bear Creek Watershed
(continued)

Inwood	Name is a short version of the term "hidden in the woods." Two of the first settlers were Sylvester Langdon and George Washington Sheridan. The Inwood Post Office was established in 1887 and discontinued in 1947. The last grizzly bear in Shasta County was killed near Inwood in 1895 by Elias G. Weigart (Smith 1999). The Ogwood-Inwood Cemetery is one of the oldest cemeteries in the area, with its first known burial occurring in 1860.
Midway	Received its name when Highway 44 was built in 1936. Located five miles west of Shingletown. Was first settled by Charles Ogburn in 1848 who established Charlie's Place
Pine Grove	Was first settled by Robert Meyers in 1850 alongside Nobles' Emigrant Trail 2.5 miles west of Shingletown. Sometime prior to 1855, Meyers and a partner built the Meyers and Donaldson Hotel which became a popular stopping place for emigrants on the trail. Purchased by Ezekial Thatcher in 1879 who continued to operate it as a stopping place. Was the site of one of Thatcher's first sawmills
Plateau	Began being settled in the early 1880s on the east side of Battle Creek parallel to the Shingletown Ridge at the Battle Creek Bridge. Was first settled by Bateman. The town suffered from a lack of water and as a result many settlers left. All the Plateau property was sold to Northern California Power Company in 1908. The Plateau Post Office was established in 1889 and discontinued in 1909. The Mt. Lassen Baptist Church organized at Plateau with a membership of over 50 in 1898 and built a large edifice. A 1917 forest fire destroyed most of the remaining homes.
Shingle-town	Is California Historical Landmark No. 8. First called Shingle Camp. Named for the many shingle making camps in the area. James King and Thomas Asbury were possibly the first shingle and shake makers. Became Sierra Precinct in 1853. The Shingletown Post Office was established in 1874 in the Shingletown Store. John McCarley was first postmaster. The post office was discontinued in 1919 and re-established in 1945. Historic Shingletown businesses included a door, window sash and furniture factory operated by Klotz, numerous sawmills, a store, Post Office, blacksmith shop, dance hall and hotel before the turn of the century. Shingletown was strategically located at the junction of three popular roads from east to west. Some of the recreation and gambling activities during the mid-1800s consisted of horse racing at a track in Pine Grove, and bull and bear fights. The area went into economic despair from the early 1900s until World War II, when the demand for lumber rose. In the early 1950's it was lucky if there were 100 voters, but by the 1960s, the precinct list contained about 1500 names. By the late 1960s Shingletown's economy expanded and diversified to include a service-sector economy based on tourism. The area is known as Redding's bedroom community, as many Shingletown residents are retired or work in Redding.

STOPPING PLACES AND BOARDING

A great number of people traveled through the Bear Creek watershed into Shasta County via Nobles' Trail prior to the development of the railroad. As such, stopping places, boarding houses, and hotels served the needs of these weary travelers, and provided goods and/or income to those hosts. The following list (Table 11-4) has been compiled by Smith (1999, 2004).

Table 11-4. Bear Creek Watershed Assessment 2005
Stopping Places Within the Bear Creek Watershed

Adams Ferry Site Hotel	The real name of the hotel is unknown; what is known is that a hotel or boarding house existed here. It was operated by Lewis Powers in the early 1870s near the Adams Ferry landing site on the east side of the Sacramento River upriver from the mouth of Ash Creek. It accommodated 30 boarders. Was demolished in approximately 1890.
Baker's Place	AKA Baker's Station, Baker's Stage Station, the Tent Place and the Tent Lodging Place. Settled and established by Solomon D. "Doc" Baker in approximately 1850 alongside Nobles' Emigrant Trail beside Bear Creek (today's location is where Dersch Road crosses over Bear Creek). Was a tent stopping place, stage station and roadhouse for emigrants traveling on Nobles' Emigrant Trail, and was the last place to stop and rest on the east side of the Sacramento River (prior to the building of Fort Reading). George Dersch purchased the property in 1860 and from then on it became known as the Dersch Place.

Table 11-4
Stopping Places Within the Bear Creek Watershed
(continued)

Charlie's Place	Local historic landmark. Also spelled as Charley's Place. Early roadhouse and stopping place established by Charles E. Ogburn beside Nobles' Emigrant Trail approximately five miles west of Shingletown. Two historic plaques mark the site; each is spelled differently (Charley's Place and Charles Place) and each has contradicting information. See Charles E. Ogburn in Early Settlers Section. Was renown for the peach brandy and bull and bear fights.
Deer Flat	AKA Old Hill Station. Was the location of the first campsite/stopping place on Nobles' Emigrant Trail west of the Sierra Summit in 1852. Was located one mile off Highway 44 on Deer Flat Road in Viola. Was known as Hill's Trading Post in 1852 and Deer Flat Stage Stop in 1890 under the ownership of William W. Smith. Smith sold to Thomas Benton Armstrong in 1890 who continued operating it as a stopping place for cattle and sheepman driving their stock to and from summer and winter ranges. Under Armstrong's ownership it became known as the Upper Armstrong Ranch.
Dersch Stopping Place	California Historical Landmark No. 120. First called Baker's Place, a well-known stopping place located beside Nobles' Emigrant Trail; became known as the Dersch Place and/or Dersch Station upon purchase by George Dersch in 1860 who took over operation and farmed the adjoining 160 acres with wife Marie. The place continued to be widely known and popular. Located 11 miles east of Anderson on Dersch Road beside Bear Creek. Marie was attacked and killed here by Indians in 1866. Was destroyed by fire in 1934; rebuilt in 1935.
Fleaville Stopping Place	Owned by Ezekial Thatcher. Located on Nobles' Emigrant Trail south of Foot of the Mountain Station on the north side of Ash Creek and Dersch Roads. Was the site of a hog ranch. Named for the large flea population. Teamsters supposedly had to sleep on top of lumber stacks to escape the fleas. Was abandoned in approximately 1912.
Foot of the Mountain Station	aka Wayside Inn. Built and established by William Worthington Lassengree Smith in 1858 beside Nobles' Emigrant Trail. Smith turned ownership of the station and adjoining 240 acres over to employee/housekeeper Phoebe Colburn as payment for a \$500 loan.
McCumber Mill Stopping Place	Built in 1851. Was located beside Nobles' Emigrant Trail beside Mill Creek; today's location is 0.2 mile on Sutters Lane off Mill Creek Road just south of present-day Big Wheels Restaurant. Was a popular stopping place and the first white settlement on Nobles' Emigrant Trail (the mill workers lived here).
Mountain Home	Was a popular roadhouse and stopping place located south of McCumber Lake at the confluence of Battle Creek and Manzanita Creek beside Nobles' Emigrant Trail approximately four miles northwest of Viola in 1862. Was operated by Walter Forward and family during the winter of 1866-67 and homesteaded by Hiram Z. Taylor, Sr. in 1874 who sold to Sierra Flume & Lumber Company in 1876.
Parkville Stopping Place	Served as a stopping place for the California-Oregon Stage Company in 1857. Was located beside Bear Creek approximately four miles north of Balls Ferry.
Pine Grove Hotel	Was first known as the Meyers and Donaldson Hotel. Built by Robert Meyers and Donaldson (first name unknown) in the early 1850s beside Nobles' Emigrant Trail approximately 2.5 miles west of Shingletown. Became a popular stopping place for emigrants. Purchased by Ezekial Thatcher in 1879.
Shingletown Hotel	Built in 1854 by merchants John McCarley and Albert F. Smith. Was a 2-story wooden structure, contained approximately 12 rooms, and was located about 1660 feet from the present Shingletown Store. Was destroyed by fire in 1905 and replaced with a larger building in almost the same place. Purchased by B. F. Loomis in 1923 who moved it to Viola and re-established it as the Viola Resort. Destroyed by fire in 1953.
Viola Resort	Established and operated by B. F. Loomis in 1923. Was originally the Shingletown Hotel, which Loomis purchased, moved to Viola, and renamed. Was located at the present site of the Lassen Pines Christian Center. Was destroyed by fire in 1953; Mrs. Loomis died the same night in Anderson.
Wayside Inn	See Foot of the Mountain Station.

CEMETERIES AND OTHER IMPORTANT PLACES

Two public cemeteries are present within the Bear Creek watershed, and are briefly described below. Other pioneer burial places (known and unknown) such as the Klotz family site (see Rudolph Klotz under "Settlers" section of this paper) are also present within the watershed; however, they will not be discussed here. Information relating to the Bear Creek School in the Inwood area will also be presented here.

PARKVILLE CEMETERY

In 1851, Ezekial Thatcher and his wife homesteaded on Bear Creek on land that enjoined that of Stephen Park. The Thatcher's and Park's donated land to develop the Parkville Cemetery in order to bury the deceased children of the Thatcher's. The cemetery is located beside present-day Ash Creek Road, and is one of the oldest public cemeteries in Shasta County (Dubose 1998; Smith 1999). A number of early Shasta County pioneers and their relatives are buried at the cemetery, including Darrah, Dersch, Klotz, Thatcher, and Tuggle family members, among many others pioneer families of notoriety. Chuck Hornbeck has recently produced a map of the Parkville Cemetery, and it, as well as older maps of the cemetery, are available for viewing at Shasta Historical Society. The cemetery is currently cared for by Dave Dubose (Shasta Historical Society, personal communication, October 2004).

OGBURN-INWOOD CEMETERY

The following is derived from Ogburn-Inwood Cemetery Association Directors (1964). The Ogburn-Inwood Cemetery is located in the vicinity of the Ogburn settlement directly across Nobles' Emigrant Trail from the Ogburn homestead. The first known burial, that of the young Harriet Ball, took place in April, 1860. When she died, the Ogburn family may have given land that they thought belonged to them for a cemetery, or the land may have been public domain. There is a chance that others were buried in the area prior to Ball's internment due to the moderately flat topography and its locale in relation to Nobles' trail.

In 1910, more land was added and a wire fence was erected around the cemetery. In order to care for the cemetery, an association was formed whose members were Alexander Thatcher, Minnie E. Aldridge, Jefferson D. Ogburn, Morgan Albery, Arthur McMurray, and Jefferson D. Aldridge. All members of the association, aside from Alexander Thatcher (buried at his family plot at Parkville Cemetery), are buried in Ogburn-Inwood Cemetery. Although a number of bodies were interred without the placement of a marker and/or headstone, Harriett Ogburn grew up knowing the location of nearly every grave. In 1910, when a map of the cemetery grounds was proposed, Harriett Ogburn (then Mrs. Grout) was instrumental in placing all the graves on it.

In 1954, the Bear Creek 4-H Club made 100 grave markers and placed them at the heads of all unmarked graves. In 1963, 0.25 acres were purchased from a landowner to the south so that a parking lot could be constructed. In this same year, a committee was formed to create a memorial for buried pioneers at the cemetery, which consisted of geneological research and contacting relatives of those buried in the cemetery. Ogburn-Inwood Cemetery Association Directors in 1963 were Walter B. Aldridge, Martha Aldridge, Ross Edwards, Ernest Wengler, Bill Sutter, and John R. Shuford.

During the late 1990s, the Shingletown Historical Society released the *Ogburn-Inwood Cemetery Tour* offering more detailed information on those buried in the cemetery. It is available through the Shingletown Historical Society.

THE BEAR CREEK SCHOOL

According to a Covered Wagon article (1959:27) the Bear Creek 4-H Club erected a monument in 1955. The monument reads as followed: "DEDICATED TO THE BEAR CREEK SCHOOL BUILT BY PIONEERS NEAR THIS SITE IN 1862 AND HONORING THE CHILDREN WHO ATTENDED IT". The monument honors pioneers and their children who later built up the Inwood community. There is a document placed in a tin box and buried in the cement and stone monument that contains various information relating to the school, subject matters taught, and social conditions of the time. The following are excerpts from the document:

- "After the Gold Rush Days of '49, people in Shasta County began settling on land in the mountains. There was not much money but willing hands, strong backs, and determination gradually brought homes out of the wilderness. Homes meant children, and children meant schools".
- "The other end of the room contained a shelf for lunch pales (usually cans with holes in each side for wire bails)". "Quills were used as pens and ink was the juice from berries or sap from green oak balls. Blackboards were painted wood boards, erasers were squares of untanned sheepskin, nailed wool side out on wooden blocks, and slates were used for writing".
- "Many of the children walked or rode horseback to school, a distance of two and one half to three miles, twice a day, on trail-like roads set with wild animals and Indians".
- "Despite the crudeness of the schoolhouse, from it came six children who were to become Shasta County teachers, as well as many useful citizens".

More information on the schoolhouse can be obtained by contacting Shingletown Historical Society.

EARLY SETTLERS

Early pioneers and settlers of eastern Shasta County were amazing individuals who carried with them the propensity and strength to leave their previous lives with hopes to forge new and better lives. Most of them emigrated from the mid-west or eastern United States, some of them immigrated from Europe and Asia, and all of them came to this relatively untamed area with particular dreams. Their most admirable and defining quality consisted of their ability to transform themselves into miners, loggers, teamsters, ranchers, ferry operators, farmers or businessmen as dictated by whatever economic demands were required to support the 1050 percent population increases that occurred in the Shasta County between 1850 and 1860. The following list and corresponding information on early settlers within and near the Bear Creek watershed is provided by Dottie Smith (1999, 2004).

**Table 11-5. Bear Creek Watershed Assessment 2005
Early Settlers of the Bear Creek Watershed Area**

Aldridge, Jefferson Davis	Known as Jeff. Became a partner with brother John in the operation of Snow Creek Ranch in 1896. Was killed by a bull in 1937. Was the son of William.
Aldridge, John Cablebreckenridge	1860-1914. Was a partner with brother Jefferson in the operation of the Snow Creek Ranch in approximately 1895. Also worked for Northern California Power Company. Was the son of William .
Aldridge, William	1819-1891. Arrived in Shasta County in 1861. Purchased 160 acres in 1862 on Snow Creek at the confluence of Bear Creek and established Snow Creek Ranch. The ranch name was later changed to the Aldridge Ranch and even later in 1896 to Bonnie Craigs Ranch by wife Minnie. The name is Scottish and the ranch was named for the crags located on the ranch. The ranch became a member of the State of California's "100 Year Club" in 1962 for being in business for 100 years. Was the father of Jefferson Davis and John Cablebreckenridge .

Table 11-5. Bear Creek Watershed Assessment 2005
Early Settlers of the Bear Creek Watershed Area
(continued)

Asbury, William	1832-1927. Homesteaded on the south slope of Asbury Peak (now known as Black Butte) on what had previously been the homestead of Simon Darrah in 1872 and established a ranch. He leased the land in 1898 to the Fuller Cattle Company of San Francisco who later sold to the Northern California Power Company .
Ball, Aaron J.	1802-1863. Father of William and Irvin. Arrived at Shingletown in the early 1850s. Owned what became the Vilas Mill at Shingletown from 1861 until 1867.
Ball, Irvin L.	aka Irving. Son of Aaron. Was one of the first raft riders to ride the lumber rafts from Logan's Ferry and Ball's Ferry on the Sacramento River. Began operating Ball's Ferry in 1888 upon the death of brother William. Operated the ferry until 1897 when Shasta County built a bridge across the river at the ferry site
Ball, William Wallace	1829-1888. Worked as a sawyer at the Vilas Mill in 1864. Purchased a ferry from William Wilcox who had quite probably purchased the same ferry from the estate of Pierson B. Reading in 1868. Ball operated the ferry across the Sacramento River approximately 100 feet downstream from the present bridge near the present day location of Ball's Ferry Fishing Resort. Ball also established, owned, and operated the Ball's Ferry Hotel, Post Office and Corral at the ferry site on the east side of the Sacramento River. He became the first Ball's Ferry postmaster in 1875. He lived with his daughter Nellie May in a small addition behind the store in the hotel and post office. He became hard of hearing and depended on Nellie May to hear the customers yelling from the opposite side of the river when the ferry was needed. He operated the ferry until his death in 1888; the ferry was then operated by his brother Irvin.
Cunningham, Abraham	1816-1896. Arrived at the Clear Creek Diggings in 1849 to mine for gold. He drove an ox team here. He was a member of the first party of gold prospectors who entered the forbidden Cottonwood Creek Indian territory in 1850 and made the first known verbal Indian treaty. He returned to Missouri in 1851 and then returned to Shingletown with his family in 1874. He then homesteaded land at Plateau and purchased the Vilas Mill at Shingletown from M. B. Vilas. He sold the mill back to Vilas four years later. He was known as "Old Buck" and his flint-lock rifle was known as "Old Scrape Fire."
Darrah, George Andrew	1866-1938. Son of pioneer Simon. Worked With his father hauling logs by ox team to the Sidney Charles Mill. Lived in Shingletown for several years, later moved to Bear Creek near Millville where he raised goats, sheep, and hogs. Two of his houses burned at Bear Creek; when the last house burned in 1920 he moved to Cow Creek. He was elected District #3 Supervisor for 8 years.
Darrah, Joseph H.	Farmer at Shingletown in 1881. Was also affiliated in the same year with the business of J. S. Darrah & Bros. who manufactured and sold sugar pine lumber three miles north of Shingletown.
Darrah, Simon Hillery	Born in 1832. Blacksmith, sawyer, butcher, teamster (usually drove ox teams), farmer, and raft rider. Worked at Fort Reading in approximately 1861 for a short time as a teamster. Moved to Dry Mill below Shingletown and married 16-year-old Arzilla Shipton in 1861, the mill cook. Moved to Battle Creek in approximately 1866 and homesteaded the place now known as Darrah Springs and built a house which the Indians burned. They then moved near the Adams Ferry on South Cow Creek, and later to the Sidney Charles Mill on Bear Creek. Was one of the first Sacramento River raft riders. Rode the large lumber rafts downriver as far south as Sacramento beginning at either Ball's Ferry or Logan's Ferry and returned by stagecoach. Owned many oxen and logged for several early mills. Was friends with Joaquin Miller. Was a member of the Millville Volunteers. Darrah Springs, Darrah Creek, and Darrah Springs Fish Hatchery all named for him. The Darrah Springs Fish Hatchery is built on his homestead.
Dersch, Frederick, Sr.	Born in 1824. Known as Fred. Brother of George. Arrived at Whiskey Creek in 1850 by ox team and mined for gold until 1861. Lost his eyesight from a mining explosion and settled on Bear Creek with brother George where he became a well known farmer, stockraiser and orchardist. Was picking peaches with George's children when sister-in-law Marie was attacked and killed by Indians in 1866.
Dersch, Frederick, Jr.	Was a farmer at Millville in 1881. Returned to the Bear Creek ranch and operated it the remainder of his life.

Table 11-5. Bear Creek Watershed Assessment 2005
Early Settlers of the Bear Creek Watershed Area
(continued)

Dersch, George	Born 1831. Arrived at Whiskeytown in 1853. Purchased Baker's Place , a stage station and stopping place on Bear Creek in 1860 and continued to operate it as a stopping place. Wife Marie was killed here by Indians in 1866. Was a member of the Millville Volunteers. Was appointed District #4 Roadmaster (Fall River Valley) in 1871. Owned the Hughes Ferry in 1881.
Dersch, Marie	Wife of George. Arrived at Whiskeytown in 1853 with husband. Moved to the Baker Place beside Bear Creek in 1860 where she was killed by Indians in 1866 at age 35. Name on gravestone reads Annie Maria Kemmelmier. Volunteer militia companies from nearby Pine Grove and Millville immediately organized after her murder and killed untold numbers of Indians at the Jelly's Ferry, Cottonwood, and Millville Indian rancherias in retaliation.
Gransbury, John W.	1868-1938. Homesteaded most of Long Hay Flat between Viola and Manton in 1891. Raised sheep, cattle, root vegetables, and made cedar and white fir posts and shakes.
King, James	Possibly he and Thomas Asbury were the first shingle/shake makers in the Shingletown area. He was a business partner of James LaTour in a Shingletown shake-making business. He also owned and operated a blacksmith shop in 'downtown' Shingletown next to Freeland's Store in 1855. The last blacksmith shop stood two stories tall; the 2 nd floor was used as a dance hall and was the location of many gala affairs. He owned a horse racing track at Pine Grove in the 1860s. He pastured his horses and mules at Kings Creek Meadows approximately two miles southeast of Lassen Peak. Kings Creek, Kings Creek Falls, and Kings Creek Meadows are all named for him.
Klotz, Rudolph	1832-1885. Brother of Fred, Dan and John. Arrived at Shasta in 1853 and established a butcher shop with brother John. Purchased a Shingletown sawmill in 1856 near present-day Nora Lake, made many improvements and established the Klotz Factory. He then ox-teamed lumber from the mill to Logan's Ferry where it was rafted downriver by his brother Dan. He raised cattle and horses. Built two fish ponds, one for catfish, the other for trout. Built a winter home in Parkville District because the Shingletown winters were too severe for his family. Built a subscription school near the factory, and later in 1865 built the Parkville schoolhouse. Was a member of the Millville Volunteers in 1866. Owned the Dry Mill and the Eureka Mill with partner Sylvanus Leech. Was the 1 st Shasta County millman to take advantage of the railroad and built a spur railroad line from the Sacramento River to Panorama Point. Built a 14-room mansion just above the mill and surrounded it with an orchard. The mansion burned and another was house built on the same spot, that house also burned. A PG&E maintenance building now stands on the spot. His home was the center of the Shingletown area social scene. He became a wealthy and influential timber baron and owned thousands of acres of timberlands. Elected Assemblyman in 1874. Committed suicide in 1885. Was buried beside his sons in Klotz Mill Cemetary near the factory (Shuford 1070).
LaTour, Christopher Albert	1881-1936. Son of James. Named for his father's friend Kit Carson. Was a cattleman/rancher. Lived near Black Butte, also Balls Ferry, and later at Anderson.
LaTour, James Cochran	1827-1906. Known as Loving Uncle Jim. Arrived at Shasta in 1849 by ox team. Was a blacksmith, freighter, and Scribe. Had a knack of braying like a mule. Jackass Flat (near Horsetown) supposedly received its name because of him. Acquired squatter's rights to meadowland north of Viola in 1850. Partnered with James King in a shake-making business near Shingletown on Shingle Creek. Partnered with Matthew Brand in cattle raising, a freighting business, the operation of Hill's Trading Post, and a relay station for the California-Oregon Stage Line. Brand and LaTour hauled the first bullion load from Shasta to the mint at Carson City, Nevada. The round trip sometimes took months. While in Carson City, LaTour heard of Brand's death, sold the ox team and walked back to the trading post in freezing weather and knee deep snow. Purchased 320 acres in 1872 which later became known as LaTour Meadows. Blazed and cut the first road from Hill's Trading Post to LaTour Meadows. LaTour Meadows, LaTour Butte, LaTour Lookout Station, and LaTour Demonstration State Forest are all named for him.
Logan, Pleasant Dixon	1824-1899. Settled at Cottonwood in 1868. Invented the world's 1 st traction engine inside the Logan and Wise Foundry building located on the south side of Front Street at Cottonwood. Patent supposedly was lost to the Holt and Gregg firm of Anderson. Purchased the Adams Ferry in 1878 and renamed it Logan's Ferry. Moved to Palo Cedro in 1890 after the ferry was destroyed.

Table 11-5. Bear Creek Watershed Assessment 2005
Early Settlers of the Bear Creek Watershed Area
(continued)

Logan, Richmond	1860-1944. Clayton was his actual name. Son of Pleasant. Lived primarily in the Ball's Ferry area. Was a farmer, sheepman, and cattleman. He was also a crack shot and avid hunter. He and his sons hunted, captured, and tamed wild horses. Helped in the operation of Logan's Ferry from 1878 until 1890. Helped build the Logan and Wise Foundry on Main Street in Cottonwood; a marker designates its location. Logan Butte, Little Logan Butte, Logan Lake, and Logan Mountain were summer pasture for three generations of Logan cattlemen. All are located north of Lassen Peak and west of Old Station. Logan Road is named for Ralph Logan, former owner of the property prior to development. Lilla Lane in Palo Cedro is named for Lilla Logan, farmer and wife of Richmond; Sheridan Street and Grant Streets in Redding are named for other family members. The Richmond Logan Memorial Bridge across Cow Creek in Palo Cedro was formally dedicated on 5-3-1999.
Loomis, Benjamin Franklin	1857-1935. Known as Frank. Arrived at Manzanita Lake in 1874, built a cabin and became a shakemaker. Traveled to New York City in 1886 and studied at the American Institute of Phrenology (the study of the shape of the human head) until 1887. Returned and homesteaded in 1888. Named his homestead Viola after his mother. Established and operated a store at the site in 1896. Married Estella Loomis in 1897. Hauled shakes to the Sacramento valley and freight back to Viola. Purchased the Vilas Mill in 1906 plus considerable timberlands, and began logging. Some of the logs were so large that holes were drilled in them to blast them in half. Was among the first to photograph the eruption of Lassen Peak in 1914 and took many photos of later eruptions. Purchased the Shingletown Hotel in 1923 and moved it to Viola where it stayed in operation until December 26, 1953 when it was destroyed by fire. Estella died the night the hotel burned to the ground. Built the Mae Loomis Memorial Museum (currently known as Loomis Visitor Center) as a memorial to his only child Mae. Deeded 40 acres and the museum to Lassen Volcanic National Park in 1929. Loomis Peak is named for him.
Noble, Hamden Holmes	1844-1929. He was usually known as H. H. Noble. Was originally a San Francisco businessman. He founded the Keswick Electric Power Company in 1900 to supply hydroelectric power to the smelters of Mountain Copper Company. He reorganized the company in 1902 as the Northern California Power Company and expanded by purchasing small electric companies and building others. He sold to Pacific Gas & Electric Company in 1919. He had the Nobles' Bungalow, also known as The Castle in the Sky, and Nobles' Castle built in 1903. It was located on a rocky point on the south rim of Shingletown Ridge just south of Nora Lake overlooking the Manton valley (see Historic Places for more info).
Ogburn, Charles E.	Known as Charley. He was one of the first Shingletown area settlers and supposedly blazed a trail from the area of Balls Ferry to the Shingletown Ridge and settled on the ridge in 1848 at the present day location of Midway. He then traveled home to North Carolina and returned with brother John and friend Isaac Shouse. Together they planted large vegetable gardens and sold the vegetables to travelers on the nearby Nobles' Emigrant Trail. They also improved and expanded the homestead into a roadhouse and stopping place popularly known as Charlie's Place. The place became famous for his peach brandy and excellent blacksmithing. A distillery was on the premises as well as a sawmill. The distilling process started with the peach season and continued until all the fruit was made into brandy. Charlie supposedly returned to North Carolina for good in 1856 at which time he sold the place to brother John. Bull and bear fights were held on the property; supposedly a bear chain rung is still embedded in an oak tree and remnants of the bear pens still exist. People came from as far away as Sacramento to witness the events and numbered in the 100s. Betting was heavy. A BBQ and dance lasting until daylight followed the fights. The last fight was held in Sept. 1859 and by then the law had stepped in to put a stop to this favorite Mexican sport. The arena was built of logs around a deep trench. Poles about 20 feet high buried 3 feet in the ground were placed close together and securely nailed at the top. It was round in form and about 60 feet across with a drop door made from a slab of a large log. Wagons were backed up to the door and the bear was prodded into the arena with hot irons where a bull was waiting for him. The spectators sat around on the outside of the stockade where they could look down on the fight on elevated seats. Two plaques locate the place; each has contradicting information about the history and the name (Charley's Place and Charlies Place). One states the place wasn't settled by Ogburn until 1853 while the other says he built a road to the site in 1848. Herbert "Ringtail" Johnson purchased the ranch in 1942. The second house on the property, built in 1867, burned to the ground in 1952.

Table 11-5. Bear Creek Watershed Assessment 2005
Early Settlers of the Bear Creek Watershed Area
(continued)

Nunes, Antone C.	Settled on a portion of the Briesgau Grant beside Battle Creek. Received title to the land in 1866. Purchased Mountain Home as summer range for his cattle.
Park, John W.	1823-1879. Settled on a portion of the Rancho de Briesgau grant in 1850 on the south side of Bear Creek. Filed for squatter's rights prior to 1852. Received a legal patent in 1861. The Parkville Post Office was named for him.
Phelps, Robert E.	1874-1933. Settled at Shingletown in 1895 to make shakes. Married Alta LaTour in 1897. Owned the first Edison phonograph in the Shingletown area. Purchased a sawmill located approximately 1.5 miles E of Shingletown beside Baldwin Creek in 1909 and operated it until 1914. Moved to Anderson in 1910 for better schooling for their children; moved permanently in 1915. Was on top of Lassen with his mill crew when it erupted in 1914. Purchased a second mill at Whitmore in 1916.
Smith, William Worthington Lassengree	1821-1893. Known as Billy. Traveled to California by wagon train in 1853 and settled at Shingletown. Purchased the Dry Mill (later called the Old Dry Mill) at Shingletown in 1853. Sold the mill in 1856 to George C. Woodall. Built and established the Wayside Inn aka Foot of the Mountain Station beside Nobles' Emigrant Trail in 1858. Turned ownership of the station and the adjoining 240 acres over to employee/housekeeper Phoebe Colburn (freed black slave), as payment for a \$500 loan. Became the 1 st postmaster of the Parkville Post Office in 1871. Purchased the Deer Flat Stage Stop in 1872 and made improvements consisting of a 2-story, 10-room house, tavern, large barns and corrals. Deer Flat became an overnight stopping place for stockmen and thousands of sheep and cattle driven to and from summer pasture ranges. He sold to Thomas B. Armstrong in 1890 and settled in Parkville and raised cattle. Appointed to the Public Highway Board. Also served as a school trustee and a County Supervisor.
Thatcher, Ezekial Thomas	1825(?) -1908. Arrived at Shasta in either 1850 or 1852. Gold-mined and hewed and whipsawed lumber for a short time. Settled on Bear Creek in 1853 approximately two miles up-creek from Parkville and engaged in farming, stock-raising, teaming and lumbering. Was continually involved in the lumber business throughout his life although his sons were more involved. Hauled the first load of lumber out of the mountains with three yoke of oxen from Shingletown to the Baker Place on Bear Creek. Hauled produce and stock to Shasta for sale. Hauled the lava rock that was used to build Fort Reading. Purchased the Pine Grove Ranch in 1870 west of Shingletown and continued operating the hotel and adjacent corrals. Provided blacksmith services and oversaw the cutting of millions of feet of lumber at the ranch sawmill. Was a member of the Millville Volunteers.
Tuggle, William M.	1824-1900. Arrived here in 1862. Was a teamster between Shasta and Red Bluff. Purchased the Shingletown property of Lewis Thomas in 1872 and built a 2-story house, barn and milk house over a spring under which flowed the headwaters of Baldwin Creek. Sold to a Mr. Ward in 1883, who sold to Harriet Brand, who sold to Northern California Power Company in 1899. Moved to the Churn Creek area.
Vilas, Marcellus B.	1834/35(?) -1906. Known as MB. Arrived in 1859 as a goldminer. Purchased the McCumber Mill in 1865 on Mill Creek, sold to Abraham Cunningham in 1875, purchased the mill back in 1879, and greatly improved it. The mill then became known as the McCumber-Vilas Mill and was considered the granddaddy of all the mills. Vilas built a 12-room palatial house surrounded by apple trees near the mill plus many smaller houses for his mill workers. The employee houses were destroyed by a 1933 forest fire.
Witherow, Samuel N.	1854-1924. School teacher. Arrived at Shasta with his family at age 14. Returned to Los Angeles with his family in 1873, returned at age 20 and homesteaded on Bear Creek with Joseph Darrah, later purchased Darrah's share. Taught school in the mountains in the summer and in the valley during the winter. Was appointed Deputy County Clerk in 1898 and elected as County Clerk in 1906, a position he held until his death in 1924.

Hardscrabble: A Narrative of the California Hill Country is an autobiographical account of the first eighteen years (1907-1925) in the life of Anita Vivian Aldridge Kunkler. The family of William Aldridge, originally from the hill country of North Carolina, took over the homestead of James and Elizabeth McCoy in eastern Shasta County in 1862, and built a house near the confluence of Snow Creek and North Fork Bear Creek within the Bear Creek watershed. In 1889, David Atheson (a.k.a. Att) and Sarah Parker filed a claim for

government land located three miles up North Fork Bear Creek from his parents ranch. Att named the ranch Hardscrabble, and in 1907, Anita Kunkler was born at Hardscrabble.

In *Hardscrabble*, Kunkler describes various physical and cultural conditions within the Bear Creek watershed, and the interplay between humans and the environment. She constantly refers to streams, mountains, communities, ranches, economic and social conditions, and lifestyles of various people within the watershed. What makes this book special is that Kunkler clearly and concisely gives a voice to those that otherwise are not represented in history books. In a macrocosmic sense, the book provides insight into the lives of people who emigrated from the Appalachian and Ozark Mountains into the mountains of Shasta County. In a microcosmic sense, the book is informative with relation to Eastern Shasta County and the Bear Creek watershed, particularly during the period from 1907 to 1925.

Hardscrabble is available for reference through the Shasta County Library, the Shingletown Historical Society, and the Shasta Historical Society. The book can be purchased at the Shingletown Historical Society.

CENSUS AND DEMOGRAPHIC DATA

Official census counts in Shasta County began in 1860. However, there was no differentiation in census counts between the Millville area within the Cow Creek watershed, and the Shingletown/Inwood area within Bear Creek watershed. By 1900, the census divided Shasta County into 16 enumerated townships, which included a division between the Millville and Shingletown townships. In 1970, Shasta County Planning Department conducted a more detailed census, which included the collection of more precise demographic data within Shingletown-Viola, and Inwood, separately. And by 1990, the U.S. Census had created a system of census tracts, block groups, and blocks, with public access to the data, supplying the most precise census information specific to the Bear Creek watershed.

Table 11-6. Bear Creek Watershed Assessment 2005
Shasta County Decennial Census Data
 (on file, Shasta County Library)

<i>Decade</i>	<i>Population</i>	<i>% change from previous year</i>
1850	378	
1860	4351	1050
1870	4173	-4
1880	9492	127
1890	12133	28
1900	17318	43
1910	18920	9
1920	13361	-42
1930	13927	4
1940	28800	107
1950	36413	26
1960	59468	63
1970	92100	54
1980	115715	25
1990	147036	27
2000	163,256	11

In general, population in Shasta County has been erratic, and dependent upon economic conditions. The greatest increases in population took place between 1850-1860 as a result of the gold rush, 1870-1880 as a result of the copper boom and the arrival of the railroad, and in 1930-1940 as a result of the Central Valley Project. The greatest losses in population occurred from 1860-1870 and from 1910-1920. The 1860-1870 population decline was the result of the depletion of easily acquired placer deposits, and a shift from independent gold mining operations to highly financed corporate ventures. The decline of 1910-1920 was the result of the closure of mines due to the low price of gold, and a sharp decline in the lumber industry as mentioned in the "Lumber Industry" section of this document. Local residents termed the period of the early 1920s as the "doldrums", and the Great Depression of 1929 actually struck the Redding area ten years earlier. As one long-time resident put it: "When the depression struck Shasta County, its effect was not major, we already had nowhere to go but upward." (Petersen 1972)

According to the 1860 census records on file at Shasta Historical Society, the 1860 population for Millville, which included the Shingletown area, was 118 people. The population was composed of 79 males and 38 females. Of these, 70 were employed as followed: 26 farmers; 35 laborers; 2 sewers; 2 servants; and a black smith, milliner, wagon maker, lawyer, and student.

Population and demographics for Shingletown proper are only available from 1900 forward. This is due to district boundaries changing from area-based prior to 1900 to a more city-specific survey thereafter. However, the 1900 census incorporates the towns of Inwood, Viola and the surrounding areas outside of the Bear Creek watershed with no distinction being possible at this time. Also there were 16 people of Chinese ancestry (their ages ranged from 38 to 60) that have been omitted from the following statistics due to the inability to distinguish male from female. As shown in Table 11-8, they all listed "gardener" as their occupation, with one being head-of-household and the remainder regarded as "servant". The data shown in Tables 11-7 and 11-8 was compiled at the Shasta Historical Society.

**Table 11-7. Bear Creek Watershed Assessment 2005
Total Population from the 1900 Shingletown Census**

<i>Ages</i>	<i>Male</i>	<i>Female</i>
0-10	157	153
11-20	104	89
21-30	93	77
31-40	88	62
41-50	54	34
51-60	48	30
61-70	49	15
71-80	17	8
81-90	2	5
Total	612	473
Oldest Age	86	
Heads of Household	219	14

**Table 11-8. Bear Creek Watershed Assessment 2005
Occupations, 1900 Shingletown Census**

At School	226	Flour Miller	2
Farmer	172	Mill Wright	2
Day Laborer	96	Stock Herder	2
Farm Laborer	25	Store Clerk	2
Teamster	16	Broom Maker	2
Gardener	16 (All Chinese, listed above)	Board Maker	2
School Teacher	10	Minister	1*(See "Clergyman")
House Keeper	9	Cattle Herder	1
Cook	7	Sheep Herder	1
Merchant	6	Timber Faller	1
Blacksmith	6	Logging	1
Sawyer	5 *(See "Mill Sawyer")	Fireman	1
Servant	5 *("Occupation" category, also under "Relationship")	Dentist	1
Carpenter	5	Shoe Maker	1
Dress Maker	4	Painter	1
Sawmill Engineer	3	Wheel Wright	1
Engineer	2	Road Grader	1
Mill Sawyer	2*(See "Sawyer")	Cattle Dealer	1
Log Cutter	2	Salesman	1
Mill Owner	2	Miner	1
Mill Laborer	2	Machinist	1
Clergyman	2*(See "Minister")	Cigar Maker	1
		Actress	1

According to records on file at Shasta County Public Library within the Boggs Collection, in 1970, the Shasta County Planning Department provided population data more specific to the Bear Creek watershed, in addition to population projections. The Inwood area was divided from the Shingletown area; however, Shingletown populations also included the Viola area (outside of the watershed). At this time, population densities in Shasta County were 20.07 persons per square mile, and the racial makeup of the county consisted of 96.9% Whites, 1.7% Native Americans, 0.8% Blacks, and 0.2% other.

**Table 11-9. Bear Creek Watershed Assessment 2005
1970 Population Statistics and Projections**

<i>Area</i>	<i>1970 population</i>	<i>1980 projection</i>	<i>1990 projection</i>
Shingletown-Viola	1050	2550	3350
Inwood	200	450	600

CENSUS 2000

Census 2000 studies conducted by the U.S. Census provide population/demographic data specific to the Bear Creek watershed. The watershed is subdivided into census tracts, block groups, and blocks, each with a corresponding number. The watershed falls within Shasta County Census Tract # 126.02, of which the watershed incorporates about 40 percent of the tract (Figure 11-1). Within Tract 126.02, the watershed is further divided by Block Groups # 1, 2, 3, and 4 (Figure 11-2). These block group boundaries are still not specific enough to provide accurate populations within the watershed. In order to obtain the most accurate population counts for the watershed, census records for 250 census blocks within the boundaries of the watershed were investigated and tabulated into an MS Excel spreadsheet, and these blocks are shown in Figure 11-3. Of the 250 total blocks within the watershed, 131 of these are not populated. Total population/ethnic tabulations are shown for 119 populated blocks within the watershed

below (Table 11-10). A more detailed spreadsheet, with demographic information for each block, is attached (Appendix 11-A).

**Table 11-10. Bear Creek Watershed Assessment 2005
Total Population and Ethnicities**

<i>Population</i>	<i>Persons</i>	<i>% of total</i>
Males	1651	51
Females	1585	49
White	2958	91
Hispanic	122	4
Native American	46	1
Asian	11	< 1
Black	8	< 1
Pacific Islander	2	< 1
Other:	7	< 1
Two or more races	82	3
Total	3236	100

Census data is provided by the U.S. Census's American Fact On-line at (<http://factfinder.census.gov>)

REGISTERED SIGNIFICANT HISTORICAL SITES

In general, in order for cultural resources to be considered significant and eligible for listing in the National Register of Historic Places, they must possess integrity of location, design, setting, materials, workmanship, feeling and association, and must (a) be associated with significant events, or (b) be associated with the lives of persons significant in our past, or (c) embody distinctive design/construction, or (d) have yielded, or may be likely to yield, information important in prehistory or history. To be eligible for listing in the California Register of Historical Resources, cultural resources must also possess the above characteristics, with additional attention focused on California and local history and prehistory. Locally recognized historical sites (such as Charlie's Place listed below) are not regulated by state or federal mandate, and as such, their recognition of significance can be initiated through local historical societies, organizations (such as the 4-H Club) and communities. The following list of registered federal, state, and local historic sites located within and near the Bear Creek watershed was compiled by Dottie Smith (2004).

**Table 11-11. Bear Creek Watershed Assessment 2005
Listing of Registered Significant Historical Sites
within the Bear Creek Watershed**

Balls Ferry (ferry and townsite)	California Historical Landmark No. 4
Battle Creek Bridge	National Register of Historic Places
Charlie's Place	Local historic site with two plaques
Cottonwood Historic District	National Register of Historic Places
Dersch Homestead	California Historical Landmark No. 120
Nobles' Bungalow	Local historic site with a plaque
Nobles' Emigrant Trail	National Register of Historic Places
Nobles' Trail Twin Bridges	National Register of Historic Places
Shingletown	California Historical Landmark No. 8
Volta Powerhouse	National Register of Historic Places

11.4. List of Historical Societies and Historic Collections

The following organizations are responsible for the stewardship and dissemination of historical information relating to collections they possess. Additional historical and genealogical information relative to the Bear Creek watershed can be obtained by contacting those organizations.

Anderson Historical Society
2330 Ferry Street
Anderson, CA 96007

Bureau of Land Management
Redding, CA
(for General Land Office records and maps)

Shasta Historical Society
1449 Market St.
Redding, CA 96001

Shasta County Public Library, Redding
The Boggs Collection

Shasta College Museum and Research Center
11555 Old Oregon Trail
Redding, CA 96003

Shingletown Historical Society
P. O. Box 291
Shingletown, CA 96088

11.5. List of Organizational Tribal Councils

The following list of Native American Tribes and groups is provided below. This list is time-sensitive, and subject to updates; additional information can be obtained through the State of California Native American Heritage Commission. This list is a general starting point whenever information regarding prehistoric cultural resources, burial grounds, or Traditional Cultural Properties is requested.

Native American Heritage Commission
915 Capitol Mall, Room 364
Sacramento, CA 95814

Pit River Tribe of California
37014 Main Street
Burney, CA 96013

Pit River Tribe of California, Illmawi Band
P.O. Box 48
Fall River Mills CA 96028

Pit River Tribe of California, Ajumawi Band
P.O. Box 1253
Burney, CA 96013

Pit River Tribe of California, Madesii Band
P.O. Box 141
Montgomery Creek, CA 96065

Redding Rancheria Tribal Office
2000 Redding Rancheria Road
Redding, CA 96001

Roaring Creek Rancheria
P.O. Box 52
Montgomery Creek, CA 96065

Wintu Education and Cultural Council
12138 Lake Blvd.
Redding, CA 96003

Wintu Tribe and Toyon Wintu Center
2675 Bechelli Lane
Redding, CA 96001

11.6. Conclusions

The Bear Creek watershed has a diversity of natural resources, which have been utilized by Native Americans for at least 5,000 to 7,000 years. Native Americans in the watershed were complex hunter-gatherers who practiced a transhumance subsistence strategy consisting of the utilization of various native resources for use within the local economy and in limited trade. European Americans settled in the watershed in the 1830s and practiced a sedentary agricultural/ranching subsistence strategy which consisted of the utilization of land in order to produce and maintain native and non-native resources for use in the local, state, and national economies. Settlement increased dramatically following the completion of Noble's Emigrant Trail in 1851. The most significant and lasting impacts to the landscape by European Americans are the exclusion of fire, introduction of exotic plants and animals, logging, mining, water diversion and management, and stock grazing.

11.7. References

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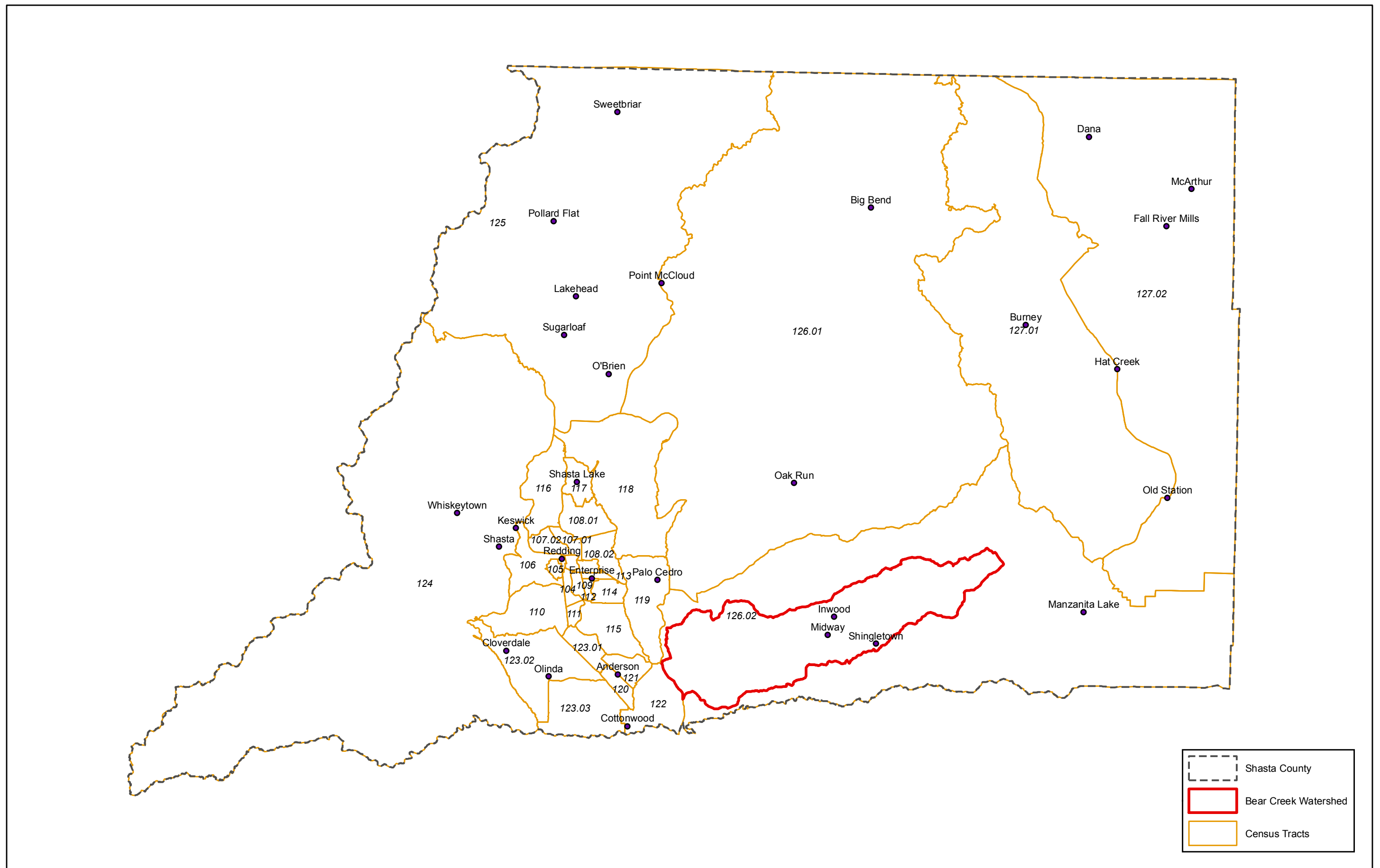


Figure 11-1
Census 2000 Census Tracts, Shasta County
Bear Creek Watershed Assessment 2005

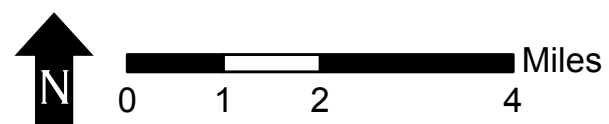
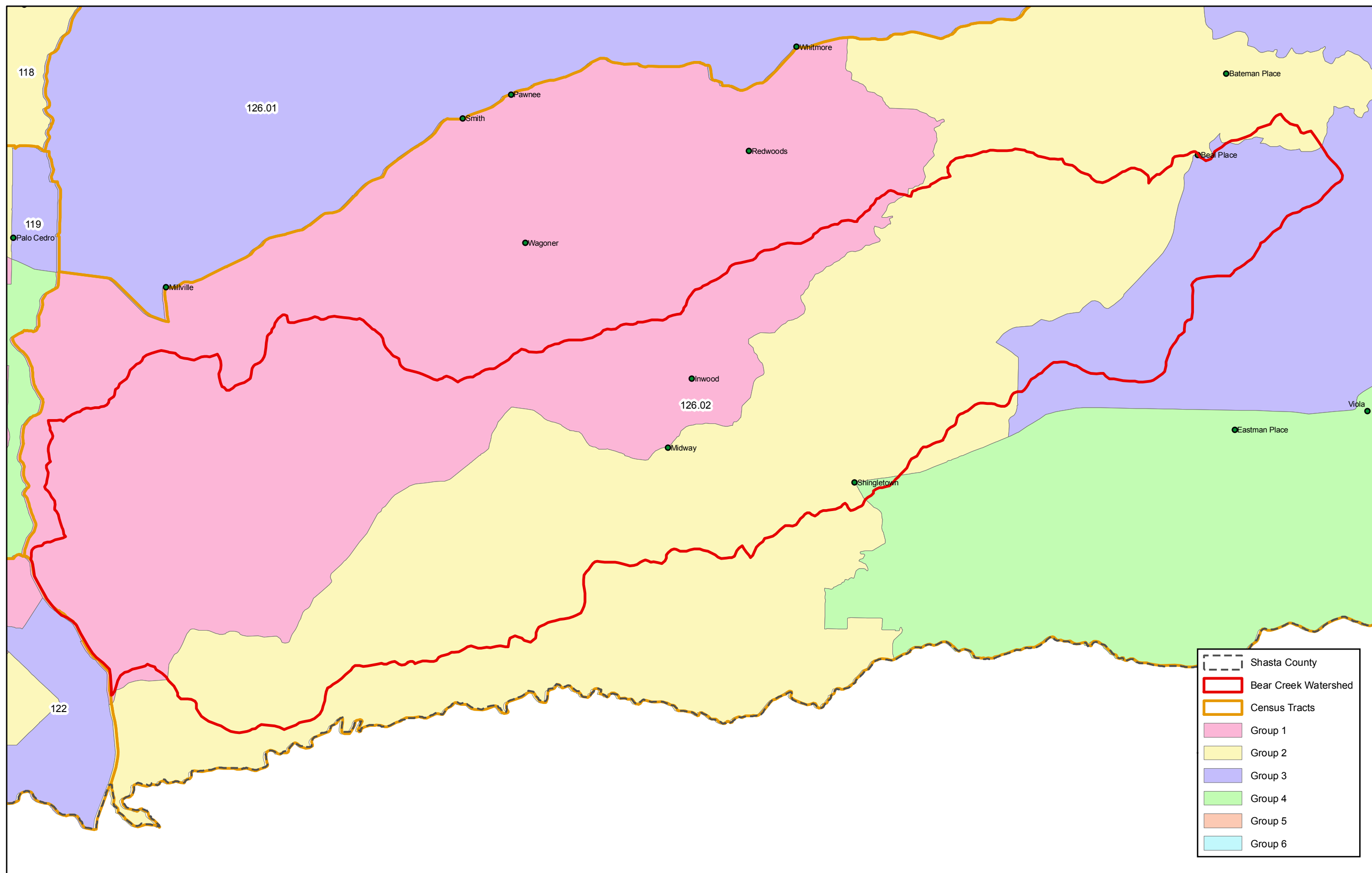


Figure 11-2
Census 2000 Block Groups
Bear Creek Watershed Assessment 2005

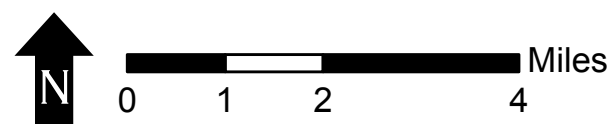
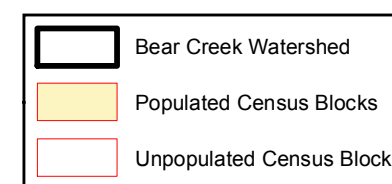
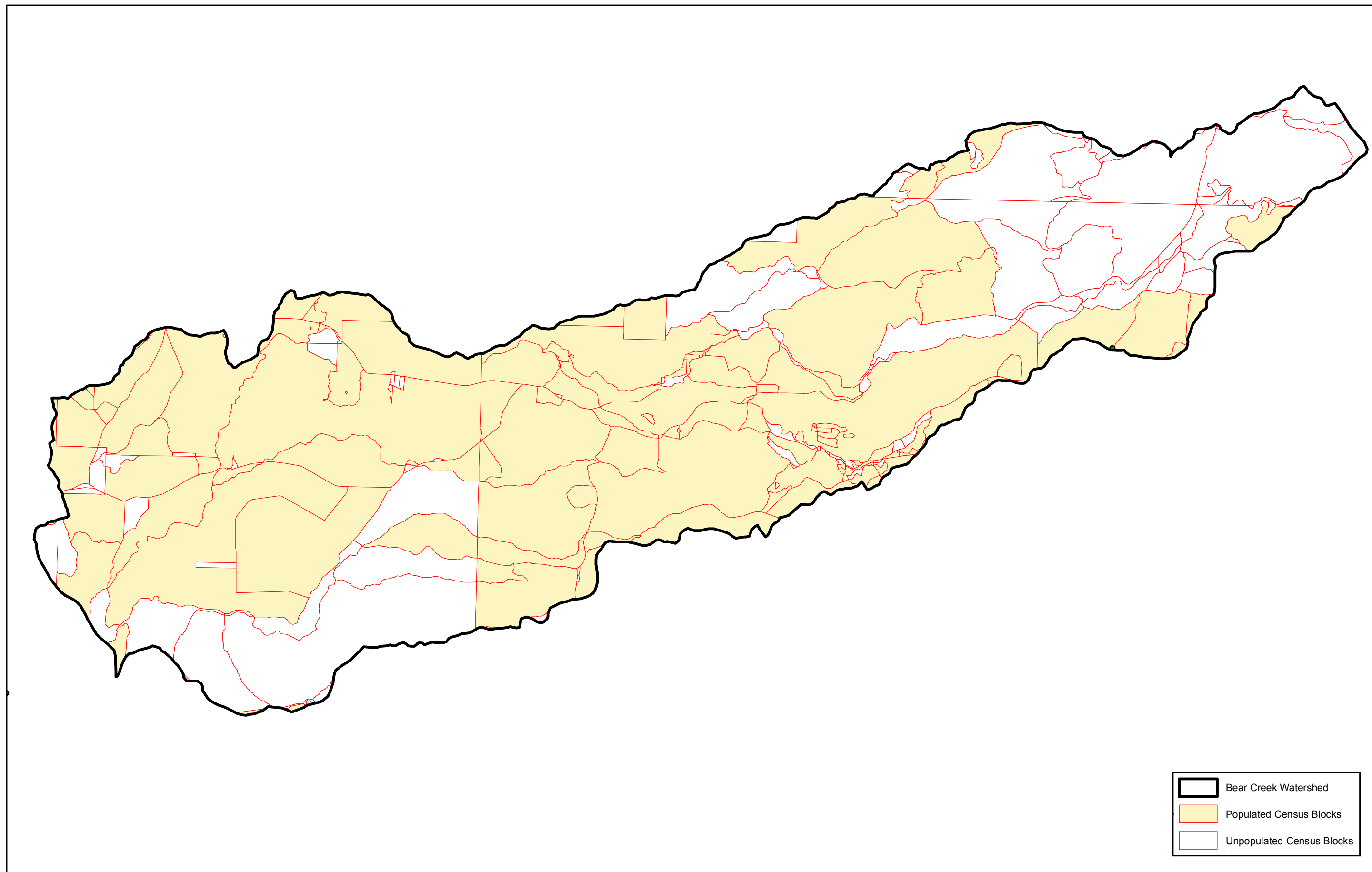


Figure 11-3
Census 2000 Blocks
Bear Creek Watershed Assessment 2005

APPENDIX 11-A

Census 2000 Block Data within the Bear Creek Watershed

CENSUS 2000 BLOCK DATA WITHIN THE BEAR CREEK WATERSHED																					
Key: Pop = Population; M = Male; F = Female; Wht = White; Blk = Black; As = Asian; His = Hispanic; NA = Native American; Two + = Two or more races																					
Tract #	Block	Pop	M	F	Wht	Blk	As	His	NA	PA	Other	Two +	NA/Wt	As/Wht	Blk/Wht	NA/Blk	Wht/Other	NA/As	As/PA	Wht/As/PI	
12602	1025	65	32	33	63			1				1	1								
12602	1032	57	29	28	52				2		0	3	3								
12602	1034	11	6	5	11																
12602	1035	14	6	8	14																
12602	1036	7	3	4	7																
12602	1052	16	8	8	11			3	1	1											
12602	1053	10	4	6	6						0	4	4								
12602	1054	4	3	1	4																
12602	1055	2	1	1	2																
12602	1056	5	2	3	5																
12602	1059	47	31	16	47																
12602	1061	20	10	10	19						1										
12602	1065	1	0	1	1																
12602	1066	9	3	6	9																
12602	1067	2	1	1	2																
12602	1068	4	2	2	2							2	2								
12602	1069	28	15	13	27		1														
12602	1071	1	0	1	1																
12602	1073	10	6	4	10																
12602	1074	69	37	32	63				4			2	2								
12602	1075	185	101	84	171			9	2	1		2	2								
12602	1076	8	4	4	8																
12602	1077	15	6	9	15																
12602	1079	33	15	18	33																
12602	1080	23	10	13	23																
12602	1081	48	25	23	39			3	2			4	3	1							
12602	1083	8	4	4	8																
12602	1090	1		1	1																
12602	1092	2	1	1	2																
12602	1093	10	5	5	8			2													
12602	1094	10	4	6	10																
12602	1096	2	1	1	2																
12602	1097	1		1								1	1								
12602	1099	9	4	5	9																

CENSUS 2000 BLOCK DATA WITHIN THE BEAR CREEK WATERSHED																					
Key: Pop = Population; M = Male; F = Female; Wht = White; Blk = Black; As = Asian; His = Hispanic; NA = Native American; Two + = Two or more races																					
Tract #	Block	Pop	M	F	Wht	Blk	As	His	NA	PA	Other	Two +	NA/Wt	As/Wht	Blk/Wht	NA/Blk	Wht/Other	NA/As	As/PA	Wht/As/PI	
12602	1101	33	20	13	32			1													
12602	1103	4	2	2	4																
12602	1105	5	3	2	4		1														
12602	1106	87	48	39	63	1		12			4	7	5			2					
12602	1108	19	9	10	19																
12602	1114	39	22	17	32	4		1	1		1										
12602	1129	6	4	2	6																
12602	1130	10	6	4	10																
12602	1131	9	5	4	9																
12602	1132	55	27	28	48			6				1					1				
12602	1133	8	4	4	8																
12602	1135	2	1	1	2																
12602	1136	35	18	17	35																
12602	1144	5	2	3	2			3													
12602	1146	13	7	6	13																
12602	1150	7	5	2	7																
12602	1152	4	1	3	4																
12602	1156	5	4	1	5																
12602	1157	14	6	8	14																
12602	1160	4	2	2	4																
12602	1176	1	1		1																
12602	2026	6	3	3	5						0	1	1								
12602	2036	2	1	1	1				1												
12602	2037	5	3	2	4			1													
12602	2039	6	3	3	6																
12602	2041	19	10	9	17						0	2	2								
12602	2043	2	1	1	2																
12602	2044	415	215	200	405	1	1	2	3			3	3								
12602	2045	14	7	7	14																
12602	2046	92	47	45	88			3			0	1	1								
12602	2047	42	17	25	40			2													
12602	2048	37	17	20	32				1		0	4	3		1						
12602	2049	72	35	37	64			6	2												
12602	2050	107	48	59	101			5				1			1						

CENSUS 2000 BLOCK DATA WITHIN THE BEAR CREEK WATERSHED																					
Key: Pop = Population; M = Male; F = Female; Wht = White; Blk = Black; As = Asian; His = Hispanic; NA = Native American; Two + = Two or more races																					
Tract #	Block	Pop	M	F	Wht	Blk	As	His	NA	PA	Other	Two +	NA/Wt	As/Wht	Blk/Wht	NA/Blk	Wht/Other	NA/As	As/PA	Wht/As/PI	
12602	2053	5	4	1	4				1												
12602	2055	8	4	4	7				1												
12602	2056	63	34	29	55		1	1			0	6	2	4							
12602	2058	21	11	10	20			1													
12602	2059	2	1	1	1				1												
12602	2060	184	92	92	177			5	1			1	1								
12602	2061	14	8	6	13			1													
12602	2062	194	104	90	165			13	4			12	8				3	1			
12602	2063	20	12	8	20																
12602	2064	16	7	9	16																
12602	2065	13	6	7	13																
12602	2067	88	45	43	72		5	11													
12602	2068	40	18	22	40																
12602	2069	2	1	1	2																
12602	2070	4	1	3	4																
12602	2071	12	8	4	12																
12602	2072	50	23	27	39			7	3		0	1		1							
12602	2074	2	1	1	2																
12602	2076	3	3	0	3																
12602	2080	13	6	7	11				2												
12602	2081	27	14	13	23			1			0	3							1	2	
12602	2082	2	1	1	2																
12602	2083	2	1	1	2																
12602	2084	12	6	6	9				1		0	2	1				1				
12602	2087	3	1	2	3																
12602	2088	43	20	23	36			3	2		0	2		2							
12602	2089	20	10	10	20																
12602	2096	4	2	2	3						0	1	1								
12602	2097	14	5	9	13						0	1	1								
12602	2098	5	1	4	5																
12602	2101	9	5	4	9																
12602	2102	1	1	0	1																
12602	2105	1	1	0	1																
12602	2106	33	16	17	33																

CENSUS 2000 BLOCK DATA WITHIN THE BEAR CREEK WATERSHED																					
Key: Pop = Population; M = Male; F = Female; Wht = White; Blk = Black; As = Asian; His = Hispanic; NA = Native American; Two + = Two or more races																					
Tract #	Block	Pop	M	F	Wht	Blk	As	His	NA	PA	Other	Two +	NA/Wt	As/Wht	Blk/Wht	NA/Blk	Wht/Other	NA/As	As/PA	Wht/As/PI	
12602	2107	49	24	25	44			4				1		1							
12602	2124	2	1	1	2																
12602	2125	2	1	1	2																
12602	2126	5	2	3	5																
12602	2128	2	1	1	2																
12602	2143	10	5	5	1	2		6	1												
12602	2144	5	2	3	5																
12602	2147	3	1	2	2				1												
12602	2148	28	14	14	26				2												
12602	2150	16	9	7	13				2		0	1	1								
12602	2163	8	3	5	8																
12602	2164	5	3	2	4				1												
12602	3054	33	13	20	33																
12602	3095	60	33	27	53			1			0	6			3		3				
12602	3108	101	50	51	92		1	4	2		0	2	1	1							
12602	3109	7	4	3	7																
12602	4168	39	22	17	29			4	2		1	3	2	1							
12602	4170	10	7	3	8		1				0	1	1								
TOTAL		3236	1651	1585	2958	8	11	122	46	2	7	82	52	11	5	2	8	1	1	2	