

Tehama County Resource Conservation District

# WUI and Watershed Protection / Emergency Access Assessment (Coleman Fish Hatchery Road and Ponderosa Way)

Final Report, including background, public outreach, fuels and roadway assessments, GIS methodology, photographic galleries, field notes, and recommended future projects together with funding strategies.

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# **SECTION 1**

## **Project Background**



# SECTION 1

## PROJECT BACKGROUND

### Introduction

This project began in 2008 funded by a grant of \$30,000 from the US Fish & Wildlife Service (USFWS) to Tehama County Resource Conservation District (TCRCD). The point of contact for the USFWS is Project Officer Miriam Morrill of the Sacramento National Wildlife Refuge Complex, 752 County Road 99W, Willows, California 95988, 530-934-2801, [Miriam.Morrill@fws.gov](mailto:Miriam.Morrill@fws.gov). The project director for TCRCD is Tom McCubbins, 2 Sutter Street, Suite D, Red Bluff, California 96080, 530-527-3013, [tom@tehamacountyrcd.org](mailto:tom@tehamacountyrcd.org). The study area covers two roadways: Coleman Fish Hatchery Road in Shasta County and

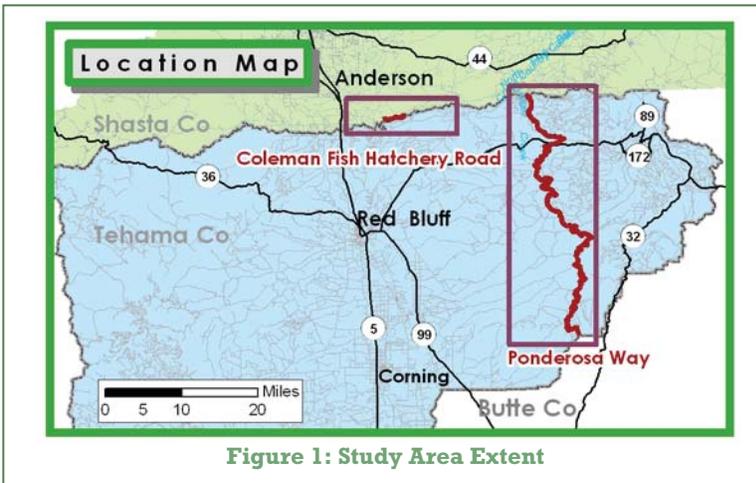


Figure 1: Study Area Extent

Ponderosa Way in Tehama County. See Figure 1 for a map showing the study area extent, and refer to Appendix G for an enlarged, 11x17-inch map of the study area. In addition to serving as de facto fuel breaks, these two roadways also serve as emergency access routes for firefighters and for residents of remote communities such as Cohasset, Lyman Springs, Lyonsville, and the east side of the Manton area. The scope of work for this project includes

assessment of the hazards, risks, partnership options, and potential projects for protecting the community infrastructure, emergency access, and watershed values along the two roads, especially as identified in the Tehama East Community Wildfire Protection Plan. Accordingly, two major goals of this assessment are (a) to determine the feasibility of developing the two roads as shaded fuel breaks and (b) to prioritize future fuel treatment and road maintenance projects.

### Project Components

*Project Activities.* To achieve the project goals, TCRCD has undertaken the following activities:

- Identify landownership along and adjacent to Ponderosa Way and Coleman Road.
- Create a photographic gallery of hydrologic crossings along Ponderosa Way using ArcGIS and Google Earth to aid the Project Manager in understanding the existing fuels and road conditions.

- Analyze current conditions using publicly available Geographic Information System (GIS) datasets, testing the feasibility of remotely identifying priority locations for maintenance along Ponderosa Way.
- Perform field visits along both roadways.
- Coordinate public outreach to interested parties along both roadways.
- Determine the need for reduction of wildland fuels and performance of road surface maintenance along both roadways.
- Create a list of recommended future projects with strategies for funding mechanisms for both roadways.
- Create this planning and strategy document.

*Outreach and Education.* The following actions were completed during the term of the project:

- *Watershed group meetings.* TCRCD staff presented project details and requested public input at two meetings of the Battle Creek Watershed Conservancy in 2009 and 2010.
- *Fire safe council meetings.* Tom McCubbins has organized, attended, and chaired the Tehama-Glenn Fire Safe Council meetings during all project years. Pursuant to requests by fire safe council members, he is developing a programmatic CEQA document for use throughout Tehama County. Additionally, TCRCD staff members have attended three meetings of the fire safe council, presented information related to the project, and received input from members that has been incorporated into this assessment process.
- *Fire-related project database.* TCRCD staff members have created an online mapping tool for reporting, viewing, and printing the location, title, contact, and area covered by fire-related projects in Tehama, Glenn, and Shasta Counties and adjacent to the study area, such as prescribed burns, fuels maintenance, and chipping. This Fire-Related Projects Webtool was created in 2008 and updated during 2010; it may be found on the TCRCD website in the Services section and at the following URL: <http://www.tehamacountyrcd.org/programs/fire2.html>. This webtool helps to keep interested parties informed of proposed, planned, ongoing, and completed projects adjacent to the study area. New projects can then be planned that will take advantage of already-completed work and that will build upon adjacent projects. Because this webtool is available online, outreach has been expanded to a very widespread audience. This webtool will be most effective if it continues to be updated annually.
- *Fire safety workshops.* Two defensible space and fire safety workshops were held in Manton, California under the auspices of the Manton Fire Safe Council and the Battle Creek Watershed Conservancy, on June 18 and again on September 9, 2009. A third workshop was held in Red Bluff on July 23, 2009. A fourth and final workshop relating to fire safe landscaping and defensible space was held on April 10, 2010 at the Tehama County District Fairgrounds in Red Bluff. Total attendee count at all four workshops was 140 persons.
- *Outreach by mail.* TCRCD has conducted a mailing regarding this project to residents living along Ponderosa Way to request their comments regarding the fuels and road conditions. The letter was sent to approximately 43 landowners on August 10, 2009. The form of letter is found in Appendix A.
- *Virtual Tour.* For the Ponderosa Way portion of the study area, a new method has been explored to examine existing conditions along this remote route. A virtual tour

has been created for Google Earth that allows the viewer to virtually “travel” the length of Ponderosa Way from the Shasta County border in the north to the Butte County border in the south, without the need to physically visit the site. The necessary “kmz” file for the virtual tour can be downloaded from the TCRCDD website in the Library section and then played using the free Google Earth software. This new technology allows forestry and natural resource managers and planners to make an initial estimation of conditions from the office and provides an opportunity to plan field visits. More detail is contained in the Virtual Tour paragraph found on Page 24.

- *Photo Gallery.* To further help forest managers and fire prevention personnel gain a broad understanding of the existing conditions along Ponderosa Way, an online photographic gallery of the roadway was created by combining the Google Earth imagery with hydrologic analysis from GIS datasets. This photo gallery shows sequential views of each hydrologic crossing along Ponderosa Way together with the upstream contributing region to each crossing. The web gallery is posted on the TCRCDD website and may be found at the following URL:  
<http://www.tehamacountyrcdd.org/library/publications/Ponderosa/index.html>. More detail is contained in the Web Gallery paragraph of SECTION 3 found on Page 24.
- *Final report.* This report and the accompanying maps in Appendix G will be available digitally by contacting TCRCDD and by downloading from the TCRCDD website in the Library section. However, certain notes and communication contained in Appendix A through Appendix E are provided only with paper copies of this report.

*Environmental Compliance.* In SECTION 2 and SECTION 3 under paragraphs titled Recommended Future Projects and Funding Strategies, lists have been compiled of completed projects related to the study area. In those paragraphs, environmental compliance for the recommended future projects has been outlined, future needs have been described, and possible funding sources and strategies have been included. Additionally, in response to requests from fire safe council members, TCRCDD is pursuing development of a programmatic CEQA in order to avoid potential impacts to the environment and to reduce compliance needs for fire-related projects in Tehama and Glenn Counties.

*On-the-ground project work.* No unexpended project funds remain with which to accomplish on-the-ground projects. However, TCRCDD hopes that this document will aid in obtaining funding for recommended future projects listed at the ends of SECTION 2 and SECTION 3 below.

The following sections discuss the project components relating to each of the two roadways.

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# **SECTION 2**

**Coleman Fish Hatchery Road**

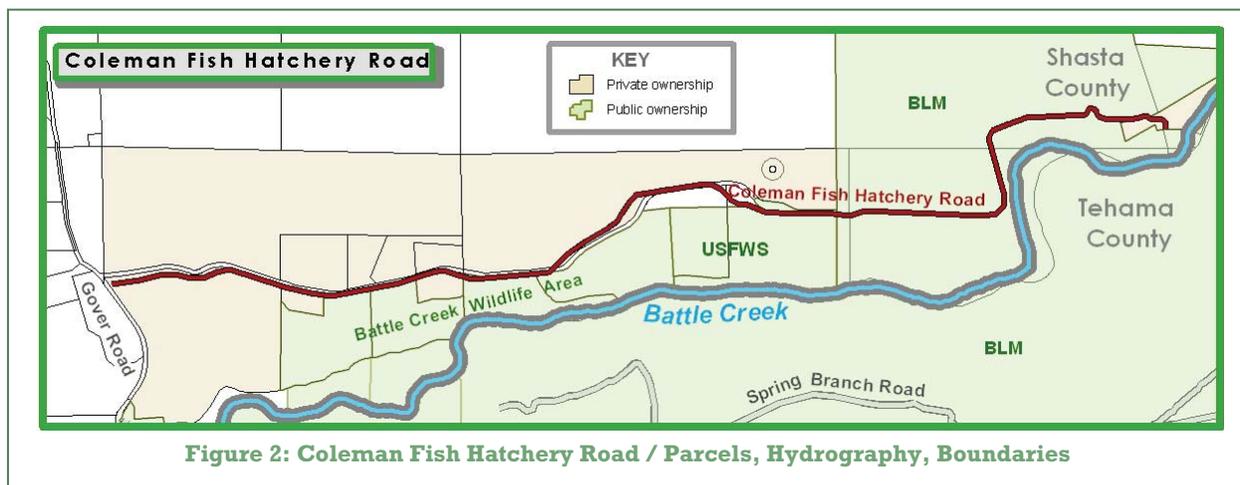


## SECTION 2

### ASSESSMENT OF COLEMAN FISH HATCHERY ROAD

#### Background and History of Coleman Fish Hatchery Road

*Background.* Coleman Fish Hatchery Road is situated on the western flanks of Mount Lassen in Shasta County, California and measures 3.5 miles in length (GIS Advisory Committee, 2008). The route serves the USFWS facilities located at the Coleman National Fish Hatchery alongside Battle Creek in Shasta County, California. Visitors to the hatchery travel from Interstate Highway 5 onto Jelly's Ferry Road, merge onto Gover Road, and then drive east on Coleman Fish Hatchery Road to reach the hatchery facilities. Twenty-three parcels along the roadway are owned by 10 different landowners with parcels ranging in size from one acre to 280 acres. Of these 23 parcels totaling 1,364 acres, 521 acres are privately owned, and 843 acres are in the public domain. For the most part, the privately held lands lie to the north of the roadway. The public acreage is found at the eastern end of the roadway and to the southern side of the roadway adjacent to the nearby stream course of Battle Creek. See Figure 2 for parcel ownership, hydrology, and county boundaries along Coleman Fish Hatchery Road.



Toward the eastern end of Coleman Fish Hatchery Road, the Coleman National Fish Hatchery can be found. This facility was established in 1942 along Battle Creek near the border between Tehama and Shasta Counties. The hatchery contains an array of building and fish production facilities where hatchlings are produced annually, with a long term goal of producing 12,000,000 Fall-run Chinook salmon; 1,200,000 Late Fall-run Chinook salmon; 1,500,000 Winter-run Chinook salmon; and 600,000 Steelhead trout (USFWS, 2010).

*WUI Density and Land Use.* Land use adjacent to Coleman Fish Hatchery Road includes relatively sparse residential development, remote ranch lands, dams and other hydroelectric power operations, and extensive publicly owned lands available for recreational uses. Figure 3 below shows year 2000 WUI density of housing development along Coleman Fish Hatchery Road.

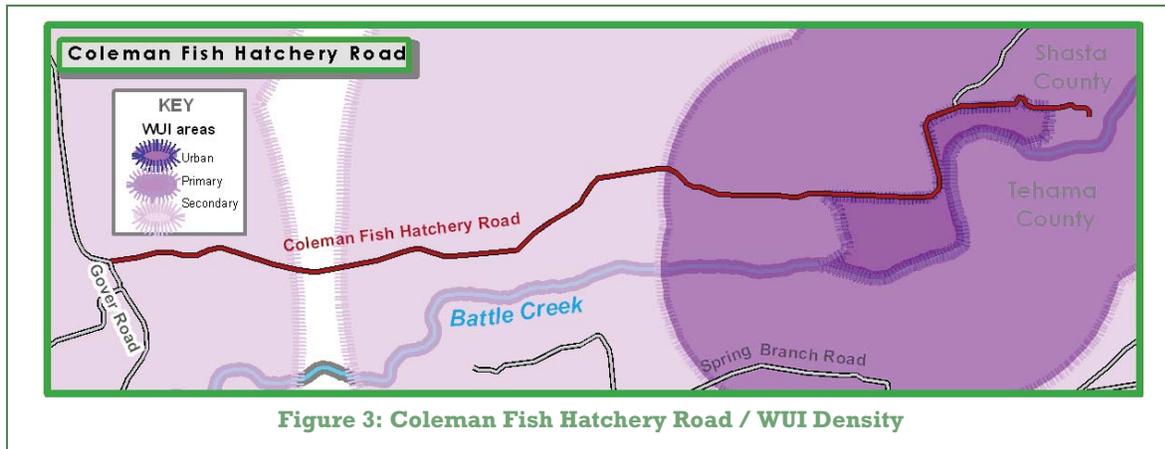


Figure 3: Coleman Fish Hatchery Road / WUI Density

*Watershed values.* Coleman Fish Hatchery Road is located near the main stem of Battle Creek. This snow-fed stream of the Sierra Nevada foothills is unique among Sacramento River tributaries due to its capability of supporting all four runs of Chinook salmon. Currently there are only two remaining suitable spawning habitats for Winter-run salmon: Battle Creek and the upper Sacramento River. Stream channel conditions (e.g., gravel distribution and abundance, sedimentation, and channel morphology) within the main stem of Battle Creek are considered suitable for salmon reproduction. In addition, Battle Creek is the only habitat that can consistently provide the cold waters that Winter-run salmon need for spawning success. Due to the fact that Battle Creek is recognized as having the best potential for restoring all four runs of Chinook salmon, as well as Steelhead trout populations, agency efforts to restore salmon and steelhead to the Sacramento River watershed have specified Battle Creek as a high priority tributary. An agreement known as the Battle Creek Salmon and Steelhead Restoration Project was instituted in January 2000 between the California Department of Fish and Game, National Marine Fisheries Service, U.S. Bureau of Reclamation, U.S. Fish & Wildlife Service, and PG&E to remove dams, restore in-stream flows, and install fish ladders and screens (Bureau of Reclamation, 2000). Improvements to stream flows, to migratory passage at diversion dams, and to operations at the Coleman National Fish Hatchery are aimed at significantly improving anadromous fish migration and reproduction in Northern California. See Figure 4 on the following page for an aerial view of the hatchery facilities (Google Earth, 2009).

In addition to anadromous fish species, numerous stream-dependent vertebrate, invertebrate, and plant species utilize the aquatic and riparian habitat provided by Battle Creek near Coleman Fish Hatchery Road. Many of these species are known to be sensitive to changes in stream flow, water quality, water temperature, and sediment transport and deposition. For example, the Valley Elderberry Longhorn Beetle is a federally-listed species found in the Battle Creek watershed. This beetle requires Valley elderberry bushes for larval and adult life cycles, and these bushes are found largely within the riparian area of Battle Creek adjacent to Coleman Fish Hatchery Road.

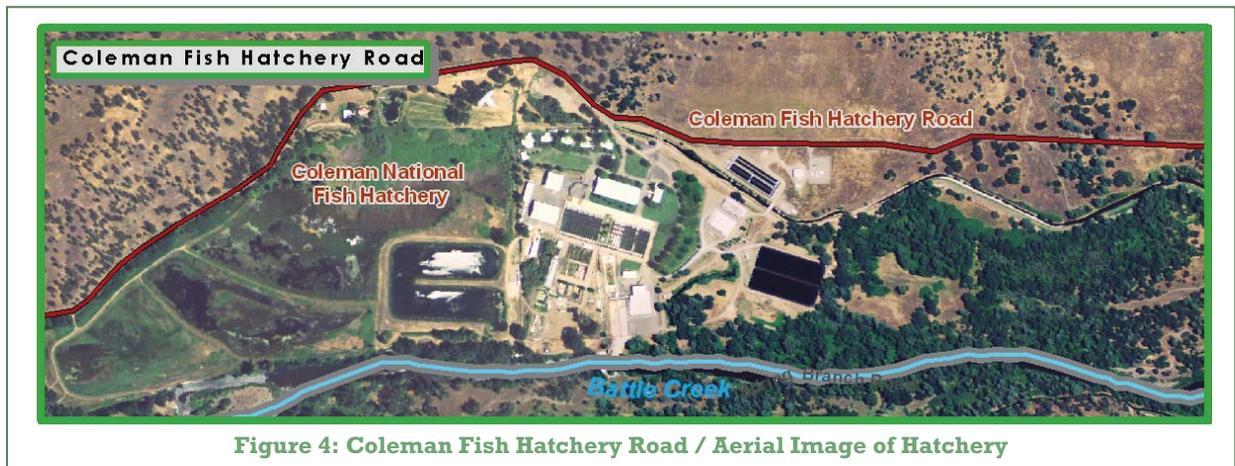


Figure 4: Coleman Fish Hatchery Road / Aerial Image of Hatchery

The landscape surrounding Coleman Fish Hatchery Road consists of a combination of grasslands, oak woodlands, and riparian habitat. Plant and animal species found in these habitats include winter-run Chinook salmon, bald eagle, vernal pool tadpole shrimp, Boggs Lake hedge-hyssop, and slender Orcutt grass, listed as endangered by federal and/or state authorities. Threatened species include the bank swallow, vernal pool fairy shrimp, and the Valley Elderberry Longhorn Beetle (Department of Fish and Game, 2005).

*Battle Creek Wildlife Area.* The Battle Creek Wildlife Area managed by the California Department of Fish and Game lies just to the southwest of the Coleman National Fish Hatchery near the lower main stem and mouth of Battle Creek. These protected public lands provide important spawning grounds for Chinook salmon. They also contain riparian forests, marshes, and oak woodlands, all of which provide important habitat for bald eagle, osprey, and Western pond turtle. Primary access to the wildlife area is via Coleman Fish Hatchery Road, but a portion of the wildlife area can be accessed from the east using primitive ranch roads. The location of these lands is shown on Figure 2 found on Page 5. Photographs showing the trailhead are also included below on Page 11 under the paragraph titled Roadway Assessment / Field Visit.

*Infrastructure.* Coleman Fish Hatchery Road is paved for its entire length, and the road surface is in good condition and wide enough to easily pass a passenger car or a fire truck. Significant infrastructure occurs at the hatchery facilities toward the end of the roadway, where an aqueduct, penstocks, campground, gaging station, and railroad spur are located near the Coleman Powerhouse/Substation. Water flowing downstream in Battle Creek along Coleman Fish Hatchery Road has already been regulated upstream by four small power plants together with several diversions and small reservoirs. More information about hatchery facilities and infrastructure can be obtained from USFWS or found online at the following URL: <http://www.fws.gov/coleman/>.

## Public Outreach

**Tehama-Glenn Fire Safe Council.** Tom McCubbins, Project Manager for TCRCD, has organized, chaired, and attended numerous meetings of the Tehama-Glenn Fire Safe Council during the term of this project.

**Fire Safety Workshops.** Under the auspices of the Battle Creek Watershed Conservancy, the first public meeting was held in the Grange Hall in Manton on June 18, 2009 to discuss fire safety and defensible space. At this meeting, TCRCD staff members and CalFire employees presented fire safety information and details relating to this project. There was lively discussion and participation from attendees.

A followup email was sent on July 1, 2009 to all attendees at the Manton public meeting again encouraging public comments. There were no public comments received by TCRCD regarding Coleman Fish Hatchery Road, but there were numerous comments regarding Ponderosa Way, which are detailed in SECTION 3 beginning on Page 20 under the paragraph heading Public Outreach.



Figure 5: CalFire Speaker on 10-22-2010



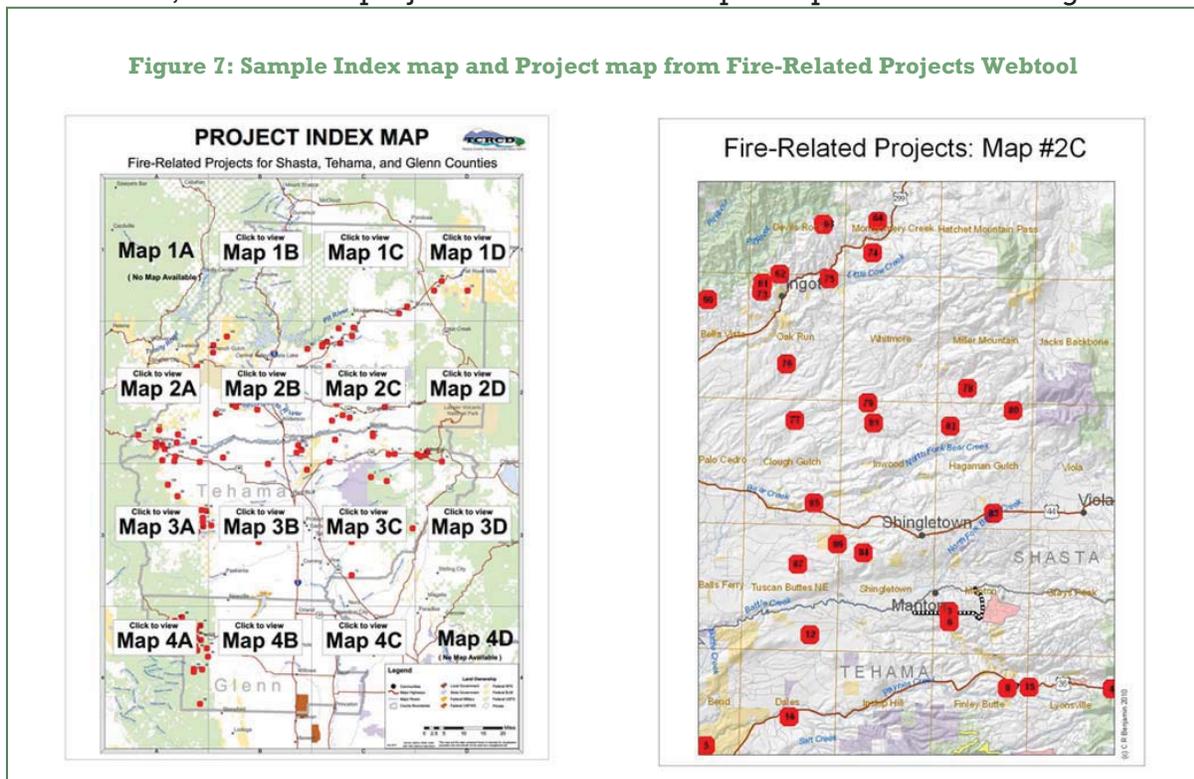
Figure 6: Workshop flyer

Local residents were also invited to a free fire safety workshop and ice cream social held in Red Bluff on July 23, 2009 with announcements sent via the usual methods of press releases, radio bulletin, and email. A third workshop was held in Manton on September 9, 2009, at which materials regarding defensible space were explained, disseminated, and discussed. The fourth and final workshop was held on April 10, 2010 in Red Bluff at the Tehama County District Fairgrounds titled “Fire Foresight: Gardening for Wildfire, Wildlife and Pest Management.” Speakers at this workshop were from CalFire, UC-Cooperative Extension—Glenn County, USFWS, Western Shasta County Resource Conservation District, and Sierra Pacific Industries. Total attendee count for all four workshops was 140 persons.

**Fire-Related Project Database.** TCRCD staff members have created and updated an online mapping tool for reporting, viewing, and printing fire-related projects (such as prescribed burns, fuels maintenance, and chipping) in Tehama, Glenn, and Shasta Counties, including Coleman Fish Hatchery Road. This Fire-Related Projects Webtool may be found at

the following URL: <http://www.tehamacountyrccd.org/programs/fire2.html>. This webtool helps to keep interested parties informed of proposed, planned, ongoing, and completed projects in the local region, and new projects can then build upon completed projects. Online visitors may find nearby projects by visually examining the maps provided. The webtool provides the location, title, contact, and area covered by each project in a spreadsheet format that can be viewed on screen or downloaded. In creating this webtool, TCRCRD georeferenced reported project locations and created web-enabled maps. Using this visual information, regional project planners can conceptualize the relationship between their project and other nearby projects, whether in the planning stage, in progress, or completed. The webtool is most useful if it is not static. Fire management projects are constantly being proposed, implemented, and completed. The Tehama-Glenn Fire Safe Council and other agencies and individuals should be invited to send project descriptions to TCRCRD so that the project database can be kept current, and constructive feedback should be incorporated into the design and maintenance procedures in updating the webtool on an annual basis, before a fire project is undertaken. Sample maps are shown on Figure 7 below.

**Figure 7: Sample Index map and Project map from Fire-Related Projects Webtool**



## Fuels Assessment

*Fire as a Landscape Process.* Fire is an important natural process for sustaining the ecological health of watersheds in California. Wildfire risk of past decades led to somewhat indiscriminate fire suppression and lack of broad-scale prescribed burning, which altered the age and size structure of oak woodlands and foothill chaparral plant communities. Lack of prescribed burning has also allowed invasive species such as medusa-head grass to dramatically alter the composition of the grasslands matrix among oak woodlands and foothills chaparral on a significant spatial scale. A recent 2009 study used FlamMap and WindNinja to model fire behavior in the Lassen Foothills, including the Battle Creek

watershed in which Coleman Fish Hatchery Road is located. (Schmidt, 2009) The study modeled the “potential for a fire to move from low elevation grass and shrubs up into higher elevations to the east” and assumed high-risk conditions such as high winds, low humidity, and high spread rates. Even in such a worst case scenario, the sparse nature of the fuels in the study area (i.e., grassland with scattered oaks) was deemed to keep potential fire behavior to a relatively low-intensity level. Consequently, prescribed burning of grasslands near Coleman Fish Hatchery Road would help to maintain a more functional ecosystem with a normal fire regime that would complement and enhance the riparian system. Furthermore, prescribed burning would also reduce the risk that a grassland fire would spread uphill to nearby chaparral and timber.

CalFire records indicate that the two primary causes of wildfire in the Battle Creek watershed are lightning and human activities such as equipment use, vehicle exhaust, and debris burn escapes. With increased urban development, the fire risk along Coleman Fish Hatchery Road would be expected to increase proportionately. Attention to appropriate fire management techniques at an early date would be advantageous to both the natural and human communities.

*Fuel Conditions along the Roadway.* For use by state citizens and public agencies pursuant to the California Fire Plan, CalFire has created a GIS dataset showing fuel rank that indicates “moderate, high and very high fuel rankings based on inputs, such as fuel, slope, brush density (ladder), and tree density(crown cover)(CalFire, 2005). Because the scale of this dataset is based on a 30-square meter cell, it can only be considered as generalized information for the 3.5-mile length of Coleman Fish Hatchery Road, together with the fact that fuel conditions change from year to year and between dry and wet years. Notwithstanding this, Figure 8 assists in gaining an understanding of the fuel conditions along Coleman Fish Hatchery Road.

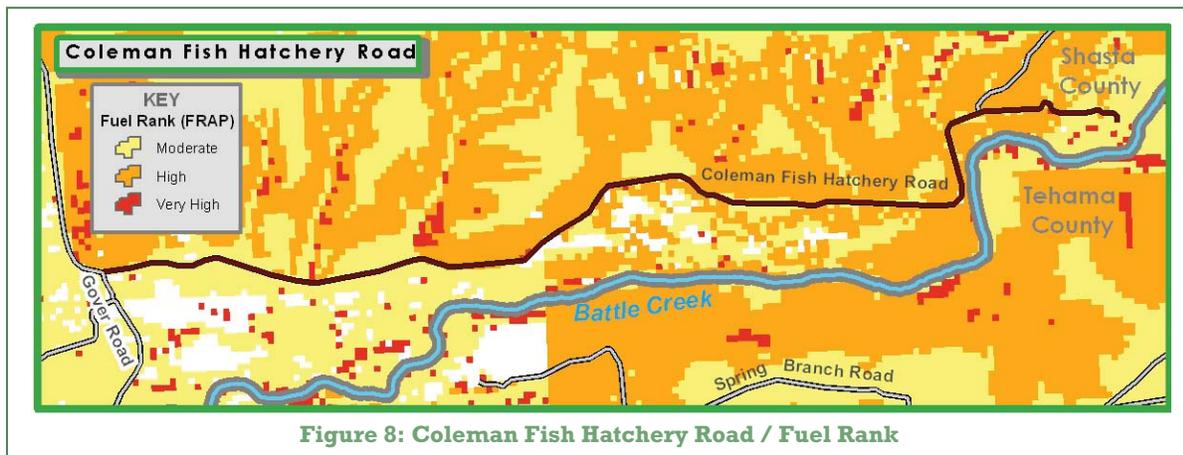
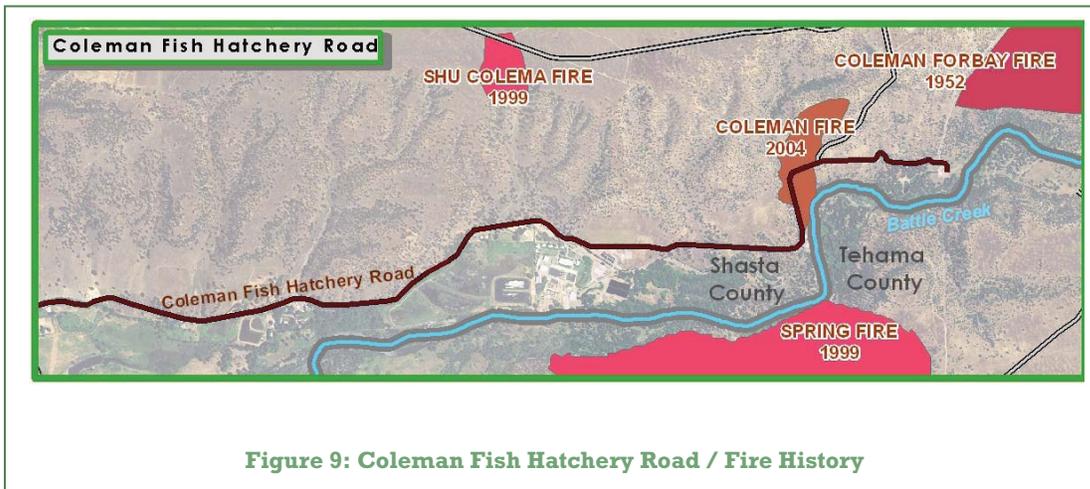


Figure 8: Coleman Fish Hatchery Road / Fuel Rank

A second GIS dataset containing historic fire perimeters is also available for public use from CalFire and is included in

Figure 9 below for Coleman Fish Hatchery Road. It is wise to note that this dataset contains most known fires but, of course, cannot include every small grass fire that occurs. Coleman Fish Hatchery Road is especially vulnerable to grassland fires due to the characteristics of its surrounding landscape. The dataset does include four fires that occurred near the roadway in 1952, 1999, and 2004.



### Roadway Assessment / Field Visit

TCRCD staff drove the length of Coleman Fish Hatchery Road on June 26, 2009. The photographs taken on that visit are shown below, beginning at the junction with Gover Road, passing by the Battle Creek Wildlife Area, and ending at the Coleman National Fish Hatchery facilities. These photographs show that there is some need for removing low-hanging branches on roadside vegetation as a best management practice but that for the most part the roadway is bordered only by grasslands. There is also ample clearance for passage of emergency vehicles such as fire trucks.





5.jpg



6.jpg



7.jpg



8.jpg



9.jpg



10.jpg



11.jpg



12.jpg



### Recommended Future Projects and Funding Strategies

*Projects already completed.* The Fire-Related Projects webtool created by TCRCDC reports recent activities reported to the Tehama-Glenn Fire Safe Council by its members. This webtool does not show that there have been recent fire-related projects near Coleman Fish Hatchery Road.

*List of recommended future projects.* The following paragraphs list recommended future projects for the enhancement of fire safety along Coleman Fish Hatchery Road.

- *Prescribed burning of grasslands.* As discussed above in the Fuels Assessment paragraph, the benefits of prescribed burning in the vicinity of Coleman National Fish Hatchery Road are (1) restoring a more natural fire regime to the ecosystem; (2) discouraging invasive species; and (3) preventing spread of wildfire to vulnerable riparian areas, chaparral, and timber.
- *Chipping program.* As seen in the photographs of Coleman Fish Hatchery Road in the Roadway Assessment / Field Visit paragraph above, some biennial pruning of tree branches along the roadway would be beneficial. TCRCDC has the capacity to provide brush removal and chipping services if desired.
- *Bureau of Land Management Juniper Removal along Battle Creek.* Stands of juniper are increasing on lands managed by the Bureau of Land Management located along Battle Creek's main stem about one half mile upstream from the Coleman Fish Hatchery near Spring Branch Road. These juniper stands have the potential of

escalating low intensity grass fires into fast moving high intensity crown fires that can destroy mature blue oak woodlands as well as significant riparian habitat along Battle Creek. Consequently, it is recommended that the Bureau of Land Management actively pursue treatment of any juniper stands that develop along Coleman Fish Hatchery Road or that are located uphill from the roadway.

- *Fire-Related Projects Webtool*. This webtool is described above in the Public Outreach paragraph. Though there are similar tools developed at a statewide level, there are no equivalent tools for coordinating local fire-related project information. For this reason and because the webtool is helpful in keeping interested parties informed of proposed, planned, ongoing, and completed projects in the local region, it is recommended that the Fire-Related Projects Webtool continue to be updated annually with input from fire safe council members, agency personnel, and other natural resource managers and professionals. Alternatively, concerned citizens may work toward developing a method to incorporate local fire-related project information into statewide databases.
- *Best Management Practices*. Development of guidelines such as Best Management Practices for the grasslands surrounding Coleman Fish Hatchery Road would be beneficial for landowners to avoid future impacts of wildfire.

*Environmental compliance for recommended future projects*. TCRCD is pursuing development of a programmatic CEQA document to streamline fire safety projects in Tehama and Glenn Counties. If any future project work takes place in a streambed, the “Notification of Lake or Streambed Alteration” form should be obtained from and submitted to the local office of the California Department of Fish and Game; permitting fees may be applicable.

*Incorporation of Defensible Polygons GIS dataset created by The Nature Conservancy*. As part of the Tehama East Community Wildfire Protection Plan, a GIS dataset was created by The Nature Conservancy (TNC) showing logical geospatial divisions of the landscape of eastern Tehama County according to level of defensibility during wildfire occurrences. This dataset addresses the area near Coleman Fish Hatchery Road and should be considered in the development of any future fire-related project planning. This dataset is available upon request from TNC or from TCRCD.

*Funding strategies for recommended future projects*. Possible sources of funding for these recommended future projects are described below:

- Tehama County Resource Advisory Committee, if the project is located adjacent to USFS lands;
- CalFire assistance programs;
- California Fire Alliance;
- TCRCD chipper programs;
- USFS cooperative road maintenance programs; and
- USFWS WUI program.

# **SECTION 3**

**Ponderosa Way**



## SECTION 3

### ASSESSMENT OF PONDEROSA WAY

#### Background and History of Ponderosa Way

*Road of lore and legend.* Ponderosa Way was initially constructed in the 1930's by the Civilian Conservation Corps and "may be the longest invisible federal road in America," stretching 672 miles from the Kern River to the Shasta Bear Lookout in Shasta County (Aylworth, 2007). Some reports claim that the Ponderosa Trail, as it was first called, actually ran 800 miles all the way from Mexico to the Oregon border (National Park Service, 2008). Local oral history of the road recites that young CCC workers from Southern California were based out of the conservation camp in Panther Springs near the boundary of Lassen National Forest and were paid \$25 per day for their labor (Schoendienst, 2010). With graders, jackhammers, and dynamite over a period of 10 years, a portion of the roadway was blasted out of lava bedrock between Antelope Creek and Deer Creek watersheds. The roadway was intended to serve as an emergency access route and as a firebreak, trending generally north to south at the ecotone between chaparral and timber in the Sierra Nevada foothills. The construction of this particular roadway was CCC's most significant contribution toward wildfire protection of timber lands. Though it is now difficult to discern its exact path at the northern and southern extremes, Ponderosa Way is a well known route through eastern Tehama County that is used for recreational access to public lands and for daily access to small towns and scattered residences along its length.

*Assessing a remote roadway.* Ponderosa Way winds roughly 76 miles from the Shasta County border in the north to the Butte County border in the south at roughly 1,000 feet in elevation on the eastern half of Tehama County. Along this length, 66 stream crossings intersect the roadway, according to the medium resolution (1:24,000) National Hydrography Dataset provided by the USGS (US Geological Survey, 2010). A multitude of landscape characteristics can be determined by examining publicly available aerial imagery in conjunction with GIS datasets using GIS software. Such a preliminary remote analysis could guide field work and could increase efficient use of funds and personnel. Further, once developed and confirmed through groundtruthing, this methodology could be used for other remote roadways. With increased use of GIS and remote sensing technologies combined with the many free datasets provided by the State of California, this methodology could easily be accomplished by many natural resource agencies and organizations. Three methodologies for remotely examining Ponderosa Way have been developed by Cathie Benjamin, TCRCDC GIS Manager, that are further discussed in the paragraphs below entitled "

GIS Analysis: Remote Determination of Fuels and Roadway Hazards" on Page 20, "Virtual Tour" on Page 24, and "Web Gallery" on Page 24.

*Overview of Ponderosa Way.* Included in Appendix G are a series of seven maps created by Jas O'Growney, TCRCDC GIS Analyst, showing aerial views of Ponderosa Way

(in red) winding through Tehama County, with hydrologic crossings highlighted in yellow. Public ownership is indicated with green shading; hydrography, major roads, county boundaries, and parcel lines are also shown. The aerial photography in the background of the maps gives a very broad indication of vegetative cover; closer examination would be required in order to determine whether the road surface itself was clearly visible or obscured from the air. This closer visual examination is discussed in the Virtual Tour and Web Gallery paragraphs below.

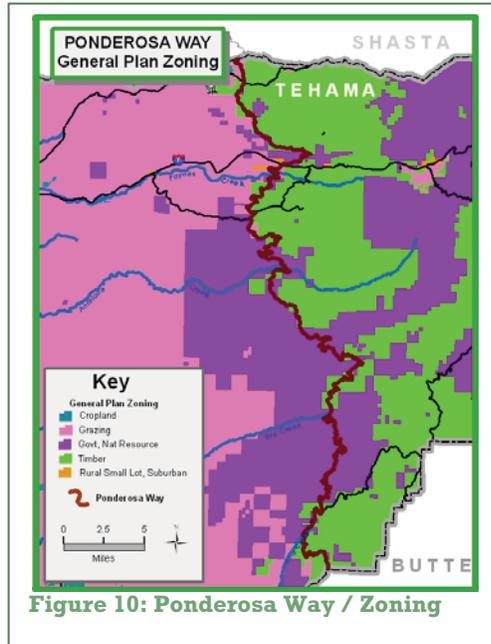


Figure 10: Ponderosa Way / Zoning

### Assets at Risk for Ponderosa Way

*WUI density and land use.* Land use adjacent to Ponderosa Way includes extensive grazing, timber, and public lands, with scattered holdings of small residential lots and some croplands, as reflected in the general plan zoning for Tehama County shown on Figure 10.

CalFire has identified fringe areas where human development and the natural landscape meet called the Wildland Urban Interface (WUI). Along Ponderosa Way, there are three such areas located at the Shasta County border (Manton), at the intersection with Highway 36 (Battle Creek Estates and Ponderosa Sky Ranch), and near the Butte County border (Campbellville). A second factor in considering fire risk is the CalFire dataset depicting

historic fire perimeters. The educated assumption is that if a fire has recently burned at a specific location, the likelihood of burning again within five to ten years is minimal. Alternatively, if a location in the Sierra Nevada foothills has not burned for many decades, the risk of wildfire occurring there is correspondingly higher due to increased fuel loading as revegetation occurs. The historic fire perimeters and locations of Wildland Urban Interface areas for Ponderosa Way are shown on Figure 11. The concentric purple rings of the WUI areas range from dark purple (urban areas) to lighter purple shades as distance from developed areas increases. Colored symbology for historic fire perimeters ranges from recent dates in yellow (lesser risk) to older dates in red (higher risk). It is apparent that wildfire along Ponderosa Way is a recurring event throughout the decades.

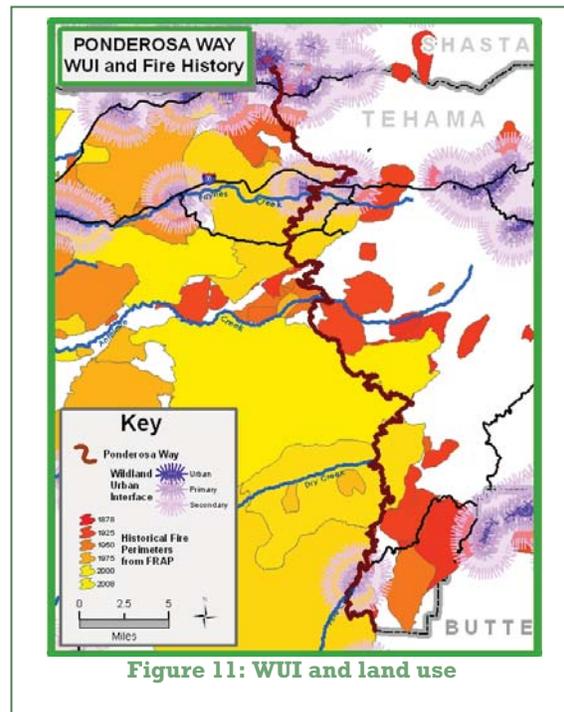


Figure 11: WUI and land use

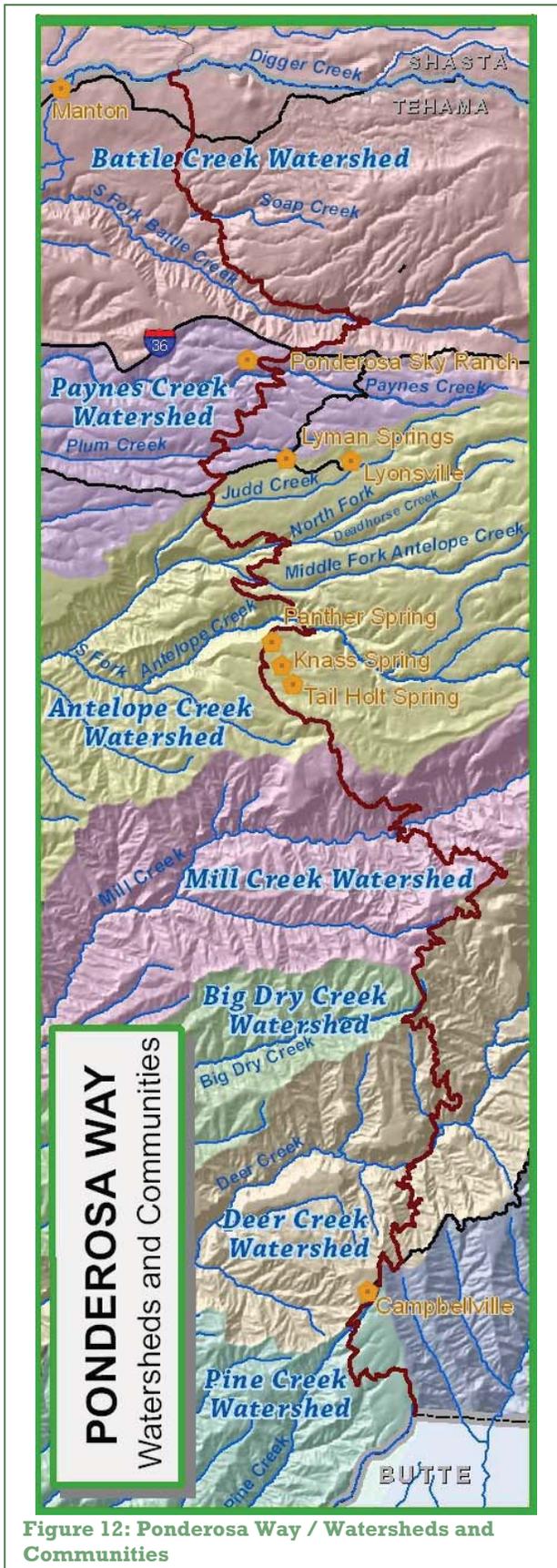


Figure 12: Ponderosa Way / Watersheds and Communities

*Watershed values.* Due to its generally north-south trending orientation, Ponderosa Way cuts across many significant waterways of eastern Tehama County. From north to south, these watersheds are Digger, Soap, and South Fork Battle Creek; Paynes and Plum Creek; Judd, Deadhorse, and various forks of Antelope Creek; and then Mill, Big Dry, Deer, and Pine Creeks. Depicted in Figure 12, these vast drainage basins supply water to some of the most pristine and scenic rivers of the Sierra Nevada foothills. Snowmelt and surface runoff from these intersecting streams contribute tremendously important quantities of freshwater to the Sacramento River system. The array of important natural environments found there provide important fish habitat (especially the anadromous fisheries of Antelope, Mill, and Deer Creeks and their tributaries), together with critical habitat for many other sensitive, threatened, and endangered plant and animal species. The regionally significant Tehama Deer Herd shelters in these forests. Unique landscapes surround Ponderosa Way, such as the Tehama Wildlife Area, Ishi Wilderness Area, Black Rock Campground, Devils Paradedground, and Graham Pinery. Sites of cultural and historical significance, including ranches, primitive structures, Native American sites, and other areas of human occupation, are located along the length of the roadway, most notably the flumes and mills of the Gold Rush era. These lands are utilized for commercial purposes, such as grazing and timber, and for scattered human habitation in the small rural communities of Panther Spring, Boondocks, Lyonsville, Lyman Springs, and Campbellville. Primary access to these upper watersheds is via Ponderosa Way, also sometimes labeled as US Forest Service Road 28N29), traversing the eastern half of Tehama County from north to south connecting Highway 36 and Highway 32.

## Ownership, Maintenance, and Permission to Pass

*Ownership.* Land ownership, maintenance responsibility, and locked gates are significant issues for Ponderosa Way along its entire 672-mile length. Various counties handle maintenance responsibilities in various ways. Especially in recent economic times, very few public agencies can expend funds on maintenance for such a remote road that serves such a comparatively small number of citizens. As Figure 13 shows on the next page, in Tehama County a mix of private parties and public agencies own or manage property adjacent to Ponderosa Way, including US Forest Service, Sierra Pacific Industries, Collins Pine, and Pacific Gas & Electric Company. A more detailed version of Figure 13 as a large format map is included in Appendix G and contains land ownership, major roads, and hydrography.

*Maintenance.* Maintenance responsibilities are equally patchy but for the most part are the domain of Tehama County Public Works, Bureau of Land Management, and the US Forest Service. County employees try to drive the entire length of the roadway every other year to insure passability, with the most recent drive during 2007, when they found it passable by a passenger car (Brownfield, 2008). Tehama County attempts to maintain Ponderosa Way in good condition for the 15-mile segment between Highway 36 and US Forest Service Road N8006. This 15-mile segment has a top gutter and approximately 20 feet of drivable surface, and the segment was bladed in spring 2009. One county-maintained bridge at the Judd Creek crossing was upgraded in 2002 and is now a steel structure. A slab crossing is also maintained by Tehama County Public Works at the north fork of Antelope Creek at the confluence with Deadhorse Creek and just below Deadhorse Falls. A 4-foot concrete box and paving were installed at this slab crossing to address concerns created by a prior flood event that brought debris downstream and caused a blocking and moving of the stream course of Antelope Creek. After the county-maintained segment joins with USFS Road N8006, Ponderosa Way then continues on to the Butte County Line under USFS jurisdiction.

*Current road condition and locked gates.* As of the summer of 2010, TCRCDC field workers have reported Ponderosa Way to be passable with a 4-wheel drive vehicle, except for a short stretch north of Highway 36 where field workers could not gain access. This short stretch of Ponderosa Way just north of Highway 36 has been closed to public use, and Tehama County Public Works personnel have no knowledge of the road condition from Highway 36 north to the Shasta County line (Brownfield, 2008). A private gun club now claims dominion over that short stretch of Ponderosa Way as a private lane and has installed a locked gate across it near Highway 36. This right to maintain the locked gate has been validated through a court ruling in a decades-old lawsuit, but access through the gate is currently granted to SPI, CalFire, police, and neighboring landowners (Coleman, 2009). TCRCDC field workers have been able to travel south on Ponderosa Way from the Shasta County line to a point a few miles north of Highway 36. At this point, the roadway had become so poorly maintained that it was impassable. A second locked gate reported on Ponderosa Way near the Butte County border (Hamill, 2009) has not been encountered by TCRCDC field workers. In summary, TCRCDC has confirmed that most of the length of Ponderosa Way is passable by 4-wheel drive vehicle as of summer 2010 with the exception of a few miles north of Highway 36 in the vicinity of a locked gate maintained by a private gun club.

# PONDEROSA WAY Land Ownership

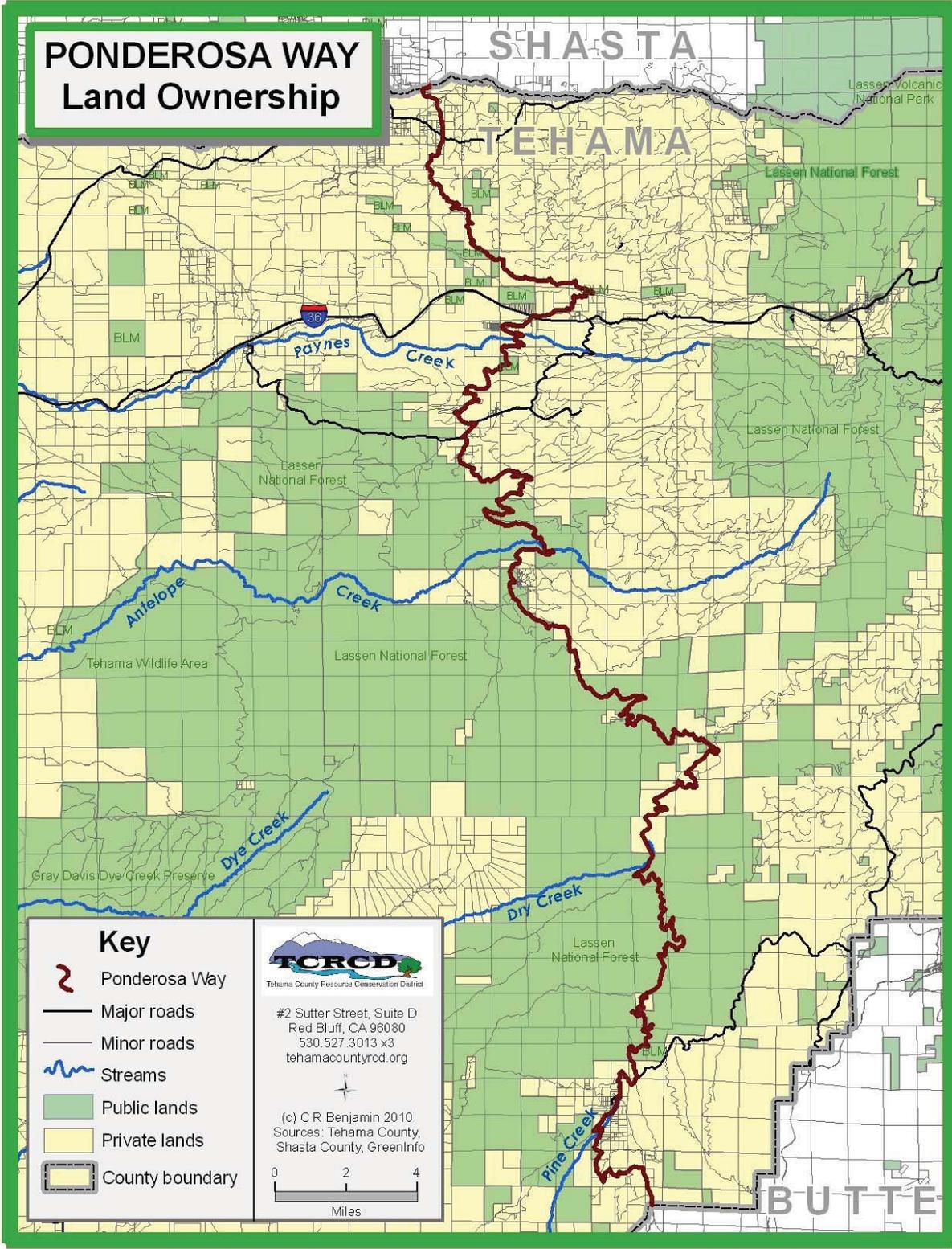


Figure 13: Land Ownership

*Best and highest use.* Due to the issues of ownership, maintenance responsibility, and permission to pass as described above, developing Ponderosa Way as an emergency access route may not be useful. Further, according to a representative of Sierra Pacific Industries (“SPI”), an alternative roadway east of Ponderosa Way itself is typically used for egress and ingress by SPI personnel, and this alternative roadway may also be typically used by CalFire personnel (Mitzell, 2009) for emergency access. In any case, the most populated areas of Ponderosa Way are located at the northern and southern ends of the roadway near Ponderosa Sky Ranch and Cohasset, respectively. In an emergency, these residents would wish to travel the quickest route out (i.e., immediately northward and immediately southward), and they most likely would not choose to travel on the middle segment of Ponderosa Way. The original purpose for construction of Ponderosa Way as a fuel break seems to be its best and highest use even today.

## Public Outreach

*Knowledge of local residents.* TCRCD staff members attended a public meeting in the Manton area and presented information about this project. Copies of the maps used in this presentation can be found in Appendix G. Following this community meeting, on August 10, 2009, TCRCD mailed advisory letters to 52 landowners along Ponderosa Way requesting their input concerning fire safety and road maintenance; the form of letter is found in Appendix A. Presentations were also delivered to several meetings of the Tehama-Glenn Fire Safe Council, whose members gave input as to proposed, planned, ongoing, and completed fire projects in the vicinity of Ponderosa Way. A total of four defensible space and fire safety workshops were held during the term of the project which were advertised by radio, newspaper, and flyer.

Numerous responses were received as a result of these outreach efforts that helped to guide field visits to Ponderosa Way and that informed the recommended projects listed at the end of this section on Page 26.

In addition to gathering local knowledge regarding the condition of Ponderosa Way as an access route and as a fuel break, TCRCD has conducted technical analyses aimed at efficiently assessing this remote roadway using publicly available data, digital photography, internet, and Geographic Information Systems (GIS). Utilizing the information gained from these remote analysis techniques to prioritize areas of the roadway most likely in need of attention, on-the-ground fieldwork has been accomplished to gather actual field data and to verify the remote results. The following three paragraphs detail these methodologies.

## GIS Analysis: Remote Determination of Fuels and Roadway Hazards

*Summary.* Cathie Benjamin, GIS Manager for TCRCD, developed an additive vector overlay analysis using ESRI ArcGIS and publicly available datasets. In this analysis, various landscape factors that would affect vegetation and roadway conditions were remotely examined along Ponderosa Way. These factors were weighted and combined to prioritize locations where road erosion or vegetation conditions would likely warrant project work. This analysis assigned numerical ranking values in eight classes at 66 hydrologic crossings along Ponderosa Way, resulting in five locations that were assigned the highest rankings of 6 and 7 and that were most likely to need future project work. The GIS analysis was followed by field visits to independently gather similar on-the-ground information at each mile to

half-mile segment of Ponderosa Way. The outcome of the field work was then compared to the GIS results to evaluate the effectiveness of the remote analysis techniques.

*Introduction to GIS methodology.* The GIS analysis had two goals. First, to increase the usability of Ponderosa Way as an emergency access route, the analysis would pinpoint likely locations where the road surface might be degraded. Second, to enhance the possibility of maintaining the road as a fire break, needs for roadside thinning or fuels maintenance would be determined.

All datasets were focused on 66 discrete points where perennial and intermittent streams intersect Ponderosa Way, according to the National Hydrography Dataset provided by the USGS (US Geological Survey, 2010). The scale of this GIS dataset is 1:24,000, containing all the streams from topographic maps of that scale, both perennial and intermittent. Depending on the size of the upstream contributing area, certain of these stream crossing locations would be more likely candidates for road maintenance, since an excess of flowing water has the potential to detrimentally erode the road surface, especially where culverts are undersized or impaired. These stream crossings would directly affect the first goal of examining road condition. Additionally, slope and aspect of the hillsides adjacent to Ponderosa Way would further affect the road condition. Steep slopes encourage land movement and may undermine the roadbed, and southern exposures experience more intense freeze/thaw cycles. Finally, these factors would become especially significant wherever soil was considered to be highly erodible (National Resources Conservation Service).

The second goal of enhancing fire break purposes along Ponderosa Way would also be informed by examining slope, aspect, and highly erodible soils at selected stream crossings, plus the abundance of water at the stream crossings might encourage excess vegetative growth that would necessitate thinning of fuels or pruning of tree branches. Additionally, the fire history and fire modeling data provided by CalFire's FRAP (Fire and Resource Assessment Program) would indicate the relative degree of fire risk along Ponderosa Way related to vegetative conditions.

*Details about GIS datasets.* The entire length of Ponderosa Way within the Tehama County borders was buffered on both sides 100 feet from centerline. Seven datasets were then clipped to this buffer and incorporated into the analysis:

- **Color imagery.** Aerial photography of the 66 selected stream crossings was visually examined to compare canopy cover and size of contributing basin at each location. Each stream crossing was buffered with a circle measuring 200 feet in diameter. Forty-six of the crossing locations were subjectively evaluated as higher risk than the others and were assigned a value of 1.
- **Slope.** Steep slopes are less stable and more prone to moving soil downhill. A raster representing percent slope was generated from the USGS 10-meter digital elevation models. Steep slopes are customarily defined as 15 percent or greater; using this definition, 66% of Ponderosa Way is adjacent to steep slopes, including slopes as great as 60% and higher in many locations. Those areas having slopes equal to or greater than 15 percent were converted to polygons. Areas were then selected within the 200-foot buffer and assigned values as follows: (a) for slopes equal to or greater than 15 percent yet less than 45 percent, a value of 1, and (b) for slopes greater than 45 percent, a value of 2.

- **Aspect.** The direction that a hillside faces will strongly influence vegetation patterns. Southern exposures often have sparse vegetative cover due to high heat and moisture stress. As a result of reduced cover, fluvial erosion rates are often higher than on more densely vegetated, north-facing slopes. Observations made by a geography professor traveling Ponderosa Way by bicycle have confirmed that “south-facing road surfaces were rockier and generally much less passable than north-facing road surfaces.” (Melcon, 2009) A raster representing aspect was generated from the USGS 10-meter digital elevation models. Because Ponderosa Way trends north-south, many areas of the roadway were adjacent to southerly facing slopes. These areas within the 200-foot buffer of the roadway with a southerly aspect (i.e., between 160 and 200 degrees) were converted to polygons and assigned a value of 1.
- **Fuel rank.** Calfire has developed a fuel ranking methodology assigning “ranks based on expected fire behavior for unique combinations of topography and vegetative fuels under a given severe weather condition (wind speed, humidity, and temperature) (CalFire, 2005). From this dataset, areas within the 200-foot buffer were converted to polygons and assigned values. Those areas designated as having a “high” fire behavior potential were assigned a value of 1, and areas within the 200-foot roadway buffer designated as “very high” were assigned a value of 2.
- **Fire hazard severity.** From the FRAP dataset representing fire hazard severity zones (currently in draft form as of 2007 and not officially adopted as yet), areas designated as having a “very high fire hazard severity” were assigned a value of 1.
- **Wildland Urban Interface areas.** This dataset was developed by the CalFire Redding Field Office and provided to TCRCD. The intent is to delineate the interface of developed areas of human habitation with natural areas, bringing attention to those lands nearby human residences that are impacted by wildfire. Three progressive rings around urban areas outline first the urban area itself (“Urban”), then .5 mile away from the urban area (“Primary”), and then 1.5 miles away from the urban area (“Secondary”). The entire WUI dataset was clipped to the 200-foot buffer of Ponderosa Way. Urban areas were assigned a value of 30; this high value of 30+ would thus appear only where Urban polygons directly intersect Ponderosa Way. Primary polygons were assigned a value of 20; thus, a value between 20 and 29 would appear only where these “Primary” areas intersect Ponderosa Way. Finally, Secondary polygons were assigned a value of 10; thus, a value between 10 and 19 would indicate a portion of Ponderosa Way within 1.5 miles of a developed area of human habitation.
- **Highly Erodible Land.** This is a category of soil type defined by the local NRCS office as being particularly subject to erosion. There was only one location along Ponderosa Way which was so classified; the portion of that area falling within the 200-foot buffer was assigned a value of 1.

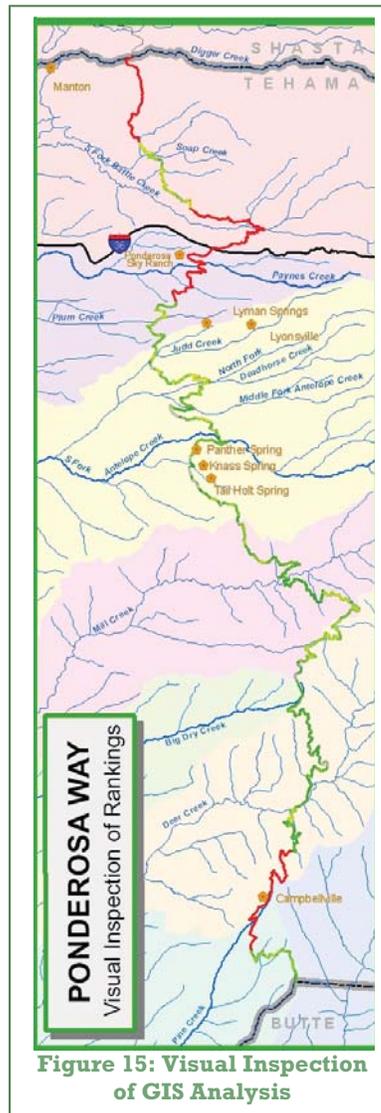
In a simple vector overlay analysis, the above seven datasets were combined geospatially, and their values were added together into a new shapefile. This resulted in numerically ranked polygons with values in four classes grouped in the following ranges: from 0 to 7, between 10 and 19 (for Secondary WUI locations), between 20 and 29 (for Primary WUI), and greater than or equal to 30 (for Urban WUI).



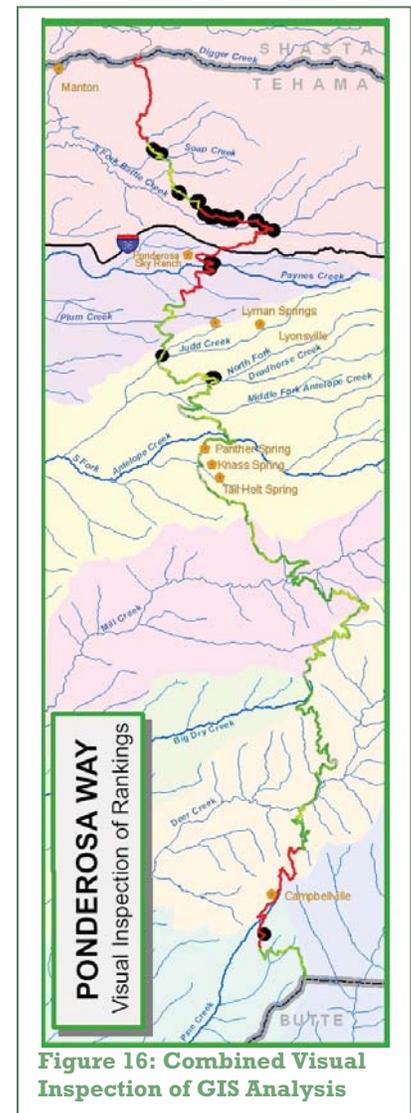
**Figure 14: Prioritized Stream Crossings**

Nine of the numerically ranked polygons attained at least the two highest values in the first class (i.e., either 7 or 6), indicating areas where landscape factors had combined to produce the highest likelihood that road or fuels maintenance would be needed. These nine multipart (i.e., spatially dispersed) polygons were then intersected with the 66 focused stream crossings, and five stream crossings were thus selected. These five stream crossings would warrant closer examination during a field visit and would be likely candidates for future project work, according to the GIS analysis. These five stream crossings are Site 43 on Judd Creek, Site 50 on Paynes Creek, Site 54 just below the confluence of Panther Creek with South Fork Battle Creek, Site 55 slightly downstream on the South Fork Battle Creek, and Site 58 in Snoqualmie Gulch in the vicinity of Grapevine Spring, as shown in Figure 14.

For the other ranked classes that accounted for proximity to WUI areas, it is informative to make a visual examination of the rankings along the entire length of the roadway within Tehama County. In Figure 15, the 200-foot buffer of Ponderosa Way has been filled with the numerically ranked polygons resulting from the vector overlay analysis. The polygons have been assigned a color ramp from green to orange to red, with all values of 7 and above being given the color red. This technique provides a quick visual display of the numerically ranked polygons along the entire length of Ponderosa Way from the northern border of Tehama County to the Butte County line, without regard to the 66 focused stream crossings. As one might logically expect, the red-colored segments of the roadway are concentrated near the Manton urban area, near Highway 36, and near the community of Campbellville, where developed urban areas are found and where the WUI values have increased the ranking values. However, as an additional insight, black haloed areas have been



**Figure 15: Visual Inspection of GIS Analysis**



**Figure 16: Combined Visual Inspection of GIS Analysis**

added to Figure 16 wherever the landscape characteristics have resulted in a value of either 6 or 7. These black haloed areas help to emphasize the importance of certain high value polygons. In other words, in addition to being WUI areas, these black haloed areas also exhibit significant landscape features, such as steep slopes in conjunction with a southern exposure, or a closed canopy at the crossing of a perennial stream. One can now see that these black haloed areas are concentrated north of Highway 36 in particular and that they occur outside of WUI areas. These black haloed areas would be important to examine closer during a field visit. By synergizing the two visualization methods of symbology, a deeper understanding of the datasets is achieved.

Further study will compare the results of the remote GIS analysis with results from the field visit described below in the paragraph titled Field Visit.

### Virtual Tour

For the Ponderosa Way portion of the study area, a new method has been explored to examine existing conditions along this remote roadway. A virtual tour has been created for Google Earth that allows a reviewer to virtually “travel” the length of Ponderosa Way from the Shasta County border in the north to the Butte County border in the south, without the need to physically visit the site. The color aerial photography used by Google Earth along Ponderosa Way in Tehama County is obtained from the USDA and presently is current as of summer 2009. This imagery is flown by the NAIP program in the summer growing season and is updated on an annual basis. The imagery is then purchased by the State of California for public usage, and this NAIP imagery is commonly utilized in GIS mapping.

The necessary “kmz” file for the virtual tour can be downloaded from the TCRC website in the Library section and then played using the free Google Earth software. This new technology has the potential to allow forestry and natural resource managers and planners to make an initial estimation of conditions from the office and thus to better plan field visits.

### Web Gallery

To further assist in gaining a broader understanding of the existing conditions along Ponderosa Way, forest managers and fire prevention personnel could virtually examine stream crossings of a remote roadway using the color aerial photography on Google Earth in conjunction with the National Hydrography Dataset, with ArcGIS shapefile formats converted to the appropriate kml (keyhole markup language) format. The imagery could be combined into an online web gallery of photographs, which would allow easy sharing between spatially diverse collaborators. Two important landscape features relevant to a project could be seen on these sequential images. First, the relative size of the land area contributing to each stream crossing can be broadly indicated; the relative size of this drainage basin would influence the amount of water running across the roadway during a storm event and, consequently, would indicate how likely it might be that the crossing would wash out the roadway. Second, the amount of canopy closure at each crossing as viewed from the air would indicate the need for vegetation removal to enhance access during an emergency event. If the roadway was totally obscured, the assumption would be that dense vegetation is growing over the roadway. If the roadway was clearly visible in the

imagery, then the assumption would be that passage along the roadway at the crossing would be unhampered.

Cathie Benjamin, TCRCD GIS Manager, has created such an online photographic gallery of Ponderosa Way that combines the Google Earth imagery with hydrologic analysis from GIS datasets. A screenshot of this online web gallery is shown in Figure 17.

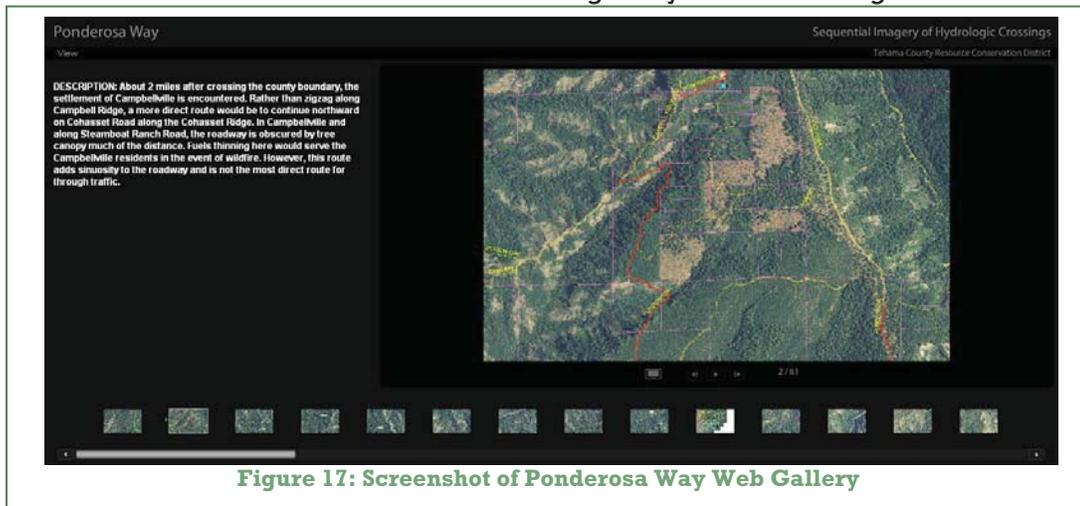


Figure 17: Screenshot of Ponderosa Way Web Gallery

This web gallery shows sequential views of each hydrologic crossing along Ponderosa Way, together with the upstream contributing region for each crossing. In these images, Ponderosa Way is shown as a red line, and crossings are marked with green dots. Each contributing basin is traced upstream from the stream crossing. The following acronyms are sometimes used to indicate hydrologic information about the stream crossing: “I” for intermittent, “P” for perennial, “E” for ephemeral, and “A” for artificial path. Locations of springs are included as blue asterisks.

The web gallery of hydrologic crossings is posted online in the Publications section of the Library at the TCRCD website.

## Field Visit

*Introduction and purpose.* Vector overlay analysis is used in GIS to combine several datasets into one in order to find locations which exhibit certain characteristics. This virtual examination of data takes place on the computer screen, and groundtruthing is needed to evaluate its accuracy in reflecting real-world conditions. TCRCD field personnel visited both roadways, where they made observations and recorded photographs at each mile to half-mile point and at culverts, ecotones, and hazardous locations. From this information, TCRCD staff made conclusions about the need for road and fuels maintenance work along Ponderosa Way. These results were then compared with the recommendations from the GIS analysis.

*Methodology.* TCRCD field workers were given a spherical densiometer to measure canopy cover, a digital camera to capture images, a stadia rod to measure size of culverts, and a measuring tape to measure road width. In Appendix B is a copy of the instructions and list of materials given to field workers. In Appendix C is a blank copy of the form used in the field to collect data at each mile to half-mile stop along Ponderosa Way. Digital photographs

were taken at each stop in the four cardinal directions, and images were also taken at culverts and other locations. In Appendix D is a blank copy of the form used to collect ancillary data about culverts, road hazards, or other conditions that were observed. All data collected in the field has been converted into a digital spreadsheet and reproduced here in Appendix E. All field photographs have been processed into an online web gallery that can be viewed on the TCRC D website; printed copies of the field photographs have also been included in Appendix F of this report and are provided on a CD in the side pocket of this report binder. Each stop made by the field workers was given a site number, and a map of these sites is provided in Figure 18 in a reduced file size. An additional large format map is included in the side pocket of this report binder.

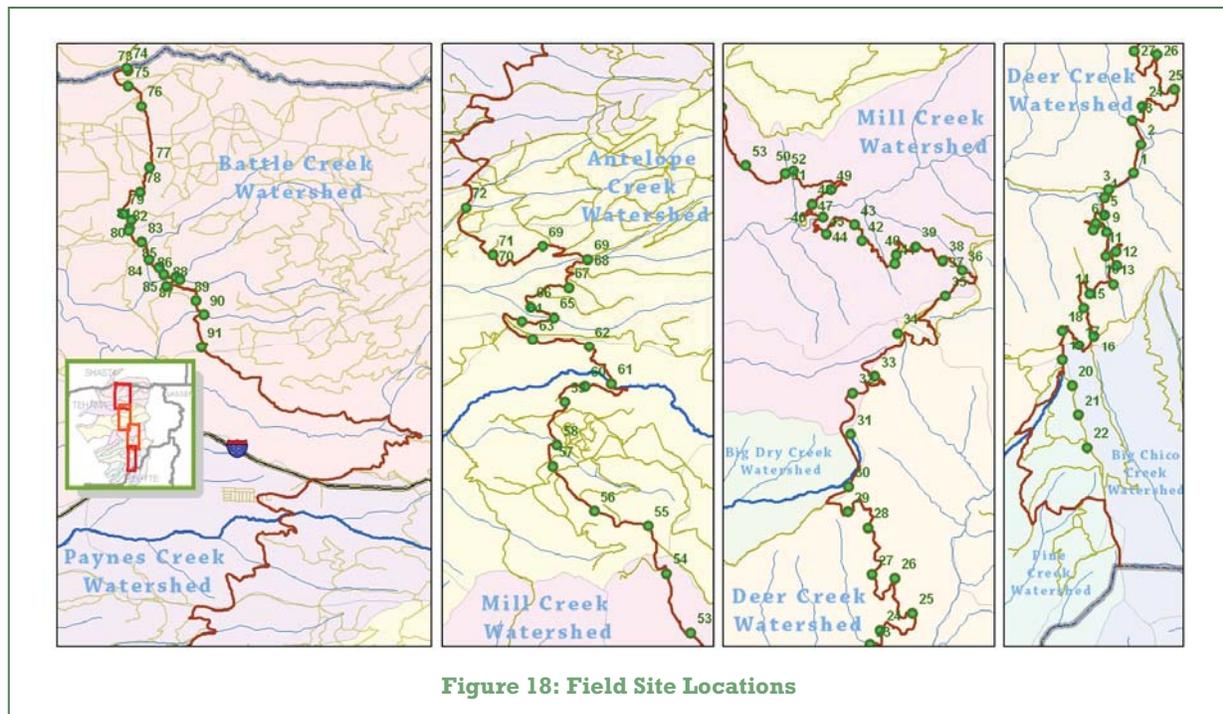


Figure 18: Field Site Locations

**Results.** Tom McCubbins, TCRC D Project Manager and coordinator of the Tehama-Glenn Fire Safe Council, reviewed the field notes and the photographs that were collected. Drawing on his knowledge of forestry, wildfire prevention, and community needs, he has created a priority list of tasks for road and fuels maintenance along Ponderosa Way that are described below in the paragraph titled Recommended Future Projects and Funding Strategies.

### Recommended Future Projects and Funding Strategies

**Prior projects completed.** Fire protection infrastructure currently in place in eastern Tehama County is described in the 2008 Tehama East Community Wildfire and Protection Plan found on the TCRC D website in the Publications section of the Library. The infrastructure relevant to Ponderosa Way includes the Hazen Road Fuel Break, Ponderosa Sky Ranch Fuel Break, and Ponderosa Sky Ranch Landing Strip. The plan also makes the following statement about the usefulness of Ponderosa Way as a fuel break:

“Ponderosa Way makes a useful anchor point for new projects due to the considerable break in vegetation created during its construction. Because the roadway is located at the transition zone between chaparral/oak woodland and timber lands, some portions of roadside thinning along Ponderosa Way would require little, if any, short term maintenance.”(McCubbins, 2008)

Fire-related projects nearby Ponderosa Way that have recently been completed include the following:

Project title	Status	Agency	Contact	Area
Ponderosa Sky Ranch Fuel Break	Completed	Private	Gary Lyon	2 miles
Panther Springs/Boondocks	Planned	USFS	Tom Garcia	580 acres
Cold Springs Fuel Break	Completed	USFS	Ken Larson	200 acres
SPI fuels maintenance projects (N Fk Antelope and Deadhorse Creeks)	Completed	Sierra Pacific Industries	Mike Mitzell	103 acres
Paynes Creek Community Fuel Break (Lyman Springs Component)	Planned	TCRCD	Tom McCubbins	
Biomass thinning (Mill Creek)	Planned	Interagency	LNF, SPI, Collins Pine	4 miles

*List of recommended future projects.* TCRCD recommends future project work along Ponderosa Way as described in the Tehama East Community Wildfire and Protection Plan (TECWPP) and additional future project work as a result of this assessment. The following paragraphs describe these recommended future projects in detail.

1) *RECOMMENDATIONS FROM TEHAMA EAST COMMUNITY WILDFIRE AND PROTECTION PLAN (TECWPP).* Various recommended future projects for eastern Tehama County are described in the 2008 TECWPP document found on the TCRCD website in the Publications section of the Library. Many of these recommended projects are relevant to Ponderosa Way. These relevant projects are summarized below, but more details can be found in the TECWPP document.

a) *Howell Ridge Fuels Reduction Project.* Project work would involve thinning and removal of fuels along the ridge to form a fuel break, protecting natural resources along Paynes Creek and the communities of Paynes Creek and Ponderosa Sky Ranch. Possible funding sources would be private landowners, US Forest Service, Tehama County Resource Advisory Council, or California Department of Fish and Game. (Refer to #4 on Figure IX-2 of the TECWPP on the TCRCD website for a map of this recommended project.)

b) *Ponderosa Sky Ranch Airport Fuels Reduction, Maintenance and Extension.* This airstrip might be permanently maintained to serve as a fuel break in this community and might contribute to other thinning and fuels removal projects along Highway 36. (Refer to #7 on Figure IX-2 of the TECWPP on the TCRCD website for a map of this recommended project.)

c) *Power Line Right-Of-Way Maintenance between Ponderosa Sky Ranch and Lyman Springs.* A wooden pole power line connecting utility facilities between Ponderosa Sky Ranch and the Lyman Springs community might serve as a fuel break to protect these two communities and various historic sites, together with pine plantations to the east managed by Sierra Pacific Industries. (Refer to #8 on Figure IX-2 of the TECWPP on the TCRCD website for a map of this recommended project.)

- d) *Battle Creek Estates Fuel Project.* The Battle Creek Estates development was constructed within heavy stands of chaparral vegetation and oaks, and a fuel break should be developed around the perimeter of the estates area. The developers of Battle Creek Estates might fund the purchase of a chipper for use by the community's residents. (Refer to #9 on Figure IX-2 of the TECWPP on the TCRCO website for a map of this recommended project.)
- e) *Panther, Tail Holt, and Knass Spring Improvements.* A number of structures in the Panther, Tail Holt, and Knass Springs communities could be developed into fire management infrastructure, especially using Ponderosa Way itself, less than a mile to the west. Additionally, the capacity of the pond at Knass Spring could be increased and water tanks installed for firefighting purposes. (Refer to Figure IX-3 of the TECWPP on the TCRCO website for a map of this recommended project.)
- f) *Refurbishment of Ponderosa Sky Ranch Water Tank.* The water tank located in Ponderosa Sky Ranch is unused and in need of new quick fill fittings. If refurbished and maintained, this water tank could provide considerable fire fighting water to Ponderosa Sky Ranch, Battle Creek Estates, Lyonsville, and the Lyman Springs area further to the south. (Refer to Figure IX-4 of the TECWPP on the TCRCO website for a map of this recommended project.)
- g) *Installation of 10,000 gallon water tank.* Ponderosa Way has limited sources of firefighting water in the form of ponds, tanks, flumes, and close access to streams. Water tanks provide flexibility in staging firefighting resources, are relatively inexpensive, and can be moved as yearly fire conditions change or as fire threats change in the face of community development. One candidate site for installation of a water tank is intersection of Ponderosa Way and Forward Road.
- h) *Construction of Access Road from Ponderosa Way to Highway 36.* An alternative access route should be developed between Highway 36 and the Ponderosa Sky Ranch Community for use in the event of emergencies.
- i) *Designation of Panther Spring, Boonedocks, Lyonsville, and Lyman Springs as WUI areas.* These remote communities are located at the midpoint of Ponderosa Way in Tehama County, surrounded by Lassen National Forest lands and thick stands of chaparral and small timber that create significant ladder fuels. Residents and urban development in the vicinity of these communities are at significant risk of wildfire and should be formally classified as Wildland Urban Interface areas, increasing the possibility of technical assistance and funding for community fuels reduction efforts.
- j) *Designation of Campbellville as a Wildland Urban Interface Area.* The Campbellville area is located along Ponderosa Way at the southern end of Tehama County a few miles south of the Deer Creek crossing, surrounded by LNF and BLM lands with grassy fields and heavy brush creating hazardous fuel conditions. Consideration should be given to classifying Campbellville as a Wildland Urban Interface area.
- k) *Signage.* Signs should be installed at road junctions in order to assist out-of-area firefighters.
- l) *Emergency access routes.* Residents of rural communities located along Ponderosa Way should receive information about available egress routes in the event of wildfire.

2) *RECOMMENDATIONS FROM GIS ANALYSIS.* The remotely determined sites according to the GIS analysis should be visited and recommendations made following such a field visit. These sites are discussed above beginning on Page 20.

3) *RECOMMENDATIONS FROM FIELD VISIT.*

a) *Introduction.* Based upon information and insight developed through GIS analysis and field visits to the project area, a number of issues currently limit the value of Ponderosa Way as an access route, as fire management infrastructure, and as a fuel break. These include road surface and bank conditions, road drainage infrastructure conditions and functioning, and the condition of wildland fuels and fuel loading. In addition, lack of established formal responsibility for maintenance of these key functions also significantly limits use of the road and right-of-way as viable infrastructure. At the present time, no landowner or government entity has formal responsibility for large portions of the roadway, bridges, and drainage infrastructure, nor for maintaining appropriate fuel conditions along a significant portion of the route within Tehama County. Repairs and maintenance are often completed as needed for land management and timber harvesting on adjacent lands, but there is little coordination of these activities. As a result, significant portions of the road have fallen into disrepair and have heavy accumulations of wildland fuels.

b) *Recommended road projects.* The following recommendations relate to improvement of these key road functions.

(1) Roadway and Drainage Infrastructure Improvements. The following recommended projects related to road and drainage infrastructure maintenance or improvements are based upon the premise that Ponderosa Way will continue to have value as a transportation corridor in the future. Road information provided by area landowners show that a significant system of public and private transportation infrastructure has developed to the east of Ponderosa Way and is used extensively by CalFire and US Forest Service personnel, along with other users accessing lands within the Lassen National Forest. In order for project work to be funded and completed, consensus must be obtained from adjacent landowners, fire fighting entities, state and federal resource agencies, and other area stakeholders that this roadway has value and is worth maintaining. Once consensus has been obtained, road system improvements and fuel management implementation measures developed through this analysis must be agreed upon, prioritized and funded, along with additional recommendations from stakeholders.

(2) Surface and Bank Erosion. Road conditions along Ponderosa Way include surface and bank erosion that could be a major source of sediment into adjacent streams if not addressed. Within the study area, a number of significant anadromous streams and their tributaries are impacted by road system sediments. These streams include Battle Creek, Antelope Creek, Mill Creek, and Deer Creek, all of which support anadromous fisheries. Compacted road surfaces increase the rate of surface runoff, and road cuts intercept and bring groundwater to the surface. Ditches concentrate storm water runoff and can transport sediment to nearby stream channels and their tributaries. Culverts in stream crossings can plug, causing fill washout gullies

where the diverted flow of water runs down nearby roads and hillslopes. Similarly, road segments constructed on steep or unstable slopes can impact both the usefulness of the roadway as well as water quality issues due to landslides which deposit sediment into stream channels. In these situations, large amounts of road sidecast materials can fail, often many years after they were put on steep hillslopes. Finally, lack of inspection and maintenance of drainage structures and unstable road fills can result in soil movement and sediment delivery to stream courses. Roadway reconstruction provides an opportunity to upgrade and improve a road that is substandard in one or more elements of its design. Considering that most road reconstruction work entails earth moving that has the potential to disturb soil stability, only those areas that most urgently require repair have been considered in this analysis and the list of improvement measures.

- (3) Road Surface. Poorly maintained road surfaces along Ponderosa Way will channel water, reduce road life, and increase erosion and fine sediment pollution into streams. In addition, this condition can result in airborne sediments entering stream channels during summer months and can cause a rough ride hindering access by fire fighting forces through damage to equipment and blowouts. Over years of hauling, grading, or neglect, road surface materials break down or migrate to the road edge by traffic movement, often exposing large rock fragments. Along portions of Ponderosa Way, these types of large rock fragments jut out of the road bed, together with rock rubble from side slopes. If Ponderosa Way is to remain a viable access route, intermittent grading, resurfacing, and clearing of loose boulders will need to be completed. If satisfactory surfacing materials have worked their way to the outside edge of the roadway, they can be retrieved and worked back into the roadbed reducing both maintenance costs and the concentration of runoff into stream channels during storm events.
- (4) Seasonal traffic control. Minimizing traffic during the wet season is critical to the maintenance of stable road surfaces. Even the best road surface can be severely damaged by overuse during wet conditions. Serious damage begins with the loss of road drainage and excess water standing at the surface. Ruts indicate that road strength is deteriorating. Similarly, traffic on a dry road beds in the summer can chum and pulverize road surface material and create thick, loose layers of soil and rock dust. Loose materials can then erode and flow into streams with the first fall runoff. Proper road maintenance as well as an overall reduction to road costs can be achieved if roads are graded only when needed in order to maintain a stable, smooth running surface and to retain the original surface drainage. Over grading can result in unnecessary erosion and an increase to road rock surface wear. Grading should only occur when surface materials are slightly damp. Road surfaces graded when they are excessively dry will not compact and will result in subsequent erosion. Grading should cut deeply into the road surface so loose material will mix, compact and bind with underlying materials. If deep potholes or ruts cannot be graded out, the surface should be ripped and then graded and

recompacted to achieve proper binding. Otherwise, individual holes and ruts that are patched will quickly reform in the same locations.

- (5) Culverts. Culverts can be upgraded to current standards and additional drainage structures can be installed. Based upon information obtained from technical literature as well as road engineers, road maintenance specialists, and land managers within the project area, drainage structures need to be inspected in order to determine whether they are capable of passing 100-year flood flows. Any stream crossings that require reconstruction should be redesigned for this level of protection through the replacement or removal of all intact drainage infrastructure that is undersized for this level of storm flow. Culverts can be retro-fitted with trash barriers above the inlets to prevent plugging along with downspouts and/or rock energy dissipation infrastructure to prevent erosion or down cutting of road fill and slopes at outlet areas.
- (6) Stream Crossings. Roads that intersect stream channels have the potential to impact both water quality and road surface conditions. Consequently all stream crosses need special consideration. This includes the development of dips into and out of stream channels in order to assure that stream flows are not diverted onto roadways during storm events. Washed-out stream crossings present common obstacles on older roads. Often, all or part of a crossing's fill will be eroded and lost downstream because a drainage structure was too small, not maintained, or not installed. If fill is only partially eroded from the crossing, the remaining material in the channel bottom will likely need to be excavated down to the original channel bed before a new culvert is installed. This may include removal of sediment and buried logs.
- (7) Road Benches. Failed road benches can present serious obstacles to road passage and reconstruction. In areas of steep inner gorge slopes such as are found on that portion of Ponderosa Way between Bluff Springs and Highway 36 and near Cohasset, failure of the road bed can extend all the way downslope to fish-bearing streams. Road reconstruction where failures have removed most or all the former road bench are likely to require an engineered solution, such as reinforced fill crib walls. In a number of instances along portions of Ponderosa Way, as much as one-third of the road prism has been lost as a result of fillslope failures. In one road location within the Deer Creek watershed, failure of a reinforced roadbed segment would completely sever the roadway, cutting off transit use of a significant portion of the road. Cutslope and bank failures which block the road surface generally represent a less serious erosion problem than fillslope failures, since the road bed may store much of the failed cutbank material and prevent it from moving downslope.
- (8) Rolling Dips. Rolling Dips are breaks in the grade of a road. They are sloped either into a ditch or to the outside of the road edge to drain and disperse road surface runoff. These features are installed in the road bed as needed to drain the road surface and prevent rilling and surface erosion and are most frequently used on outsloped roads. As a road becomes steeper, rolling dips need to be made deeper and

placed at a steeper angle to adequately capture and divert road runoff surface and to prevent rilling or surface erosion. Rolling dips are installed on both new roads as well as on in-place roads that are being retrofitted for improvements to surface drainage. Excavation for a rolling dip typically begins 50 to 100 feet up-road from where the axis of the dip is planned. Material is progressively excavated from the road bed, slightly steepening the grade, until the axis is reached. This is the deepest pan of the excavation, with the overall depth being determined by the slope of the road. The steeper the road, the deeper the dip will have to be in order to reverse grade. In order to safely and effectively direct runoff to the side of the road, the axis of a rolling dip should be angled about 30 degrees to the road alignment. On the down-road side of the rolling dip axis, the road bed slope is developed so that it rises slightly to ensure that runoff cannot continue down the road surface. The rise in grade is carried for about 10 to 20 feet before the road surface begins to fall again at its original slope. This transition from axis bottom, through rising grade, to original falling grade is achieved in a road-distance of 15 to 30 feet. Unlike a water bar, the reverse grade portion of a rolling dip is not composed of fill. The entire drainage structure is excavated into the roadbed. Rolling dips require very little maintenance if they are constructed properly and at an adequate spacing. If properly developed, a series of rolling dips will assure that each one will not collect enough runoff to develop significant erosion. The length and depth of the rolling dip should be adequate to divert road runoff but not so great as to interrupt or endanger traffic at normal speeds.

- (9) Road Slopes and Ditches. Current wildland road design dictates that insloped roads (those where the road surface is sloped inwards toward the cutbank) should be constructed only where road surface drainage discharged over an outside fillslope would cause unacceptable erosion or discharge directly into stream channels. Inslope road segments are also developed where fillslopes are unstable, or where outsloping would create unsafe conditions for use. Generally, modern wildland roads are designed and improved using outsloped road surfaces in order to disperse road surface runoff before it has a chance to concentrate and before it requires construction of a ditch to direct water out of the road prism. Portions of Ponderosa Way were developed using an inslope roadway and ditch. Although it is preferable to drain these ditches at intervals that will reduce water volume, flow velocity, and the potential for ditch erosion, a significant portion of the roadway's ditch system drains large volumes of surface flows into a limited number of culverts or drop inlets with unprotected outlets. At many of these locations, culverts crossing the roadway are undersized, clogged, and showing signs of overflow crossing the roadway, causing surface erosion.
- (10) Roadway Storm Water Filtration. Filtering of storm water sediment prior to flows entering water courses can dramatically improve water quality in streams that provide critical anadromous species habitat. Improving runoff is particularly important along Ponderosa Way, as a considerable portion of the road's surface was developed using inside

slopes and ditches that generate runoff at relatively high velocities. These insloped road surfaces may not drain flow volumes quickly enough to avoid gulying. A number of ditches along Ponderosa Way discharge directly into the inlet of a water course without first directing flows through an adequate filter strip. The cost of retrofitting in-place drainage features with filtration systems would be much less costly than reworking these road segments into outside slopes or developing rolling dips. Filtration systems can be accomplished through a variety of methods, including the use of thick vegetation, gentle slopes, settling basins, or filter windrows of woody debris and mulches placed and secured on the slope.

(11) Improvements in Roadside Fuel Conditions. Considering that road surface and bank slope erosion can be minimized by keeping soil exposure to a minimum, vegetation needs to be retained within the Ponderosa Way road prism. In order to improve the route as a fuel break, a balance needs to be struck between maintaining vegetation for roadway stability and removing excess vegetation that can carry fire across the road, hinder fire suppression and ignition activities, or prevent the road from being used as a control point for prescribed burning operations. To achieve this, a number of recommended improvements have been developed for the Tehama County portion of the route that will result in:

- (a) Wide vegetation corridors along all wet and dry stream channels,
- (b) Significant thinning of roadside chaparral fuels and mixed conifer thickets to within 100 feet of Ponderosa Way's centerline throughout Tehama County,
- (c) Creation of shaded fuel breaks within roadside mixed conifer stands that extend beyond 100 feet of the centerline, and
- (d) Development of prescribed burning prescriptions for overgrown chaparral lands adjacent to Ponderosa Way.

c) *Determination of maintenance responsibility*. In order to improve road and fuels conditions along Ponderosa Way in an equitable, comprehensive, and cost effective manner, responsibility for road maintenance needs to be established. A legal determination of such responsibility needs to be made and agreed upon by all the landowners and right-of-way holders along the route. A request for a determination might be made to the Tehama County Council's office; based upon that determination, recommendations for maintenance might be made to appropriate landowners and right-of-way holders.

d) *Wet weather closures along nonessential road segments*. A number of the problems related to road conditions and sediment entering stream channels along Ponderosa Way relate to road use during wet weather. Ruts created during the rainy season have been found along the route which channels water down or across the road surface, both creating and exacerbating erosion problems and carrying sediment laden flows into streams. Information provided by public and private landowners indicate that the primary use of Ponderosa Way between the Shasta/Tehama County line and its intersection with Forward Road is for access by year round residents of the Manton community and its Wildland Urban Interface area. Between Forward Road and its intersection with South Fork Battle Creek, the road is used for

access by hunters, fire suppression forces, and prescribed burning crews during the late spring, summer, and fall just prior to the rainy season. Traffic is reported to drop dramatically in the winter months along this segment, but use does continue during the wet season. Between South Fork Battle Creek and Highway 32, greater use is made of the road throughout the year. In addition to hunting and fire crew access, the road is used by residents of the Ponderosa Sky Ranch, Panther Springs, and Campbellville communities. A number of rural recreation communities also use the route for access, including the Battle Creek Rod and Gun Club, Paynes Creek Rod and Gun Club, and the community of Boondocks. In order to protect the road from damage attributable to wet conditions, consideration could be given to establishing a wet weather closure program coordinated between all landowners along the road that utilizes the locked gates present on Ponderosa Way. Among possible closure points would be (a) just north of Bluff Springs on the south side of Forward Road and (b) a second gate located further to the south where the road crosses the Battle Creek Rod and Gun Club property boundary on the north side of South Fork Battle Creek. In addition to the installation of barriers, a program of wet weather protection measures could be established for the barricaded segment which would include inspection, maintenance, and erosion control work needed to insure drainage of the road surface along with the free flow of water through ditches and drains. In addition, all culverts would be cleared of debris to insure that their maximum capacity could be achieved during storm events. Since a majority of the roadway is unsurfaced, water bars may be required at intervals dictated by the road gradient and the permeability of the soil. Trash barriers, culvert inlet basins, and pipe inlets would be cleaned of floatable debris and sediment accumulations. Ditches that are partially or entirely plugged with soil and debris would be cleared, and heavy concentrations of vegetation which impede ditch flow would be trimmed. Once these winter protection measures were completed, the road might be closed to all "non-essential" traffic.

e) *Cooperative road maintenance.* Once legal responsibility for road maintenance has been established, a cooperative program of annual and storm period inspections could be developed that would utilize knowledge of road issues and drainage structures held by all entities determined to have responsibility for road maintenance. Timely maintenance of drainage infrastructure can prevent small problems from growing into large failures. When ditches become blocked by cutbank slumps, they need to be cleaned, and the spoils deposited in a stable location. Where inside ditches are used, ditch maintenance is important in order to clear blockages and maintain the flow capacity required to remove surface runoff. Inspecting ditches during periods of high runoff will indicate which segments need grading to improve their capacity and which segments carry too much water. If cutbank slumps have blocked ditches, these inspections will allow for immediate remediation. Summer culvert inspections and maintenance can be performed at the same time as ditch maintenance. The critical component of successful culvert maintenance is to fix problems before complete failure occurs. These inspections can also spot floatable debris in catch basins and material wedged in culvert inlets or debris barriers. Sediment deposits that threaten to plug culverts may need to be excavated, and culvert ends that have been bent or damaged can be straightened and re-opened. Wet weather

inspections can spot culvert outlets that are experiencing erosion and that are in need of armoring, installation of a downspout, resizing, or a second overflow pipe installed at a crossing. Bridges and fords may also require maintenance. Permanent fords that show signs of erosion may need additional rock armor prior to the first winter storm.

f) *Color coded culvert signs.* Some drainage structures are more prone to problems than others. Culverts on streams with heavy sediment loads or floating woody debris are more likely to plug. In contrast, many culverts, ditches, and road surfaces rarely have erosion problems regardless of storm severity. Through the use of landowner information about stream flow patterns and drainage structures along road segments, a cooperatively developed rating system, inspection plan, and signage for this infrastructure could be established for those portions of Ponderosa Way that are not closed and winterized during the winter season. Signs would note where the culvert is located (road name and milepost), the diameter of the culvert, and a system of color coding (e.g., red, yellow, and green) that would signify how likely the culvert is to plug, and thus its relative need for inspection during winter storms. The color coded rating system could be based on past maintenance experience with a particular culvert and could be used in the field to alert inspection crews as to which culverts should be inspected first during and following winter storms and floods. Culvert coding schemes have been found to be especially useful for large landowners with many miles of road frontage and who rely on employees unfamiliar with the road system to perform inspections and field maintenance. Culvert marking is also useful to grader operators, so they can avoid damaging culvert inlets when grading the road or ditch.

g) *Coordinated roadside thinning and shaded fuel break development along Tehama County segments of Ponderosa Way.* A number of public and private landowners manage parcels along Ponderosa Way. As a first step in improving the road as a significant north-south fuel break, vegetation treatments need to be completed within and immediately adjacent to the road prism throughout Tehama County. Other site specific measures need to be completed as well. To accomplish improvements in a timely, efficient, and cost effective manner, all roadside landowners and entities having responsibility for road maintenance need to participate in these efforts. Participation would take the form of permission for access and financial contributions. In addition to local financial resources, various state, federal and private sources of fuels management funding are available. These programs generally require that specific implementation measure work scopes be developed and prioritized so that financial contributions are expended on the most critical measures first. It is recommended that a consortium be established of area landowners, land managers, and agencies having jurisdiction over road maintenance as a means to develop, strategize, and prioritize implementation efforts that address the fuels issues identified in this document. As a Special District that works with both public and private landowners on natural resource protections efforts, TCRCD could coordinate the efforts of such a consortium by integrating landowner initiated and funded fuel management efforts with those completed using outside funds. In addition, TCRCD has extensive experience in developing funding proposals and administering fuels projects funded by outside sources. Among the

significant fuel reduction efforts that TCRCD has developed and administered are various roadside chipping projects and the development and maintenance of fuel breaks. TCRCD will soon complete the Ponderosa Way Fuel Break project which addresses roadside fuels issues along a seven mile segment of the route between the Shasta/Tehama County line and a point about 1.5 miles south of Bluff Springs.

h) *Site specific road infrastructure and fuel management measures.*

**(1) Battle Creek Watershed**

(a) *Fuel conditions and fuel management recommendations for Sites 73 to 91.* Sites 73 and 76 are located within the Manton Wildland Urban Interface. Along this portion of Ponderosa Way, homes and small parcels intermingle with dense stands of small second growth mixed conifer. Once the road crosses Forward Road just prior to Site 77, the mixed conifer stands became more open and mixed with chaparral species including manzanita, buckbrush and whitethorn. This ecotype continues from Sites 77 to 82. At Site 83, the road crosses a stream channel at Bluff Springs, an area consisting of dense riparian vegetation and large conifers. From Sites 84 to 86 the road passes through chaparral stands with scattered gray and Ponderosa pines. At Site 87 the road once again crosses a riparian corridor area. Between Sites 88 and 91 Ponderosa Way passes through pockets of chaparral and mixed conifer stands. With the exception of riparian areas that are protected by no treatment zones, in order to dramatically improve the roadway as a fuel break, vegetative fuels along this portion of Ponderosa Way should be treated within 75 feet of the roadway center line by either hand cutting and chipping or by cutting, piling, and burning of conifer and chaparral vegetation.

(b) *Road conditions and recommendations for Sites 73 to 91.*

(i) Site 73. An 11'3" high overhead flume crosses Ponderosa Way at this location. In discussions with CalFire and US Forest Service fire personnel, the crossing height is sufficient for both state and federal fire engines. However, oversized water tenders and truck/trailer combinations hauling dozers would probably not be able to pass under the structure. It was mentioned that with the construction of a new CalFire station on Manton Road to the west of Ponderosa Way, oversized equipment can take alternative routes around this crossing.



Nevertheless, if equipment arrives on the wrong side of the flume, it would take a considerable amount of time to back up, return to Manton, and take another route in the opposite direction. This could be of particular importance in the event out-of-area crews

respond to a wildfire or if dispatchers are given a fire location that is actually on the opposite side of the structure.

- (ii) Site 75. This flat segment of the road has a section of ditch 65 feet long by 3 feet wide that is poorly maintained on the east side and that had begun to erode and narrow the drivable portion of the road surface. The ditch directs water and silt onto



a flat basin located within adjoining forest land. Consideration should be given to rocking this short length of culvert to prevent further cutting and narrowing of the roadway.

- (iii) Site 81. This site contains a 12-inch culvert with a flat rock wall armoring the roadway on the inlet side. The culvert is partially blocked on the inlet side but has a deep basin containing several feet of vegetative debris to catch flows. An ineffective rolling dip appears to have been installed over the top of the old, undersized culvert. The outslope of the dip has not been



rocked, and erosion is occurring that both narrows the road surface and is eroding the road bed. Erosion from surface flows continues down the embankment to vegetation located below the embankment. Removal of the faulty culvert and installation of a rolling dip would allow the removal of the upslope basin, improve road surface runoff, and prevent erosion damage to the downslope side of the road embankment.

- (iv) Site 85. This site contains an old undersized culvert that has a damaged end on the outside slope. As a result, erosion of the roadbed and road surface has occurred; at the present time,



this erosion is only minor. However, depending on the volume and velocity of storm flows that pass through this intermittent stream channel, additional erosion could continue to occur unless a rolling dip is installed or the damaged

undersized culvert pipe replaced with an appropriately sized pipe having armored and rocked inlet and outlet ends.

- (v) Site 89. A 500-foot section of ditchless roadway at this site shows signs of diagonal surface flows and resultant road bed rutting and erosion. Fine roadbed material has eroded to an extent where subsurface rock outcrops have been exposed at the



surface. Erosion on the inboard side of the roadbed has cut this portion of the roadway downward, and it is now approximately 2 feet lower than the outboard side. A short term, low cost fix to this road segment might include regrading of the roadway using soil from roadside berms as surface material. Any swales or other low areas that show signs of directing water onto the roadway should be redirected away from the roadway or into properly sized culverts in order to pass flows across the road prism and into stream channels on the opposite side of the road. As a permanent solution

to the road surface issues found in this portion of roadway, the roadway could be regraded and sloped in order to create an outsloped roadbed configuration. If properly executed, outsloping will reduce erosion from water accumulating in ditches and low spots. Lowering of the roadbed on the outboard side along with fill and spoils generated from grading can be used to cover ditched areas or low spots.

- (vi) Site 91. This portion of Ponderosa Way is just north of where the road begins its southerly descent into the canyon of South Fork Battle Creek. A 12-inch culvert has been installed to pass



storm flows out of a small ravine. The inlet of the culvert has been crushed and is almost completely full of soil and vegetative debris. The outlet has been “shotgunned” out to approximately 4 feet from the embankment. The

clogged inlet has resulted in stream flows passing over the road bed and severely cutting the road surface and outside embankment. At its deepest intrusion, the cut has intruded

almost 6 feet into the passable road surface and is approximately 3 feet deep on the outslope. This faulty drainage feature has the potential to severely erode the road surface and could make it impassable in the near future unless corrected with the installation of a rolling dip or correctly sized replacement culvert that is installed with a screened and collared inlet and armored outfall. After this site, the field survey was terminated as the road became impassible for the crew vehicle.



- (vii) Site 91 to State Route 36E. Between Site 91 and Ponderosa Way's intersection with State Route 36E, the road became impassible by vehicle, and it was determined that surveys on foot would be impractical and cost prohibitive. Consequently, this segment of the road was not assessed by field inspections. Information obtained from a number of public and private sources indicate that this portion of the road has numerous slide and slump areas that block passage as well as significant roadbed failure that limits use by vehicles. An analysis of aerial photography and remote sensing data indicate areas along Ponderosa Way adjacent to riparian zones in this area that are in need of roadside thinning. These fuel treatments would improve the road as a midslope fuel break, and they would also protect critical riparian habitat of South Fork Battle Creek and Grapevine Creek from the impact of wildfire. In addition, fuel treatments within this canyon area of South Fork Battle Creek would help to protect structures and other developed areas of the Battle Creek Road and Gun Club, as well as homes on Canyon View Loop which is adjacent to State Route 36E.
- (2) **Paynes Creek Watershed.** A significant portion of Ponderosa Way within the Paynes Creek watershed between Ponderosa Sky Ranch and the road's intersection with Plum Creek Road is maintained by Tehama County Public Works. This segment of the road and its drainage features are well maintained. Consequently, no recommendations are made for improvements.
- (3) **Antelope Creek Watershed.**
- (a) *Fuel conditions for Sites 55 to 72.* In general, roadside chaparral and mixed conifer fuels should be treated within the road prism out to

approximately 100 feet on both sides of the roadway centerline in this watershed in order to reduce the threat of roadside ignitions to adjoining wildlands. These treatments would be intermittent where needed and of low environmental impact. In order to greatly increase the roadway's benefit as a fuel break, more extensive treatments would need to be made that address large scale fuel issues such as pine and fir thickets, heavy accumulations of chaparral in young conifer stands and plantations, and dense conifer and oak stands located in deep soils on moist north facing slopes. Such large scale treatments would also serve to protect the numerous riparian zones and aquatic habitats that intersect Ponderosa Way in the Antelope Creek watershed.

(b) *Site 64.* This site is located on a relatively moist north facing slope. Dense second growth stands of small mixed conifers have developed. Additional thinning treatments within one-quarter mile of the roadway between Site 63 and the edge of the riparian zone at Site 65 are recommended. Such treatments would leave only pockets of pine and fir thickets and trees 12 inches in diameter and greater, significantly increasing the ability of this roadway segment to bring crown fire to the forest floor where effective control and containment could be accomplished.

(c) *Site 66.* Along a 500-foot section of roadway cut slope at this site,



fine material from the road surface has been eroded by summer traffic and storm flows. As a result, numerous subsurface rocks and rock outcrops have been exposed at the surface. The road track shows signs of gullyng from lateral flows which have washed fine sediments over the outslope towards a watercourse below. It is recommended, at a minimum, that this portion of the roadway be graveled in order to prevent future gullyng of the roadbed material.



**(4) Big Dry Creek, Mill Creek, and Deer Creek Watersheds.**

(a) *Fuel conditions and fuels management recommendations for Sites 25 to 54.* Sites 25 to 29 are located within open chaparral stands, some natural and others that have developed after wildfire occurred in low elevation pine stands. These brush stands transition into oak/grassland stands that are intermixed with conifer plantations in the vicinity of Sites 30 and 31. Sites 32 to 38 are located within young stands of mixed conifers containing large thickets of suppressed pines and firs along with scattered large pines, particularly on north and east facing slopes. Near Site 39,

vegetation returns to open stands of grass/oaks woodlands and pockets of live oaks. At Site 53 there are approximately 125 acres of dense mature chaparral vegetation on the east side of the road prism that extend approximately one-half mile eastward into oak woodlands. This vegetation has the potential of directing wildfire upslope into oak woodlands, thus minimizing the effectiveness of the roadside fuel treatments recommended for the entire length of Ponderosa Way within Tehama County. Consequently, cutting or prescribed burning of these extensive brush stands would dramatically improve the usefulness of Ponderosa Way as a fuel break. Thinning or prescribed fire treatments in the area of Sites 32 to 39 are recommended in order to create pockets of fir thickets rather than extensive continuous stands that can carry wildfire originating in lower elevation chaparral into upslope timber stands. In addition, thinning of brushy understory fuels and individual trees up to 8 inches in diameter is recommended in order to reduce ladder fuels from reaching the crowns of large pines in the area. These additional fuel treatments would create more open vegetation such as is found to the south between Sites 25 and 29. These open areas are less likely to carry either grass fires or crown fires, and it is easier to execute backfires or other wildfire control procedures. These open areas also provide safe sites from which to ignite prescribed burning operations on an ongoing basis, which would help to make Ponderosa Way a significant permanent fire management infrastructure.

(b) *Road conditions and recommendations for Sites 25 to 54.* Other than rutting and some relatively minor surface erosion attributable to use in wet weather at Site 52, no road conditions were found that could lead to impassability or road failure.

**(5) Pine Creek and Big Chico Creek Watersheds.**

(a) *Fuel conditions and fuels management recommendations for Sites 1 to 53.*

(i) Sites 3 to 6. Slopes along the portion of Ponderosa Way between Site 3 (the bridge crossing on Deer Creek) and Site 6 are steep and are generally at a north facing aspect. The vegetation on these slopes has developed into extremely dense stands of conifers and broadleaf species. Slope steepness impacts fire behavior in that it affects flame angle. As slopes increase, flames are closer to upslope vegetation, resulting in preheating that increases fuel combustibility and rate of spread. The steepness of the slope along this portion of the road is such that if a roadside fire occurred, flames could travel upslope at a rapid rate. Consequently, it is recommended that appropriate roadside clearances be maintained and that additional thinning be completed up to approximately one-quarter mile upslope from the roadway along this road segment in order to compensate for both fuel loading and the effect of slope on wildfire.

(ii) Sites 19 to 22. For the most part, Cohasset Road substitutes for the segment of Ponderosa Way that passes through the Pine

Creek and Big Chico Creek Watersheds. This portion of the roadway provides access to numerous small parcels and is intersected by a number of private roads. The roadbed along this segment of the route has a weak subbase consisting of fine soils. Consequently, traffic during the wet season has resulted in rutting. The combination of fine soils and considerable traffic during dry months pulverizes the road surface, creating additional removal of surface material in the form of road dust. There is minimal formal drainage infrastructure in the area. As a result, during the wet season a significant risk exists for fine sediments to enter intermittent streams and the waterways of Pine Creek and Big Chico Creek, both of which are considered to provide significant anadromous fish habitat. As a sediment control and aquatic habitat protection measure, it is recommended that the portion of Ponderosa Way between the Butte County line and Site 19 be chipped sealed.

- (iii) Sites 16 to 18. Winter traffic and fine roadbed materials have resulted in significant rutting within this segment of Ponderosa



Way. Lateral surface flows have exacerbated roadbed erosion. Without repair and stabilization, surface erosion could result in rendering this portion of the road impassable and could lead to sedimentation entering any intersecting intermittent streams.

Outsloping of this road segment would greatly improve surface drainage, and rocking would help to prevent damage to the subbase.

- (iv) Site 11. At this site, approximately one-quarter mile of the roadway is located along a rock outcrop, and a steep dropoff is adjacent to the outslope. The site is highly unstable, as indicated by a cement retaining wall that has been constructed



in order to hold the roadbed in place. The wall is held on the slope using rebar which has become exposed due to the loss of road surface material attributable to traffic and erosion from storm flows. Continued

deterioration of the retaining wall and its connecting rods could

result in failure of the structure and severing of the roadway. In order to prevent the loss of access to a significant portion of Ponderosa Way, it is highly recommended that the retaining structure be replaced utilizing modern construction techniques and materials. Although this would be an expensive repair, the stabilization of this road segment is perhaps the most critical need that was noted along the entire portion of Ponderosa Way within Tehama County.

- (v) Sites 6 and 7. These sites are located at primitive low water crossing at intermittent streams. Both crossings consist of rocks



placed in road cuts that have been created by stream flows. These crossings provide no control of the stream flows being delivered from the adjacent stream channels, and rock areas of the road crossings obviously do not protect the entire portion of the road surface that is inundated during storm flows. Flows appear to be cutting into the road surface and road bed. Flows passing over the inboard and outboard edges of the roadway appear to be cutting into the roadway from the side, narrowing its operating surface. If the rocks used to create the crossing wash out during high flow events, extensive vertical and horizontal cutting of the road surface and bed could occur, rendering the road impassable. It is highly recommended that either a rolling dip with armored inlets and outlets be constructed or that a properly sized culvert be installed at this location.

- (vi) Site 5. A well constructed 40-inch culvert's flow capacity at this site has been reduced by roughly 50 percent due to rocks and vegetative debris being lodged both inside the pipe and at the inlet. If the structure becomes completely blocked, the sizable flows passing across the road prism at this point could either

severely erode the road surface and bed or could completely wash out the culvert and its head structure. Yearly inspection and maintenance of this road feature would be a cost effective means of assuring its continued operation.



4) *IMPROVEMENT OF SLAB CROSSING AT DEADHORSE CREEK.* The slab crossing maintained by Tehama County Public Works at the confluence of Deadhorse Creek and North Fork Antelope Creek is in need of examination and possible redesign.

5) *FIRE-RELATED PROJECTS WEBTOOL.* This webtool is described above in the Public Outreach paragraph beginning on Page 20. Though there are similar tools developed at a statewide level, there are no equivalent tools for coordinating local fire-related project information. For this reason and because the webtool is helpful in keeping interested parties informed of proposed, planned, ongoing, and completed projects in the local region, it is recommended that the Fire-Related Projects Webtool continue to be updated annually with input from fire safe council members, agency personnel, and other natural resource managers and professionals. Alternatively, concerned citizens may work toward developing a method to incorporate local fire-related project information into statewide databases.

6) *BEST MANAGEMENT PRACTICES.* Development of guidelines such as Best Management Practices would be beneficial for the scattered communities along Ponderosa Way concerning such activities as creation of defensible space, appropriate burning and grading methods, and emergency evacuation procedures in the event of wildfire.

7) *REMOTE SENSING TECHNOLOGIES.* Techniques that involve remote sensing technologies should be developed to utilize the recently released Color Infrared band of the NAIP imagery available free from the State of California, together with the LandSat imagery now offered free to the public from NASA. This technology can offer insights into burn severity, vegetation health and density, and change in vegetation.

8) *EMERGING TECHNOLOGIES.* New technologies should continue to be developed to assist land managers in decision making. This report documents the use of GIS

analysis, Google Earth virtual tours, and web galleries as a tool for management. A further example would be the development of a methodology for calculating the slope of a road surface using publicly available GIS datasets, which would be helpful for determining the need for road maintenance on a remote roadway.

*Environmental compliance for recommended future projects.* TCRCDD is pursuing development of a programmatic CEQA document to streamline fire safety projects in Tehama and Glenn Counties. If any future project work takes place in a streambed, the form titled “Notification of Lake or Streambed Alteration” should be obtained from and filed with the local office of the California Department of Fish and Game; permitting fees may be applicable.

*Incorporation of Defensible Polygons GIS dataset created by The Nature Conservancy.* As part of the Tehama East Community Wildfire Protection Plan, a GIS dataset was created by The Nature Conservancy (TNC) showing logical geospatial divisions of the landscape of eastern Tehama County according to level of defensibility during wildfire occurrences. This dataset addresses the area to the west of Ponderosa Way and should be considered in the development of any future fire-related project planning. This dataset is available upon request from TNC or from TCRCDD.

*Funding strategies for recommended future projects.* Sources of funding for these recommended future projects are described below:

- Tehama County Resource Advisory Committee, if the project is located adjacent to USFS lands;
- CalFire assistance programs;
- California Fire Alliance;
- TCRCDD chipper programs;
- USFS cooperative road maintenance programs; and
- USFWS WUI program.

## **PERSONAL CONTACTS:**

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Wyman, Adam. Forester, CalFire Red Bluff, adam.wyman@fire.ca.gov, 530-528-5106

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## **APPENDICES**



## Appendix A

### Postcard Mailing to Residents along Ponderosa Way



#### Tehama County Resource Conservation District

2 Sutter Street, Suite D ♦ Red Bluff, California ♦ 96080 ♦ 530-527-3013 ♦ Fax: 530-527-7451

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<DATE>

<LANDOWNER NAME AND ADDRESS>

We are contacting you as a landowner with property along Ponderosa Way in Tehama County. Tehama County RCD is conducting a research project identifying problem areas on Ponderosa Way that (when corrected) will help it serve as a fire break as well as a safe path for resident evacuation and firefighter access during wildfires. This particular study for the US Fish and Wildlife Service will recommend projects that will fix trouble spots in road condition. It will also study plant life that has grown too close to the road or too high near the road as a fire hazard.

Because of your unique knowledge of Ponderosa Way as a landowner, we invite you to contact us and share your concerns and ideas about the condition of Ponderosa Way. Please include road conditions (locations of bad spots), areas of overgrown brush & trees near the road, locked gates, etc... anything that might interfere with travel or cause fires to jump the road.

Tehama County Resource Conservation District is a non-regulatory public agency whose mission is to "assist citizens with managing, conserving, and improving the natural resources of Tehama County." We recently sponsored the fire-safe meetings that you may have attended in Manton. We sponsor these and other projects with the goal of helping you and your neighbors make your homes and property safe during fire season.

*(To find more about what we do please visit our website at <http://www.TehamaCountyRCD.org>)*

Thank you in advance for helping to make the foothills a safer place for residents and property owners. Please contact us by any of the following methods:

Mail:  
Tehama County RCD  
RE: Ponderosa Way  
2 Sutter Street, Suite D  
Red Bluff, CA 96080

Email:  
[jas@TehamaCountyRCD.org](mailto:jas@TehamaCountyRCD.org)

Phone:  
530-527-3013 ext. 3

We look forward to hearing from you!

---

Jas O'Growney  
Tehama Co. RCD

## Appendix B

### Field Visit (Checklist and Instructions)

#### Checklist and Instructions

#### **Supplies:**

- Auto power supply that plugs into lighter
  - Digital camera with download cable, battery, cards
  - Laptop w/power cord, ArcGIS w/key, datasets (roadway, NAIP, crossings, dem, slope, aspect, parcels 2007, landownership, analysis layers)
  - Water, lunch, snacks
  - Trimbles (TCRCD and CSUC w/ArcPad), stylus, case, manual, charging cradle and cable, and download cables
  - Forms, clipboard, pencils
  - Car w/gas, oil, air pressure in tires, water in radiator
  - Cell phone with a full charge
  - Stadia rod, 100-ft measuring tape, spherical densiometer
- 

#### **SPHERICAL DENSIOMETER INSTRUCTIONS:**

This instrument is used to estimate forest canopy coverage. Take measurements of forest overstory density from unobstructed sighting positions. The spherical-shaped reflector mirror engraved with a cross-shaped grid of 24 quarter squares delineates an overhead plot. Leveling bubble assists with accurate positioning.

1. Take four densiometer readings, one each facing north, east, south, and west. Average these four readings.

2. Standing on the road centerline, keep the instrument leveled (indicated by the round level in the lower right-hand corner). Hold the densiometer far enough away from your body so that your head is just outside the grid (12-18" away).

3. There are a total of 24, 1/8" x 1/8" squares in the grid. Each square represents an area of canopy opening (sky image or unfilled squares) or canopy cover (vegetation image or filled squares). Count the number of canopy opening squares. If there are squares that are only partially filled, these can be aggregated together to count as complete squares.

4. The uncovered area is determined by multiplying the number of squares by 4.17. Subtract this number from 100% to determine overstory density as a percentage.

*For example, 100% - (10 unfilled squares x 4.17) = 58% overstory density*

5. If more than half of the canopy area is open sky the counting process can be reversed. Count the filled square areas that are covered by the canopy. Multiply by 4.17 to obtain the estimated overstory density directly in percent.

*For example, 10 filled squares x 4.17 = 40% overstory density*

(Taken from "Forest Densiometer Instruction Sheet" by Robert E. Lemmon, FOREST DENSIOMETERS  
5733 SE Cornell Drive, Bartlesville, OK 74006)

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**DIGITAL CAMERA:** Set the camera to capture a raw image of medium filesize. Use program mode for automatic shutter and aperture adjustment. Avoid framing both very bright and very dark areas in the same frame; instead, shoot two separate frames to cover both areas. Always include a scale reference in each frame, such as a stadia rod, ruler, or measuring tape. When taking a picture, frame the scene carefully, squeeze halfway to achieve focus, and then slowly squeeze fully to complete the shot. Document the location, date, and time of the image, together with other field notes.

---

## Appendix C

### Field Visit (Field Notes, blank)

#### FIELD NOTES

Photograph the road conditions every half mile, anywhere a specific issue is noted, and at each specified crossing point. Include a fieldworker holding the stadia rod in each frame, and separately photograph each culvert that is encountered. At the same time, record coordinates of the photo point and observations of the fieldworker. Be extremely careful to tie the recorded observations to the images using a numbered list or other method. Periodically download images from the camera's memory card to the laptop. Take care that all batteries retain a charge during the entire field visit, using the car charger whenever needed. Observe standard safety rules, and drink plenty of water!

Fieldworker name: \_\_\_\_\_ Date/Time: \_\_\_\_\_  
Location Number: \_\_\_\_\_ Crossing #, if any: \_\_\_\_\_  
Coordinates: \_\_\_\_\_ Mileage: \_\_\_\_\_  
(deduct current mileage from beginning mileage)  
Condition of culvert: \_\_\_\_\_  
Image # \_\_\_\_\_ Diameter in inches: \_\_\_\_\_

Describe any blockage: \_\_\_\_\_  
(e.g., clear, 30% filled with gravels, 75% blocked by vegetation, etc.)

Describe any issues: \_\_\_\_\_  
(e.g., overtopping, erosion around base, washed away, etc.)

Condition of roadway:  
Type of surface: Asphalt [ ] Gravel [ ] Dirt [ ] Other: \_\_\_\_\_

Describe any issues: \_\_\_\_\_  
(e.g., eroded at culvert, extreme washboard, blocked by fallen tree, etc.)

Rate the passability: Passable by passenger car [ ] Passable with 4-wheel drive [ ] Impassable [ ]  
Comments: \_\_\_\_\_

Condition of vegetation:  
Type of canopy: Deciduous [ ] Conifer [ ] Evergreen [ ]  
Percent canopy cover (using spherical densiometer, see instructions): \_\_\_\_\_  
Type of understory:  
Density of understory: Sparse [ ] Other: \_\_\_\_\_

Description of ladder fuels: \_\_\_\_\_

Ground (check all that apply): Vegetative cover [ ] Duff and litter [ ] Bare soil [ ] Exposed rock [ ]  
Describe any evidence of dead, diseased, or fallen trees (e.g., dead tops or brown foliage, trunk rot or deformities, excessive mistletoe growth, downed or leaning trees, or excessive conch growth, woodpecker holes, or insect activity):  
\_\_\_\_\_  
\_\_\_\_\_

Image Notes:



**Appendix E**  
Field Visit (Digitized Field Notes)

Excel spreadsheet follows.



## Appendix F

### Field Photographs, Maps, and Web Galleries

**DVD format.** The DVD(s) provided in the pocket of this report binder contain digital copies of several media created during this project.

1. **Digital photographs** were taken by TCRCDC staff during the field visit to Ponderosa Way in September 2010 at each site where field workers stopped. Several versions of the photographs are provided, as follows:

a. **Raw.** With the USFWS and TCRCDC report binders, the original digital shots are provided “as shot” in raw format. The “sidecar” file with an .xmp extension contains information about the adjustments that were made to each of these raw photographs during processing, such as brightness, contrast, color balance, levels, and curves. The raw image may be opened using the sidecar file, or it may instead be opened in an “as shot” condition. Adjustments were aimed at increasing visual information in all areas of the image.

b. **SiteJPG.** In the folder titled “SiteJPG,” the adjusted shots were saved in folders corresponding to the numbered site locations shown on Figure 8 of this document. The file names for each jpg contain the number of the original image, the site number, and an alphabetic symbol indicating the direction that the photographer was facing, with the character U representing a generally northward direction or “Up road,” D for generally southward or “Down road,” L for generally eastward or “Left of road,” and R for generally westward or “Right of road.” Also contained in the caption itself is an indication if the images depict culverts, bridges, or other structures. For example, the filename “2863\_1R.jpg” indicates that the raw image is numbered 2863 and that this image shows Site 1 looking to the right, or generally southerly down the road. Likewise, the filename “2918\_culvert\_13a.jpg” indicates that the raw image is numbered 2918 and that it depicts a culvert.

c. **SiteSets.** This folder contains fully processed imagery, with adjustments for visual information, grouped according to site numbers. These images are also presented in an online web gallery that can be found in the Library section of the TCRCDC website.

2. **Maps.** Digital PDF formatted files are provided of the three large format maps.

3. **Web Galleries.** Two digital web galleries were created during this project: one containing images of each site visited by TCRCDC field workers and one containing aerial photography of hydrologic crossings along Ponderosa Way within Tehama County. To view these web galleries, find the file called index.html, and open this file in a browser. The web galleries can also be viewed online under the Publications heading in the Library section of the TCRCDC website.

## Appendix G

### Maps

#### Section 1: Project Background

In the pocket of this document binder, please find the large format map showing an overview of the study area, including Coleman Fish Hatchery Road and Ponderosa Way, by Jas O’Growney, TCRCDD GIS Analyst, and Cathie Benjamin, TCRCDD GIS Manager.

#### Section 3: Ponderosa Way

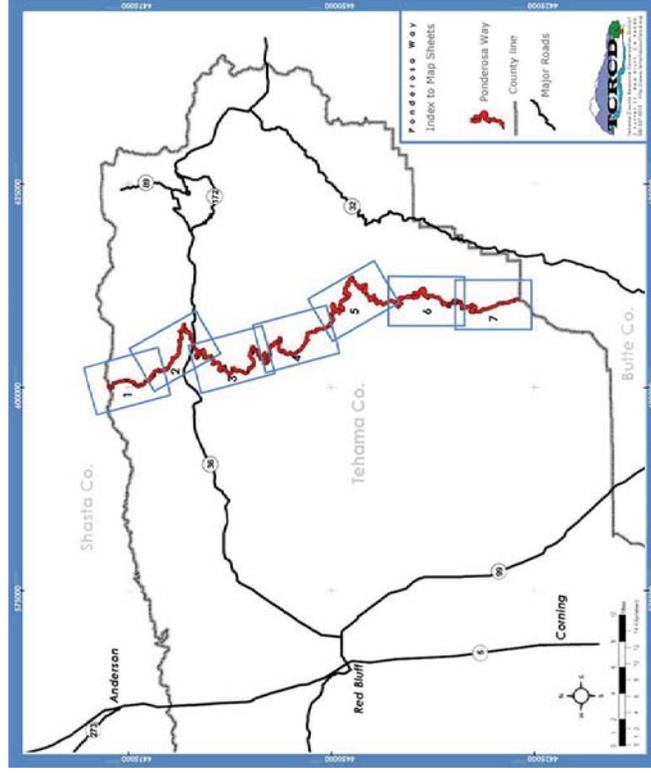
On the following pages, please find an index map and a series of seven map sheets in 11x17 format showing an overview of the Ponderosa Way study area, authored by Jas O’Growney, TCRCDD GIS Analyst, and Cathie Benjamin, TCRCDD GIS Manager.

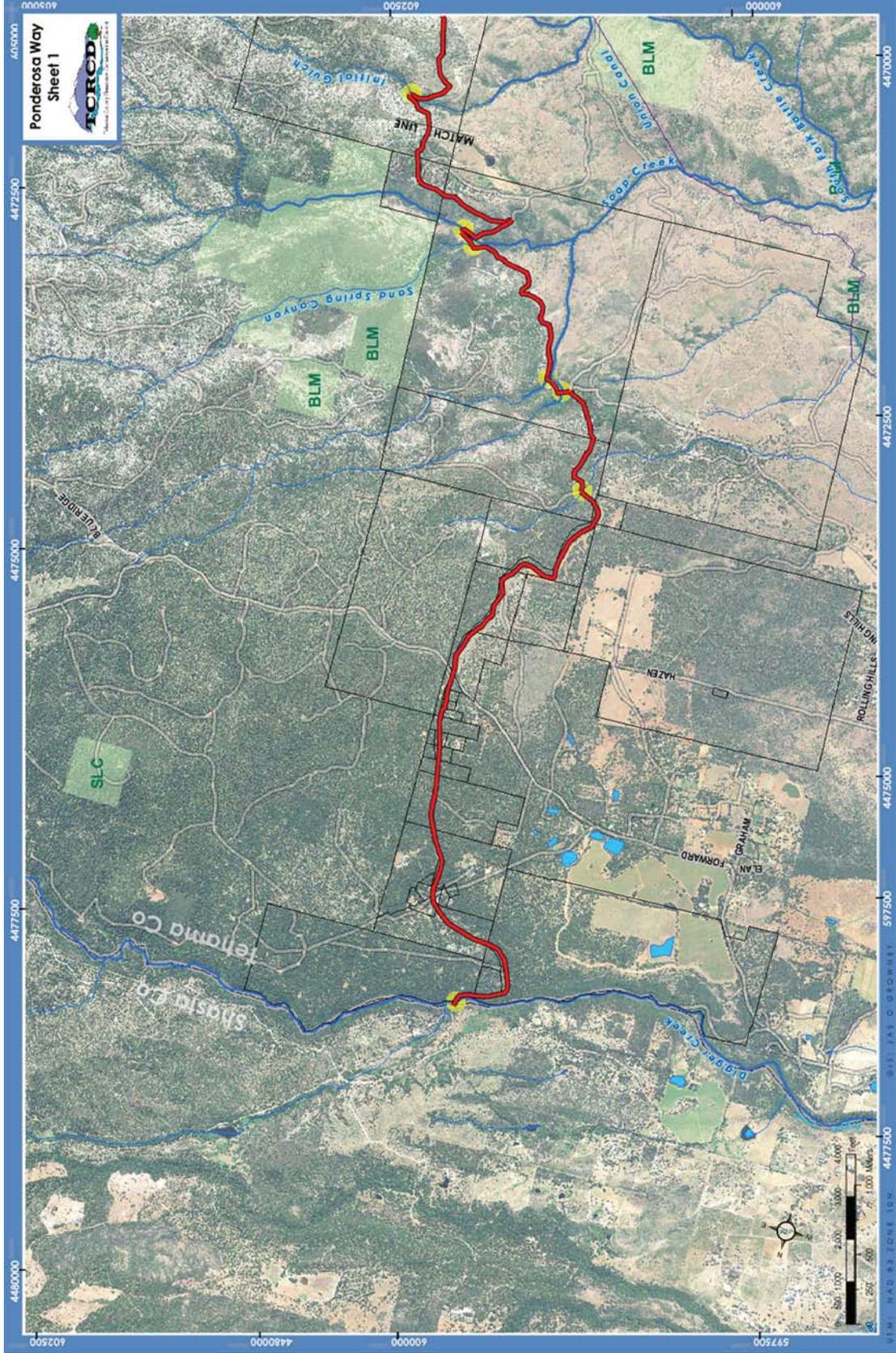
In the pocket of this document binder, please find the wide format map depicting an enlargement of Figure 13: Land Ownership, including datasets relating to public and private land ownership labeled with assessor’s parcel numbers where relevant and feasible, hydrography, and major roads, authored by Cathie Benjamin, TCRCDD GIS Manager.

On the following pages, please find the Manton and Manton/Shingletown maps presented in public meetings and authored by Jas O’Growney, TCRCDD GIS Analyst.

In the pocket of this document binder, please find the large format map depicting an enlargement of Figure 18: Field Site Locations, authored by Cathie Benjamin, TCRCDD GIS Manager.

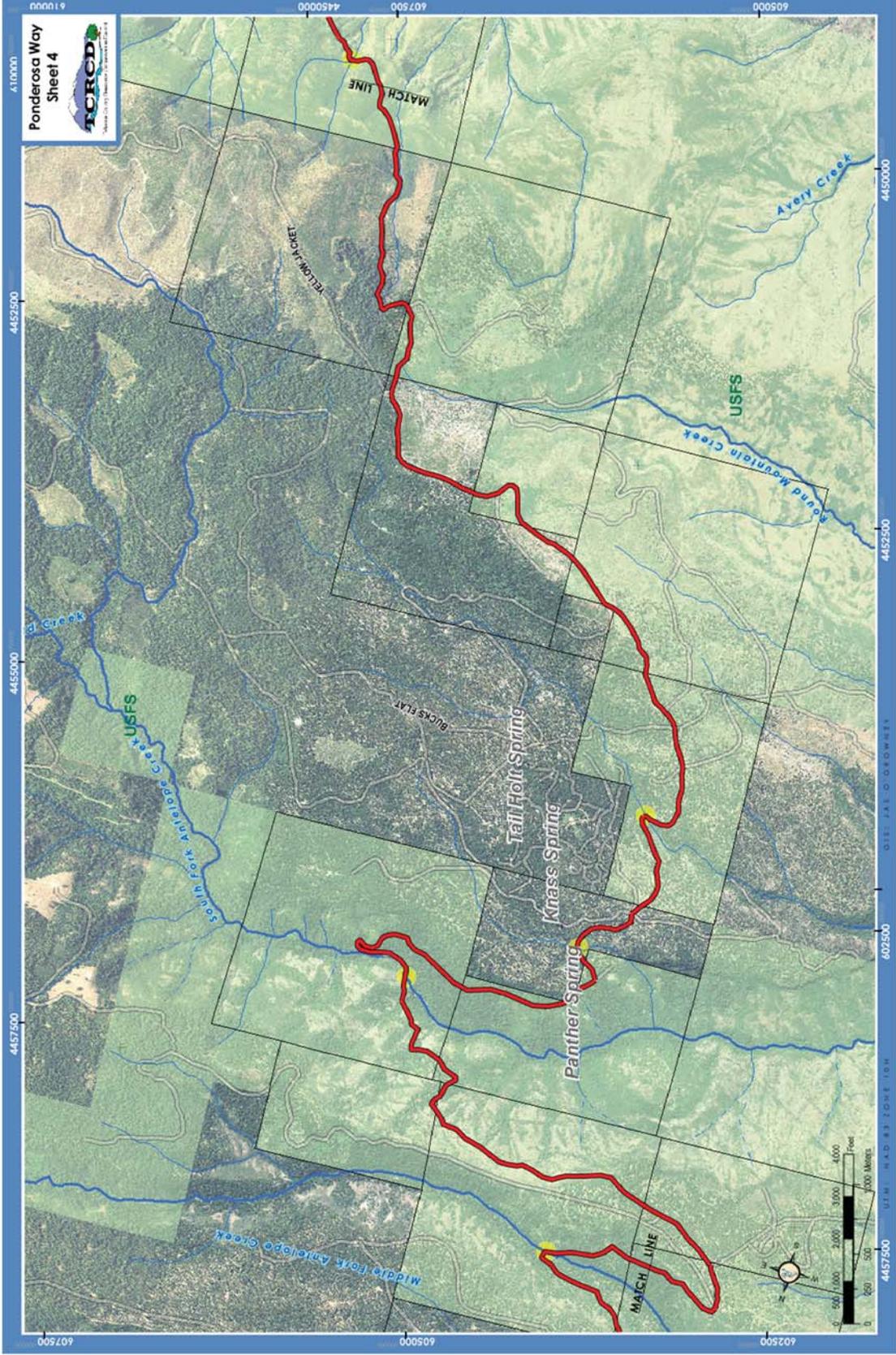
The following pages contain seven map Sheets depicting the extent of Ponderosa Way within Tehama County with aerial photography, yellow highlighted hydrologic crossings, major roads, rivers, lakes, county boundaries, and public lands shaded in green.



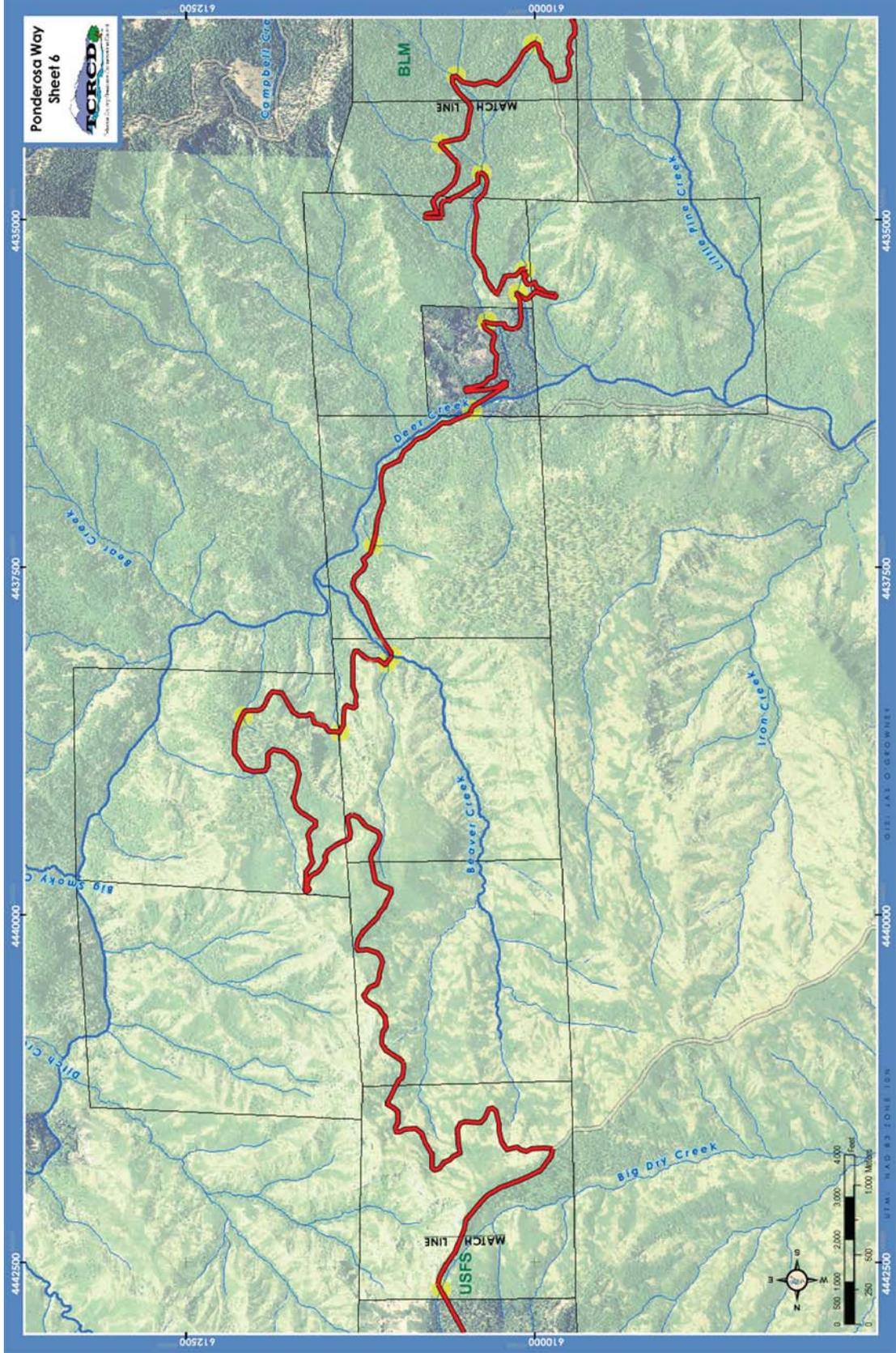


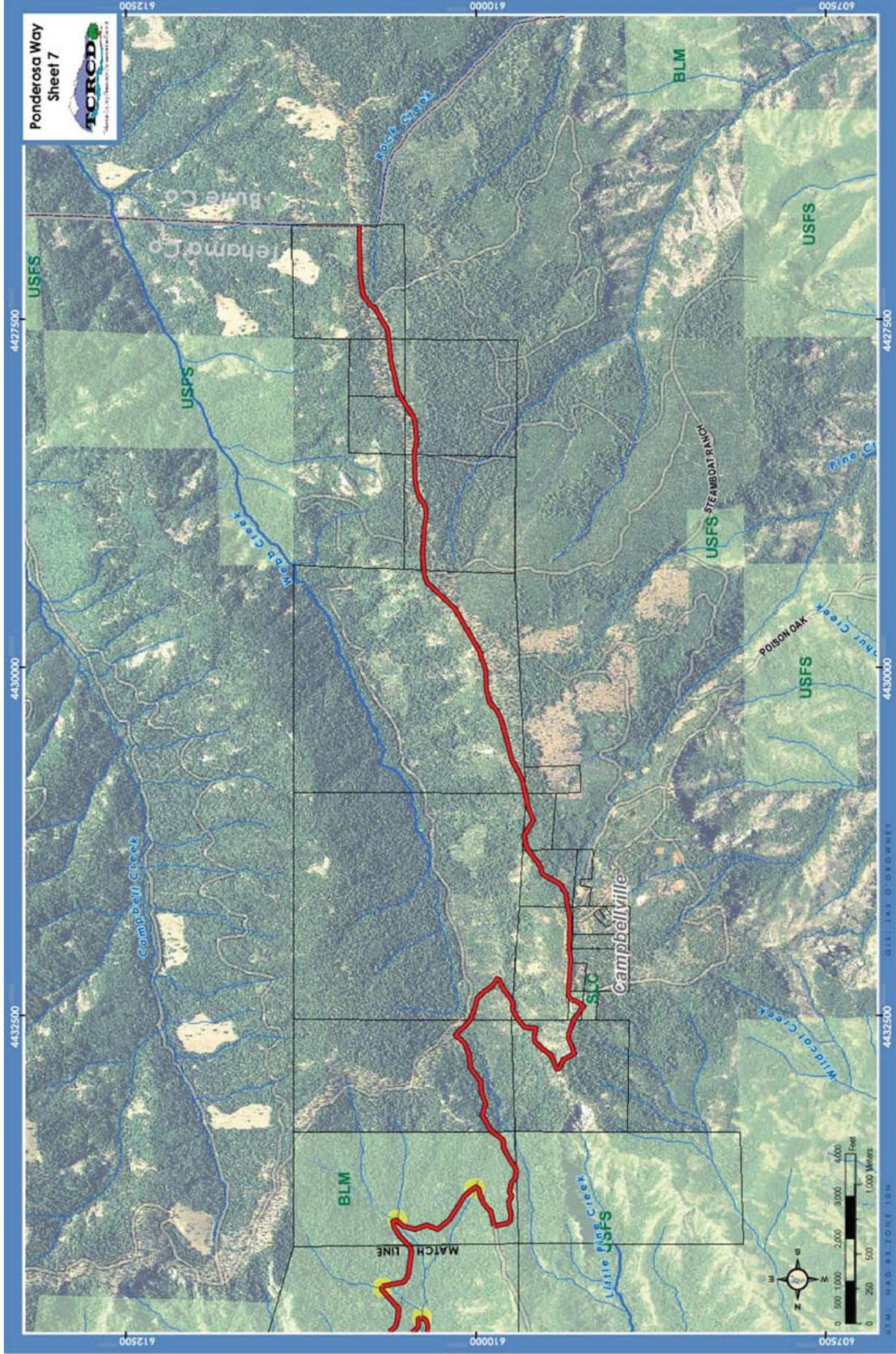


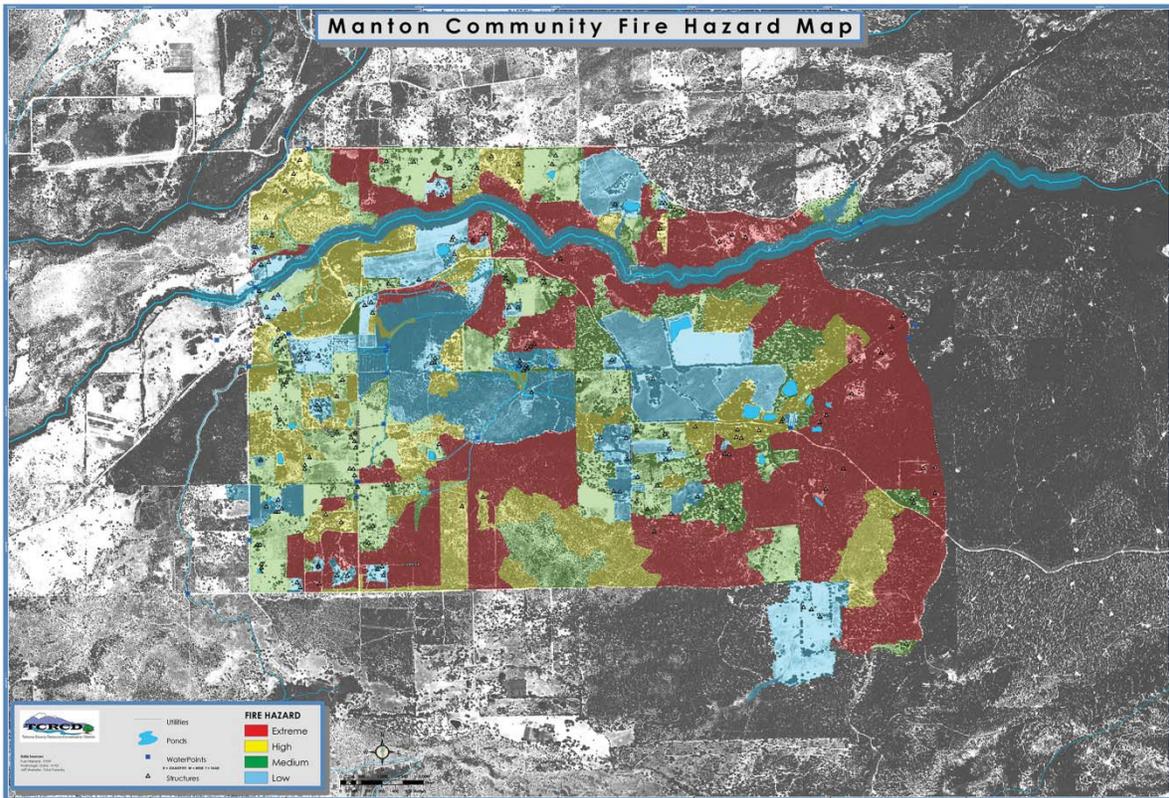




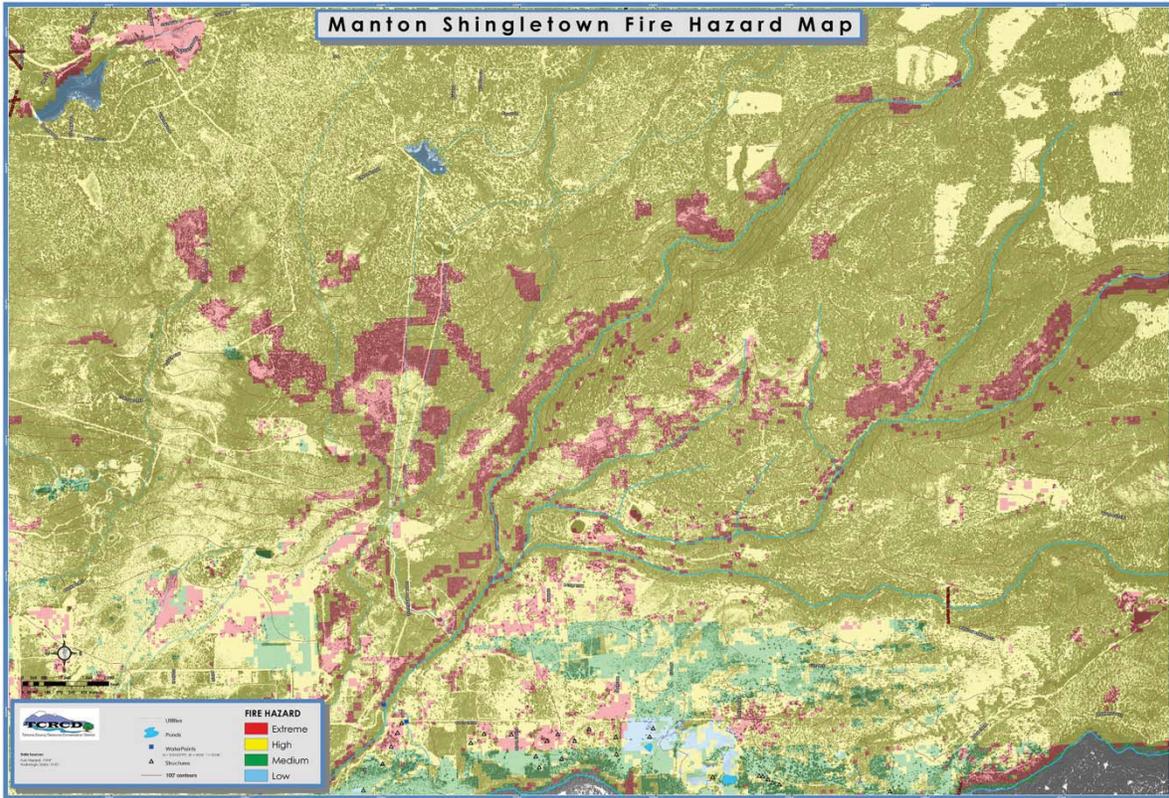








Manton Community Fire Hazard Map, originally created by Shasta Community College for the Manton Fire Safe Council, with this map presented in public meetings and authored by Jas O'Growney, TCRCDD GIS Analyst.



Manton/Shingletown Fire Hazard Map presented in public meetings and authored by Jas O'Growney, TCRCDD GIS Analyst.