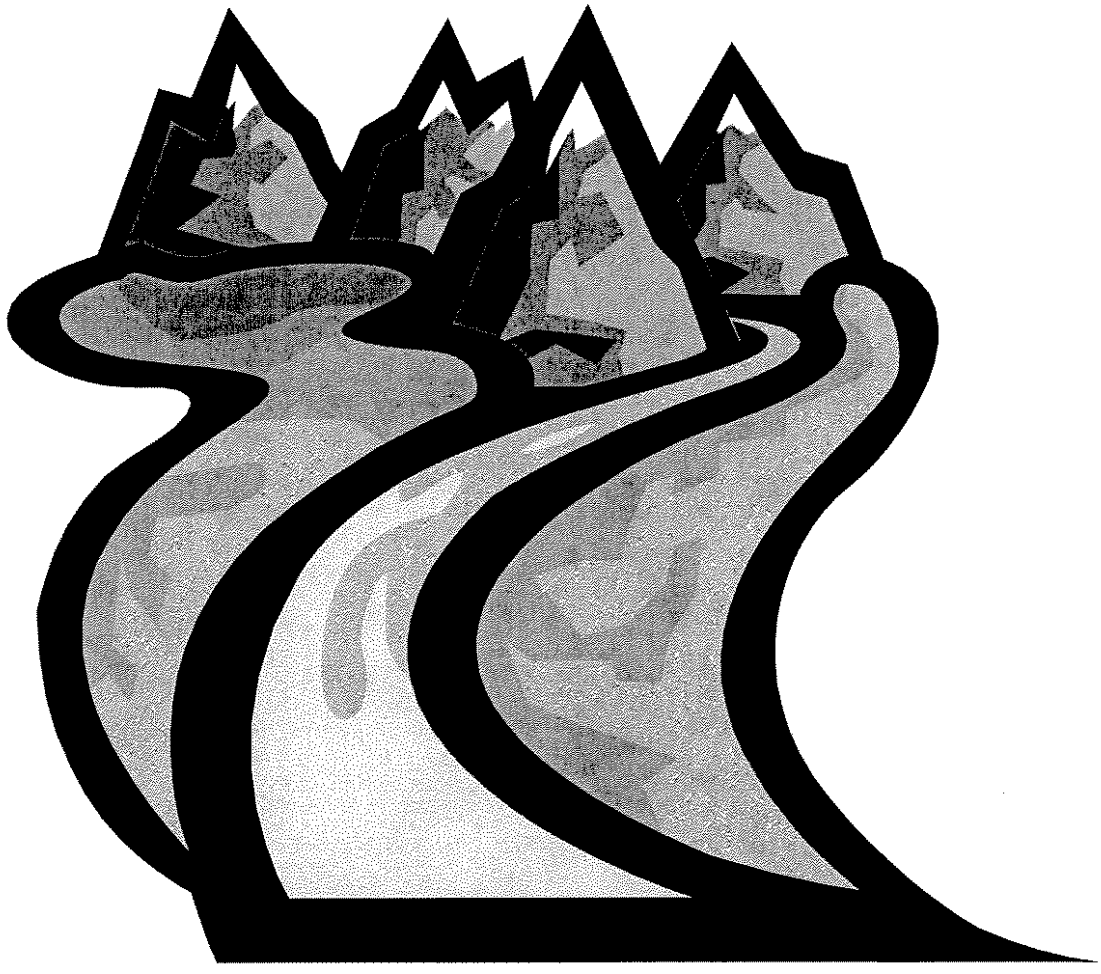
MIDDLE FORK AMERICAN RIVER
WATERSHED ASSESSMENT



Foresthill Ranger District

Dear Interested Citizen:

Enclosed is the Watershed Assessment for the Middle Fork American River. It analyzes the US Forest Service lands in the Middle Fork American River from its headwaters in Granite Chief Wilderness to the outlet of Oxbow Reservoir, and includes the North Fork of the Middle Fork American River. The Middle Fork American River has been identified as a priority watershed for the Foresthill Ranger District, and as a result, we have made a commitment to focusing our efforts on restoring and managing its watershed health.

This document assesses the current status of resources in the watershed, compares them to historic or reference levels, and determines opportunities for management and/or restoration. It also identifies priority issues in the watershed as well as data gaps. This watershed assessment is not a decision document. Rather, it is a guiding document to assist with future management in the watershed by identifying issues and priorities at a landscape level.

We welcome any comments you have on the content of this document. The watershed analysis is intended to be a living document that will be re-assessed as data is collected to fill identified data gaps, and as new issues are identified. If you have any questions or comments about this document or its use, please contact Mary Grim, Project Leader, at (530) 367-2224.

Sincerely,

/s/Richard A. Johnson

RICHARD A. JOHNSON
District Ranger

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2003INTRODUCTION

Analysis Overview

Watershed analysis is ecosystem analysis at the watershed scale; it is both an analysis and an information gathering process. The purpose is to provide a means by which the watershed can be understood as an ecological system and to develop and document the understanding of the processes and interactions occurring within. That is the purpose of this analysis of the Middle Fork American River (MFAR) watershed.

This analysis focuses on the issues and key questions specifically identified for this watershed. They are assessed in terms of their biological, physical and social features. Types of information used in the analysis may include: beneficial water uses; vegetation patterns and distribution; wildlife species and their habitat; human use patterns; and the importance of vegetation and riparian corridors. The analysis also includes an identification of the management opportunities that would provide background for the development of management decisions in the future.

The analysis process is also used as a vehicle for implementation of Forest planning direction. It is an intermediate analysis between land management planning and project planning. It is purely an analysis step and does not involve National Environmental Policy Act (NEPA) decisions. It provides a means of refining the desired condition of the watershed, given the Goals and Objectives, Management Areas and Standards and Guidelines from the Tahoe National Forest (TNF) Land and Resource Management Plan (LRMP), current policy, and other applicable State and Federal regulations.

Process and Document Organization

The analysis was conducted by and interdisciplinary team of TNF resource specialists. During the analysis phase, participation and involvement of personnel from the Eldorado National Forest as well as local governments and private landowners was encouraged.

The following is a summary of the six steps utilized in conducting this ecosystem analysis:

Step 1 – Characterization
Step 2 – Issues and Key Questions
Step 3 – Current Conditions
Step 4 – Reference Conditions
Step 5 – Interpretation
Step 6 – Recommendations

Step 1 -- Characterization

The purpose of this step is to place the watershed in context within the river basin, provinces or a broader geographic area. It briefly describes the dominant physical, biological and human dimension features, characteristics and uses of the watershed.

Step 2 – Issues and Key Questions

This step identifies the variety of uses and values associated with the watershed. It focuses the analysis on key elements of the ecosystem that are most relevant to the management issues, human values or resource conditions within the watershed. Also involved in the step is the formulations of analysis questions using the indicators most commonly used to measure or interpret these ecosystem elements.

Step 3 – Current Conditions

This step documents the current range, distribution, and conditions of the relevant ecosystem elements.

Step 4 – Reference Condition

Step 4 develops a historic reference for comparison with current conditions. This step explains how existing conditions from Step 3 have changed over time as the result of human influence and natural disturbances.

Step 5 – Interpretation

This step compares existing, historical and, reference conditions of specific landscape elements and explain significant differences, similarities or trends and their causes. Desired conditions for each issue are discussed.

Step 6 – Recommendations

This step identified those management activities that could move the ecosystem towards achievement of management objectives or desired conditions. Management opportunities specified in Step 6 are expressed in general terms – they identify what needs to be done and why, but not how. This step ultimately produces the purpose and need for implementation of individual projects designed to achieve desired conditions.

This watershed analysis will be an ongoing process. The initial analysis report will serve as a foundation onto which new information will be added in the future. In addition, the analysis process will continue to be refined as new methods and strategies are developed and applied.

CHAPTER 1 – WATERSHED CHARACTERIZATION

The purpose of this chapter is to provide an overview of the physical, biological and cultural/social settings of the watershed analysis area (WAA). This characterization of the watershed provides the context to identify and evaluate the relevant elements (including components, structures, and processes) involved in the various functions within ecosystems that are addressed in the analysis.

General Location and Watershed Setting

The MFAR watershed is located east of Foresthill, CA and lies entirely within Placer County. It consists of two 5th field watersheds: the Upper Middle Fork American River (UMFAR) and the North Fork of the Middle Fork American River (NFMFAR).

The MFAR watershed drains approximately 130,067 acres, 100,849 of which are managed by the USDA Forest Service (USFS), 253 are managed by the BLM and 28,965 are privately owned. Of the USFS lands, 94,238 acres are on the Tahoe National Forest and 6,611 acres are on the Eldorado National Forest. Across both federal and private ownerships, 35,954 acres are include in a game refuge, 17,219 are within the Duncan Canyon Inventoried Roadless Area (IRA) and 6,694 acres are within the Granite Chief Wilderness Area.

The MFAR watershed is characterized by rugged, steep topography. Elevations range from approximately 9,000 feet at Granite Chief and 1,000 at Ralston Reservoir. Prominent features include Deadwood Ridge, Mosquito Ridge, Chipmunk Ridge, Red Star Ridge, Duncan Peak, Granite Chief, Lyon Peak and Mount Mildred. Four reservoirs exist within the system: French Meadows Reservoir, Duncan Diversion Dam, Interbay Reservoir and Ralston Reservoir.

Mild, wet winters and hot dry summers typify the climate of this watershed. The average precipitation is 53 inches, with slightly higher amounts at higher elevations. Rain on snow events frequently occur within the 3,500 – 6,000 feet elevation range. Air temperatures range from 19 – 80° F at 5,000 feet elevation. Temperatures are slightly warmer at lower elevations and slightly cooler at higher elevations.

Land Allocations and Management Prescriptions

Table 1-1 summarizes the Management Areas within the WAA, as designated by the Tahoe National Forest (TNF) Land and Resource Management Plan (LRMP)

Table 1-1. Management Areas and prescriptions from the TNF LRMP

Management Area	Summary of Available Management Practices
080 Granite Chief	• Wilderness Area Management • Recreation • Stream Fisheries • Range Management • Minerals Management • Land Acquisition • Trail Construction/Management • Fire Protection
083 Wabena – Steamboat	• Recreation • Vegetation Management • Habitat Improvement • Water/Soil Resource Improvement • Range Management • Minerals Management • Land Adjustment • Transportation Management • Trail Construction/Management • Fire Protection
089 French	• Recreation • Stream Fisheries • Lake Fisheries • Vegetation Management • Habitat Improvement • Wet Meadow Improvement/Management • Flow Timing Improvement • Range Management • Minerals Management • Land adjustment • Transportation Management • Trail Construction/Management • Fire Protection
091 Sunflower	• Recreation • Stream Fisheries • Vegetation Management • Habitat Improvement • Flow Timing Improvement • Minerals Management • Land Adjustments • Range Management • Transportation Management • Trail Construction/Management
092 Peavine	• Recreation • Stream Fisheries • Vegetation Management

	• Habitat Improvement • Minerals Management • Land Adjustments • Range Management • Transportation Management • Trail Construction/Management • Fire Protection
098 Eldorado	• Recreation • Stream Fisheries • Vegetation Management • Habitat Improvement • Minerals Management • Land Adjustments • Transportation Management • Trail Construction/Management • Fire Protection
099 Mosquito	• Recreation • Vegetation Management • Habitat Improvement • Minerals Management • Land Adjustments • Range Management • Transportation Management • Trail Construction/Management • Fire Protection
102 End of the World	• Recreation • Stream Fisheries • Vegetation Management • Habitat Improvement • Minerals Management • Land Adjustments • Range Management • Transportation Management • Trail Construction/Management • Fire Protection
104 Big Trees	• Recreation • Minerals Management • Trail Construction /Management • Fire Protection
106 Big Oak	• Recreation • Stream Fisheries • Vegetation Management • Habitat Improvement • Flow Timing Improvement • Minerals Management • Land Adjustments

	• Range Management • Fire Protection
107 Big Tree	• Recreation • Vegetation Management • Minerals Management • Land Adjustments • Range Management • Transportation Management • Trail Construction/Management • Fire Protection
108 Little Oak	• Recreation • Vegetation Management • Wet Meadow Improvement/Management • Habitat Improvement • Minerals Management • Land Adjustments • Transportation Management • Trail Construction/Management • Fire Protection

The Sierra Nevada Framework Plan Amendment (SNFPA) amended the LRMP in 2001 and added the land allocations illustrated in the SNFPA Map in Appendix A. Table 1-2 summarizes the land allocations designated by the SNFPA.

Table 1-2. SNFPA land allocations within WAA (allocations can overlap)

Land Allocation	**Acres**	**% Of WAA**
Old Forest	62,065	48%
Spotted Owl PAC♠/HRCA♣	22,726	17%
Goshawk PAC/HRCA	2,545	2%
General Forest	15,148	12%
Threat Zone	22,570	17%
Defense Zone	2,139	2%

♠PAC = Protected Activity Center
♣HRCA = Home Range Core Area

Geology

The lower portions of the watershed, particularly the south facing slopes of Mosquito ridge are primarily sedimentary in origin. The higher elevation areas are primarily volcanic in origin, although some granitic areas occur east of French Meadows Reservoir and around Granite Chief. Glacial deposits occur in high elevation areas, particularly within the valley area of Granite Chief Wilderness Area.

Geomorphology

In general, steep, unstable slopes with high to very high erosion hazards characterize the WAA. The geomorphology of the Sierra Nevada (including this watershed) is a block mountain range (formed by block faulting) tilted west with accordant crests (crests with similar orientation). The WAA is within the Sierra Nevada geomorphic province.

Soils

Soils in the WAA were formed by the weathering of volcanic, sedimentary, granitic and glacial rock formations (see discussion of geology for more information on underlying bedrock formations). The soils in the WAA are rated as having high or very high maximum bare soil erosion hazard ratings. Past management activities in the WAA have left some areas of residual soil displacement and compaction (e.g., roads, landings, and skid trails). These areas have altered soil productivity and hydrologic function that increases the potential of surface run off and gully erosion. Gully erosion is present within the WAA and is typically initiated by channelized water runoff from areas of rock outcrops, roads, landings and skid trails.

In 2001, the Star Fire burned approximately 17,000 acres within the WAA and impacted soil resources. Within the burn perimeter, 34% of the area experienced unburned or low burn severity, 39% moderate severity and 27% high severity (BAER report 2001). Areas that burned with moderate or high severities have reduced ground cover and may experience accelerated soil erosion.

Hydrology and Water Quality

Major hydrologic features within the watershed include French Meadows Reservoir, Duncan Diversion Dam, Interbay Reservoir, Ralston Reservoir, and the Middle Fork American River. A number of mid-sized perennial streams exist throughout the WAA, including Duncan Canyon, Chipmunk Creek, Mosquito Creek, Dolly Creek, Rice Creek, Eldorado Canyon, Deep Canyon and Peavine Creek. Many seasonal streams exist and tend to be primarily ephemeral in nature.

Water quality does not appear to be a major concern within the watershed (refer to the HCA in Appendix B). No reports of contaminants or known point source pollutants exist. Studies of mining related mercury pollution has shown the Middle Fork American drainage has a low level contamination, particularly in comparison to the Yuba River system. Sedimentation does appear to be a concern, based on the frequent need to remove excess material from behind Duncan Diversion, Interbay and Ralston reservoirs. However, other than the quantities removed from these reservoirs, little data exists about the amount of sedimentation occurring or its sources.

Water flows in this system are primarily controlled by the American River Project managed by Placer County Water Agency (PCWA). The project was constructed during the 1960's for the purpose of conserving and controlling water for irrigation, domestic and commercial purpose and electric generation. The project includes French Meadows Reservoir, Duncan Diversion, Interbay Reservoir and Ralston Reservoir within the WAA. Hell Hole Reservoir is also part of this project, but exists outside of the WAA; however, water from this reservoir enters the WAA through a tunnel that empties near Interbay Reservoir.

Roads

Approximately 647 miles of roads exist within the WAA, ranging from seasonally used logging roads to the paved Mosquito Ridge Road. With the exception of the Soda Springs Road (managed by Placer County), all roads within the watershed are USFS managed roads. The main arterial and collector roads in the WAA are: 16, 22, 44, 51, 57, and 96. All of the other roads in the watershed are local roads that branch of these primary roads and are typically private, recreation, and logging roads, or access to water and power facilities.

The Duncan Canyon IRA lies entirely within the WAA. The 17,219 roadless area was considered during the 1979 USFS Roadless Area Review and Evaluation process (Rare II) and designated during the California Wilderness Act in 1984. Nine roads, totaling 4 miles exist within the IRA.

Forest Vegetation

Two forest types are found within the WAA: Westside Mixed Conifer and Upper Montane. The Westside Mixed Conifer areas exist below 5,000 feet elevation and include ponderosa pine, sugar pine, incense cedar, white fir, Douglas fir, black oak and live oak. These areas vary in species make up depending on elevation and aspect. The lower one-third of southwest slopes and northeast facing slopes are considered moist, productive sites where shade tolerant species dominate the layers with white fir, Douglas fir and incense cedar being the most common species. The upper two-thirds of southwest facing slopes and lower elevation ridge tops are considers dry, productive sites where pines dominate. In both areas, sugar pine is prevalent and black oak occurs scattered or in large patches. The Westside Mixed Conifer areas also contain hardwood-conifer forest that dominated with oaks with scattered of co-dominant conifers. These hardwood areas are typically found on shallow soils, on steep slopes or on large canyons. The Upper Montane areas are found above 5,000 feet elevation and include white fir, red fir and Jeffery pine.

In 2001, the Star Fire impacted approximately 16,500 acres of vegetation within the WAA. On the TNF lands within the burn perimeter, 3,769 acres experienced greater than 75% stand mortality. Another 3,787 acres are predicted to experience greater than 75%

stand mortality in the next 1-3 years. Of the 2,417 acres of Eldorado National Forest (ENF) lands that were burned, 71% experienced greater than 75% stand mortality.

Vegetation types for this watershed are dominated by fire adapted/resistant species. The exclusion of fire, along with other anthropogenic disturbances, has initiated a transition to a fire regime characterized by less frequent, high intensity fire events and associated vegetation types changes (i.e. greater abundance of white fir). Fire is one of the known disturbance regimes in this watershed, as revealed by the fire history in the WAA (See Fire History Map in Appendix A).

Threatened, Endangered, Sensitive (TES) and Watchlist Plant Species

Suitable habitat for federally threatened and endangered plants is not known to occur in this watershed. Suitable habitat for Forest Service sensitive plants occurs in the MFAR. A limited number of on-the-ground surveys have occurred within the watershed. A list of sensitive plant species with known or suspected occurrence within the WAA is presented in Table 1-3.

Table 1-3. Sensitive plants known or suspected in the WAA

Scientific Name	Common Name	Habitat
Astragalus webberi	Webbers milk-vetch	2,700-4,000', mixed conifer forest
Botrychium ascendens, crenulatum, lineare, montanum	Moonworts or Grapeferns	4,000'+, moist and riparian areas
Calochortus clavatus var. *avius*	Pleasant Valley Tulip	3,000-5,800', semi-open forest, south-facing slopes
Clarkia biloba spp. *brandegeae*	Brandegee's Fairyfan	Dry places below 2,500'
Clarkia stellata	Lake Almanor Fairyfan	3,000-6,000', conifer forest
Cypripedium fasciculatum	Clustered Lady's Slipper Orchid	500-6,00', moist mixed conifer forests
Cypripedium montanum	Mountain Lady's Slipper	<7,500', openings in forested areas
Epiloblium howellii	Subalpine fireweed	6,000-9,000', wet areas
Erigeron miser	Starved Daisy	6,000'+, granite
Eriogonum umbellatum var. *torreyanum*	Donner Pass Buckwheat	6,000-8,000', desert-like sites
Fritillaria easwoodiae	Butte Fritillaria	100-5,000', Westside forested areas
Lewisia cantelovii	Wet-cliff Lewisia	1,300-5,000' wet cliffs and outcrops
Lewisia longipetala	Long-petaled Lewisia	8,300-9,500', damp gravel in alpine areas.

Lewisia serrata	Sawtoothed Lewisia	1,300-5,000' wet cliffs and outcrops
Meesia uliginosa and M. triquetra	Moss	Wet meadows and fens
Monardella follettii	Follett's Monardella	2,000-6,500', serpentine
Phacelia stebbinsii	Stebbin's Phacelia	3,000-6,000'
Sheuchzeria palustris var. *americana*	American Scheuchzeria	4,500-6,00', sphagnum moss bogs

TES and Management Indicator Fish and Wildlife Species

Threatened and Endangered Fish and Wildlife Species

Bald Eagle
No bald eagles are known to nest within the WAA. Bald eagles have been observed foraging at French Meadows Reservoir and potential nesting habitat exists at this reservoir. The Middle Fork American River provides potential foraging habitat for this species, but is unlikely to provide nesting habitat.

California Red-legged Frog
This species has been sighted within the WAA at a pond within a powerline corridor on Ralston Ridge, between the Middle Fork American River (MFAR) and Rubicon Rivers. The sighting occurred in the summer of 2001 and follow-up surveys of the pond and areas of the MFAR have failed to result in any additional sightings. A historic sighting exists in Michigan Bluff. Survey throughout the watershed has located dispersal habitat and a few ponds provide low quality breeding habitat.

Valley Elderberry Longhorn Beetle
This watershed does not provide suitable habitat for Valley Elderberry Longhorn Beetle. Habitat for this species is found primarily in moist valley oak woodlands along the margins of rivers and streams in the lower Sacramento River and San Joaquin Valley below 2,500 feet.

Lahontan Cutthroat Trout
This species is not found within the WAA as it is primarily found on the eastern slope of the Sierras.

Sensitive Wildlife Species

A number of sensitive wildlife species have been sighted or have suitable habitat within this watershed. A limited number of surveys have occurred within the watershed, most often associated with other project work. A list of sensitive wildlife species with known or suspected occurrence within the watershed is presented in Table 1-4.

Table 1-4. Sensitive wildlife known or suspected in the WAA.

Common Name	Scientific Name	Presence in WAA
American peregrine falcon	*Falco peregrinus anatum*	Nesting and foraging habitat present. No detections within the WAA.
California spotted owl	*Strix occidentalis occidentalis*	Nesting and foraging habitat present. 31 PACS exit within the WAA.
Great gray owl	*Strix nebulosa*	Nesting and foraging habitat present. No detections within the WAA.
Northern goshawk	*Accipter gentilis*	Nesting and foraging habitat present. 11 PACS exit within the WAA.
Willow flycatcher	*Empidonax trailii bresteri (west slope of Sierra) and Empidonac trailii adastus (east slope)*	No nesting or for aging habitat present.
Greater sandhill crane	*Grus Canadensis tabida*	No habitat exists within the WAA.
Pacific fisher	*Martes pennanti*	Habitat is present within the WAA. No detections have occurred.
Marten	*Martes Americana*	Habitat is present within the WAA. No detections have occurred.
Sierra Nevada red fox	*Vulpes vulpes necator*	Habitat is present within the WAA. No detections have occurred.
California wolverine	*Gulo gulo pallidus*	Nesting and foraging habitat present. Sightings within or near the WAA have occurred at Robinson Flat and in Granite Chief Wilderness Area.
Townsend's big–eared bat	*Corynorhinus townsendii*	Habitat is present within the WAA. No detections have occurred.
Pallid bat	*Antrizous pallidus*	Habitat is present within the WAA. No detections have occurred.
Western red bat	*Lasiurus blossevilli*	Habitat is present within the WAA. No detections have occurred.
Northwestern pond turtle	*Clemmys marmorata marmorata*	Breeding and foraging habitat present. No detections within the WAA.
Foothill yellow-legged frog	*Rana boylii*	Breeding and dispersal habitat present. No detections within the WAA.
Mountain yellow-legged frog	*Rana muscosa*	Breeding and dispersal habitat present. No detections occur within the WAA, but immediately outside in Lyon Bog.
Northern Leopard Frog	*Rana pipiens*	No habitat within the WAA. Eastern Sierra species.
Great Basin rams-horn snail	*Helisoma newberryi newberryi*	No habitat within the WAA. Eastern Sierra species.
Lahontan lake tui chub	*Gila bicolor pectinifer*	No habitat within the WAA. Eastern Sierra species.

Hardhead	*Mylophardodon concephalus*	Habitat and sightings exist within the Middle Fork American River downstream of French Meadows Reservoir.

Heritage Resources

The area encompassed by the WAA has a long history of Native American occupation and utilization for over 5,000 years and through the last half of the nineteenth century. Two different Native American ethnographic groups (Nisean or Southern Maidu and Washoe) likely utilized the resources within the WAA. Archaeological evidence documents seasonal use as exemplified by bedrock milling features, lithic scatters and petroglyphs.

During the Gold Rush, beginning in 1848 and in subsequent years, miners and other groups of immigrants displaced Native Americans in the area. The discovery of gold in California caused a virtual population explosion of Euro Americans in the Foresthill Area. The growths of the golf mining industry eventually lead to the establishment and development of other businesses and industries in the area. Historic mining sites, cabins adits, artifact scatters, ditches, tunnels, tailings and trails associated with this era have been identified within the WAA.

Human Uses

In addition to the management prescriptions described earlier in this chapter, a variety of human activities occur within the WAA. Most of the 28,965 acres of private land are managed for commercial timber harvest. Mining operations continue throughout the watershed, primarily in or near stream channels. Grazing occurs within the watershed with the management of the Mosquito allotment.

The Middle Fork American River hydroelectric project is managed by PCWA for flood control, water conservation and use and electricity generation. Within the WAA, the project includes French Meadows Reservoir, Duncan Diversion, Interbay Reservoir and Ralston Reservoir. Hell Hole Reservoir is also part of this project, but exists outside of the WAA; however, water from this reservoir enters the WAA through a tunnel that empties near Interbay Reservoir.

The French Meadows Basin receives a moderate to high level of recreational use, primarily in the form of camping at its seven campgrounds and two day-use picnic sites. Two boat ramps exist at the lake and are a popular fishing location. A trailhead accessing the Granite Chief Wilderness Area is located at the Ahart campground.

Two well-known recreational events transect portions of the WAA: the Western States Run and the Tevis Cup horse race. Both the Western States Trail and the horse race also use the Tevis Cup Trail.

CHAPTER 2 -- ISSUES AND KEY QUESTIONS

The purpose of this chapter is to focus the analysis on the key elements of the ecosystem that are most relevant to the management questions and objectives, human values, or resource conditions in the watershed. Watershed concerns are identified and framed within the context of issues. The interdisciplinary team and local landowners and agencies developed watershed issues and key questions.

Part of Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis, Version 2.2 (August 1995) lists seven core topics that should be addressed in all watershed analyses. The core topics and core questions that accompany each topic address the basic ecological conditions, processes, and interactions at work in the watershed.

Watershed Core Topics:

1 – Human Uses
2 – Vegetation
3 – Species and Habitats
4 – Watershed Processes*

*The interdisciplinary team decided to group core topics covering erosion processes, hydrology, stream channels and water quality into a single core topic.

Issues focus the analysis on the main management questions to be addressed. Issues are those resource problems, concerns, or other factors upon which the analysis will be focused. Some of the issues for this analysis were developed during the analysis phases of the French Meadows, End of the World, Red Star, Star, Codfish, Cajun Cod, Cavenaugh and Screwauger projects conducted by the USFS. Other issues were developed from additional interdisciplinary input and public input. Issues for the MFAR are listed below. Issues will be discussed within the context of the core topics in Chapters 3, 4 and 5.

Watershed Issues (applicable core topics are in parentheses):

- Fire and Fuels Management (1, 2, 3)
- Hydroelectric Facilities Management (1, 3, 4)
- Recreation (1, 2, 3, 4)

*Issue 1 – **Fire and Fuels Management***

In August 2001, the Star Fire burned approximately 16,500 acres within the WAA. While the fire resulted in the consumption of fuels over a large portion of the fire area, fuel loads are expected to increase to extreme levels over the next 30 years as the result of fire-related tree mortality and shrub growth. Hazardous trees exist along many trails and roads in the WAA as a result of the Star Fire.

Fuels loads remain high in areas outside of the burn perimeter where little or no vegetation management has occurred over the past 10 years. A number of plantations

exist throughout the WAA that need vegetation management in around them to make them resilient to future wildfires. Plantations areas resulting from the Volcano Fire are particularly in need of treatment, especially those areas around Michigan Bluff. Many streamside areas were also planted after the Volcano Fire and may require some treatments to return them to a more natural condition.

Important wildlife habitats in old forest emphasis areas and oak dominated stands need management to make them more resilient to future wildfires. Some areas of the watershed have been identified as containing bear grass that is desired for basket making and requires frequent fire return intervals or harvest.

Key Questions:

- How will the Star Fire impact fuel loading and future fire and fuels management in the WAA?
- How do past and current projects in the WAA coordinate to create fuels and fire management areas within the WAA?
- What actions are needed to reintroduce fire as a management tool in the WAA?
- What is the need to manage Wildland Urban Intermix (WUI) areas in the WAA?
- What areas and prescribed burning techniques should be developed for bear grass management?
- What options exist for fuels and stand treatments in streamside plantations to return the vegetation to a more natural state?

*Issue 2 – **Middle Fork American Project Management***

The Middle Fork Project was completed in 1967 and resulted in a series of dams, diversions and power plants within the WAA that are used for flood control, power generation, domestic and commercial water supply and recreation. The project is due for FERC re-licensing in 2013.

Key Questions:

- What recreation uses are associated with the hydroelectric project?
- What wildlife and fish species are present within the project area and how do operations affect their habitat?
- What options are available for long term sediment disposal needs associated with the hydroelectric project?

- How do land ownership patterns and their associated future land use impact project operations?

- How has upslope land management affected the project?

- How might changes in project operations impact species habitat and human uses in the watershed?

Issue 3 - ***Recreation***

A high to moderate level of recreation use occurs within the WAA. The French Meadows Basin is used for camping, and fishing. Deer hunters use the areas outside of the wildlife refuge. The Ralston Reservoir area is a heavily used whitewater rafting staging area. Hikers and backcountry campers access the Granite Chief Wilderness Area. Two nationally recognized runs and rides utilize the Western States and Tevis Cup trails that transect the WAA.

Key Questions:

- What actions could be taken to improve recreational fishing access in the WAA?

- What day-use opportunities exist in the WAA and do any other opportunities exist?

- What options exist for future management of the Western States Trail, including rehabilitation after the Star Fire and making the trail eligible for National Recreation Trail status?

CHAPTER 3 – CURRENT CONDITIONS

The purpose of this chapter is to describe current watershed condition by gathering existing information. The relevant issues and key questions identified will direct the data assembly and review for the description of current conditions. The current range, distribution, and condition of the relevant ecosystem elements are described.

Human Uses

Recreation

The WAA receives a moderate to high level of recreational use. Recreational use is primarily concentrated around the French Meadows Recreation Complex that is managed for developed recreation with an emphasis upon water-related activities on the reservoir. The Complex includes 4 campgrounds with 139 campsites, 7 group campgrounds, 2 picnic areas and 2 boat ramps with a combined parking capacity of approximately 400 vehicles (Table 3.1).

Table 3-1. Facilities that comprise the French Meadows Recreation Complex

Facility Type	Facility Name	Capacity
Campgrounds	French Meadows	75 units
	Lewis	40 units
	Poppy	12 units
	Ahart	12 units
	French Meadows	7 units
Picnic Areas	McGuire	10 units
	French Meadows	400 vehicles
Boat Ramps	McGuire	Two 25-person sites and one 75-person site
	Gates	
Group Campgrounds	Coyote	Three 25-person sites and one 50-person site

Most of the recreation use in this complex occurs from Memorial Day weekend through the Labor Day weekend. Lighter use occurs in the fall until snow limits access to the French Meadows area. Facility use averages 25-32% occupancy range and increases nearly 2% every two years.

In 1984, approximately 18,700 acres were designated as the Granite Chief Wilderness Area, of which, approximately 6,600 acres are in the WAA. Hiking, camping and trail riding are the primary uses in the wilderness area. Access to the area is limited by snow until late May or early June. Three trailheads within the WAA provide access to the wilderness area, including access of horse riders on the Tevis Cup Trail.

Additional campground facilities exist at Robinson Flat, and Secret House. Trailheads, such as Beacroft, Devils Thumb, Deadwood and Last Chance, occur throughout the watershed and receive light to moderate use.

The Western States and Tevis Cup trails transect the WAA and are used lightly during the summer months and receive heavy use during the Western States Run in June and the Tevis Cup ride in July. In 2001, the Star Fire burned over the portion of the Western States Trail within Duncan Canyon and resulted in a large number of hazardous trees along the trail. This portion of the trail was closed to public use the Western States Run developed an alternate route for its 2002 event. Another portion of the trail currently traverses private land, requiring an agreement or diversion for large events and making the trail in eligible for National Recreational Trail status.

Developed day-use recreational areas exist at the Placer County Big Trees Grove and the Grouse Falls Overlook. The Big Trees area includes a picnic area, a designated National Recreation trail, a restroom and water system. Approximately 7,000 hikers used the trail in 1999. Some of those trail users also utilize the picnic area, but other visitors stop only to use the picnic area or restroom. The day-use area is generally accessible from May to December and secondary educations classroom field trips are common during the month of May.

A state game refuge encompasses approximately 36,000 acres within the WAA and hunting is prohibited within its boundaries. Some deer, upland game and bear hunting occurs outside of the refuge boundaries and during the fall season, up to 12 hunting camps typically exist at any given time within the WAA. The most common dispersed activity is fishing which occurs primarily along the shores of the three reservoirs, along the Middle Fork American River and Duncan Canyon. Camping outside of developed campgrounds is prohibited under Tahoe National Forest Order 17-95-169, but some dispersed campsites exist throughout the WAA.

The majority of the whitewater rafting occurs downstream of Ralston Reservoir, accessing the Middle Fork American River from Indian Bar. Water releases from the Middle Fork Project are managed to allow whitewater rafting during the summer months, including the flows and facilities within the WAA. Some rafting or kayaking may occur on the portions of the Middle Fork American River within the WAA, but because those activities would not be associated with any of the rafting companies under special use permit with the USFS, the level of that use is unknown.

Transportation

There are 647 miles of roads throughout the WAA, the majority of which are natural surface roads. Most all of the developed campgrounds as well as the main roads in the area have asphalt surfaces.

Current road maintenance emphasis is on the main roads in the system and the roads within recreational facilities. The main roads are the arterial and collector roads associated with road numbers 16, 22, 44, 43, 48, 51, 57 and 96, all of which are under USFS jurisdiction. The USDS is the primary maintainer, operator and enforcement agency on all of the primary roads in the WAA except for the Soda Springs Road. The Soda Springs Road 6001 runs along the WAA boundary to the north side of Duncan Canyon and is under Placer County jurisdiction.

All of the other roads in the WAA are local roads that branch off of the primary roads listed above. The local roads are generally single purpose facilities such as private roads, campground roads, logging roads and roads to hydroelectric facilities.

Current road maintenance focuses mainly on safety and upkeep on the arterial roads, collector roads and high-use local roads (e.g., roads accessing recreational sites). Local roads generally receive only custodial care and repairs are only done to correct problems causing resource damage. There is no routine maintenance schedule and those roads with little or now use may become overgrown or blocked by fallen trees.

Approximately 9,200 acres of the WAA are within the Duncan Canyon IRA. Of those acres, 539 acres have been substantially altered by road construction and timber harvest associated with the Red Star Ahart timber sale in the 1980s and access in to private land in Section 8. Nine roads totaling four miles were constructed as a result of these timber sales.

The WAA contains four HUC-6 watersheds by which certain characteristics can be summarized. The density of roads and number of road crossings can be an indicator of the potential of the transportation system to impact fisheries and wildlife in a watershed. Table 3-2 summarizes the transportation system for the four HUC-6 watersheds in the WA. The Secret watershed has the highest road density, and the greatest length of dirt roads, which tend be greater sediment produces. The French Meadows watershed has the highest number and greatest density of stream crossings.

Table 3-2. Transportation characteristics for HUC-6 watersheds in the WAA.

	Duncan (52.2 mi^2)	**French (58.5 mi^2)**	**Michigan Bluff (54.3 mi^2)**	**Secret Canyon (38.2 mi^2)**
Dirt (mi)	108.4	138.0	134.4	141.8
Improved (mi)	18.5	12.8	31.8	15.7
Secondary Highway (mi)	13.3	6.7	17.6	8.4
Total Roads (mi)	140.2	157.5	183.8	165.9
Road Density (mi/mi^2)	2.7	2.7	3.4	4.3
Number of Crossings	85	130	7.	52
Crossing Density	1.6	2.2	1.3	1.4

The density of roads and crossings alone cannot be considered when discussing the impact of the transportation system upon the landscape. Because road-stream interactions are often detrimental to aquatic ecosystems, the miles and types of roads

within streamside areas can also indicate where problems may exist. Table 3-3 summarizes the transportation system within riparian conservation areas (RCAs). RCAs are delineated as 300 feet on either side of perennials streams and special aquatic features and 150 feet on either side of seasonal streams.

Table 3-3. Road Lengths within RCAs by HUC-6 watersheds in the WAA.

	Duncan	French	Michigan Bluff	Secret Canyon
Dirt (mi)	17.1	18.4	14.0	10.3
Improved (mi)	2.2	3.1	5.2	3.8
Secondary Highway (mi)	1.9	1.1	1.1	0.1
Total Roads (mi)	21.2	22.6	20.3	14.2
Road Density (mi/mi^2)	1.9	2.5	1.6	1.9
Acres of RCA	11.4	9.0	12.4	7.6

When comparing these tables, the high road density in Secret Canyon that was revealed in Table 3-2 does not appear to be as big of an aquatics concern when the number of roads in proximity to streams is considered. Table 3-3 indicated that the roads-stream interactions are of the greatest concern in the French and Duncan watersheds.

During the Star Fire, a number of roads in the WAA were used to access the fire area or as part of the suppression activities. As a result, substantial damage to roads ad related structures occurred. Impacts typically included damage to culvert ends, elimination of water bars, dips and other drainage structures, damage to asphalt surfacing, burned signs, burning of woody debris that undermined dill slopes and road prisms, falling debris on roadways and damaged gates and barricades.

A full analysis of roads within the WAA and their risk to the terrestrial and aquatic environments was done during the Middle Fork American River Roads Analysis. Please refer to Appendix C for a full discussion of the results from that analysis.

Grazing

Two active cattle allotments occur within the WAA: the Mosquito and Chipmunk allotments. These allotments are currently managed as late season forage pasture from August 1 to October 31. The grazing resource consists of scattered forbs, grasses and shrubs. There is a relatively high amount to late season grasses on these allotments. Although this approaches a sod-like coverage in a limited number of places, it is scattered through the forested land and is not a true meadow. Shrubs contribute over 50 percent of the grazing resource.

Mining

Gold mining activities began in the WAA during the 1840's. Evidence of historic mining occurs throughout the watershed in the form of abandoned mines, ditches, adits and

mining debris. Much of this activity was in or near streams and the areas of Michigan Buff, Last Chance, Deadwood and Greek Store.

A number of active mining permits are known to exist in the WAA. Most of this activity is dredging, although a small amount of placer mining occurs. The highest concentration of activity is around the Middle Fork American River.

Heritage Resources

A number of surveys have occurred throughout the WAA, locating both prehistoric and historic sites. Prehistoric sites in the WAA include petroglyphs in Picyune Valley, bedrock milling stations, and lithic scatters. Historic sites include cabins, ditches, flumes, tunnels, adits, tailings and trails.

The 2001 Star Fire considerable degraded the integrity of some sites within the burn perimeter. Effects ranged from melting, spalling, and charring to complete incineration of wood cabins and flumes at the Red Star Mine site. Loss of vegetation, increased visibility and damage to the soil structure are additional effects of the fire that may impact sites. Sites located in areas of high tree mortality may incur additional damage from falling dead trees.

Middle Fork American Project

Water development in the Middle Fork American River began in 1957 with the creation of the Placer County Water Agency (PCWA). The project consists of two storage and five diversion dams, five power plants, diversion and transmission facilities, five tunnels and related facilities. Construction on the project was completed in 1967. The power plants have a combined dependable generating capacity of 190,700 KW and the two storage reservoirs have a combined capacity of 340,000 acre-feet.

The portions of the project within the WAA are French Meadows Reservoir, Duncan Diversion Dam, Interbay Reservoir and Ralston Reservoir. Tunnels transfer water from Duncan Diversion Dam to French Meadows Reservoir, from Hell Hole Reservoir to Interbay Reservoir and from Interbay Reservoir to Ralston Powerplant.

For a full discussion of the hydrology of this system, including flows and storage capacities, refer to the Hydrologic Condition Assessment in Appendix B.

Vegetation

Vegetation Zones

General vegetation zones within the project are range from lower montane at the lower elevations to upper montane and even some isolated patches of subalpine zones at higher

elevations. The lower montane zone is characterized by ponderosa pine, black oak and live oak forest with interspersed chaparral. At higher elevations within this zone, Douglas fir often dominates north and east aspects and occurs in smaller amounts elsewhere. Between 4,000 and 5,000 feet, white fir intermixed with Douglas fir occurs in this zone. Large areas with black oak as dominant or co-dominant occur in this zone as well, particularly on ridges or upper slopes or south and west aspects.

The mid-montane zone occurs above 5,000 feet as a narrow band between the lower and upper montane zones, and is typically dominated by white fir and Jeffery pine. Vegetation varies considerably in this zone from mixed conifer to pure white fir with the common element being that white fir is either dominant or co-dominant. Sugar pine and incense cedar are also commonly present. Douglas fir is absent or present in low amounts. Red fir may be present in low amounts. Extensive areas, particularly with rocky or shallow soils may be dominated by or intermixed with evergreen shrubs such as huckleberry oak and greenleaf manzanita.

The upper-montane zone generally occurs above 6,000 feet but can finger down to lower elevations where cold air drainage and pooling occurs. Red fir is the dominant species across most productive sites. Forests vary from pure red fir to varied mixtures of red and white fir. Rocky areas are more prevalent here than in other zones are typically dominated by Jeffery pine and various amounts of evergreen shrubs such as huckleberry oak and pinemat manzanita.

Major Forest Type Subcategories

Within the vegetation zones, forest types vary depending on elevation, aspect, topographic position, soil depth, subsurface water and bedrock fracturing. Generally below 5,000 feet in elevation, the mixed conifer forest type of the lower montane can be further categorized by aspect and slope position into subgroups called mixed conifer dry (upper 2/3 of south and southwest facing slopes and ridgetops), mixed conifer moist (lower 1/3 of south and southwest slopes and north and northeast facing slopes) and mixed conifer rocky. Generally, mixed conifer dry slopes have more pine, while mixed conifer moist sites have higher amounts of Douglas fir. Mixed conifer stands of the mid-montane zones (elevations higher than 5,000 feet) can be similarly categorized dry productive, dry rocky, moist productive and moist rock using the same topographic features as previously mentioned. These higher elevation mixed conifer stands typically have more pine on the dry sites. The upper montane can be grouped into red fir productive, red fir rocky and Jeffrey pine (rocky). However, within the WAA, there are broad transitions with red fir, mixed conifer, pure white fir and white fir-red fir stands, as well as unique combinations of red fir, white fir and Douglas fir. Consequently, stands do not always fit into these categories.

Star Fire

In 2001, the Star fire burned approximately17,500 acres, resulting in areas of high tree mortality. Approximately 3,700 acres experiences greater than 75% mortality, particularly on the southeast facing slope of lower Red Star Ridge and much of the portion of Chipmunk Ridge that lies within the fire perimeter. Another 4,000 acres are predicted to experience 75% mortality within the next 1-3 years as fire damaged trees continue to fade and die. A patchy burn pattern occurred in other areas, particularly the northwest slope of lower Red Star Ridge and Mosquito Ridge. Hardwood stands in the project area suffered severe damage to the above ground portions of tree boles, which are extremely susceptible to fire-induced mortality. However, most hardwoods are expected to re-sprout from below ground burls or root crowns. Table 3-4 illustrates the impact of the Star Fire upon vegetation patterns within the burn perimeter by comparing pre- and post-fire seral stages by acreage.

Table 3-4. Pre and post- Star Fire seral stages on the TNF

Seral Stage	Description	Tahoe NF pre-fire acres	Tahoe NF post-fire acres
1	Grass/forbs stage with or without scattered shrubs and seedlings.	1,286	2,950
2	Shrub/seedling/sapling stage	146	68
3A	Pole/medium tree stages. Tree canopy is less than 40%. Commonly supports a substantial shrub layer.	1,252	722
3B & C	Pole/medium tree stage. Tree canopy is greater than 40%. Shrub layer is variable.	3,086	1,776
4A	Large tree stage, mature and over mature. Tree canopy is less than 40%. Commonly supports a substantial shrub community.	896	563
4B & C	Large tree, mature and over mature. Tree canopy cover is greater than 40%. Shrub layer is variable.	2,823	1,392

Forest Pests

Insects and disease contribute to vegetative diversity throughout the WAA. Tree growth and vigor are reduced by competition for water, sunlight and nutrients, making them more susceptible to disease and insects. These conditions reduce tree health and result in increased tree mortality and a reduction in species diversity.

Diseased trees exist throughout the WAA, but are most frequently found in the overcrowded stands. Crowded stands containing a large percentage of white fir almost always contain some amount of annosus root disease (*Heterobasidion annosum*) in the fir. This disease decays tree roots. Some infected trees have slowed growth rates resulting from inter-tree competition and their roots are dying faster than they can

regenerate. Incense cedar, ponderosa, Jeffrey, sugar and lodgepole pines are resistant to the annosus strain of root disease and historically the forests contained more of these species than white and red fir. However, pines throughout the WAA are infected with other strains of annosus.

Insect infestations have impacted some tree species within the WAA, resulting in top kill and whole tree mortality. Infestations seen in the area include fir engraver beetle (*Scolytus ventralis*) in white and red fir, *Ips spp.* in ponderosa, Jeffrey, sugar and lodgepole pines, *Dendroctonus ponderosae* in ponderosa, sugar and lodgepole pines, *Dedroctonus brevicomus* in ponderosa pine and *Dendroctonus jeffreyi* in Jeffrey pine.

White pine blister rust (*Cronartium ribicola*) is present within the analysis area. This disease is specific to the five needle pines: sugar and western white pine. Infections are scattered throughout the area and occur in all tree sizes. Some of the younger trees have been killed by this disease an older infected trees have reduced growth and vigor.

Dwarf mistletoe (*Acreuthobium spp.*) is also present within the WAA and reduces the growth and vigor of the trees in infests. For example, portions of the Cavanah area were heavily infected and were harvested to eliminate this pest.

The Star Fire in 2001 created patches of fire damaged trees that are susceptible to bark beetle attacks. Concentrations of beetles and related tree mortalities typically occur within the first two to three years after a fire. Except during a period of moisture stress, trees not injured by the fire, either within the area of the burn or in the surrounding forest, are rarely attacked because of the concentrations of bark beetles in fire-injured trees. Fire damaged trees that survive are the most likely candidates to be attacked during periods of moisture stress in subsequent years.

Fire and Fuels

Fire history records from 1921 to 2001 show eight fires greater than 200 acres have occurred within the WAA. A number of small fires (less than 10 acres) have occurred within the analysis area, the majority of which were lightening caused. It is estimated that the fire return interval for the area well exceeds the 14 to 59 year time period predicted for mixed conifer areas and is at or above the extreme maximums for the upper montane forest types (96 years).

The vegetation species mix within the WAA generally produces high vegetation densities when fire is excluded, as it has been through much of the analysis area. The growth pattern of the understory of shrubs, hardwoods and smaller conifers creates a mosaic of variable interconnected canopies that range from near the ground surface, up into the largest trees. Pockets of heavy fuels exits in areas where dead standing trees are associated with accumulations or large dead and down material. The forest floor is covered by needle cast, twigs, limbs and logs from dying trees. In some areas, 10-20 year old logging debris provides additional fuel.

During the End of the World project, comprehensive fuels inventories were conducted. These surveys indicated an average of 500 trees per acre occurred among natural stands in that area, with 65% of those trees being white fir and incense cedar. Measures of surfaces fuels within this area were 28.6 tons per acre. Ladder fuels, including needles and fine branches, were estimated to be 2.7 tons per acre. Fuel modeling based these surveys determined the area to be best represented by a Fire Behavior Prediction System (FBSP) Fuel Model 10.

Other surveys in the WAA have estimated tree densities to exceed 150 trees per acre with some patches exceeding 300 trees per acre. Dead fuel loads in those surveys averaged 40 tons per acre and ranged from 20 to 100 tons per acre on conifer-dominated sites. Hardwood dominated sites averaged 10 to 30 tons per acre.

In 1999, the Codfish project area was described as being a high fire hazard area due to overstocked plantations and patches of bug-killed trees. In 2000, approximately 100 acres in this area was burned by a wildfire. Fire killed trees were removed soon after the fire and fuel reduction efforts continue in the project area.

The 2001 Star Fire had a significant impact on fuel loads within the burn perimeter. In many areas nearly all of the downed material was consumed, generally resulting in less than 10 tons per acre of surface dead fuels. However, the amounts of standing dead biomass increased, depending upon the mortality level. In areas with greater than 75% tree morality, it is estimated that 150 to 315 tons per acre exits, 95% of which is the result of dead standing trees. In areas with less than 75% mortality, deal fuel loads are estimated to range from 125 to 225 tons per acre, 70% of which is dead standing trees.

Noxious Weeds

Noxious weeds are generally non-native plants that have been introduced into an area. They can invade an area with or without disturbance, but become established more readily after disturbance. Noxious weeds can be introduced into an area in a number of ways. Vehicles however, provide one of the most frequent sources of movement of plant materials from place to place.

Many noxious weeds are found in the WAA, including bull thistle (*Crisium vilgare*), Klamath weed (*Hypericum perforatum*), cheatgrass (*Bromus tectorum*), wooly mullein (*Verbascum thapsus*), skeleton weed (Chondrilla juncea), yellow star thistle (Centaurea solstitialis), and spotted knapweed (Centaurea maculosa). Mosquito Ridge Road is known to have a number of areas with skeleton weed and yellow star thistle infestations. Cheat grass infestations have been associated with livestock unloading areas near Little Mosquito Creek. The spotted knapweed infestations in the WAA are associated with mining activities.

Species and Habitats

Sensitive Plants

A number of surveys have occurred throughout the WAA to determine the presence of sensitive and watchlist plant species. No federally listed plants occur within the WAA. Table 1-3 lists all TES and watchlist species that have potential habitat within the WAA. Occurrences of *Phacelia stenninsii, Botrychium ascendens, Silene invisa, drosera rotundifola, Viola tomentosa* and *Sphagnum sp.* are known to occur within the Star Fire perimeter. Surveys during the End of the World project located one sensitive species, *Clarkiia stellata*, two watchlist species in that area, *Viola tomentosa* and *Torreya californica*, as well as two fens. Unidentifiable *Frtiillaria spp.* and *Vaccinium spp.* were found during those surveys, but it is unknown if they were the sensitive species. Surveys done in the Codfish project area located *Viola tomentosa* and *Torreya californica* as well as a number of fens, bogs and aspen groves.

Aquatic Species

There are approximately 164 miles of perennial streams within the WAA, most of which have the potential to contain fish or herpetiles. The major fish bearing streams in the analysis area are the Middle Fork American River, Duncan Canyon, Dolly Creek, Rice Creek, Spruce Creek and Big Mosquito Creek. All of these streams as well as many of their perennial tributaries are known to contain rainbow trout. Some sightings of brown trout occur in the Middle Fork American, probably as the result of their stocking in French Meadows Reservoir.

No federally listed aquatic species are known to occur within the WAA. The TNF routinely conducts surveys of ponds under 5,000 feet elevation for California red-legged frogs or their habitat. No frogs or breeding habitat has been located within the WAA. A single sighting of a red-legged frog occurred in 2001 at a pond along Ralston Ridge which is less than a mile from the WAA; follow-up surveys have failed to located any additional frogs or located suitable breeding habitat for this area. A historic sighting exists in the Michigan Bluff area, but recent surveys of the drainages near this sighting have failed to locate any frogs.

A number of USFS sensitive aquatic species occur throughout the WAA. Hardhead has been identified from the Middle Fork American River downstream of French Meadows Reservoir and likely occurs throughout that river. Foothill yellow-legged frogs are known to occur in the North Fork of the Middle Fork American River and Eldorado Canyon. No mountain yellow-legged frogs have been identified in the WAA. Suitable habitat for both of these species exists in the perennial streams throughout the drainage and these species are likely to occur. Northwestern pond turtles have been located on Ralston Ridge and in the NFMFAR. Suitable habitat exists for this species within the WAA, particularly along the MFAR and the NFMFAR, and it is likely that this species exist within the analysis area.

Wildlife

The various wildlife habitat types within the WAA will be discussed utilizing the California wildlife habitat relationship (CWHR) classification system. The analysis area is comprised of 7 different CWHR types: montane hardwood-conifer, montane hardwood, red fir, Sierran mixed conifer, montane chaparral, white fir, and montane riparian (refer to Vegetation Types map in Appendix A). These habitats are distributed across the landscape in a mosaic pattern. Generally, red fir occupies the higher elevations, montane hardwood and montane chaparral occupies the lower elevations and white fir, Sierran mixed conifer and montane hardwood-conifer occupies the mid-elevation ranges. Montane riparian habitats are most often associated with aquatic features and in this watershed, are found in stringers around streams and springs.

Historically, lightening fires, insects and other natural events were the elements of disturbance in the WAA. In the last 60 years, timber management has become the primary form of disturbance to wildlife habitats. Sierran mixed conifer and montane hardwood-conifer exist in all seral stages of ecological succession.

The distribution of old forest stands is somewhat fragmented, but can be found in large continuous patches throughout the WAA, depending on aspect, slope, soils, microclimate and history of disturbance. These old forest stands, where present, provide good habitat for old forest associated species such as spotted owls, northern goshawk and pileated woodpecker.

Red fir habitat is generally found above 6,000 feet elevation, and its spatial diversity and vegetation dynamics supports a diversity of wildlife species. White headed woodpeckers, blue grouse, chestnut-backed chickadee, Douglas' squirrel, flying squirrel and American marten are all species associated with red fir habitats.

Closed canopy stand distribution in Sierran mixed conifer is both extensive and patchy, depending on slope, soils, microclimate, and history of disturbance within the area and provides good quality habitat for spotted owls, northern goshawk, and pileated woodpecker. The western tanager, western gray squirrel and raccoon are also common residents to Sierran mixed conifer areas.

The montane chaparral areas, distributed across lower elevations and driers sites, provides habitat for a wide variety of wildlife. The mule deer and black bears depends on the diversity of shrub species for mast and browse. The mountain quail, spotted towhee and many species of rodents can be found in the habitat type.

A large State Game Refuge lies entirely within the WAA and is generally centered on the upper Duncan Canyon area. This refuge is part of the summer range for the Blue Canyon deer heard.

In 2001, the Star Fire had a dramatic impact upon the wildlife habitat in the analysis area. Approximately 3,700 acres of the tree-dominated habitat within the burn perimeter

experienced greater than 75% mortality, leaving little remaining canopy cover or structural diversity. A tree mortality survey in the burn area predicts that within 1 to 3 years, another 4,000 acres can be expected to attain greater than 75% mortality. A with all fires, the Star Fire burned with varying intensities, leaving stands of live trees with a few dead trees, to parches of completely to mostly dead trees. The remaining stands with predominately live trees are expected to provide a refuge for wildlife dependant on higher canopy closures and vertical diversity. These patches may act as an inoculation source of wildlife species for the re-colonization of the adjacent highly intensely burned areas. Currently, the largest patches of live trees are found on north facing slopes along Duncan Canyon.

In the areas that burned with moderate to high intensities, little understory canopy remains. Anywhere from 90 to 100% of the forbs and shrubs were consumed. Areas that burned with low intensity have patchy forbs and shrub understory cover. Unfortunately, in these low intensity areas, post-fire mortality surveys have shown that may of the large trees experiences cambium kill due to the extended duration of the smoldering surface fuels around the base of the trees, essentially girdling them.

Dead trees provide an important wildlife habitat component in the form of snags and downed woody material. The number of dead trees in the Star Fire area has increased significantly since the fire. Post fire surveys have estimated that on average there are 30 to 50 snags per acre over the size of 15 inches dbh within the burn perimeter. Snags that existed prior to the fire are the most important for nesting immediately after the burn for cavity nesting birds. Recently fire-killed trees such as Douglas fir, sugar pine and incense cedar may take up to 5 years to decay to a suitable conditions that can be used by cavity nesting birds. Large diameter snags persist longer and provide habitat for cavity dependant wildlife over a longer period of time than smaller diameter snags.

An individual eagle has been identified feeding along the shore of French Meadow Reservoir. Surveys of this reservoir has failed to locate any breeding eagles and it is believed the reservoir is used foraging as eagles transit from summer and winter breeding grounds. The Middle Fork American River also provides foraging habitat, but does not provide any suitable nesting habitat.

Peregrine falcon and habitat surveys occurred in the WAA during the 1980's. No peregrine falcons have been located in the analysis area, but suitable habitat was identified in the Duncan Canyon area. This species has relatively strict nesting requirements, needing vertical cliff habitat with large potholes or ledges that are inaccessible to land predators. This habitat is preferentially located near habitat that has a high avian prey population. The areas in Duncan Canyon that were identified to have these characters have been surveyed many times in recent years, but have failed to located any peregrine falcons.

No great gray owls have ever been detected within the WAA. This species is found in mixed conifer forests with meadows or other vegetated openings. Nesting usually occurs within 600 feet of the forest edge and adjacent open foraging habitat. Nests are generally

built in broken top snags of firs, but can be found in platforms created by old hawk nests or mistletoe infected limbs. Meadows are considered to be optimal foraging habitat, and so surveys are often centered on meadow habitats. No large meadows exist in the analysis area, but some smaller meadows occur within the Picyune Valley. No detections of this species have occurred in that area.

The analysis area has been surveyed extensively for northern goshawks. Eleven goshawk protected activity centers (PACs) have been established in the WAA based on the detection of goshawk nesting activity. Goshawks utilize mixed conifer, ponderosa pine, red fir, montane hardwood and montane riparian habitats. Suitable nesting habitat usually includes overstory trees greater than 24 inches dbh with a canopy closure greater than 60% on gentle north to east facing slopes. Foraging habitat is considered mature to late seral stands with at least 40% canopy cover. Five goshawk PACs existed within the Star Fire perimeter and one was rendered unsuitable as the result of the fire.

The analysis area has also had a number of spotted owl surveys done in conjunction with projects throughout the area. Protected activity areas have been designated for 31 breeding owl pairs in the WAA, covering a total of 9,000 acres. Spotted owls utilize mixed conifer, ponderosa pine, red fir and montane hardwood vegetation types. Nesting is primarily characterized by dense canopy closure (greater than 70%) with medium to large trees and multi-storied structured stands. Foraging habitat can include all medium to large tree stands with greater than 50% canopy closure. Also important is availability of large snags and down logs that are utilized for nesting and supports the owl's prey base of mainly flying squirrels and woodrats. On the TNF, owls are typically found between 3,000 and 7,200 feet elevation in Sierran mixed conifer habitats. The Star Fire impacted the spotted owl habitat that existed within the burn perimeter. It is estimated that 5,900 acres of suitable habitat existed prior to the fire, and afterwards, only 3,175 acres existed. The fire impacted seven PACs and one PAC was rendered completely unsuitable as the result of an area of high intensity burn.

Pacific fisher and American marten habitat occurs within the analysis area, but no occurrences of either species is known within the WAA. Pacific fisher habitat is generally found between 3,000 and 7,000 feet elevation in large, relatively un-fragmented blocks of older forest, characterized by a 40-100% canopy closure, multi-storied structure and a high number or large snags and downed logs. Preferred resting, foraging and denning habitats are generally characterized by older, mesic, mixed conifer stands bordering riparian habitat. Fishers also prefer areas with road densities less than one-half mile per square mile. Habitat for American marten is similar to that of fishers except that martens are usually found between 5,000 and 10,000 feet elevation in the red fir, lodgepole, subalpine conifer and Jeffery pine habitat types. Prior to the Star Fire, 98% of the area was designated as old forest, and had the potential to provide habitat for these species. The fire burned with such intensity that little or no fisher or marten habitat remains within the burn perimeter.

Within the WAA, Sierra Nevada red fox habitat occurs at elevations greater than 7,000 feet in red fir, lodgepole pine and subalpine fir. This species moves seasonally from the

higher elevations in the winter to mid elevations mixed conifer forests during the summer. Red fox may be more tolerant of forest openings than martens or fishers. Some surveys for this species has occurred within the WAA, without any detections. Like marten and fisher, much of the old forest habitat within the Star Fire perimeter was rendered unsuitable by the fire's intensity.

Wolverines have been sighted in Granite Chief Wilderness within the WAA and near Robinson Flat, immediately outside of the WAA boundary. Habitats used by this species include mixed conifer, red fir and lodgepole pine. The species may also use subalpine conifer, alpine dwarf-shrub, wet meadows and montane riparian habitats. Most sightings in the northern Sierra have occurred between 4,300 and 7,300 feet elevation.

No detections of Tonwsend's big-eared bat have occurred within or near the WAA. This species is usually found in low desert to mid-elevation montane habitats. Habitat associations include desert, native prairies, coniferous forests, mid-elevation mixed conifer, mixed hardwood-conifer, riparian communities, active agricultural areas, and coastal habitat types. This species almost exclusively used caves and cave like structures as roost sites. Comprehensive surveys have not been conducted in the WAA. A number of adits are known to exist throughout the area that may provide habitat for this species.

Pallid bats have not been located in the WAA, but suitable habitat is available. This species is typically found in lo to middle elevation habitats below 6,000 feet. A variety of habitats are used including grasslands, shrublands, woodlands and coniferous forest. They are most often found in open, dry habitats with rocky areas for roosting. Day roosts may vary, but are commons found in rock crevices, tree hollows, mines, caves and a variety of human made structures. Tree roosting ahs been documented in large conifer snags, inside basal hollows of redwoods and giant sequoias, and bole cavities of oaks, Cavities in the broken branches of black oaks are very important, and there is a strong association with black oak for roosting. Night roosts are usually more open sites and may include open buildings, porches, mines, caves and the under sides of bridges. No comprehensive surveys have occurred for this species within the WAA, but suitable habitat exists in the form of caves, mines, buildings and tree roosting sites.

Western red bats have not been located in the WAA, but suitable habitat exists. This species occurs throughout California at elevations up to 3,000 feet, excluding desert habitat. It is primarily found in riparian and wooded habitats, particularly in willows, cottonwoods and sycamores. Roosting has been observed in caves, but generally these bats roost singly within tree foliage or shrubs and often along edge habitat adjacent to streams or open fields.

Watershed Processes

Geology

Three primary rock types are found in the analysis area: the Shoo Fly complex of Paleozoic marine deposits, the Valley Springs formation of Miocene volcanic deposits and the Mehrten formation of Pliocence volcanic deposits (refer to Bedrock Geology map in Appendix A). Some small areas of Mesozoic granite basement rock also exist. The Shoo Fly complex is composed of folded and metamorphosed rocks that include sandstone, siltstone, slate, chert and various metavolcanic rocks. Plana features such as bedding, foliation and joints characterize the Shoo Fly complex. The Valley Springs formation is a rhyolitic ashflow tuff that includes some sandstones, siltstones and claystones. The Mehrten formation includes volcanic mudflows, tuffs, pyroclastics, andesite flows and related intrusives, conglomerates and sandstones, and debris avalanche deposits. There may also be local outcrops of basalt, dacite or rhyolite.

The primary land-forming process in the WAA has been debris avalanche. Gently sloping ridges such as Mosquito Ridge and Red Star Ridge give way to steep slopes that end in even steeper inner gorge areas such as those found along the Middle Fork American River. Most small tributaries have been formed by debris, as witnessed by the straight channels that run from top to bottom of the ridge with little or no sinuosity.

Slope failures are most likely to occur in areas where the Shoo Fly complex is adversely oriented. Landslide susceptibilities for Shoo Fly metamorphic rocks are rated extreme on slopes greater than 60% and high on 20-40% slopes. Areas of discontinuous, poorly consolidated ash in the Valley Springs formation are particularly prone to failure, as are areas where the Valley Springs and Mehrten formations meet. The lower contact of the Mehrten formation is also prone to instability, with landslide susceptibility of extreme in 40-60% slopes and high in 20-40% slopes.

Soils

The weathering of volcanic, metasedimentary, granitic and glacial alluvial rocks formed soils in the analysis area. Most of the soils in the analysis area are rated as having high or very high maximum erosion hazard ratings (EHR). The EHR estimates the risk of accelerated surface erosion on soil with no protective vegetative cover subjected to a 2-year, 6-hour storm event (i.e., an average storm event). Areas of rock outcrop, very rocky soils and shallow sols can generate runoff and concentrate surface water flow that can increase the risk of erosion.

Most of the soils in the analysis area have high rock content. Surface rock fragments can increase the risk of fully erosion by channeling surface water flow. Rock fragments in the soil can decrease the effective rooting depth of the soil, the nutrient holding capacity, and productivity of the soil. Soil productivity in the analysis areas ranges from low to high with most of the area having moderately productive soils.

Table 3-5 summarizes the soil types and properties found in the MFAR. For ease of analysis, the table summaries these factors according to the four HUC-6 watersheds found in the area.

Table 3-5. Soils and their properties in the WAA.

Productivity Acres (%)				
HUC-6 Name	**Low**	**Medium**	**High**	**NC**
Duncan	15,388 (46%)	8,488 (26%)	1,588 (5%)	7,503 (23%)
French	13,902 (43%)	9,404 (29%)	0 (0%)	9,103 (28%)
Michigan Bluff	2,259 (7%)	17,953 (53%)	1,654 (5%)	11,899 (35)
Secret Canyon	5,745 (24%)	8,682 (36%)	601 (2%)	9,401 (38%)
Parent Material (%)				
HUC-6 Name	**Glacial/Alluvial**	**Metasedimentary**	**Volcanic**	**Misc.**
Duncan	10,520 (32)	11,706 (36%)	10,052 (30%)	689 (2%)
French	9,473 (29%)	1,782 (6%)	18,282 (56%)	2,871 (9%)
Michigan Bluff	0 (0%)	22,749 (67%)	10,729 (32%)	287(1%)
Secret Canyon	1,448 (6%)	17,737 (73%)	4,785 (19%)	459 (2%)
Temperature Regime Acres (%)				
HUC-6 Name	**Frigid**	**Mesic**		
Duncan	6,842 (21%)	26,125 (79%)		
French	26,549 (82%)	5,846 (18%)		
Michigan Bluff	0 (0%)	33, 765 (100)		
Secret Canyon	5,404 (22)	19,025 (78%)		
Moisture Regime Acres (%)				
HUC-6 Name	**Dry**	**Wet**		
Duncan	30,553 (93%)	2,414 (7%)		
French	22,175 (68%)	10,234 (32%)		
Michigan Bluff	30,567 (91%)	3,198 (9%)		
Secret Canyon	23,708 (97%)	721 (3%)		

Hydrology

Hydrologic features found within the analysis area include perennial and seasonal (intermittent and ephemeral) streams, springs, fens, small natural ponds and three reservoirs. The three reservoirs are part of the Middle Fork American hydroelectric project and contribute to regulated flows on the Middle Fork American River. Table 3-6 summarizes the streams in the WAA (refer to Stream map in Appendix A).

Table 3-6. Stream types by HUC-6 watersheds in the WAA.

	Duncan	French	Michigan Bluff	Secret Canyon
Perennial (mi)	223.4	200.1	318.4	193.0
Intermittent (mi)	12.3	30.8	17.9	21.4
Ephemeral (mi)	85.5	67.7	103.3	59.2
Total (mi)	321.2	298.6	439.6	273.6
Density (mi/mi^2)	6.2	5.1	8.1	7.2

Stream Channels

Headwater streams in the analysis area are a mixture of high gradient bedrock and boulder dominated channels that are steep, highly confined and mover large material. The stream banks have high rock content. These channels have high sediment transport capacity die to steep gradients and entrenchment and are generally stable. There are also some short stretches of high gradient gravel and cobble channels among the headwater streams. These channels are more sensitive to increases in stream flow and sediment supply than the bedrock and boulder channels. Moderate gradient channels with bedrock and boulder substrates are found where the canyons open slightly and become less steep, such as Dolly and Rice Creeks and the Middle Fork American River.

A number of stream surveys have been conducted over the past 10 years as the result of various projects in the WAA. For those streams, more detailed information is available and it is summarized by stream below.

The Middle Fork American River is a low gradient stream predominated by bedrock and boulder substrates. It provides moderate fisheries habitat, with high amounts of bedrock cover, but is lacking in spawning habitat as a result of the three dams. Riparian vegetation is in good condition, with the exception of the Star Fire area. Conifers and the steep hillsopes provide most of the shade to the stream. Pool filling is generally low, but it tends to increase as you go downstream. The uplands tend to be unstable and impacted by land management practices. This instability has impacted many of the seasonal tributaries to the MFAR, resulting in high levels of bank cutting and sediment delivery to the main channel.

Dolly Creek is a perennial stream that flows into the MFAR upstream of French Meadows Reservoir. Grazing has impacted this stream in some areas, resulting in lack of riparian vegetation, bank chiseling and sedimentation. Overall, fisheries habitat was described as excellent with good cover and spawning areas. The tributaries to this drainage were more heavily impacted by grazing as well as roads and timber harvest with bank cutting and undercutting, sedimentation, pool filling and loss of riparian vegetation.

Rice Creek is another perennial stream that flows into the MFAR upstream of French Meadows Reservoir. Surveys revealed excellent fisheries habitat with ample cover and spawning habitat. An area of subsurface flow near the mouth of the stream has created a fish barrier from the reservoir, but fish were numerous upstream. Bank cutting is

common in the lower reaches and almost continuous near the headwaters. High rock content helps stabilize the banks in the middle reaches where the stream is a steep bedrock channel. The primary impact in the watershed is timber harvest as evidenced by skidding on banks and across channels.

Talbot is a perennial fish-bearing stream that flows into the MFAR upstream of French Meadows Reservoir. The stream provides high quality fisheries habitat with numerous boulders and undercut banks as well as ample riparian vegetation to provide cover. Land use activities in the area have resulted in upland instability and increase sedimentation and bank cutting in some areas.

Duncan Canyon is perennial stream for most of its length and flows into the MFAR downstream of French Meadows Reservoir. It is predominately a boulder and large cobble substrate and is moderately entrenched and confined. Gradients are generally greater than 4%. Side slopes are moderately to very steep. Although the channel is relatively stable, the system periodically transports large amounts of bedload as evidenced by recent cobble and gravel deposition. This sediment is principally derived from natural channel down cutting in the numerous unstable seasonal tributaries, as well as from some bank undercutting along the main channel that is exacerbated by periodic peak flow events. The Duncan Diversion Dam is located on Duncan Canyon approximately 1 mile upstream from the 96-road crossing. This dam is 32 feet tall and diverts water from Duncan Canyon to French Meadows Reservoir. The numerous tributaries to Duncan Canyon are predominately seasonal with 4-10% gradients and cobble/gravel substrates. Active down cutting and sediment transport is common.

Spruce Creek is a high gradient perennials stream dominated by gravels and cobbles that flows into Duncan Canyon. The channel is severely down cut for most of its length, with instable banks and pool filling. Stream banks are unstable with cutting and sloughing and pool filling commonly occurs. Mining activities have been prevalent in this drainage as evidenced tailings found frequently along the stream.

Deep Canyon is a moderate gradient bedrock channel with abundant riparian vegetation that flows into the North Fork of the Middle Fork American River. Banks are generally stable and vegetated, with the exception of the confluence with Star Ravine, where mining activity has caused instability. Mining disturbance in the vicinity of the Salvage Workings claim has also resulted in a loss of riparian vegetation, sedimentation, and pool filling.

Screwauger Canyon is very steep bedrock channel, with gradients exceeding 10% that flows into Deep Canyon. A number of waterfalls exist in this stream, limiting rainbow trout migration. This area has been heavily mined, as evidenced by numerous mining camps and piles of mine tailings. This mining activity is responsible for the bedrock-dominated channel, as it has removed much of the gravel and small cobble material. A lack of riparian vegetation and mining activity has undercut the stream banks, resulting in bank instability and sedimentation.

Grouse Creek is a very steep gradient, gravel and coarse fines dominated channel that empties into the North Fork of the Middle Fork American River. In the reaches above its confluence with Frazier Creek, the channel is unstable and characterized by extensive down cutting. High amounts of sediment has deposited behind debris jams, causing flow to become subsurface in many areas.

Frazier Creek is moderately steep bedrock channel that flows into Grouse Creek. Down cutting is prevalent in this channel. The headwaters flow through a meadow area that has been impacted by cattle, resulting in bank instability.

Eldorado Canyon is a bedrock dominated perennial stream that flows into the North Fork of the Middle Fork American River. Its mainstem is steep, entrenched and dominated by step pool formations. These steep reaches have high sediment transport potential. Relatively low in-channel sediment storage capacity and are generally very stable. While the mainstem is stable and has good recovery potential, its smaller tributaries are unstable gravel channels that have been highly impacted by mining activities. The East and West Branches are two large perennial tributaries to Eldorado Canyon and are very similar to the mainstem in gradient, substrate and entrenchment.

The North Fork of the Middle Fork is a large, moderate gradient stream with a boulder and bedrock substrate. The channel is stable, with little bank instability and healthy riparian vegetation. Mining has occurred in some areas and caused localized damage.

Beneficial Uses

State designated beneficial water uses within the forth field watershed, North Fork American River (including the MFAR), includes municipal and domestic water supplies, hydroelectric power generation, contact and non-contact recreation, cold-water fisheries habitat and wildlife habitat.

Watershed Condition

The Herger Fienstien Qunicy Library Group developed a method for assessing watersheds at the HUC-6 scale. It rates a number of factors according to their role in watershed health and tallies them for an overall condition score. Table 3-7 summarizes the analysis criteria developed for this assessment.

Table 3-7. Watershed condition analysis criteria

	Factor Rating		
	1	**2**	**3**
Watershed Sensitivity Factors			
Erosion Potential (% Watershed with High – Very High ERH)	<10%	10-40%	>40%
Slope (% Slopes in watershed greater than 60%)	<5%	5-25%	>25%
Alluvial Streams (% Streams with gradients less than 2%)	<5%	5-25%	>25%
Rain on Snow (Portion of watershed in elevation zones)	<3,500'	>6,500'	3,500-6,500'
Vegetation Recovery Potential (Average precipitation)	>50"	30-50"	<30"
Watershed Condition Factors			
Road Density + Crossing Density	<1	1-2.5	>2.5
Condition of Alluvial Stream Channel	Good	Fair	Poor
Land Disturbance (Excluding roads)	<10%	10-15%	>15%

This system then assesses the risk of cumulative effects by tallying the scores and grading the watershed according to categories in Table 3-8.

Table 3-8. Watershed condition analysis score categories

Sensitivity Scores	**Level of Sensitivity**
<7.6	Low
7.6 – 12.5	Moderate
>12.5	High
Condition Scores	**Level of Condition**
< 4.6	Low
4.6 – 7.5	Moderate
>7.5	High
Total Sensitivity/Condition Score	**Risk of Cumulative Effects**
Less than 39 points	Low
39 – 72 points	Moderate
73 – 85 points	High
Greater than 85 points	Very High

This evaluation technique was done for each of the HUC-6 watersheds (refer to HUC-6 map in Appendix A) in the MFAR WAA (Table 3-9). The analysis revealed that all of the HUC-6 watersheds in the WAA were similar in sensitivity, all having moderate ratings. This moderate sensitivity is primarily driven by the high erosion potential, and

predominately snow-on-rain elevations and poor vegetation recovery. The condition scores for most of the watershed were also moderate to high, based on a high score for land disturbance. The total score shows that the French watershed is the healthiest of the four, with a Moderate score. The Duncan and Michigan Bluff watersheds were assessed to be at a High risk of cumulative effects. The Secret Canyon watershed score at a Very High risk of cumulative effects, and seems to be more impacted by transportation than the other watersheds.

Table 3-9. Watershed condition analysis for the WAA.

	HUC-6 Watersheds			
	Duncan	**French**	**Michigan Bluff**	**Secret Canyon**
Watershed Sensitivity Factors				
Erosion Potential (% Watershed with High – Very High ERH)	3	3	3	3
Slope (% Slopes in watershed greater than 60%)	2	1	2	2
Alluvial Streams (% Streams with gradients less than 2%)	2	2	2	2
Rain on Snow (Portion of watershed in elevation zones)	3	3	3	3
Vegetation Recovery Potential (Average precipitation)	1	1	1	1
Sensitivity Score Total	11	10	11	11
	Moderate	Moderate	Moderate	Moderate
Watershed Condition Factors				
Road Density + Crossing Density	2	2	2	3
Condition of Alluvial Stream Channel	2	2	2	2
Land Disturbance (Excluding roads)	3	3	3	3
Condition Total Score	7	7	7	8
	Moderate	Moderate	Moderate	Moderate
Total Condition/Sensitivity Score	**77**	**70**	**77**	**88**
	High	**Moderate**	**High**	**Very High**

Effects of the Star Fire on Watershed Resources

The Star Fire burned in a highly mosaic pattern over its 17,500 acres (Table 3-10). The highest potential related impacts would occur in watersheds G0001 (53% high severity), G0010 (26% high severity) and G0703 (37% high severity). Burn severity is a measure of resource damage (low, medium, high). It should not be confused with fire intensity,

which is a measure of the rate of thermal energy release per unit area or length of fire line. Where burn severity was high, there was a complete loss of litter and duff; many of the large decaying logs that were present in the area prior to the fire were consumed or heavily charred; and fire-generated hydrophobic soil conditions are moderated, but patchy. Where burn severity was low to moderate, the litter, duff and large logs were only partially affected by the fire.

Table 3-10. Burn severity by sub-watershed for the Star Fire.

Burn Severity									
		Unburned		***Low***		***Medium***		***High***	
Subwatershed	Acres	Acres	%	Acres	%	Acres	%	Acres	%
G0006	1,976	1,857	94	76	4	43	2	0	0
G0008*	2,459	2,265	92	108	4	47	2	39	2
G0009*	2,669	2,001	75	222	8	220	8	226	9
G0010	1,900	757	40	204	11	439	23	500	26
G0011	1,897	467	25	93	5	319	17	1,027	53
G0012	1,847	1,589	85	60	3	127	7	87	5
G0702	2,108	691	33	689	33	503	24	216	10
G0703	1,467	25	2	628	43	276	19	538	37
G0704	1,758	418	24	413	23	685	39	242	14
G0705	1,658	950	57	662	39	73	4	0	0
G0706	1,553	879	57	543	35	64	4	67	4
G0707	1,509	1,127	75	301	20	71	5	10	<1
G0710	2,046	1,540	75	347	17	150	7	9	1

*Acres are net acres. G0008 and G0009 have 800 acres and 298 acres within French Meadows Reservoir respectively. These acres were not included in burn severity calculations.

The primary direct effect of the fire was the removal or alteration of the overstory vegetation, litter and duff layers, coarse woody debris, and soil organic matter. The riparian vegetation along perennial channels was not greatly impacted by the fire. The effects of the fire on the physical and chemical properties and processes of soil depended upon the amount of organic material consumed during burning and the magnitude and duration of soil heating. Soil organic matter is the flue that bonds soil particles together, providing resistance to detachment, the dominant reservoir for nutrient storage, and a major habitat component and food source for rhizosphere organisms. It also has a substantial influence on the amount of available soil moisture, especially at dry sites.

Increased overland flow of water due to loss of vegetation will increase erosion and mass wasting potential. The hillslopes in the area are composed of hillslopes that were formed predominantly by debris slides. These areas are the sites of naturally occurring mass wasting. Fire can increase the rate at which these feature initiate because of the loss of stabilizing vegetation and increased ground water saturation. Debris slide basins that are already loaded with sediment have a higher risk post-fire of failure because of the

increased water and sediment load. The slopes most at risk for mass wasting are along Duncan Canyon, especially on its northern side.

CHAPTER 4 – REFERENCE CONDITIONS

The purpose of this chapter is to explain how watershed conditions have changed over time as a result of human influences and natural disturbances. Existing or current conditions are compared to reference condition to attempt to describe the rate, direction or magnitude of change for a particular resource. Reference conditions do no imply that conditions should or could move to the reference level. Reference conditions are not necessarily the desired conditions – they are the conditions that would be expected if the system were operating without significant human influence.

Human Uses

The WAA has a long history of Native American occupation and utilization for over 5,000 years and through the last half of the 19th century. Two different Native American ethnographic groups likely utilized the area: the Nisenan (or southern Maidu) and the Washoe. Archeological evidence documents seasonal use as exemplified by bedrock milling features and lithic scatters.

During the Gold Rush, beginning in 1848 and in subsequent years, miners and other groups of immigrants displaced Native Americans in the area. The discovery of gold in California caused a virtual population explosion of Euro-Americans in the Foresthill area. The growth of the fold mining industry eventually led to the establishment and development of other businesses and industries in this area. Historic mining sites, cabins adits, artifact scatters, ditches, tunnels, tailings and trails associated with this era have been identified throughout the analysis area.

The steep terrain limited access to the area to mining trails until the 1949 when the Mosquito Ridge road was constructed across the North Fork of the Middle Fork American River. This opened the area to extensive timber harvest and road construction on public as well as USFS land that lasted until the mid-1980's.

The construction of the Middle Fork Hydroelectric project in the 1960's brought many new recreational opportunities to the area. Recreational facilities and campgrounds were constructed around French Meadows Reservoir.

Despite the access to and use of the area that occurred throughout the 1900's, two major areas of the analysis areas remained relatively untouched due to the steep, inaccessible terrain. The Granite Chief area remained unroaded, primarily being utilized historically for sheep grazing. In 1984 it was designated as a wilderness area. The upper Duncan Canyon area is also largely unroaded, also due to its steep terrain and inaccessibility.

Vegetation

In the early 20th century, John B. Leigberg surveyed much of the WAA as part of a report for the US Geological Survey. In his report suggest that old growth stands of timber existed within the analysis area along with uneven block of timber in various younger age classes doe to naturally occurring fires. He observed that in the Duncan Canyon drainage the forest had been so extensively burned that the stands were extremely uneven. He says that the stands occurred in blocks, mostly of small extent, separated by narrow lanes of brush or thinly scatted through dense masses of undergrowth. He goes on to say that the head of Duncan Canyon and around Duncan Peak, the forest was extremely thin and uneven with most of the timber of the red fir type, badly burned, with brush following in great quantities. The report says that the remainder of the forest was set in thick chaparral or in straggling lines along watercourses and hillsides. In canyons and on northern slopes, the trees were tall, of medium diametrical dimensions, but of poor quality, owing to fire marks. On the ridge, where ground is rocky and soil thin, the trees were stocky and limby.

Leiberg's report describes the middle portion of the main canyon of the MFAR as resembling Duncan Canyon in the character of the forest. Leiberg observed close-set stands alternating with thin lines of trees or scattered individuals rising out of heavy undergrowth. Ponderosa pine prevailed to the extent of 40% with sugar pine, incense cedar, Douglas fir, and white fir. The report goes on to say that from the lower end of French Meadows to the head of the canyon, the forest varied with elevation and the extent to which it had been burned. One the sloped west of the canyon, the stands were open and consisted of yellow pone (60-70%) and small quantities of white fir and red fir. The flats bordering the river were covered with stands of lodgepole pine, mixed with yellow pine, white fir and red fir.

As discussed earlier, two areas, Granite Chief and Duncan Canyon, remained largely unutilized because of their steep terrain and difficult access. Despite their lack of access or management, these areas are not reflective of the historic condition in the analysis area. Fire history records show that fire suppression efforts have resulted in a much longer fire return interval than happened historically. This has resulted in older, more densely vegetation stands and heavy downed fuel loads that have made forests less resilient to fire.

Prior to Euro-American settlement, the distribution of riparian communities evolved and changed over time due to changes in geologic process and changes in hydrologic regimes. The amount of riparian vegetation within the WAA fluctuated due to the availability and extent of water, temperature and light. Drought, flooding, erosion earthquakes and other natural disturbances influenced the distribution and amount of riparian vegetation. After Euro-American settlement, riparian vegetation was impacted by road building, mining, logging, grazing and water diversion. This caused the loss or alteration of riparian vegetation.

Historically, a mosaic pattern of vegetation was naturally maintained throughout the analysis area through routine, low-intensity fire disturbance. This condition continued throughout the 19th century. Wildfires had a return interval of 5 to 20 years and

consumed much of the debris on the forest flow. The killed the shrubs and sapling trees, but rarely ignited the crows of the large trees. Occasionally, some small patches (less than one acre) burned hot enough to kill some or al of the larger trees. This fire frequency produced a forest floor with a shallow layer of duff over the soil and open barren patches were shade intolerant plants such as ponderosa pine, giant sequoia, shrubs and grasses would germinate and grow.

It was common for Native Americans to set fires for multiple purposes. It is likely that the forest at that time were composed of relatively open overstory of large mixed conifers, wit a sparse conifer and hardwood understory and a light shrub layer. There were probably fewer dead and downed ground fuels and fewer ladder fuels composed of shade intolerant understory trees. Before fire suppression occurred in the early 1900's, it is likely that there were more annual fires that were generally of low severity and stayed on the ground.

Several noxious weeds have become naturalized since Euro-American settlement. Prior to Euro-American settlement, those weeds were not a problem. Settlers brought many plants species to the settlement areas from other parts of the world. When the non-native plants arrived in the analysis area, they had no diseases or predators to keep them in check. Road building, logging, mining, grazing and recreation further distributed these weeds.

Species and Habitat

Little is known of about the distribution and trend of special status plants prior to Euro-American settlement. However, it is reasonable to assume that the habitats of species stats plants have changed in amount and distribution. Prior to Euro-American settlement, special status plants evolved in response to natural disturbances such as flooding, landslides and fire. These natural disturbances varied in intensity and recurrence depending upon climatic events and geologic processes. Euro-American settlement impacts such as grazing, road construction, timber harvest, urban and rural development, fire suppression, mining, recreation and introduction of exotic species have changed the native vegetation within the analysis area.

As discussed earlier, the riparian habitats have been impacted by human activities that occurred during the settlement days, as well as from activities since. It is reasonable to assume that special status plants dependant on riparian habitats were also lost, had reduced numbers or experienced changes in nutrient and water availability.

Some of the special status plants known or suspected in the analysis area depend upon old forest habitats. The amount and distribution of old forests have changed within the analysis area since Euro-American development. Forests have been harvested intensively over the past 150 years. It is reasonable to believe that shade and old-forest dependant special status species were also lost or reduced in numbers.

Reference conditions for wildlife have changed over time, depending on human uses of their habitats and the harvest of wildlife species themselves. Prior to Euro-American settlement, plant communities shifted in response to long-term climate changes as well as short-term changes such as droughts. Habitats were also influenced by natural disturbances such as fire, flooding and wind. These natural disturbances change the age and locations of various types of vegetation and the animals that depend upon on various habitats. Prior to Euro-American settlement, wildlife species were impacted by natural disturbances and by some subsistence hunting and domestication of animals.

Euro-American settlement and forest utilization significantly impacted wildlife habitat. Forest areas were cleared to support the mining and lumber industries and to build towns and homesteads. Fire was used to clear forestlands and to improve pastureland. Early mining operations damaged riparian and aquatic ecosystems. Habitats were fragmented and in some cased eliminated. In general, wildlife species associated with upland habitats, riparian and aquatic habitats continued to exist in the WAA.

Human influences in the analysis area have altered fisheries habitat, and thus fish species. The expected native fish assemblage in foothill Sierra streams include speckled dace, Pacific lamprey, Chinook Salmon, riffle sculpin, hardhead, Sacramento pike-minnow, Sacramento sucker, California roach, and rainbow trout (including stealhead). Chinook salmon, Pacific lamprey and steelhead were extirpated from the area by the construction of Folsom Dam. Other fish species have experienced reductions in number and distribution as the result of habitat loss. The primarily form of habitat loss has been pool filling and loss of spawning gravels associated with sedimentation from mining, road building and timber harvest.

The analysis area only supports 5 of the expected 9 species common to foothill Sierra assemblages. In addition to those 5 species, a number of non-native species have been introduced to the WAA, including brown trout and brook trout.

Native amphibian species have been impacted by humans as well, most notably foothill and mountain yellow-legged frogs and California red-legged frog. All of these species have been impacted by habitat losses similar to those identified for fish, particularly related to mining activities. Foothill yellow-legged frogs and red-legged frogs populations have been reduced by the introduction of bullfrogs that prey upon these species. Bullfrogs were introduced into the area as a food source after miners had depleted the red-legged frog populations. Mountain yellow-legged frogs have been impacted by the introduction of trout into high elevations lakes.

Watershed Processes

The physiography and geology in the analysis area is the result of millions of years of geologic activity and has not changed significantly since Euro-American settlement. Some rates of erosion and mass wasting have increased as the result management

activities over the past 100 years. Historically, some mining has occurred and in those areas, the impact to geology is significant.

Prior to Euro-American settlement, the rate of sediment delivery to streams in the WAA would have been lower than current rates. Mining activity was a major source of sediment during the gold rush era and activities since then have further contributed to sedimentation. Roads and timber harvest has also contributed to increased sediment delivery through the removal of vegetation from hillslopes. More restrictive timber harvest methods and a decreased in road building have contributed to a reduction in sedimentation rates since the 1980's.

Soils change very slowly through time. Soils prior to Euro-American settlement and land management would have had a different disturbance regime. Major disturbances to soils would have been periodic fires, high intensity storm events and landslides. Since Euro-American settlement, soils have been subject to increased compaction as the result of road construction, trails, timber harvest, urban development and other land uses.

Hydrologic characteristics in the watershed prior to Euro-American settlement were controlled by long-term climatic trends, annual weather variations, and fire regimes. Periodic fires influenced the water cycle in the WAA by removing vegetation, which reduces evapotranspiration, increases water yield and local sedimentation rates. The extent of these changes would have depended on the extent and severity of the fire. The low to moderate intensity fires known to have occurred in the historic fire regime would have had local, short term effects on the hydrology of the area. Since Euro-American settlement, the major influences on hydrology in the WAA have been road construction, timber harvest, mining and water project development.

CHAPTER 5 – SYNTHESIS AND INTERPRETATION

The purpose of this chapter is to compare existing and reference conditions of specific ecosystem elements and to explain significant differences, similarities or trends and their causes. The interaction of physical, biological and social processes is identified. The capability of the system to achieve key management plan objectives is also evaluated.

This chapter addresses the issues and core topics listed in Chapter 2. Uses are addressed in two formats. In the first format, the key questions identified for each issue in Chapter 2 are addressed in the form of a narrative summary. Influences and relationships between human uses and natural processes are discussed within the context of each issue. Key questions are answered where possible and data gaps and information needs are identified.

The issues addressed in this chapter are:

- Fire and Fuels Management
- Middle Fork American Water Project Management
- Recreation

The second format discusses each issue within the context of the core topics. Additional topics that are not related to the issues are also addressed here if they are deemed to be important for guiding future management direction for the watershed or will result in a recommendation. Conversely, some topics addressed in Chapters 3 and 4 are not addressed this chapter because they are not related to the issues and are not currently for the development of management recommendations. Applicable core questions from the *Federal Guide for Watershed Analysis* are restates at the beginning of each section and are used to guide the analysis.

Core topics addressed in this chapter are:

- Human Uses
- Vegetation
- Species and Habitats
- Watershed Processes

Fire and Fuels Management

***Key Questions*:**

- How will the Star Fire impact fuel lading and future fire and fuels management in the WAA?

- How do past and current projects in the WAA coordinate to create fuels and fire management areas within the WAA?

- What actions are needed to reintroduce fire as a management tool in the WAA?

- What is the need to manage Wildland Urban Intermix (WUI) areas in the WAA?
- What options exist for fuels and stand treatments in streamside plantations to return the vegetation to a more natural state?
- What areas and prescribed burning techniques should be developed for bear grass management?

Fuels management is a complex yet important issue in this watershed. Steep terrain, mixed with heavy fuel loads and a high level of human use makes the watershed susceptible to a catastrophic wildfire. Fire suppression efforts during the 1900's have resulted in few wildfires occurring in the area over the past 100 years. As a result, many areas of the WAA have not experienced fire for over 100 years, leaving heavy fuel loads in much of the mixed-conifer and red-fir forests of the analysis area.

Historically, it is believed that the fire return interval in this area was 5 to 20 years, based on fire scars observed during Leiberg's surveys. He observed a forest that was much more open that exists currently, with a mosaic of brushy and forested areas. Few fires were crown fires in this environment and little tree mortality was believed to occur.

This historic picture of fire in the WAA is much different than the current condition, as evidence by the Star Fire. The Star fire burned Approximately 17,500 acres, 3,700 acres of which experienced greater than 75% tree mortality. Another 4,000 acres are expected to have greater than 75% mortality in the next 1-3 years, as trees continue to die as the result of the fire. In the high mortality areas, the fire was crown fire, resulting in a high burn intensity and tree kill. In the moderate to low burn areas, the fire was more often a ground fire, but because of the heavy duff and downed fuels levels, the fire burned longer, resulting in hot burning at the base of trees that girdled the trees and is the reason for the additional mortality over the next few years.

This type of fire is very different than that described by Leiberg in 1901, being greater in intensity and size than the historical fire regime. The Star Fire behaved in that manner largely as the result of the heavy fuel loading that existed in the area as the result of 100 years of fire exclusion. With the exception of the Star and Volcano Fire areas and a few other smaller areas scattered throughout the watershed, (i.e., Big Fire), much of the watershed has not experienced fire for 100 years or more. While some areas have experienced timber harvest or fuels reduction, much of the watershed is in a condition similar to the pre-burn Star Fire area, making the WAA highly susceptible to catastrophic wildfire. In addition, the Star Fire area itself has the potential to return to a high-risk condition if the high level of standing dead fuel is not removed.

The Volcano Fire areas are particularly at risk of future wildfire as a result of the post-fire restoration activities that occurred in the 1960's. Much of the area was planted with ponderosa pine plantations after the fire. The success rate of these plantations was much

higher than anticipated, resulting in many dense stands of small diameter trees. In other areas, trees were not planted and dense brush fields exist there today. Both these conditions have high fuel loads and a high risk of severe wildfires that would be difficult to suppress. Numerous fuels reduction projects have been completed in the Volcano Fire area, such as forest thinning, brush mastication and under burning. Fuel breaks have been constructed along the Foresthill Divide and around the town of Michigan Bluff.

The post-Volcano tree plantings also occurred in streamside areas, including planting to the streams edge in some stream reaches. This has resulted in streamside and riparian areas that are dominated by numerous small diameter pines, and often lack the larger trees needed for large woody debris recruitment. In areas where the stands are very dense, native riparian vegetation is often lacking. The thinning of some of these trees and the re-introduction of fire into these streamside areas would allow for larger trees to develop and for riparian vegetation to grow. Some planting of native riparian species may also be required after burning to rehabilitate these areas.

A number of projects within the WAA are ongoing or proposed and would reduce fuels levels in areas of the WAA. The French Meadows timber sale is currently being conducted in the areas north and east of French Meadows Reservoir. The objective of this project was to thin approximately 5,000 acres to improve forest health and reduce fuels. The Codfish timber sale was located in the headwaters of Eldorado Canyon and its purpose was to reduce fuels and promote forest health. The End of the World project is located in the proximity of the Big Trees Grove, Mosquito Creek and Mosquito Ridge Road. The objective of this project is to reduce manage fuels to reduce the risk and impact of potential wildfires. Activities proposed in this project include the development of fuels management zones where fuels would be reduced, and the thinning of other forest areas to improve wildlife conditions and reduces fuels. The Red Hot timber sale is currently occurring along roads within the Star Fire area, removing hazardous trees adjacent to roads and facilities. This project will result in the reduction of fuels along roadsides as well as making the area safe for firefighters and the general public.

The Red Star Restoration project is currently being developed to restore the Star Fire area by reducing fuels and promoting forest growth and health. A major component of the proposal is the development of a number of large SPLATs (strategically placed area treatments) where fuel levels would be very low and during a wildfire, would cause the behavior of the fire to change to aid firefighting efforts. A long-term objective of this project is to reintroduce fire as a natural part of the ecosystem.

All of these projects, while developed to reduce fuels and the effects of catastrophic wildfire in the WAA, did not always coordinate efforts between activities. Future management may examine ways to coordinate the fuels reduction work done in each of these projects, tying together fuel beaks and fuels reduction areas, making the WAA more resilient to fire.

As proposed in the Red Star Project, the re-introduction of fire to the ecosystem is focus of SNFPA. The activities of these projects would advance this effort, by removing fuels

and creating strategic fire management zones. Future actions in the watershed should focus on tying together these efforts and creating additional fuels reduction areas that would allow both the use of prescribed fire as well as the management of wildfire as a fire management tools.

The SNFPA also promotes focusing fuels reduction efforts within WUI areas. Threat and Defense Zone designations exist around the communities of Flight Strip, Michigan Bluff, as well as a number of small isolated residences. All of the other areas designated as Threat or Defense zones in the WAA are centered on recreational and administrative facilities.

Local Native American groups have identified numerous areas containing bear grass in the Grouse Canyon portion of the watershed. Bear grass is used to weave baskets and it is preferred to harvest it after having been burned. Areas of the watershed that can be managed for bear grass harvest, including the use of prescribed burns should be identified. Partnerships with local Native American and Native Plant interest groups should be fostered so they could be involved in the management of these areas.

Middle Fork American Project Management

Key Questions:

- What recreation uses are associated with the project?
- How does the project operations affect habitat for fish and wildlife in the WAA?
- What options are available for long-term sediment disposal needs associated with the project?
- How do land ownership patterns and their associated future land use impact project operations?
- How has upslope land management affected the project?
- How might changes in project operations impact species habitat and human uses in the watershed?

The Middle Fork Project was initiated in 1957 for the purpose of developing and operating major water facilities in Placer County. Besides proving a source of domestic water, the project provides flood protection and hydroelectric power generation. The project was completed in 1967 and consists of two storage and five diversion dams, five power plants, diversion and water transmission facilities, five tunnels and related facilities. Four reservoirs and three tunnels that are part of this project exist within the WAA.

Prior to the construction of the project, flows in the MFAR averaged 149 cubic feet per second (cfs) annually, with a mean peak flow of 11,300 cfs. After the construction of the Middle Fork Project, annual flows averaged 21.9 cfs and mean peak flow was 3,430 cfs. The construction of the project has had a major impact on the quantity of water that moves through the system annually, as would be expected for a project with the objectives of water storage and flood control.

The creation of the reservoirs provided recreational opportunities that hadn't previously existed in the WAA. A number of campgrounds and day use facilities were constructed around French Meadows Reservoir. One of these campgrounds, Talbot, is used as the primary western access point into Granite Chief Wilderness. The dams also provided recreational fishing opportunities that had not previously existed in the WAA because of the difficult access to many of its streams. The storage of water and the regulation of flows has resulted high level a whitewater rafting in the lower portions of the river that would have never been possible without the creation of the project.

Like the fisheries discussed above, the Middle Fork project created fish and wildlife habitat that had not been present prior to its construction. Brown and rainbow trout utilize the reservoirs. Bald Eagles have been observed feeding along the shores of French Meadows Reservoir. A number of other species, such as river otters, pond turtles and yellow-legged frogs continue to exist in MFAR, but little is known about how the project may have affected them.

The construction of the dams has had some impact to downstream fisheries habitats. The dams trap gravels cobbles that would normally transport through the system during high flow events. This has resulted in a deficiency of gravels in some reaches of the river and a lack of habitat for macroinvertebrates and spawning trout. The regulation of flows may also eliminate or restrict the number of high flow events that can flush fine sediments from pools and gravels, further reduction trout habitat. The level to which these habitat degradation may be occurring is unknown, as quantitative habitat surveys have not occurred in the MFAR.

Excessive sedimentation behind the dams has been an ongoing problem for the Middle Fork Project. High flow events in 1986 and 1997 resulted in 4,500 cubic yards being removed from behind the Duncan Diversion Dam in each of those years. A number of sediment removal projects have occurred at Ralston Reservoir, the most downstream reservoir in the system. Most removals took approximately 10,000 cubic yards from behind the dam, but in 1986, 1989 and 1997, 125,000, 35,000 and 65,000 cubic yards of sediment were removed from Ralston Reservoir, respectively. An additional 75,000 to 100,000 cubic yards of material will be removed in the fall 2002.

Associated with the problem of needing to remove sediment from behind reservoirs is the need to locate a disposal site for the rock. In the past, sediments have been disposed at a disposal site on Ralston Ridge or trucked to sites where it can be utilized commercially.

A sediment disposal project will be implemented in the fall of 2002 that would place cobbles and gravels removed from Ralston Reservoir on Indian Bar with the objective of recruiting gravels back into the river system. Sediment disposal will continue to be a problem for the Middle Fork Project and continued coordination between PCWA and the USFS will need to occur to find additional disposal sites and methods. Other options currently being considered are other points downstream of Indian Bar and disposal sites in the vicinity of transportation maintenance needs where rock could be crushed and placed on roads.

Besides developing alternatives for sediment disposal, another solution to solving the projects sediment problem is to identify upslope sources of sediment and where possible, reduce or eliminate that source. As stated in Chapter 3, many areas of the watershed are naturally erosive. This is best illustrated by the numerous debris slides present in Duncan Canyon. The inner gorge areas of many streams, particularly the Middle Fork American, are also susceptible to erosion because of their soil types and steep slopes. Another potential sediment source is area of the WAA with high road densities or a high number of stream crossings, such as occurs in the Mosquito Creek drainage.

Once areas of high erosion potential are identified, two options exist. The first option would be an examination of historic use in the area and identification of potential restoration activities. Examples of this may be decommissioning roads in a high road density area. The second option is to examine areas for changes in land management to prevent future increases in erosion. Examples of this would be obtaining land parcels in areas with erosion potential and managing them in a way to minimize that risk. A number of privately owned parcels along the Middle Fork American River have been identified for potential land acquisition (refer to Proposed Land Acquisition map in Appendix A). The parcels would be prioritized for acquisition because they are in headwaters areas that need protection to maintain water quality, or because they are in steep inner-gorge areas that could be managed to reduce sedimentation.

The Middle Fork Project will renew its FERC license in 2013. It is unknown at this time what changes, if any, would occur to the operations of this project as a result of the re-licensing. Changes such as timing and volume of flows could impact down stream fisheries and amphibian populations and their habitat. These changes could also impact recreational rafting and fishing in lower parts of the river. Changes in the operations of reservoirs could impact camping, boating and fishing opportunities. Knowledge of the species occurrences and habitat as well as human use levels in the watershed will be critical for participation in the FERC re-licensing.

Recreation

Key Questions:

- What actions could be taken to improve recreational fishing access in the WAA?
- What day-use opportunities exist in the WAA and do any other opportunities exist?
- What options exist for future management of the Western States Trail, including rehabilitation after the Star Fire and making the trail eligible for National Recreation Trail status?

Recreational use in the watershed historically was very low, but as the populations have exploded in the Placer County area, the demand for recreational opportunities in the WAA has increased. Recreational use is currently moderate to high in the WAA, with most of that activity centered on the French Meadows basin. Increasing amounts of recreational use is seen at the other reservoirs in the analysis area, in the form of camping and fishing. The level of recreation is anticipated to increase in the next 10 years as the population of Placer County increases and more people move into the Foresthill area.

As recreational use increases, the number of bear-human interactions is expected to increase at French Meadows Basin campgrounds. Currently, a number of bear interactions occur as the result of the high number of campers and the amount of food and garbage they bring into the area. Reducing the number of bears or the number of campers in this area is not a viable solution to the problem. A number of bear-proof dumpsters have been installed around the campgrounds.

Since the construction of French Meadows Reservoir, fishing has become a major recreational use in that area. Much of the fishing occurs from boats, although some access comes from shore. Recreational fishing has increased at the other reservoirs in the WAA, but to a limited extent compared to the level at French Meadows Reservoir. A number of fish bearing streams exist in the area that could support recreational fishing, such as Duncan Canyon, Spruce Creek, Dolly and Rice Creek. However, their use is somewhat limited due to difficult access and lack of knowledge of the opportunities by the public.

Beyond camping and fishing, the demands for day-use recreational opportunities are expected to increase over the next ten years as the local populations increase. Currently, day-use is limited to fishing, hiking and picnicking. Rafting has increased dramatically in the past few years, but most of that activity occurs just outside of the WAA at Ralston Reservoir. However, as the level or rafting use increases, additional recreational opportunities in the area, such as campgrounds, may be needed. The number of developed trails in the WAA is limited and more may need to be

constructed as recreational use increases. Mountain biking is an activity that seems to be increasing in the WAA, but the current level is unknown. Each of these activities is anticipated to increase in level in the near future, whether or not action is taken to accommodate them. Without developed opportunities, the risk is higher that hikers, campers and bikers will go into areas where recreation is undesirable and cause resource damage. An example of this potential is campers selecting sites next to stream because of their beauty and near-by water source but causing increased sedimentation and pollution to the stream.

One developed opportunity that needs restoration is the Western States Trail. In 2001, the Star Fire burned over the portion of the trail that transects Duncan Canyon. As a result, a large number of dead tries exist adjacent to the trail that poses a safety hazard to users. In addition, dead trees have fallen across the trail in some areas blocking access. As a result of safety concerns, the trail was closed in 2001 and the Western States Trail run used an alternative route during its 2002 event. To continue future use of this trail, hazards and blockages would need to be removed.

A portion of the Western States Trail currently runs through a section private land, requiring special permission to cross this property or a detour during events. A re-routing of this portion of the trail so it is on USFS lands would eliminate this problem as well as make it eligible for National Recreation Trail status. An alternate route from Duncan Canyon to Dusty Corners has been proposed and should be analyzed for completion.

Human Uses

Core Questions:

- What are the causes of change between historical and current human uses?
- What are the influences and relationships between human uses and other ecosystem processes in the watershed?

Present Conditions	Casual Mechanisms	Trends
Transportation		
Some areas of the watershed are highly roaded, such as the End of the World and Red Star Ridge. Some of those roads are in poor condition and need repair or closure. Some roads are causing increased sedimentation to streams.	Poor road design. Lack of maintenance. High level of road-stream interaction (i.e., proximity and number of crossings). High road densities on non-USFS land that may not be properly designed or maintained.	Road re-construction and decommissioning in areas where resource damage is occurring. Maintenance continues to be limited by projects and special funding sources. Continued damage to aquatic resources where roads are interacting with streams.
Grazing		
Grazing continues to occur on allotments in the WAA. A limited number of water sources and few developed watering holes have resulted in concentrations of cattle in streams and ponds and resource damage. Cattle have damaged a number of fens and stream banks have evidence of trampling and chiseling.	Lack of water resources. Lack of protection of special aquatic features. Poor range management in the past.	Further loss of fens and their special botanical species. Continued impacts to streams including bank instability and sedimentation.

Present Conditions	Casual Mechanisms	Trends
Mining		
Duncan Canyon contains a high number of historic and actives mines. Some operations continue to degrade stream habitats by increasing siltation, de-stabilizing banks and removing gravels. Some historic mines are hazardous to the public because of materials or openings. Some mines are historically significant and need archeological evaluation and protection.	Lack of monitoring of operations. No evaluations of hazards associated with abandoned mines. Easy public access to historic sites. Un-authorized mining activities.	Pool filling, bank instability and loss of gravel habitats will continue in streams as the result of mining operations.
Heritage Resources		
The Star Fire impacted heritage resources at the Red Star Mine and face increased risks as the result increased visibility.	Star Fire. Loss of protective soil and vegetation that was concealing artifacts.	Increased degradation of the Red Star Mine site.

Conclusions:

- Highly road density areas need to be evaluated for road decommissioning, obliterations or closures. Road management objectives established in End of the World and Red Star Restoration projects need to be accomplished and funds should be pursued if needed. Examine opportunities to decommission roads in Mosquito Creek drainage, including conversion of roads to trails. Areas of private land with high road densities and number of crossings should be acquired so that transportation related problems could be restored.

- Mining operations in the WAA will continue to exist. Reviews of operations and operations plans need to continue to ensure compliance. Abandoned mines need to be assessed to identify any hazards that need to be mitigated or eliminated.

- There is a need to re-evaluate range management in the WAA to allow grazing while reducing impacts to special aquatic features. The locations of fens should be mapped and a restoration and protection plan developed.

Restoration and protection of the damaged fens in the Mosquito Creek drainage should occur.

- The Red Star Mine continues to be at risk of damage as a result of the Star Fire. The site needs to be evaluated for damages that occurred during the fire and for any protections that need to be implemented. Road access throughout the WAA needs to be evaluated for opportunities to protect archeological resources.

Vegetation

Core Questions:

- What are the natural and human causes of change between historic and current vegetative conditions?

- What are the influences and relationships between vegetation and seral patterns and other ecosystem processes in the watershed?

Present Conditions	Casual Mechanisms	Trends
Forest stands in some areas are denser and more decadent than was typical prior to the 1900's	Fire suppression.	Fuel loads will increase without treatment and the re-introduction of fire.
Large areas of high tree mortality exist in areas of Red Star Ridge and Duncan Canyon	Star Fire High safety risk due to high number of snags in area. Increased dead downed material and snags for wildlife habitat.	The amount of fuel will increase as shrub re-grows and dead trees fall. Increased fuel load will make suppressing future fires difficult. The number of snags and downed dead trees will increases as more trees die and fall.

Vegetation has begun to recover throughout the area burned by the Star Fire. Many trees that initially survived the fire are at risk to stress and insect infestation. Black oaks are re-sprouting. Shrub species are recovering quickly in most areas.	Star Fire. Competition between recovering plants will favor the development of shrub species.	Vegetation will continue to regenerate naturally throughout the burn area, generally dominated by shrub species. High levels of shrubs will make the burn area more susceptible to high intensity fires in the future.
Non-native plants and noxious weeds infest many areas within the watershed.	Introductions vial grazing, recreation, mining and timber harvest. Competition with native plants, including sensitive species.	Non-native plants and noxious weeds will continue to expand their range in the area. Sensitive plants will continue to decline as noxious weeds out-compete for resources.

Conclusions:

- Fire suppression in the WAA has resulted in heavy fuel loads and forest stands that are no long fire-resilient. Future management should consider opportunities to make stands more fire resilient and to reintroduce fire as a natural part of the watersheds ecosystem.

- The fuel load in the Star Fire area will increase over the next 30 years as additional trees die and dead standing trees fall. A long term strategy for treating these fuels needs to be developed that will balance the reduction of fuels with the need to retain snags for soils, wildlife and fisheries needs.

- Without management, portions of the burn areas will become dominated by shrubs and perpetuate the high wildfire risk in the area. Replanting of conifers in some areas would accelerate regeneration and promote fire resilient forest conditions.

- As long as human uses continue in the WAA, the risk and existence of noxious weed infestations will continue. Opportunities to rehabilitate infested areas and reduce future infestations exist.

Species and Habitat

Core Questions

- What are the natural and human causes of change between historic and current species distribution for species of concern in the watershed?
- What are the influences and relationships of species and their habitats with other ecosystem processes in the watershed?

Present Conditions	Casual Mechanisms	Trends
Sensitive plants occurrences are limited and at risk of disturbance.	Grazing Transportation Mining Recreation Timber harvest Noxious weeds	Sensitive plant populations will decline as human uses and noxious weed infestations continue in the WAA.
Fens in the WAA have been damaged.	Grazing	Fens will continue to be damaged or destroyed if grazing continues as currently managed.
Fisheries habitat is impaired in many streams by lack of spawning gravels, pool filling and low levels of cover.	Mining Grazing Transportation Historic timber harvest	Fisheries habitat will continue to be impaired in areas where mining, grazing continue and road maintenance does not occur.
Many streams have low levels of large wood debris to provide cover and pool habitat for salmonids	Fire suppression Historic timber harvest	Without the re-introduction of fire as a natural disturbance in the WAA, woody debris in streams will continue to be low.
High tree mortality in the burn area will provide openings for early seral habitats to develop.	Star Fire	Habitat for deer, bear and quail will increase.

The number of snags and downed wood in the burn area has increased	Star Fire	Snags and down wood will continue to increase as trees die and fall. Increased habitat for cavity nesting birds Increased large woody debris in Duncan Canyon and MFAR
Old forest habitat is reduced in the Star Fire area as the result of high to moderate tree mortality over 7,700 acres in the WAA.	Star Fire	Loss of habitat for California spotted owls, northern goshawks, and fur-bearers.

Conclusions:

- Fens in the WAA are degraded as the result of grazing. There is a need to protect fens from grazing so these special aquatic habitats and the sensitive plant species they support will be protected.

- Streams show signs of impairment, but often the exact source of sedimentation or disturbance is not known. Surveys of the WAA need to be accomplished to better identify sediment sources and a plan to mitigate or eliminated these sources should be developed.

- Large woody debris in many streams is deficient because of the lack of disturbance to provide downed wood, such as fire. Coordination between silviculture, fuels management and fisheries should occur to identify methods to meet multiple objectives in riparian areas.

- The Star Fire eliminated old forest conditions in a large portion of the WAA and provided an opportunity for more early seral stage habitats to develop. Coordination between silviculture and wildlife should occur to develop a restoration plan that balances the habitat needs of the various species in the watershed.

Data Gaps

During the analysis of the WAA, it was recognized that a number of resources lacks information to complete analysis or make recommendations. The following are data gaps where additional survey work should be done to gather information:

- Level of dispersed recreation, including kayaking, mountain biking, fishing and hiking.
- Sources and degree of sedimentation occurring within the WAA
- Road – stream interactions resulting in resources damage
- Location of special aquatic features such as bogs, fens and small meadows
- Location of archeological resources outside of previously surveyed project areas
- Location of TES plant and wildlife species outside of previously surveyed project areas
- Water quality
- Un-authorized mining activity

CHAPTER 6 – RECOMMENDATIONS

The purpose of this chapter is to bring the results of the previous steps to conclusions, focusing on the management recommendations that are responsive to the issues and watershed processes identified in the analysis. Monitoring activities are identified that are responsive to the issues and key questions. Data gaps and limitations are also documented.

This chapter is organized by focusing on needs and opportunities identified in the conclusions made in Chapter 5. Recommendation topics in the chapter include the following:

- Fire and Fuels Management
- Middle Fork American Water Project and Management
- Recreation
- Other Resource Recommendations

This Chapter closes with a list of potential projects and resources/areas of the WAA that need additional information.

Desired Future Conditions

The SNFPA set the desired condition for much of the WAA. The Record of Decision for the SNFPA states:

> **"Desired Future Conditions**
> A desired future condition is a statement describing a common vision for a specific area. These statements are made in the present tense, indicating a condition that management will be designed to maintain or move toward, in each land allocation. Statements of desired condition take into account the natural range of variability typical for the Sierra Nevada landscape, the uncertainty of natural disturbances, the effects of past management, the unique features or opportunities that the Sierra Nevada forests can contribute and human desires and uses of the land." (SNFPA ROD, page 8)

The majority of the WAA is designated by the SNFPA as old forest (SNFPA Allocations map in Appendix A), and the desired future condition is defined as below:

"Old Forest Wilderness Areas

> Old forest conditions, as determined by site capability, exist and are maintained on the greatest proportion of acres in old forest emphasis areas as possible. Fuels treatments in old forest emphasis areas allow a natural range of conditions to develop.

Old forest emphasis areas provide a network of large, relatively contiguous landscapes distributed throughout the Sierra Nevada where old forest conditions and associated ecological processes predominate. These areas provide a substantial contribution of ecological conditions to maintain viable populations of old forest associated populations of old forest species." (SNFPA, ROD, page 8)

Some smaller patches of general forest exist south of French Meadows Reservoir, along Chipmunk Ridge (SNFPA Allocation map in Appendix A). The desired future condition for these areas are described as follows:

"General Forest
The general forest is comprised of National Forest System lands outside of the other land allocations. The amount, quality and connectivity of old forests in the general forest areas, support replacement rate reproduction for the California spotted owl and other old forest associated species. The density of large and old trees and the continuity of old forests across the landscape are increased. The amount of forest with late-successional characteristics (for example, diverse species composition, higher canopy cover, multi-layered canopy, higher density of large diameter trees, snags and coarse woody material) is also increased." (SNFPA ROD, page 8)

Areas of defense and threat zones have been designated around French Meadows Reservoir, Big Trees, Duncan Peak Lookout and the Flight Strip community (Wildland Urban Intermix Zones map in Appendix A). The SNFPA describes the desired future condition for these areas as follows:

"Urban Wildland Intermix Zones – Defense (inner) and Threat (outer)
This zone is an area where human habitat is missed with areas of flammable wildland vegetations. It extends out from the edge of developed private land into land under Federal, private and State jurisdictions.

The highest priority has been given to fuels reduction activities in the urban wildland intermix zones. Fuels reduction treatments protect human communities from wildland fires as well as minimize the spread of fires that might originate in urban areas. Fire suppression capabilities are enhanced by modified fire behavior inside the zone and providing a safe and protective area for fires suppression activities.

The highest density and intensity of treatments will have been placed in developed areas within the urban wildland intermix zone. Fuels treatments increase the efficiency of firefighting efforts and reduce risks to fire fighters, the public, facilities and structures, and natural resources. Fuel treatments provide a buffer between developed areas and wildlands.

Fuel conditions allow for efficient and safe suppression of all wildland fire ignitions. Fires are controlled through initial attack under all but the most sever weather conditions.

Under high fire weather conditions, wildland fire behavior in treated areas is characterized as follows: (1) flame lengths at the head of the fire are less than four feet, (2) the rate of spread at the head of the fire is reduced to at least 50 percent of pre-treatment levels for a minimum of five years, (3) hazards to firefighters are reduced by keeping snag levels to two per acres (outside California spotted owl and Northern goshawk PACs and forest carnivore den site buffers), and (4) production rates for fire line construction are doubled from pre-treatment levels." (SNFPA ROD, page 9)

Thirty-one California spotted owl and eleven northern goshawk PACs have been designated in the WAA. The desired future condition for those PACs are described in the SNFPA ROD as follows:

"Spotted Owl Protected Activity Centers and Home Range Core Areas
Stands in each PAC and home range core area have (1) at least two canopy layers, (2) trees in the dominant and co-dominant crown classes averaging at least 24 inches diameter at breast height (dbh), (3) at least 70 percent tree canopy cover (including hardwoods), (4) a number of very large (greater than 45 inches dbh) old trees, and (5) higher than average levels of snags and down woody material." (SNFPA ROD, page 9)

"Northern Goshawk Protected Activity Centers
Stands in each Northern goshawk PAC have (1) one to two tree canopy layers, (2) trees in the dominant and co-dominant crown classes averaging at least 24 inches dbh, (3) at least 70 percent canopy cover (including hardwoods), (4) a number of very large trees (greater than 45 inches dbh), and (5) higher than average levels of snags and down woody material. (SNFPA ROD, page 9).

The only wilderness area within the WAA is Granite Chief Wilderness. The SNFPA ROD describes the desired condition for wilderness areas as follows:

"Wilderness and Wild and Scenic Rivers
Wilderness is a unique and vital resource. It is an area where the earth and it community of life are untrammeled by humans, where humanity itself is a visitor who does not remain. It retains its primeval character and influence, without permanent improvements or human habitation. Natural conditions are protected and preserved. The area generally appears to have been affected primarily by the forces of nature, with the imprint of humanity's work substantially unnoticeable. It offers outstanding opportunities for solitude, or a primitive and unconfined type of recreation. Human influence does not impede or interfere with natural succession in the ecosystem. (SNFPA ROD, page 8)

Throughout the WAA, riparian management areas exist around streams, reservoirs, ponds and special aquatic features such as springs, meadows and fens. The SNFPA ROD describes the desired future condition for these areas as follows:

> "Riparian Management Areas
> Water quality meets the goals of the Clean Water Act and Safe Drinking Water Act; it is fishable, swimmable and suitable for drinking after normal treatment.
>
> Habitat supports viable populations of native and desired non-native plant, invertebrate, and vertebrate riparian and aquatic-dependant species. New introductions of invasive species are prevented. Where invasive species are adversely affecting the viability of native species, the appropriate Sate and Federal wildlife agencies have reduced impacts to native populations.
>
> Species composition and structural diversity of plant and animal communities in riparian areas, wetlands and meadows provide desired habitat conditions and ecological functions.
>
> The distribution and health of biotic communities in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and mashes) perpetuates their unique functions and biological diversity.
>
> Spatial and temporal connectivity for riparian and aquatic-dependant species within and between watershed provides physically, chemically and biologically unobstructed movement for their survival, migration and reproduction.
>
> The connections of floodplains, channels and water tables distribute flood flows and maintain diverse habitats.
>
> Soils with favorable infiltration characteristics and diverse vegetative cover absorb and filter precipitation and sustain favorable conditions of stream flows.
>
> In-stream flows are sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and keep sediment regimes as close to those with which aquatic and riparian biota evolved.
>
> The physical structure and condition of stream banks and shorelines minimizes erosion and sustains desired habitat diversity.
>
> The ecological status of meadow vegetation is late seral (50 percent or more of the relative cover of the herbaceous layer is late seral with high similarity to the potential natural community). A diversity of age classes of hardwood shrubs is present and regeneration is occurring.
>
> Meadows are hydrologically functional. Sites of accelerated erosion, such as gullies and headcuts are stabilized or recovering. Vegetation roots occur

throughout the available soil profile. Meadows with perennial and intermittent streams have the following characteristics: (1) stream energy from high flows is dissipated, reducing erosion and improving water quality, (2) streams filter sediment and capture bedload, aiding floodplain development, (3) meadow conditions enhance floodwater retention and groundwater recharge, and (4) root masses stabilize stream banks against cutting action.

Fire and Fuels Management

Recommendation:

Implement the fuels reduction projects proposed in the Red Star Restoration proposal, including the removal of fire-killed trees in greater than 75 percent mortality areas, the creation of SPLATS and the reduction of hazardous trees around trails. These fuel reduction activities would eliminate standing dead wood that has the potential to create a downed fuel load of over 300 tons per acres in the next 5 to 30 years. Reduction of fuels in Defense and Threat Zones would be more intensive, focusing on meeting SNFPA standards and ensuring firefighter safety from snags. The creation of SPLATS would set-up the area for the re-introduction of fire as a natural part of the ecosystem as well as establishing areas of the WAA that would be used during suppression to prevent a catastrophic wildfire from occurring.

Recommendation:

Implement the reforestation projects proposed in the Red Star Restoration proposal so that the development of old forest conditions in areas of high tree mortality will be accelerated. The acceleration of forested conditions in these areas is an important component of the long-term fire and fuels management for the area. Reforestation would be important in controlling shrub growth in the area, and thereby reducing the shrub component of the fuel load. I without reforestation, shrubs would compete with naturally regenerating trees and become the dominant vegetation type in many areas of the burn area.

Recommendation:

Create a long-term fuels management program for the Red Star Area. The fuels reduction proposals in the Red Star Restoration project will result in significant reductions of fuels in some areas of the burn, other areas will still exceed the desired condition for fuel loads. A long-term plan to treat these areas needs to be developed so that the desired fuel load can be achieved and fire can be re-introduced to the landscape.

Recommendation:

Expand the SPLAT strategy proposed in the Red Star Restoration proposal to other areas of the watershed. The creation of additional SPLATS would assist in the suppression of

any future wildlfires as well as allow the re-introduction of fire in some areas of the WAA. The End of the World project also proposed fire management zones and these areas could be integrated into the overall fire management strategy developed for the WAA. Protection of the watershed from catastrophic wildfire is important to protect the urban-intermix areas as well as the facilities of the Middle Fork American Project. Also, wildfire is a significant cause of sedimentation in many areas and high levels of sediment to the MFAR would be detrimental to water quality and the operations of the Middle Fork American Project.

Middle Fork American Project Management

Recommendation:

Assess areas around the MFAR and its reservoirs for additional recreational opportunities and improvements. As the local populations increase, the demand for recreational opportunities in the area will increase as well. By developing a plan to accommodate this demand, resource damage caused by dispersed recreation. Also, by creating these opportunities, activities around project facilities can be directed to other areas of the WAA, thus reducing the risk of vandalism.

Recommendation:

Coordinate with PCWA to develop a long-term sediment management plan. Sedimentation to and its disposal from the Middle Fork American project, particularly at Duncan Diversion and Ralston Reservoir has been an on-going problem for the management of the facilities and the USFS lands adjacent to them. Long-term management needs to include not only disposal options, but also identification and restoration of areas causing sedimentation.

Recommendation:

Identify potential land parcels for acquisition. Many areas of the watershed, such as headwaters, meadows and inner gorges, are important in the eontinued watershed function and production of high quality water. These areas should be identified and where possible, acquire parcels of private land so the landscape can be managed to protect and enhance the quality of the watershed and its water.

Recommendation:

Assess the status of fish, wildlife and plant species in MFAR and Duncan Canyon. The FERC license for the Middle Fork American Project is due for renewal in 2013. Part of this process will be to summarize the known information about the project, including species that use the habitats within the project area and/or are impacted by project operations. Survey data for the streams and riparian areas exist for some portions of the

watershed. A compilation and understanding of this data will assist the District in working with PCWA by providing existing data and identifying data needs.

Recreation

Recommendation:

Assess recreational fishing use in the WAA and develop additional access opportunities. Recreational fishing access is a popular recreational activity in the WAA, but it is unknown to what extent or where it occurs. Identification of areas with high use could result in the development of additional access areas, trails or piers. Fully accessible fishing access options would also be explored at French Meadows Reservoir.

Recommendation:

Create additional day-use opportunities in the WAA, including campgrounds, interpretive, hiking and biking trails. As the population of Placer County continues to grow, the demand for day-use opportunities will continue to grow as well. Few day-use opportunities exist in the WAA currently -- limited to the Big Trees tail, the Little Bald Mountain trail and various picnic areas at the reservoirs. Rafting has become a very popular activity on the MFAR. A plan to develop the Ralston access area is currently being implemented. Further improvements or opportunities in that immediate area may be necessary to accommodate these users. Mountain biking is becoming more popular in the WAA, but no designated trails exist for this activity. As this use increases, conflicts between bikers and hikers are likely.

Recommendation:

Re-open the Western States Trail. The portion of the Western States Trail that crosses Duncan Canyon was burned over during the Star Fire, resulting in a high number of hazardous trees on and adjacent to the trail. Some areas of the trail have developed drainage problems since the fire. Hazardous trees and dead trees on the trail need to be removed. Areas where erosion is occurring need to be repaired so further damage to the trail does not occur.

Recommendation:

Re-route a portion of the Western States Trail. A portion of the Western States Trail currently crosses private land, requiring large events to seek an alternate route. A new section of trail from Duncan Canyon to Dusty Corners would eliminate this problem by placing all of the Western States Trail on public lands. This would facilitate large events such as the Western States Run and Tevis Cup Ride. It would also make the trail eligible for National Recreational Trail status.

Other Resource Recommendations

Recommendation:

Implement projects in the Mosquito Creek drainage to reduce road-stream interactions. The analysis for the End of the World project and the Roads Analysis revealed that this area has a high road density and high number of stream crossings that is impairing streams. A restoration plan for this watershed needs to be developed to eliminate or mitigate these problems. Possible actions include the closing or decommissioning of roads, the rocking or reshaping of roads and the repair or removal of culverts. The conversion of roads into hiking trails is also possible, thereby helping meet watershed, fisheries and recreational needs in the WAA.

Recommendation:

Develop a monitoring plan for the minerals program. A number of mines exist in the area that are not authorized or have not been recently visited for compliance with their operating plans. Mining can be damaging to streams and compliance with state laws and operating plans is important for limiting the impacts the activities have to aquatic resources.

Recommendation:

Restore and protect fens. A number of fens have been identified in the Mosquito Creek and Duncan Canyon drainages that have been damaged by grazing. Restoration and protection of these fens would protect these special aquatic resources and the plant species associated with them.

LIST OF PARTICIPANTS

Mary Grim – Project Leader and Fisheries Biologist
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Joel Lane – Fire and Fuels Management
Kevin Zimlinghaus – Silviculturist
Mo Tebbe - Special Uses and Recreation Management
Tony Rodarte – Timber Management
Richard Johnson – District Ranger

Eldorado National Forest
American River Watershed Group
Placer County Water Agency

FOR COPIES OF APPENDIX A, B, AND C CONTACT AMERICAN RIVER RANGER DISTRICT (530) 478-6254

APPENDIX A – MAPS

Base Map
Seral Stages
Watershed Boundaries
Mines
Vegetation Types
Fire History
Trails and Recreation Areas
Bedrock Geology
Proposed Land Acquisition Parcels
Wildland Urban Intermix Zones
Spotted Owl and Goshawk Habitat Areas
Roads
SNFPA Land Allocations
Streams

APPENDIX C – UPPER MIDDLE FORK AMERICAN RIVER ROADS ANALYSIS