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File Code: 2510
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Dear Interested Citizen:

Enclosed is the Watershed Assessment for the Middle Fork American River. It analyzes the National Forest System 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) 478-6254.

Sincerely,

RICHARD A. JOHNSON
District Ranger

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INTRODUCTION

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 explains 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 manged 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 ninteenth 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 Euroamericans 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	
	Gates	Two 25-person sites and one 75-person site
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 forb 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 Moderate	10 Moderate	11 Moderate	11 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 Moderate	7 Moderate	7 Moderate	8 Moderate
Total Condition/Sensitivity Score	77 **High**	70 **Moderate**	77 **High**	88 **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 wildfires 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 continued 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 the 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
Karen Jones – Silviculturist and NEPA/Planning Specialist
Nolan Smith – Archeologist
Carol Kennedy – Soil Scientist
Tim Biddinger – Hydrologist
Matt Triggs – Wildlife Biologist
Alan Doerr – GIS Specialist
Sally Hallowell – GIS Specialist
Scott Husmann – Transportation Planner
Joel Lane – Fire and Fuels Management
Kevin Zimlinghaus – Silviculturist
Mo Tebbe - Special Uses and Recreation Management
Tony Rodarte – Timber Management
Richard Johnson – District Ranger

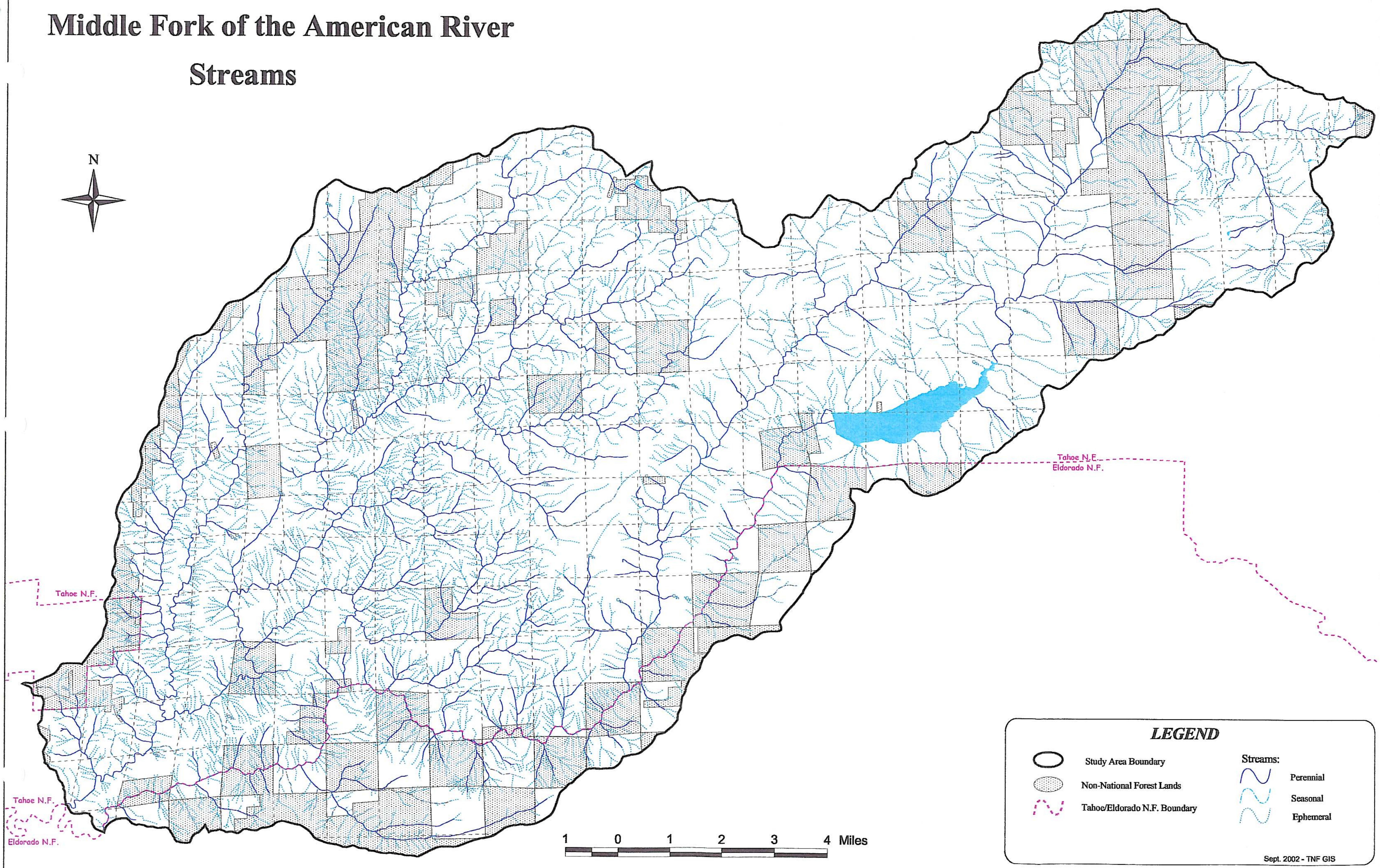
Eldorado National Forest
American River Watershed Group
Placer County Water Agency

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

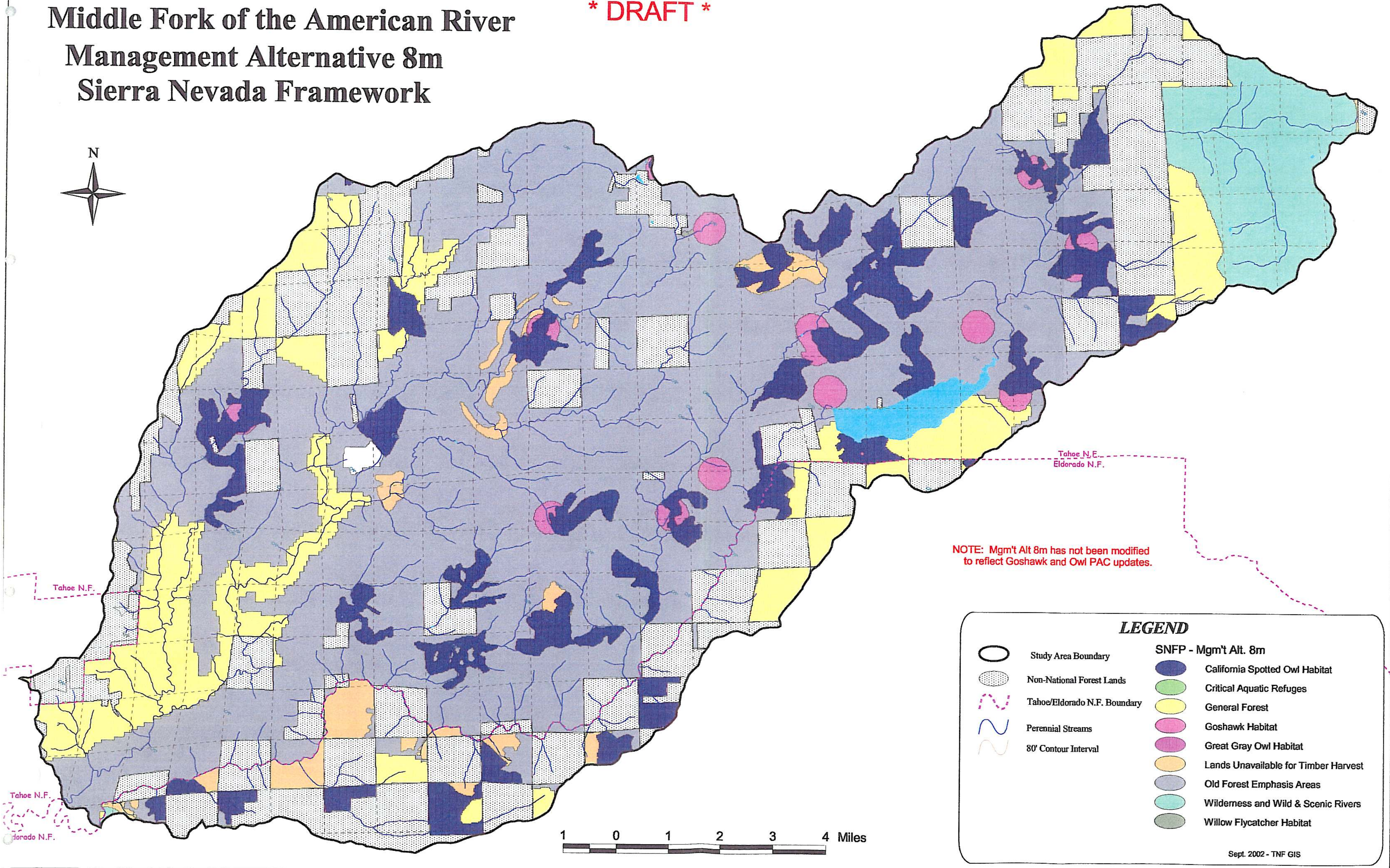
Middle Fork of the American River

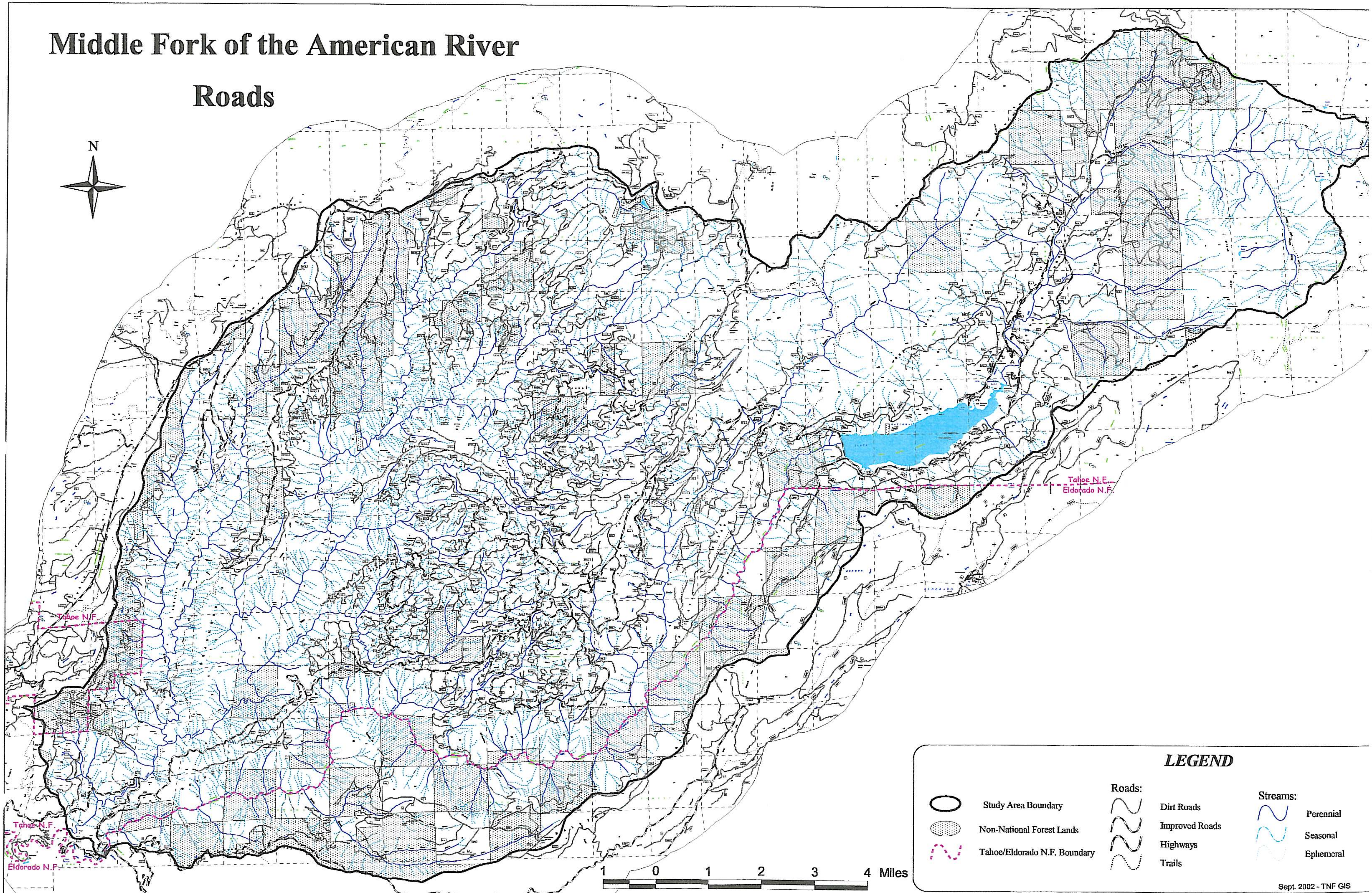
Streams



Middle Fork of the American River
Management Alternative 8m
Sierra Nevada Framework

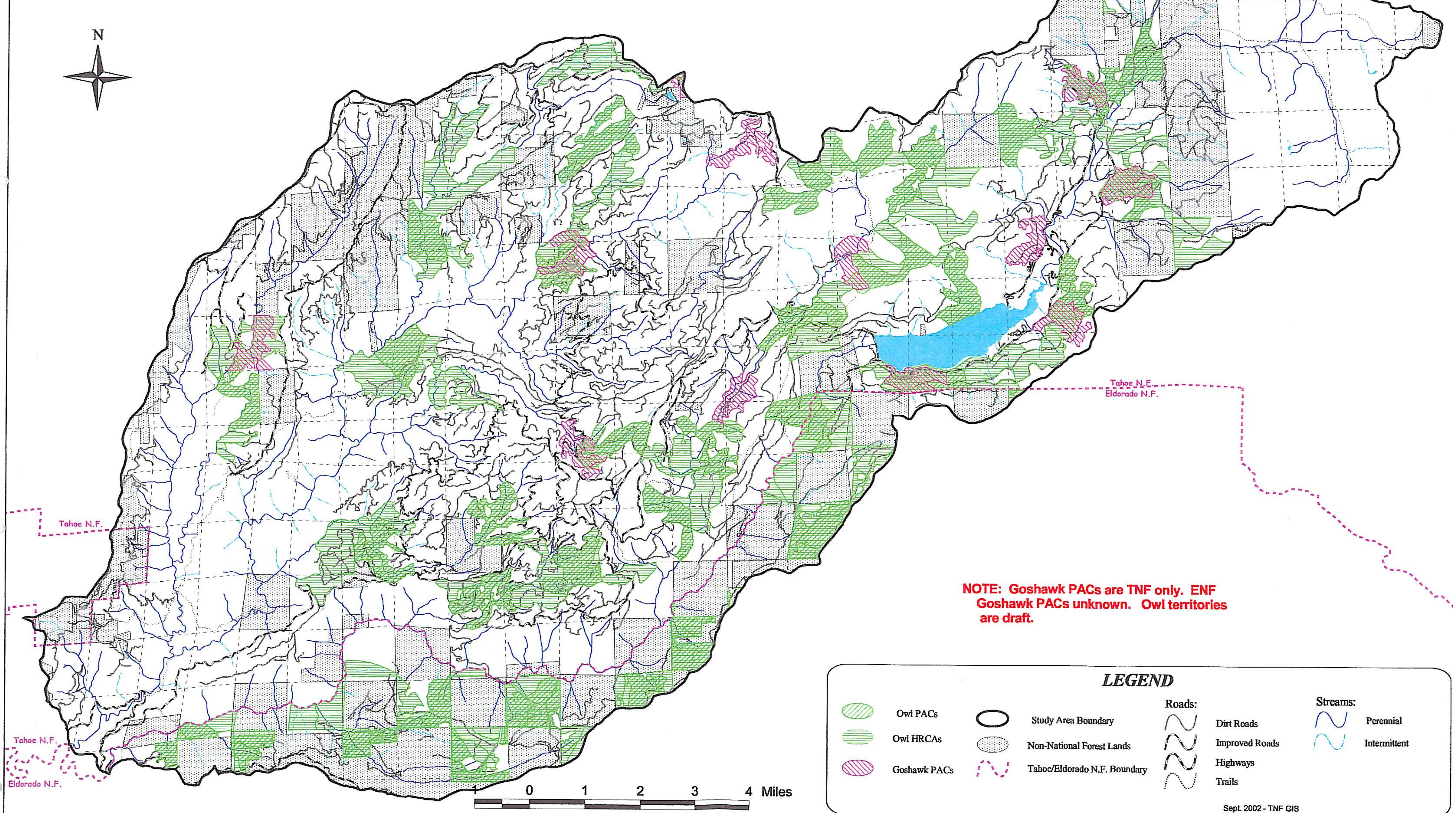
* DRAFT *

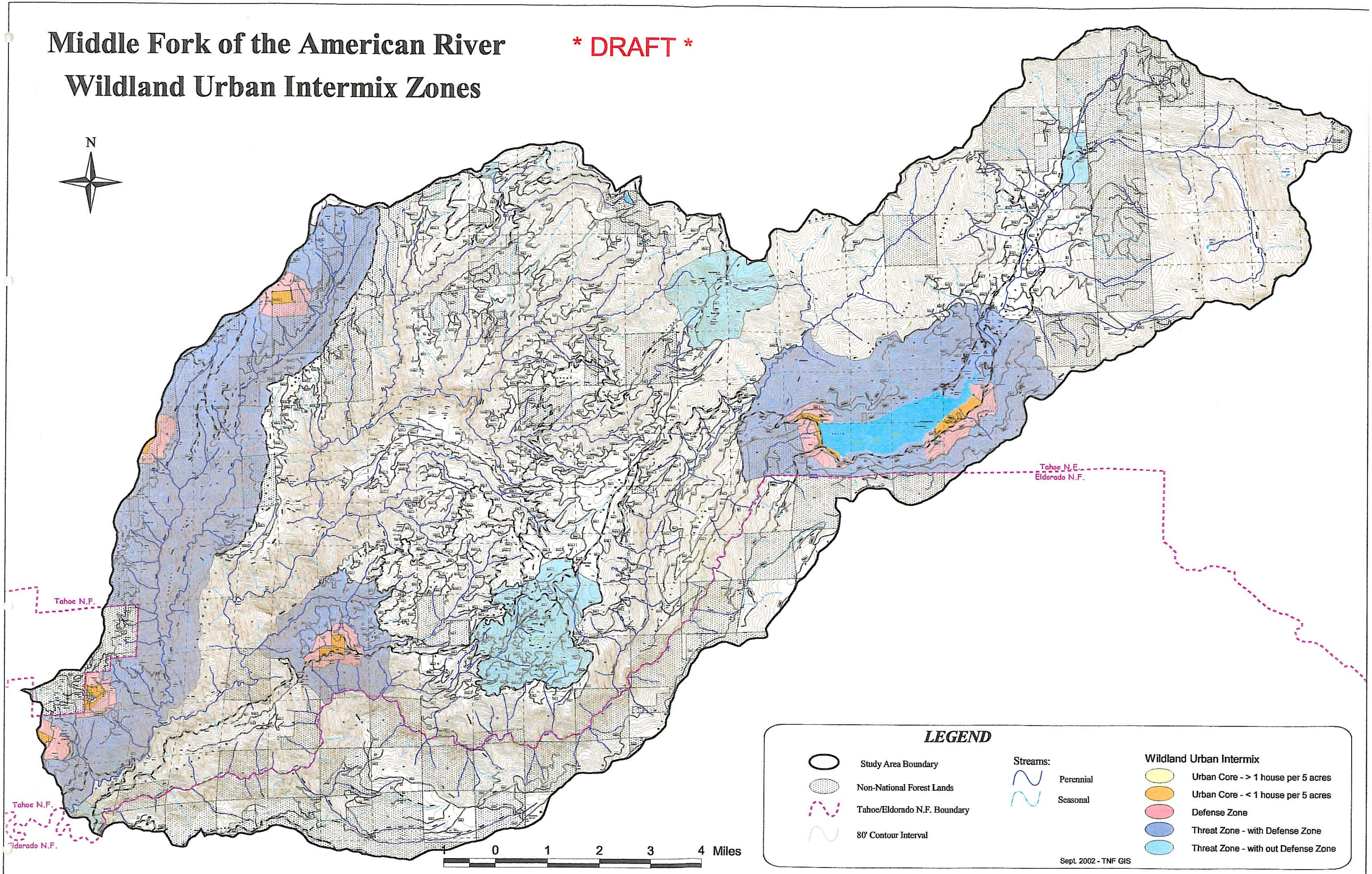



Middle Fork of the American River
Roads
N
Tahoe N.F.
Eldorado N.F.
Tahoe N.F.
Tahoe N.F.
Eldorado N.F.
LEGEND
Study Area Boundary
Non-National Forest Lands
Tahoe/Eldorado N.F. Boundary
Roads:
Dirt Roads
Improved Roads
Highways
Trails
Streams:
Perennial
Seasonal
Ephemeral
1 0 1 2 3 4 Miles
Sept. 2002 - TNF GIS

Middle Fork of the American River Spotted Owl and Goshawk Habitat Areas

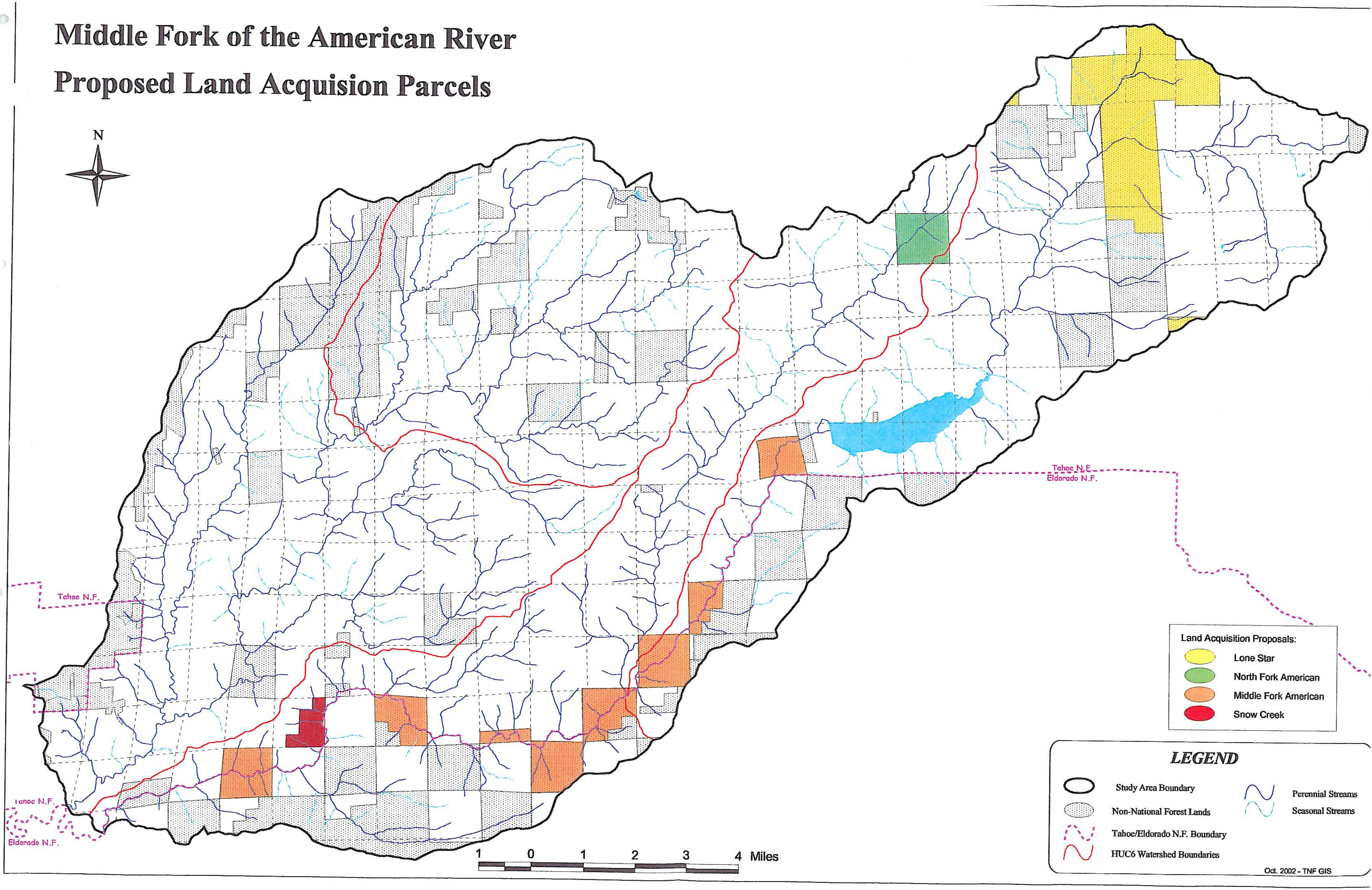
* DRAFT *





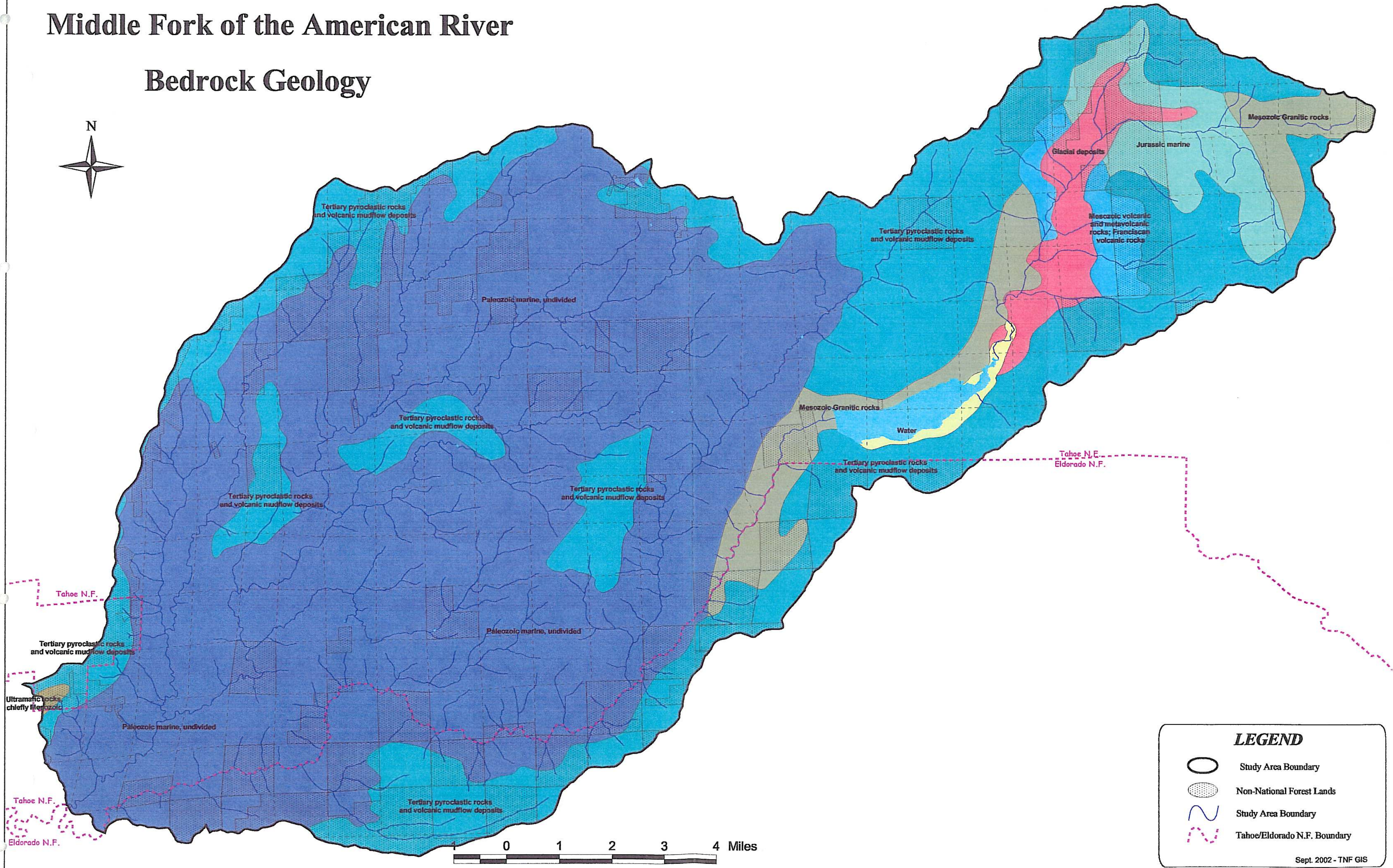
Middle Fork of the American River
Wildland Urban Intermix Zones
* DRAFT *
N
Tahoe N.F.
Eldorado N.F.
Tahoe N.F.
Tahoe N.F.
Eldorado N.F.
LEGEND
Study Area Boundary
Non-National Forest Lands
Tahoe/Eldorado N.F. Boundary
80' Contour Interval
Streams:
Perennial
Seasonal
Wildland Urban Intermix
Urban Core - > 1 house per 5 acres
Urban Core - < 1 house per 5 acres
Defense Zone
Threat Zone - with Defense Zone
Threat Zone - with out Defense Zone
1 0 1 2 3 4 Miles
Sept. 2002 - TNF GIS

Middle Fork of the American River
Proposed Land Acquision Parcels

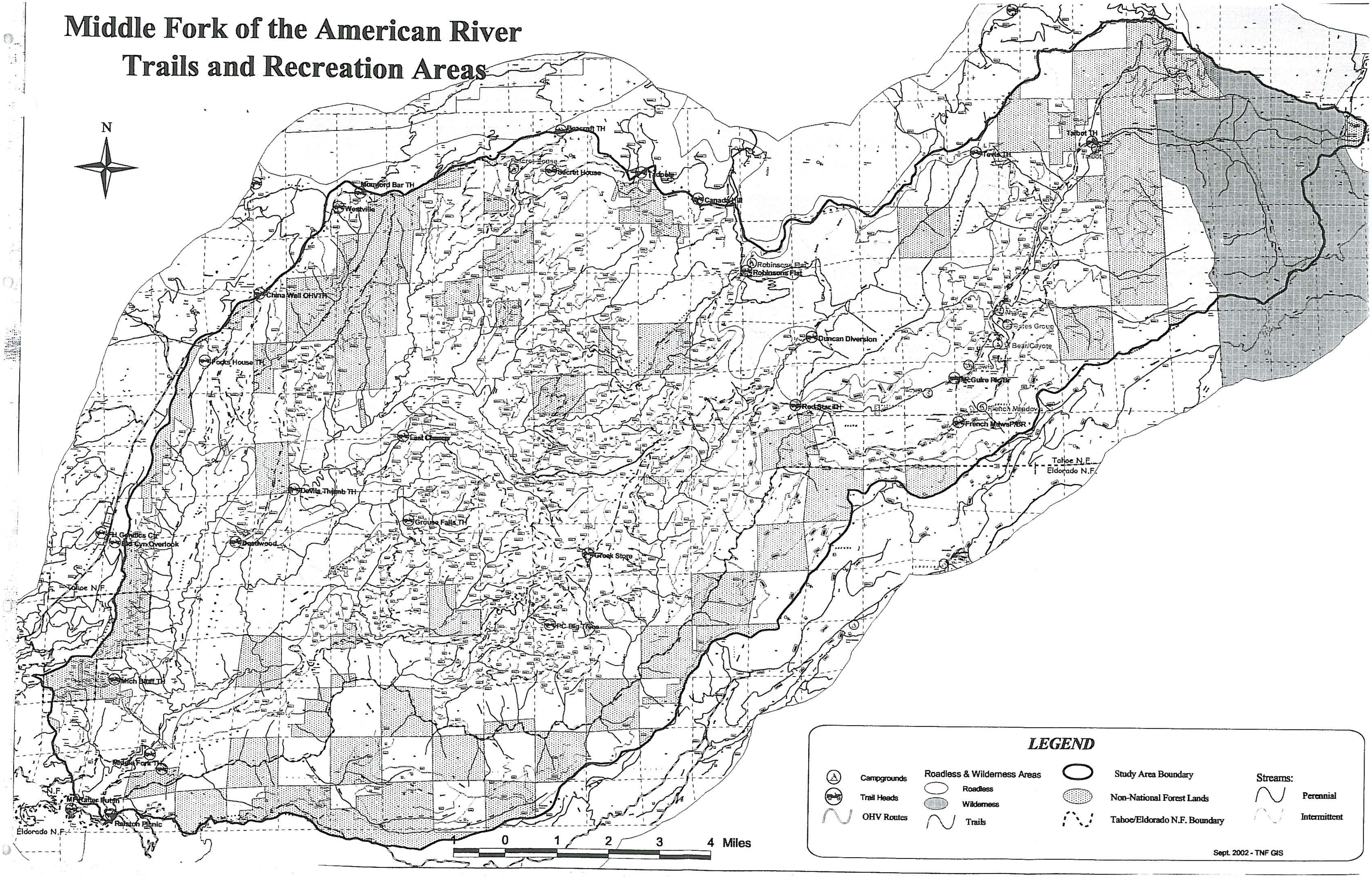


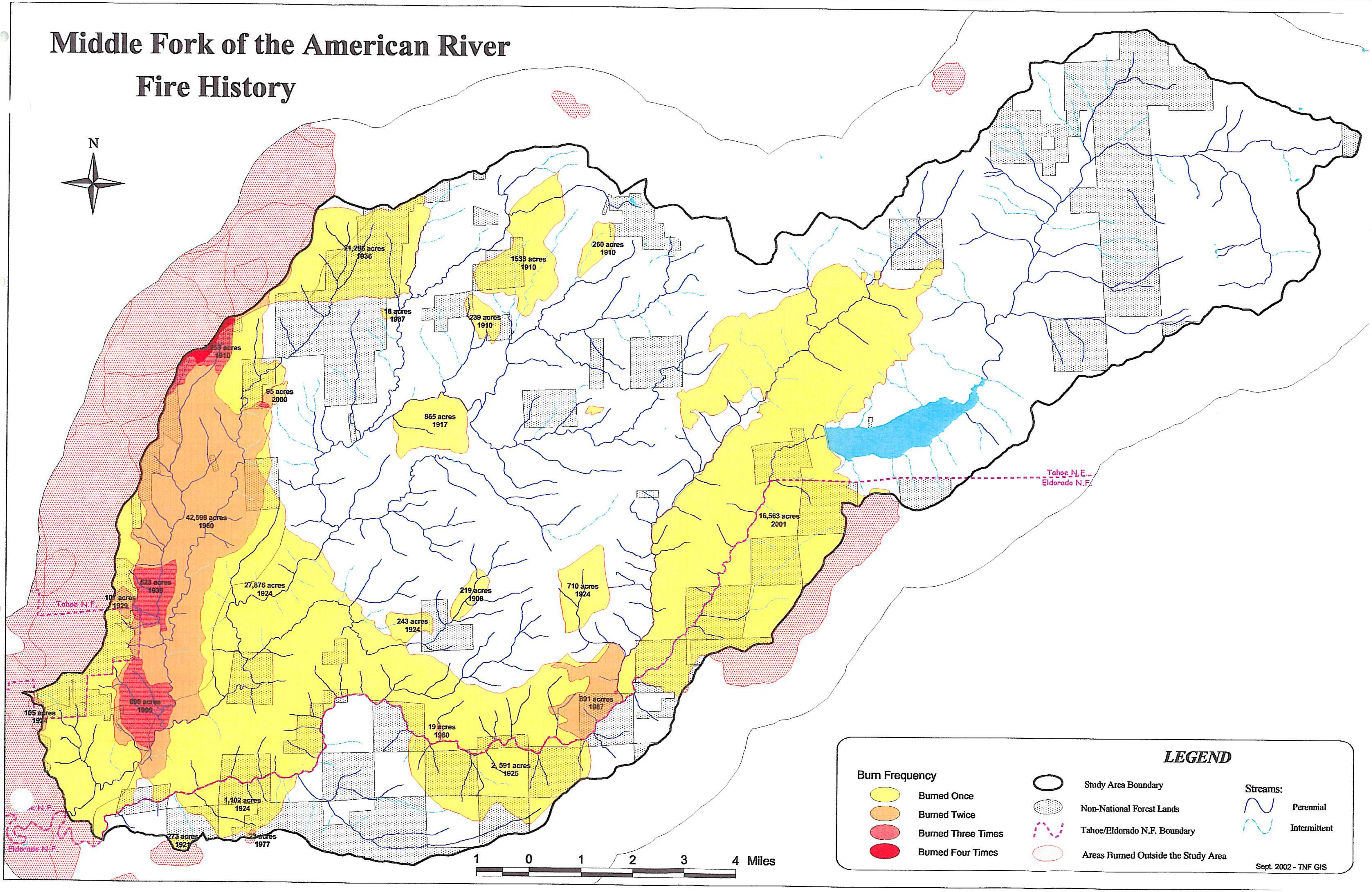
Middle Fork of the American River

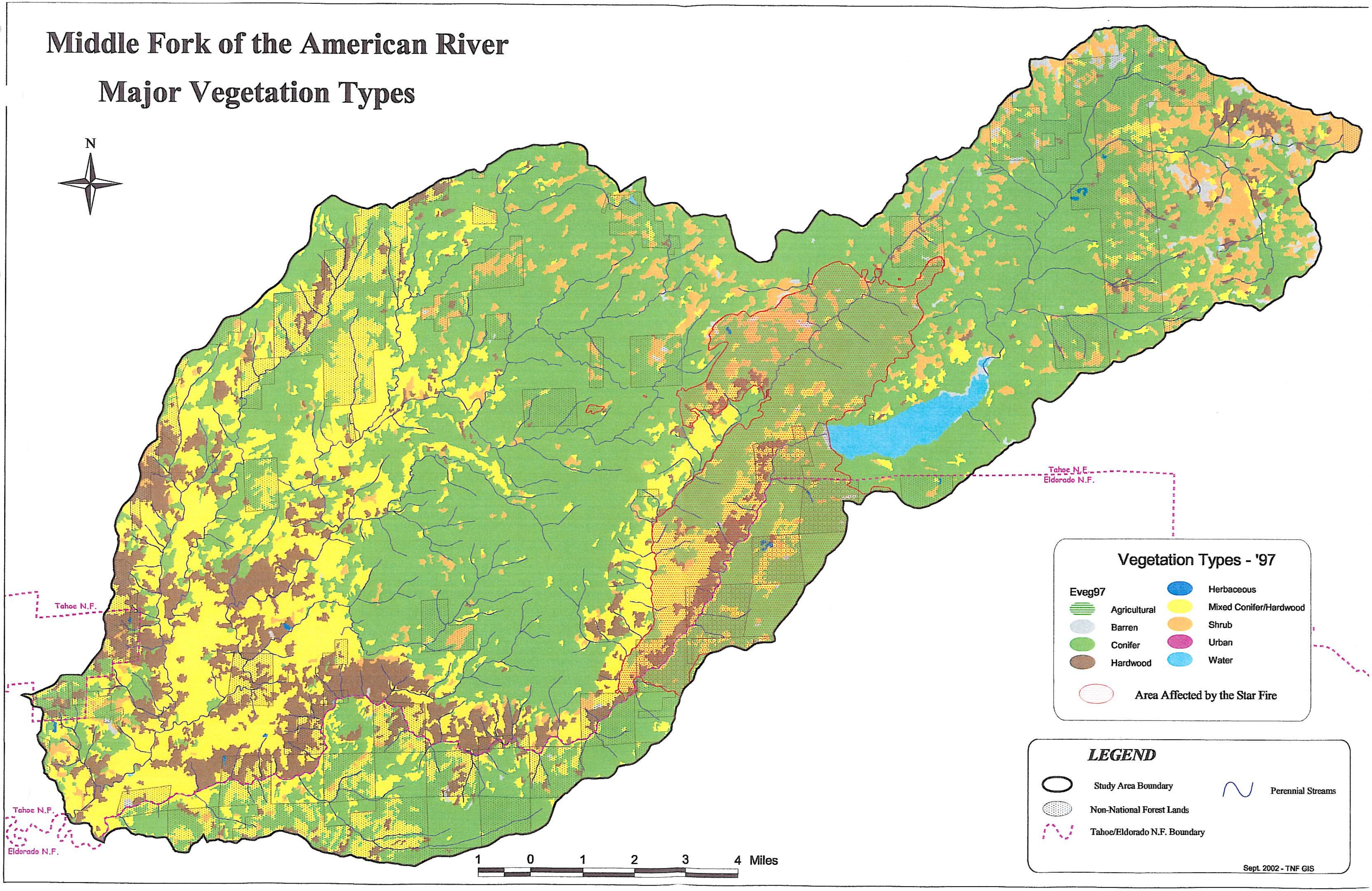
Bedrock Geology



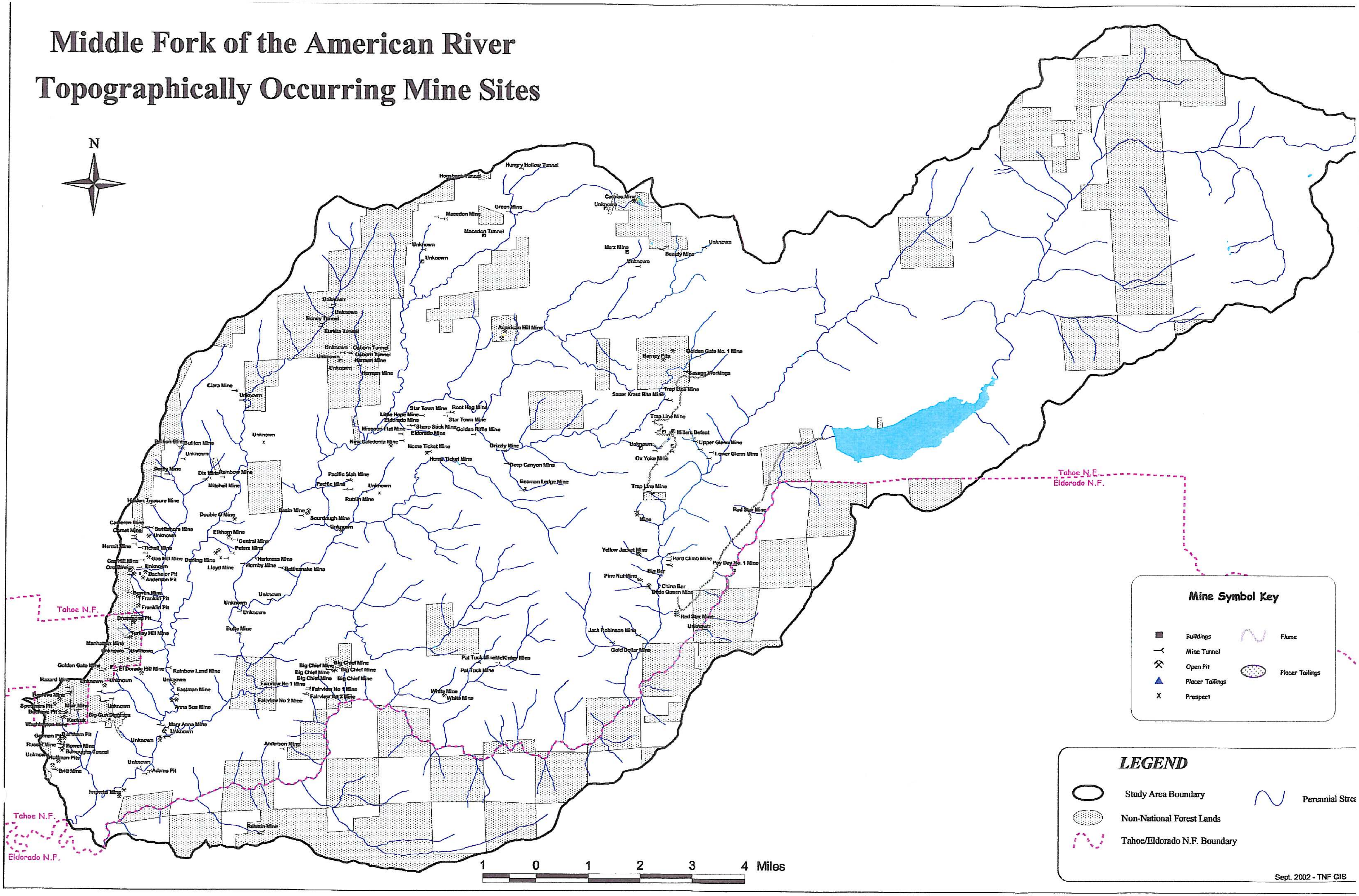
Middle Fork of the American River
Trails and Recreation Areas



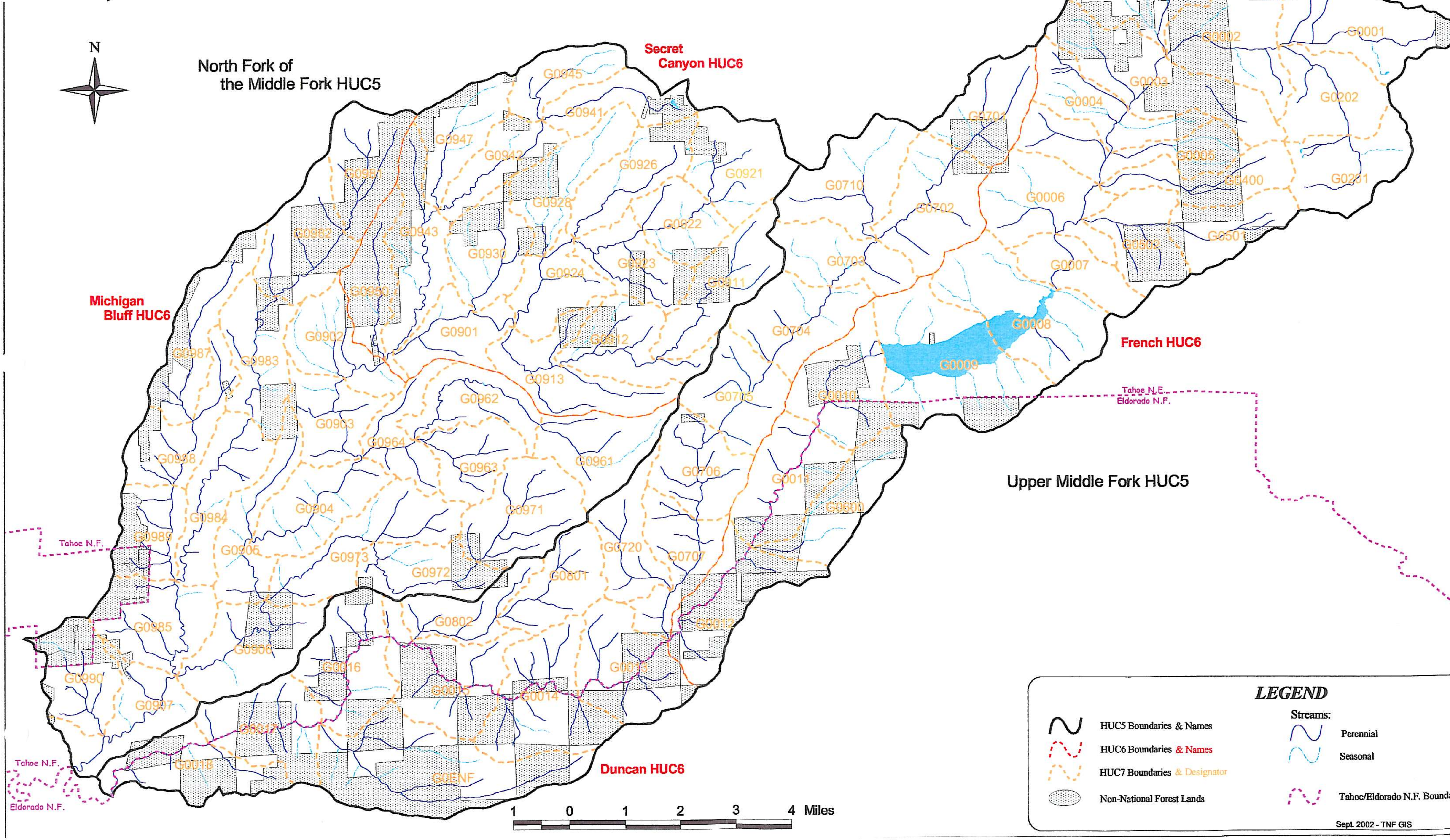

Middle Fork of the American River
Fire History
N
21,286 acres
1936
260 acres
1910
1533 acres
1910
18 acres
1987
239 acres
1910
95 acres
2000
865 acres
1917
42,598 acres
1960
27,876 acres
1924
523 acres
1939
Tahoe N.F.
Eldorado N.F.
16,563 acres
2001
219 acres
1908
710 acres
1924
243 acres
1924
891 acres
1987
19 acres
1960
2,591 acres
1925
1,102 acres
1924
105 acres
1924
273 acres
1921
23 acres
1977
1 0 1 2 3 4 Miles
LEGEND
Burn Frequency
Burned Once
Burned Twice
Burned Three Times
Burned Four Times
Study Area Boundary
Non-National Forest Lands
Tahoe/Eldorado N.F. Boundary
Areas Burned Outside the Study Area
Streams:
Perennial
Intermittent
Sept. 2002 - TNF GIS


Middle Fork of the American River
Major Vegetation Types
N
Tahoe N.F.
Eldorado N.F.
Tahoe N.F.
Tahoe N.F.
Eldorado N.F.
Vegetation Types - '97
Eveg97
Agricultural
Barren
Conifer
Hardwood
Herbaceous
Mixed Conifer/Hardwood
Shrub
Urban
Water
Area Affected by the Star Fire
LEGEND
Study Area Boundary
Non-National Forest Lands
Tahoe/Eldorado N.F. Boundary
Perennial Streams
1 0 1 2 3 4 Miles
Sept. 2002 - TNF GIS

Middle Fork of the American River
Topographically Occurring Mine Sites

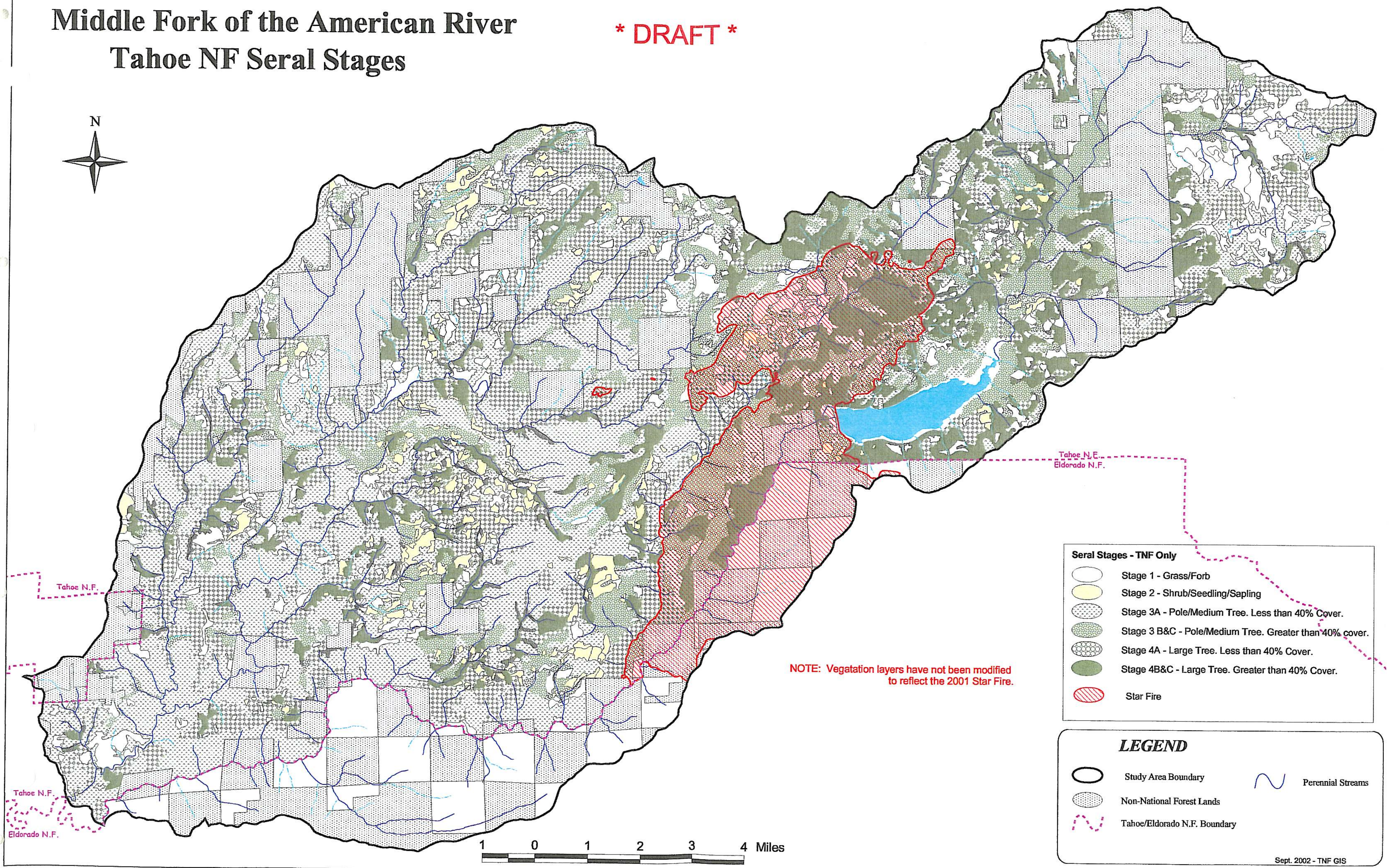


Middle Fork of the American River
HUC5, HUC6 and HUC7 Watershed Boundaries

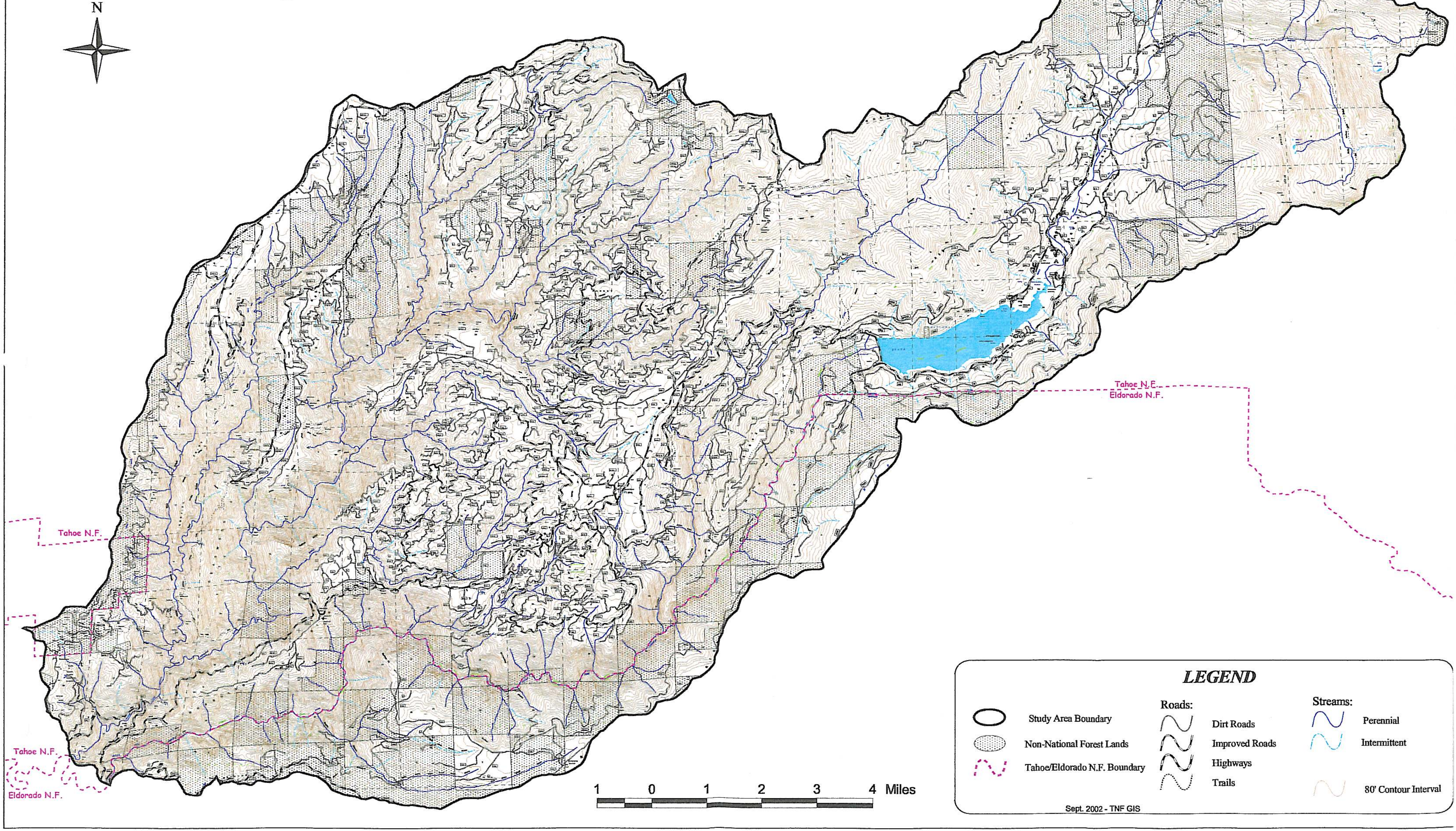


Middle Fork of the American River
Tahoe NF Seral Stages

* DRAFT *



Middle Fork of the American River
Base Map



APPENDIX A – CASEFILE

This appendix includes hydrological and meteorological data gathered from the US Geologic Service, Placer County Water Agency, USDA Forest Service and National Weather Service.

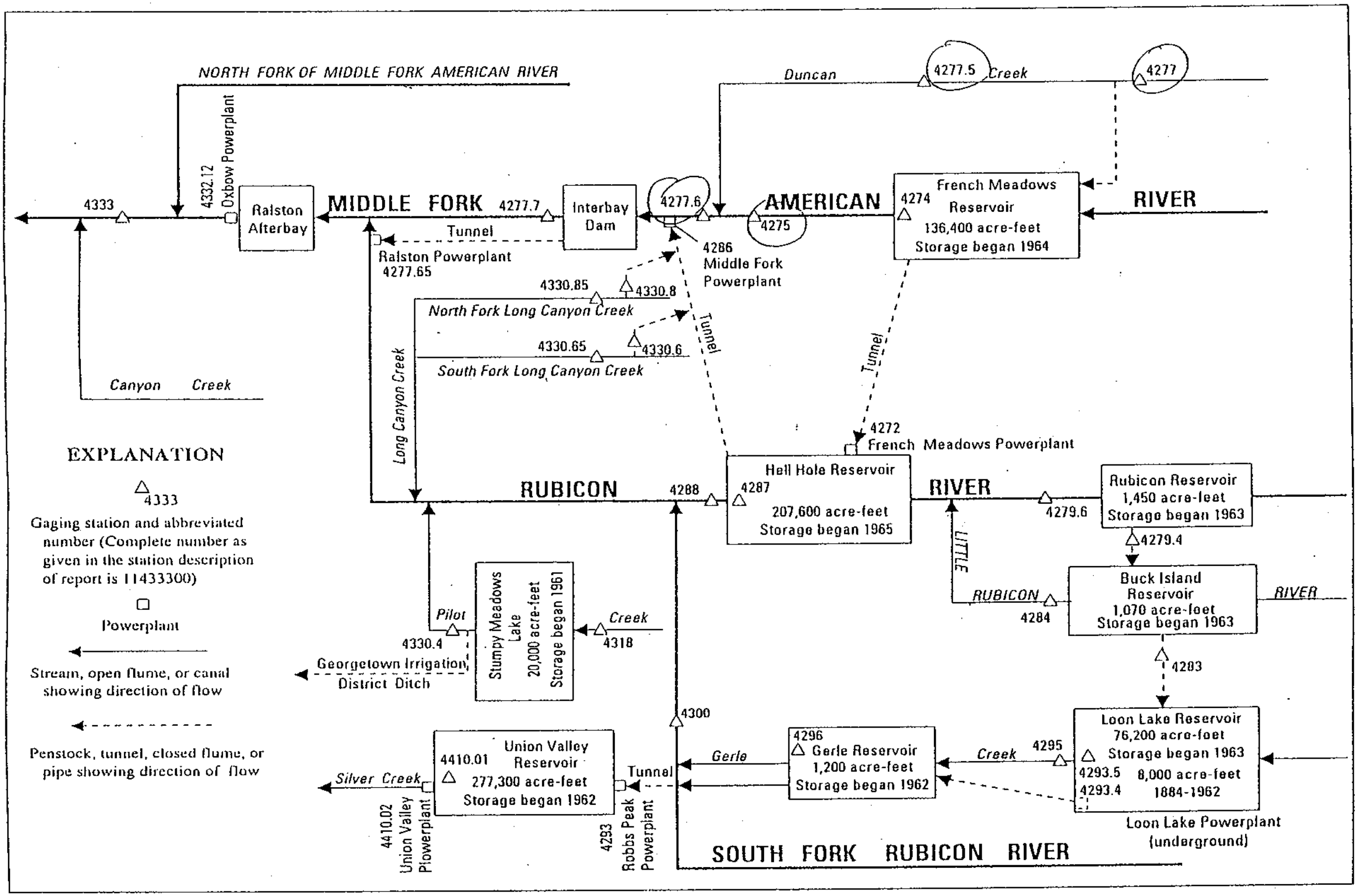


Figure 34. Diversions and storage in Middle Fork American and Rubicon River Basins.

Water Resources

Data Category: Surface Water   Geographic Area: United States   GO

Calendar Year Streamflow Statistics for the Nation

USGS 11427500 MF AMERICAN R A FRENCH MEADOWS CA

Available data for this site: Surface-water: Annual streamflow statistics   GO

Placer County, California
Hydrologic Unit Code 18020128
Latitude 39°06'35", Longitude 120°28'49" NAD27
Drainage area 47.90 square miles
Gage datum 4,920.00 feet above sea level NGVD29

Output formats

- HTML table of all data
- Tab-separated data
- Reselect output format

Year	Annual mean streamflow, in ft^3/s	Year	Annual mean streamflow, in ft^3/s	Year	Annual mean streamflow, in ft^3/s	Year	Annual mean streamflow, in ft^3/s
1952	231	1964	106	1976	5.69	1988	7.23
1953	171	1965	117	1977	3.81	1989	9.24
1954	115	1966	22.5	1978	8.08	1990	9.89
1955	170	1967	24.5	1979	8.22	1991	10.1
1956	194	1968	11.3	1980	9.09	1992	9.81
1957	130	1969	19.4	1981	10.0	1993	11.4
1958	209	1970	11.8	1982	74.6	1994	7.28
1959	76.2	1971	10.4	1983	37.9	1995	51.3
1960	115	1972	10.2	1984	13.1	1996	42.1
1961	69.1	1973	8.26	1985	9.38	1997	30.5
1962	157	1974	19.8	1986	53.2	1998	25.4
1963	195	1975	9.32	1987	9.69	1999	50.2

Questions about data h2oteam@usgs.gov
Feedback on this websitegs-w_support_nwisweb@usgs.gov
Surface Water data for USA: Calendar Year Streamflow Statistics
http://waterdata.usgs.gov/nwis/annual/calendar_year?

Return to top of page

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0.67 0.64

Water Resources

Data Category: Surface Water
Geographic Area: United States
GO

Peak Streamflow for the Nation

USGS 11427500 MF AMERICAN R A FRENCH MEADOWS CA

Available data for this site: Station home page — GO

Placer County, California
Hydrologic Unit Code 18020128
Latitude 39°06'35", Longitude 120°28'49" NAD27
Drainage area 47.90 square miles
Gage datum 4,920.00 feet above sea level NGVD29

Output formats
- Table
- Graph
- Tab-separated file
- WATSTORE formatted file
- Reselect output format

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1952	May 27, 1952		2,100
1953	Apr. 27, 1953		3,310
1954	Mar. 9, 1954		3,240
1955	May 20, 1955		1,040
1956	Dec. 23, 1955		16,300
1957	May 18, 1957		3,510
1958	Feb. 24, 1958		3,010
1959	Feb. 16, 1959		835
1960	Feb. 8, 1960		3,080
1961	Feb. 9, 1961	6.11	736
1962	Apr. 28, 1962	6.84	1,190
1963	Jan. 31, 1963	14.20	21,500
1964	Nov. 14, 1963	8.92	2,260
1965	Apr. 30, 1965	7.68	1,310[6,D]
1966	Oct. 22, 1965	6.22	418[6]
1967	Jun. 27, 1967	7.01	846[6]
1968	Feb. 20, 1968	4.92	56.0[6]
1969	Jun. 14, 1969	6.37	518[6]

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1976	Aug. 24, 1976	4.44	27.0[6]
1977	Sep. 1, 1977	4.40	24.0[6]
1978	Jan. 16, 1978	4.67	51.0[6]
1979	Jan. 11, 1979	4.70	56.0[6]
1980	Jan. 13, 1980	5.52	161[6]
1981	Mar. 25, 1981	4.63	30.0[6]
1982	Feb. 17, 1982	7.38	1,100[6]
1983	Jun. 12, 1983	6.90	792[6]
1984	Jan. 1, 1984	5.65	210[6]
1985	May 15, 1985	5.18	93.0[6]
1986	Mar. 8, 1986	10.40	2,870[6]
1987	Feb. 13, 1987	5.25	30.0[6]
1988	Sep. 12, 1988	5.13	25.0[6]
1989	Mar. 8, 1989	5.43	42.0[6]
1990	Nov. 25, 1989	4.98	18.0[6]
1991	Mar. 4, 1991	5.81	77.0[6]
1992	Feb. 20, 1992	5.01	

1970	Jan. 21, 1970	5.34	143[6]
1971	Mar. 26, 1971	4.92	69.0[6]
1972	May 22, 1972	5.27	132[6]
1973	Jan. 16, 1973	4.91	68.0[6]
1974	Jun. 2, 1974	6.89	794[6]
1975	Mar. 25, 1975	4.70	57.0[6]

			19.0[6]
1993	Mar. 17, 1993	5.64	60.0[6]
1994	Oct. 4, 1993	5.69	64.0[6]
1995	Jun. 27, 1995	8.68	1,290[6]
1996	May 16, 1996	11.61	6,050[6]
1997	Jan. 2, 1997	11.17	4,140[6]
1998	Jun. 10, 1998	9.30	1,570[6]
1999	Apr. 30, 1999	8.42	672[6]
2000	Feb. 14, 2000	6.81	105[6]

Peak Streamflow Qualification Codes.

- 6 -- Discharge affected by Regulation or Diversion
- D -- Base Discharge changed during this year

```
#
#
# US Geological Survey
#
# This file contains water quality sample data
# for stations in the water quality database.
#
# This information includes the following fields:
#  agency_cd     - Agency Code
#  site_no       - USGS site number
#  sample_dt     - Date of sample
#  sample_tm     - Time of sample
#  parameter_cd  - Parameter Code
#  result_va     - Value
#  remark_cd     - Remark Code
#  qa_cd         - Quality Assurance Code
#  qw_method_cd  - Quality Assurance Method Code
#  result_sg     - Results significant figures
#  medium_cd     - Sample medium code
#
# Data for the following sites are included:
#  USGS 11427500 MF AMERICAN R A FRENCH MEADOWS CA
#
# The following parameters are included:
#  00010  - TEMPERATURE, WATER (DEG. C)
#  00061  - DISCHARGE, INSTANTANEOUS, CUBIC FEET PER SECOND
#  00095  - SPECIFIC CONDUCTANCE (MICROSIEMENS/CM AT 25 DEG. C)
#  00300  - OXYGEN DISSOLVED (MG/L)
#  00400  - PH, WATER, WHOLE, FIELD, STANDARD UNITS
#  00900  - HARDNESS TOTAL (MG/L AS CACO3)
#  00902  - NONCARBONATE HARDNESS WATER WHOLE TOTAL, FIELD, (MG/L AS CACO3)
#  70300  - SOLIDS, RESIDUE ON EVAPORATION AT 180 DEG C, DISSOLVED (MG/L)
#  70301  - SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)
#  70302  - SOLIDS, DISSOLVED (TONS PER DAY)
#  70303  - SOLIDS, DISSOLVED (TONS PER ACRE-FOOT)
#
# Description of remark_cd column
# <  - Actual value is known to be less than the value shown.
# >  - Actual value is known to be greater than the value shown.
# A  - Average value
# E  - Estimated value
# M  - Presence of material verified but not quantified
# N  - Presumptive evidence of presence of material
# S  - Most probable value
```

U - Analyzed for, not detected
V - Value affected by contamination
#
#

agency_cd	site_no	sample_dt	sample_tm	parameter_cd	result_va	remark_cd	qa_cd	qw
5s	15s	10d	4d	5s	12n	1s	1s	1s 1s
USGS	11427500	1979-06-04	13:00	00010	12.0	3	3	9
USGS	11427500	1979-06-04	13:00	00061	6.8	3	2	9
USGS	11427500	1979-06-04	13:00	00095	30	3	2	9
USGS	11427500	1979-06-04	13:00	00300	8.9	3	2	9
USGS	11427500	1979-06-04	13:00	00400	7.7	3	2	9
USGS	11427500	1979-06-04	13:00	00900	8	3	1	9
USGS	11427500	1979-06-04	13:00	00902	0	3	0	9
USGS	11427500	1979-06-04	13:00	70300	29	3	2	9
USGS	11427500	1979-06-04	13:00	70301	22	3	2	9
USGS	11427500	1979-06-04	13:00	70302	.53	3	2	9
USGS	11427500	1979-06-04	13:00	70303	.04	3	2	9
USGS	11427500	1979-07-31	10:47	00010	9.0	3	2	9
USGS	11427500	1979-07-31	10:47	00061	7.1	3	2	9
USGS	11427500	1979-07-31	10:47	00095	32	3	2	9
USGS	11427500	1979-07-31	10:47	00300	9.6	3	2	9
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USGS	11427500	1979-07-31	10:47	00900	11	3	2	9
USGS	11427500	1979-07-31	10:47	00902	0	3	0	9
USGS	11427500	1979-07-31	10:47	70300	25	3	2	9
USGS	11427500	1979-07-31	10:47	70301	30	3	2	9
USGS	11427500	1979-07-31	10:47	70302	.48	3	2	9
USGS	11427500	1979-07-31	10:47	70303	.03	3	2	9
USGS	11427500	1979-10-26	11:00	00010	7.0	3	2	9
USGS	11427500	1979-10-26	11:00	00061	8.0	3	2	9
USGS	11427500	1979-10-26	11:00	00095	30	3	2	9
USGS	11427500	1979-10-26	11:00	00300	10.3	3	3	9
USGS	11427500	1979-10-26	11:00	00400	7.1	3	2	9
USGS	11427500	1979-10-26	11:00	00900	12	3	2	9
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Water Resources

Data Category: Surface Water

Geographic Area: United States

GO

Monthly Streamflow Statistics for the Nation

USGS 11427500 MF AMERICAN R A FRENCH MEADOWS CA

Available data for this site: Surface-water: Monthly streamflow statistics — GO

Placer County, California
Hydrologic Unit Code 18020128
Latitude 39°06'35", Longitude 120°28'49" NAD27
Drainage area 47.90 square miles
Gage datum 4,920.00 feet above sea level NGVD29

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- HTML table of all data
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YEAR	Monthly mean streamflow, in ft³/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1951										7.68	32.6	63.8
1952	40.5	96.1	91.9	458	1,034	775	232	25.3	5.06	2.73	4.31	11.6
1953	152	91.6	132	467	465	543	143	9.03	4.13	2.45	19.2	22.6
1954	33.4	82.3	287	491	353	79.0	10.0	2.06	.94	.74	8.15	29.3
1955	28.1	40.1	88.6	187	526	237	20.4	2.88	1.04	.73	4.30	882
1956	377	99.7	153	399	768	405	67.7	6.73	1.65	6.53	20.6	23.3
1957	18.4	190	276	301	472	216	20.9	3.91	1.18	3.90	19.3	39.9
1958	36.2	259	114	289	1,110	600	85.6	9.15	3.02	1.95	3.48	5.22
1959	71.0	76.6	154	322	210	69.7	6.22	1.57	.93	1.95	1.60	1.76
1960	5.57	134	367	412	306	130	7.75	1.84	.69	.40	3.53	13.0

1961	12.6	99.3	82.6	238	260	110	7.86	1.58	.64	.78	4.26	16.5
1962	14.7	82.8	55.2	537	496	259	25.8	4.01	1.59	222	36.8	146
1963	371	561	82.8	239	691	223	28.1	5.67	3.74	5.87	106	54.0
1964	42.2	57.0	81.2	286	452	213	26.2	4.84	2.74	1.67	19.8	83.3
1965	10.1	10.3	10.1	248	518	54.8	54.0	15.0	136	266	42.7	22.3
1966	13.0	11.2	14.2	13.3	69.5	94.4	8.56	8.70	8.93	8.28	8.05	11.7
1967	11.3	11.6	13.3	11.6	15.6	157	33.4	8.42	7.57	8.03	8.93	9.09
1968	9.53	14.9	13.6	13.3	12.1	12.4	11.5	10.1	9.57	9.41	10.3	9.63
1969	21.3	11.1	10.6	18.8	18.4	94.4	9.18	9.83	9.82	8.70	8.72	12.5
1970	25.7	13.0	12.5	10.1	9.77	11.0	11.5	10.7	9.47	8.17	9.18	9.80
1971	9.96	11.4	13.9	14.6	14.1	10.9	10.1	9.99	7.99	7.00	7.22	8.31
1972	9.50	9.58	14.7	12.5	10.7	9.82	9.84	10.0	9.90	7.74	7.85	9.85
1973	12.2	8.76	8.74	11.8	6.35	7.07	6.68	6.29	5.89	5.81	9.84	9.86
1974	14.0	8.19	16.0	13.6	12.4	139	7.30	5.92	5.62	5.84	5.68	5.70
1975	6.86	7.51	10.2	8.96	16.3	12.5	11.9	6.62	5.18	6.09	9.83	9.69
1976	9.46	8.84	8.88	9.44	3.95	3.72	3.80	3.84	3.79	4.52	4.29	3.91
1977	4.37	4.52	4.40	4.47	4.20	3.68	2.98	2.76	2.70	2.75	3.16	5.71
1978	9.81	7.98	12.0	8.60	5.15	7.52	7.89	7.50	7.83	7.70	7.54	7.43
1979	8.62	8.63	10.3	11.6	7.78	6.18	6.72	6.86	7.54	8.09	7.90	8.43
1980	20.4	9.61	6.87	8.74	7.56	7.76	7.55	7.92	8.19	8.21	7.65	8.49
1981	8.69	9.45	8.87	7.79	8.30	7.43	7.37	7.80	7.70	7.72	13.4	25.7
1982	23.5	201	23.5	181	274	149	8.52	8.08	8.26	8.87	10.8	13.8
1983	12.8	14.4	19.3	15.9	19.2	171	136	8.45	8.10	8.30	17.0	23.5
1984	53.6	11.2	10.4	9.11	9.25	10.6	8.25	8.56	8.23	8.32	9.95	8.77
1985	8.49	9.08	10.3	12.0	9.19	8.76	8.48	8.63	8.60	9.65	9.16	10.2
1986	14.0	90.1	375	31.7	33.8	37.2	9.46	8.91	9.12	8.71	11.0	9.17
1987	9.26	10.8	11.7	10.4	9.52	9.05	9.37	9.12	9.48	8.87	9.45	9.38
1988	9.92	10.0	9.67	9.96	10.2	5.56	5.02	4.95	5.18	4.90	5.99	5.52

1989	5.63	6.23	14.8	10.9	7.42	9.36	9.29	9.23	9.54	9.58	9.62	9.19
1990	9.64	9.65	12.1	9.99	9.98	9.82	9.30	9.21	9.73	9.66	9.81	9.79
1991	9.66	9.67	11.5	12.5	9.39	9.89	9.64	9.85	9.72	9.90	9.93	9.73
1992	9.50	11.0	9.53	9.43	9.49	9.73	9.28	9.65	9.80	9.89	9.85	10.6
1993	13.7	13.5	18.3	11.6	10.5	10.5	9.87	9.78	9.97	10.0	9.18	9.34
1994	9.35	9.74	11.1	10.1	9.52	4.80	4.83	5.15	5.16	5.35	5.84	6.53
1995	14.0	7.44	17.7	14.0	184	272	57.6	9.87	9.38	8.91	8.80	10.8
1996	13.0	21.2	14.4	12.7	345	18.2	11.4	11.0	9.87	9.27	10.8	23.3
1997	249	11.6	10.5	10.1	10.6	10.2	9.97	9.52	9.72	9.74	9.83	10.1
1998	16.3	13.3	16.0	14.4	15.7	138	41.8	10.2	10.1	9.76	9.99	10.7
1999	15.2	18.8	15.9	24.5	445	14.7	9.94	10.0	9.91	10.9	9.85	9.96
2000	13.0	16.7	14.5	11.8	10.8	10.9	9.55	9.80	9.93			
Mean of monthly streamflows	39.1	51.7	56.7	112	190	110	25.9	7.89	9.20	16.3	12.9	36.1

11427400 FRENCH MEADOWS RESERVOIR NEAR FORESTHILL, CA

LOCATION.—Lat 39°06'32", long 120°25'49", in SW 1/4 NE 1/4 sec.32, T.15 N., R.14 E., Placer County, Hydrologic Unit 18020128, Tahoe National Forest, on left bank, 2.2 mi upstream from dam, on Middle Fork American River, 6.9 mi upstream from Chipmunk Creek, and 21 mi northeast of Foresthill.

DRAINAGE AREA.—47.0 mi^2.

PERIOD OF RECORD.—December 1964 to current year.

GAGE.—Water-stage recorder. Datum of gage is sea level (levels by Placer County Water Agency).

REMARKS.—Reservoir is formed by rockfill dam with earth core. Storage began Dec. 21, 1964. Usable capacity, 125,601 acre-ft between elevations 5,125 ft, minimum operating level, and 5,263 ft, top of radial gates. Dead storage, 10,804 acre-ft. Reservoir is used to store water for hydroelectric power. Up to 400 ft^3/s diverted from Duncan Creek through a tunnel to reservoir. Water is released through a tunnel to French Meadows Powerplant (station 11427200) at Hell Hole Reservoir (station 11428700) on the Rubicon River; releases began Dec. 13, 1965. See schematic diagram of Middle Fork American and Rubicon River Basins.

COOPERATION.—Records provided by Placer County Water Agency, under general supervision of the U.S. Geological Survey, in connection with a Federal Energy Regulatory Commission project.

EXTREMES FOR PERIOD OF RECORD.—Maximum contents, 137,700 acre-ft, May 19, 1966, elevation, 5,263.9 ft; minimum since reservoir first filled, 28,500 acre-ft, Oct. 21–24, 1991, elevation, 5,157.6 ft.

EXTREMES FOR CURRENT YEAR.—Maximum contents, 128,700 acre-ft, May 30, elevation, 5,257.5 ft; minimum, 69,300 acre-ft, Jan. 14, elevation, 5,207.0 ft.

Capacity table (elevation, in feet, and contents, in acre-feet)
(Based on a survey by Placer County Water Agency in 1965)

5,125	10,800	5,200	62,400
5,130	13,100	5,230	94,100
5,150	23,700	5,270	146,500
5,170	37,100		

RESERVOIR STORAGE (ACRE-FEET), WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000
DAILY OBSERVATION AT 2400 HOURS

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	92500	75600	76200	71400	75700	82000	83100	111000	128200	120800	109800	92100
2	92000	75600	76200	71300	75600	81900	83600	111900	128200	120500	109200	91700
3	92000	75600	76200	71200	75600	81700	84400	112900	127900	120500	108600	91300
4	92000	75600	76200	71000	75700	81800	85400	113800	127600	120300	108000	91000
5	91900	75600	76200	70900	75900	81900	86600	114700	127500	120000	107500	90300
6	91900	75500	76200	70700	76100	81500	87400	115700	127200	119700	107100	89600
7	91900	75600	76200	70600	76000	81300	88000	117100	127000	119500	106500	88900
8	91700	75700	76200	70400	75700	81100	89200	120100	126800	119300	106000	88500
9	91000	75700	76300	70300	75600	80900	90300	121600	126700	119200	105400	87900
10	90300	75600	76200	70100	75800	80600	91200	122800	126300	118800	104900	87500
11	89600	75600	76200	70200	76000	80600	92100	123300	126000	118500	104300	87000
12	88900	75600	76200	70000	76200	80600	93000	123600	125600	118300	103900	86500
13	88300	75600	76300	69600	77200	80500	95500	123600	125300	118200	103600	85900
14	87500	75600	76300	69300	80900	80400	96600	123700	125100	117900	103000	85500
15	86700	75600	75900	69400	82100	80300	97800	123800	124900	117500	102400	84900
16	85900	75700	75700	69500	82700	80100	98800	124000	124700	117200	101700	84600
17	85300	75700	75400	69500	82600	80000	100000	124300	124500	116900	101100	84300
18	84500	75700	75100	70300	82700	79800	100700	124300	124500	116500	100500	83600
19	83700	75900	74700	71200	82600	80400	101000	124500	124400	116100	100000	83100
20	83100	76000	74400	72500	82500	80100	101400	124800	124100	115700	99200	82400
21	82300	76000	74000	73000	82600	80500	102200	125300	124000	115300	98500	82100
22	81500	76000	73700	73100	82700	80600	103200	125900	123600	114800	97800	81400
23	80800	76000	73400	73100	82700	80700	104000	126400	123300	114400	97100	81400
24	80000	76000	73100	74900	82400	80600	104500	127200	123200	114000	96500	81300
25	79300	76000	72900	76000	82100	81000	105300	127600	122900	113500	95800	81000
26	78500	76000	72800	76400	82200	81300	105900	127900	122500	113000	95200	80600
27	77900	76000	72500	76600	82600	81700	107000	127900	122100	112500	94900	80000
28	77500	76000	72200	76500	82300	82000	108000	128100	121700	112000	94300	79600
29	76700	76000	72000	76300	82200	82200	109000	128500	121300	111400	93700	79100
30	76000	76100	71800	76300	---	82400	110000	128600	121000	111000	93200	79100
31	75600	---	71600	75900	---	82600	---	128500	---	110300	92600	---
MAX	92500	76100	76300	76600	82700	82600	110000	128600	128200	120800	109800	92100
MIN	75600	75500	71600	69300	75600	79800	83100	111000	121000	110300	92600	79100
a	5213.2	5213.7	5209.3	5213.5	5219.4	5219.8	5243.2	5257.3	5251.8	5243.5	5228.7	5216.5
b	-17400	+500	-4500	+4300	+6300	+400	+27400	+18500	-7500	-10700	-17700	-13500

CAL YR 1999 b +1300
WTR YR 2000 b -13900

a Elevation, in feet, at end of month.
b Change in contents, in acre-feet.

11427500 MIDDLE FORK AMERICAN RIVER AT FRENCH MEADOWS, CA

LOCATION.—Lat 39°06'35", long 120°28'49", in SW 1/4 NW 1/4 sec.36, T.15 N., R.13 E., Placer County, Hydrologic Unit 18020128, Tahoe National Forest, on left bank, 0.6 mi downstream from French Meadows Dam, 4.1 mi upstream from Chipmunk Creek, and 14 mi south of Cisco.

DRAINAGE AREA.—47.9 mi^2.

PERIOD OF RECORD.—October 1951 to current year.

REVISED RECORDS.—WSP 1445: 1953–54. WSP 1931: Drainage area.

GAGE.—Water-stage recorder. Elevation of gage is 4,920 ft above sea level, from topographic map. Prior to Oct. 1, 1962, at site 0.8 mi upstream at different datum.

REMARKS.—Considerable regulation by French Meadows Reservoir (station 11427400) 0.6 mi upstream beginning December 1964. Water diverted into basin from Duncan Creek to French Meadows Reservoir since December 1964. Water diverted out of basin from French Meadows Reservoir through French Meadows Powerplant (station 11427200) to Hell Hole Reservoir (station 11428700) since December 1965. See schematic diagram of Middle Fork American and Rubicon River Basins.

COOPERATION.—Records provided by Placer County Water Agency, under general supervision of the U.S. Geological Survey, in connection with a Federal Energy Regulatory Commission project.

EXTREMES FOR PERIOD OF RECORD.—Maximum discharge, 21,500 ft^3/s, Jan. 31, 1963, gage height, 14.20 ft, from rating curve extended above 1,100 ft^3/s on basis of peak flow at former site; minimum, 0.3 ft^3/s, Oct. 4, 5, 21–25, 1960, Oct. 5, 6, 1961. Maximum discharge since construction of French Meadows Dam in 1964, 6,050 ft^3/s, May 16, 1996, gage height, 11.61 ft, from flow over spillway of French Meadows Reservoir; minimum daily, 0.8 ft^3/s, Oct. 22–25, 1964.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000

DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.7	11	10	9.9	13	14	14	9.5	11	9.7	9.9	9.9
2	10	10	10	9.9	13	14	14	9.5	11	9.7	9.9	10
3	11	10	10	9.9	13	14	14	9.3	11	9.7	9.9	9.7
4	11	10	10	9.9	13	14	15	9.1	11	9.7	9.9	9.5
5	11	10	10	9.9	13	15	14	9.3	11	9.7	9.9	9.5
6	11	10	10	9.9	13	14	13	9.8	11	9.7	9.9	9.5
7	11	11	10	9.9	13	14	11	12	11	9.7	9.9	9.5
8	11	11	10	9.9	13	13	11	15	12	9.7	10	9.5
9	11	11	10	9.9	13	13	11	12	11	9.7	9.9	9.5
10	11	10	10	9.9	15	13	11	12	11	9.6	9.9	9.5
11	11	10	9.9	11	14	13	10	11	11	9.5	9.9	9.5
12	11	10	10	10	14	14	10	11	11	9.5	9.9	10
13	11	10	10	10	24	14	14	11	11	9.5	9.9	11
14	11	10	10	9.9	60	14	13	11	11	9.5	9.9	11
15	11	11	10	11	23	15	12	11	11	9.5	9.8	11
16	11	10	10	11	19	15	12	12	11	9.5	9.7	11
17	11	8.8	10	11	17	15	13	12	11	9.5	9.7	11
18	11	8.4	10	16	16	15	13	11	11	9.3	9.7	11
19	11	9.0	10	14	15	16	12	11	11	9.3	9.7	10
20	11	9.1	10	15	15	16	12	11	11	9.3	9.7	9.9
21	11	8.9	9.9	13	15	15	12	11	11	9.3	9.7	9.9
22	11	8.7	9.9	12	15	15	11	11	11	9.3	9.7	9.9
23	11	9.3	9.9	13	14	15	11	11	11	9.3	9.7	9.7
24	11	9.7	9.9	40	14	15	11	11	11	9.3	9.7	9.7
25	11	9.7	9.9	24	13	15	10	10	11	9.4	9.7	9.7
26	11	9.7	9.9	17	14	15	10	10	11	9.5	9.7	9.6
27	11	9.7	9.9	14	19	16	10	10	11	9.5	9.7	9.5
28	11	9.7	9.9	13	16	15	9.9	10	10	9.6	9.7	9.5
29	11	9.7	9.9	13	15	15	9.9	10	9.7	9.7	9.7	9.5
30	11	10	9.9	14	---	14	9.7	9.9	9.7	9.9	9.7	9.5
31	11	---	9.9	13	---	14	---	9.9	---	9.9	9.7	---
TOTAL	338.7	295.4	308.8	403.9	484	449	353.5	333.3	327.4	296.0	303.7	298.0
MEAN	10.9	9.85	9.96	13.0	16.7	14.5	11.8	10.8	10.9	9.55	9.80	9.93
MAX	11	11	10	40	60	16	15	15	12	9.9	10	11
MIN	9.7	8.4	9.9	9.9	13	13	9.7	9.1	9.7	9.3	9.7	9.5
AC-FT	672	586	613	801	960	891	701	661	649	587	602	591
a	17320	.00	4500	6770	10210	14260	6910	14310	14510	10300	16870	12390

a Diversion, in acre-feet, from French Meadows Reservoir to Hell Hole Reservoir through French Meadows Powerplant, provided by Placer County Water Agency.

11427500 MIDDLE FORK AMERICAN RIVER AT FRENCH MEADOWS, CA—Continued

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1952 - 1964, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	19.8	20.3	101	92.5	143	151	356	550	297	52.4	6.04	2.10
MAX	222	106	882	377	561	367	537	1110	775	232	25.3	5.06
(WY)	1963	1964	1956	1956	1963	1960	1962	1958	1952	1952	1952	1952
MIN	.40	1.60	1.76	5.57	40.1	55.2	187	210	69.7	6.22	1.57	.64
(WY)	1961	1960	1960	1960	1955	1962	1955	1959	1959	1959	1959	1961

SUMMARY STATISTICS	WATER YEARS 1952 - 1964	
ANNUAL MEAN	149	
HIGHEST ANNUAL MEAN	265	1956
LOWEST ANNUAL MEAN	68.7	1961
HIGHEST DAILY MEAN	11300	Dec 23 1955
LOWEST DAILY MEAN	.30	Oct 22 1960
ANNUAL SEVEN-DAY MINIMUM	.34	Oct 19 1960
INSTANTANEOUS PEAK FLOW	21500	Jan 31 1963
INSTANTANEOUS PEAK STAGE	14.20	Jan 31 1963
ANNUAL RUNOFF (AC-FT)	108000	
10 PERCENT EXCEEDS	446	
50 PERCENT EXCEEDS	38	
90 PERCENT EXCEEDS	1.5	

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 2000, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	15.1	10.2	12.8	19.9	18.3	22.6	23.6	60.4	43.0	16.3	8.56	11.8
MAX	266	42.7	83.3	249	200	375	248	518	272	136	15.0	136
(WY)	1966	1966	1965	1997	1982	1986	1965	1965	1995	1983	1965	1965
MIN	1.67	3.16	3.91	4.37	4.53	4.40	4.47	3.95	3.68	2.98	2.76	2.70
(WY)	1965	1978	1977	1977	1977	1977	1977	1976	1977	1977	1977	1977

SUMMARY STATISTICS	FOR 1999 CALENDAR YEAR		FOR 2000 WATER YEAR		WATER YEARS 1965 - 2000	
ANNUAL TOTAL	18314.3		4191.7			
ANNUAL MEAN	50.2		11.5		21.9	
HIGHEST ANNUAL MEAN					97.3	1965
LOWEST ANNUAL MEAN					3.90	1977
HIGHEST DAILY MEAN	515	May 14	60	Feb 14	3430	May 16 1996
LOWEST DAILY MEAN	8.4	Nov 18	8.4	Nov 18	.80	Oct 22 1964
ANNUAL SEVEN-DAY MINIMUM	8.9	Nov 17	8.9	Nov 17	.84	Oct 21 1964
INSTANTANEOUS PEAK FLOW			105	Feb 14	6050	May 16 1996
INSTANTANEOUS PEAK STAGE			5.81	Feb 14	11.61	May 16 1996
ANNUAL RUNOFF (AC-FT)	36330		8310		15870	
TOTAL DIVERSION (AC-FT)a	120200		128300			
10 PERCENT EXCEEDS	36		15		15	
50 PERCENT EXCEEDS	10		11		9.7	
90 PERCENT EXCEEDS	9.9		9.5		5.8	

a Diversion, in acre-feet, from French Meadows Reservoir to Hell Hole Reservoir through French Meadows Powerplant, provided by Placer County Water Agency.

11427700 DUNCAN CREEK NEAR FRENCH MEADOWS, CA

LOCATION.—Lat 39°08'09", long 120°28'39", in NE 1/4 NW 1/4 sec.24, T.15 N., R.13 E., Placer County, Hydrologic Unit 18020128, Tahoe National Forest, on left bank, 0.2 mi upstream from diversion dam, 0.5 mi downstream from Little Duncan Creek, 2 mi northwest of French Meadows, and 20 mi northeast of Foresthill.

DRAINAGE AREA.—9.94 mi^2.

PERIOD OF RECORD.—August 1960 to current year.

GAGE.—Water-stage recorder. Elevation of gage is 5,270 ft above sea level, from topographic map. Prior to Sept. 3, 1965, at site 150 ft upstream at datum 9.56 ft higher.

REMARKS.—No regulation or diversion upstream from station. See schematic diagram of Middle Fork American and Rubicon River Basins.

COOPERATION.—Records provided by Placer County Water Agency, under general supervision of the U.S. Geological Survey, in connection with a Federal Energy Regulatory Commission project.

EXTREMES FOR PERIOD OF RECORD.—Maximum discharge, 3,650 ft^3/s, Dec. 22, 1964, gage height, 10.6 ft, from floodmarks, from rating curve extended above 400 ft^3/s on basis of computation of flow over diversion dam; maximum gage height, 10.95, Jan. 1, 1997 (backwater from debris dam); minimum daily, 0.10 ft^3/s, several days during July and August 1977.

EXTREMES FOR CURRENT YEAR.—Peak discharges greater than base discharge of 250 ft^3/s, or maximum:

Date	Time	Discharge (ft^3/s)	Gage height (ft)	Date	Time	Discharge (ft^3/s)	Gage height (ft)
Jan. 18	1545	325	7.36	Apr. 13	0515	304	7.32
Jan. 24	1815	621	7.85	May 8	0630	421	7.53
Feb. 14	0045	576	7.78				

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000

DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.78	1.4	5.9	2.8	31	33	70	140	30	3.7	1.2	1.7
2	.79	1.3	5.1	2.8	32	33	91	143	27	3.7	1.2	6.7
3	.79	1.3	4.4	2.8	30	32	117	139	24	3.5	1.2	2.1
4	.77	1.2	4.2	2.7	30	34	148	137	22	3.2	1.1	1.6
5	.77	1.2	4.4	2.9	30	34	151	134	20	3.2	1.1	1.4
6	1.0	1.2	4.1	2.8	30	30	141	114	18	3.1	1.1	1.3
7	1.1	1.4	3.9	2.6	28	27	138	165	17	3.1	1.0	1.2
8	.94	4.5	4.1	2.6	27	26	139	332	22	3.0	.99	1.1
9	.91	3.1	3.5	2.5	28	25	128	210	18	2.8	.97	1.0
10	.85	3.1	3.6	2.7	43	24	132	155	16	2.6	.97	1.0
11	.84	3.1	3.6	7.1	38	26	136	117	14	2.6	.96	1.0
12	.83	2.7	3.7	5.6	34	28	143	94	14	2.5	.92	1.0
13	.80	2.3	4.1	5.4	85	32	253	80	13	2.4	.87	.99
14	.79	2.2	4.0	5.9	431	35	185	74	12	2.4	.86	.94
15	.78	3.1	3.8	17	182	39	142	89	10	2.3	.83	.95
16	.76	3.6	3.6	19	119	40	120	79	9.6	2.2	.81	.95
17	.76	7.2	3.8	21	83	40	155	79	8.7	2.1	.79	.91
18	.76	4.1	4.3	152	64	46	118	85	8.2	2.1	.75	.85
19	.76	9.9	5.9	130	55	56	97	96	7.6	2.0	.74	.82
20	.76	15	6.7	166	50	53	94	107	7.0	1.9	.79	.79
21	.76	8.1	5.2	74	46	47	105	115	6.5	1.8	.79	.78
22	.76	5.2	4.4	43	41	48	110	112	6.0	1.7	.77	.88
23	.76	4.1	4.1	35	38	52	110	124	5.6	1.7	.75	.99
24	.77	3.5	3.9	269	33	57	107	130	5.3	1.6	.73	.93
25	.78	3.6	3.8	174	30	64	110	102	5.0	1.5	.71	.87
26	.81	4.0	3.6	89	32	72	123	80	4.7	1.5	.69	.85
27	2.5	3.7	3.4	61	59	85	149	67	4.5	1.5	.69	.83
28	19	3.2	3.4	47	40	82	150	57	4.2	1.4	.68	.80
29	2.4	3.2	3.3	38	36	76	128	48	3.9	1.3	.69	.79
30	1.7	6.3	2.8	34	---	73	130	40	3.7	1.3	.83	.74
31	1.5	---	2.8	30	---	68	---	35	---	1.2	.85	---
TOTAL	48.28	117.8	127.4	1450.2	1805	1417	3920	3479	367.5	70.9	27.33	36.76
MEAN	1.56	3.93	4.11	46.8	62.2	45.7	131	112	12.2	2.29	.88	1.23
MAX	19	15	6.7	269	431	85	253	332	30	3.7	1.2	6.7
MIN	.76	1.2	2.8	2.5	27	24	70	35	3.7	1.2	.68	.74
AC-FT	96	234	253	2880	3580	2810	7780	6900	729	141	54	73

11427700 DUNCAN CREEK NEAR FRENCH MEADOWS, CA—Continued

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1960 - 2000, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	4.00	17.5	34.0	44.5	41.9	51.5	77.2	121	61.2	9.29	1.59	1.13
MAX	51.1	172	256	213	291	161	162	245	316	100	10.4	4.51
(WY)	1963	1984	1965	1997	1986	1986	1989	1993	1983	1983	1983	1982
MIN	.22	1.09	.76	1.76	3.24	5.75	12.7	12.9	2.71	.51	.19	.34
(WY)	1978	1977	1977	1991	1977	1977	1977	1992	1992	1977	1977	1960

SUMMARY STATISTICS	FOR 1999 CALENDAR YEAR		FOR 2000 WATER YEAR		WATER YEARS 1960 - 2000	
ANNUAL TOTAL	16197.88		12867.17			
ANNUAL MEAN	44.4		35.2		38.7	
HIGHEST ANNUAL MEAN					86.8	1982
LOWEST ANNUAL MEAN					4.27	1977
HIGHEST DAILY MEAN	408	May 25	431	Feb 14	2800	Jan 1 1997
LOWEST DAILY MEAN	.76	Oct 16	.68	Aug 28	.10	Jul 31 1977
ANNUAL SEVEN-DAY MINIMUM	.76	Oct 16	.71	Aug 23	.11	Aug 8 1977
INSTANTANEOUS PEAK FLOW			621	Jan 24	3650	Dec 22 1964
INSTANTANEOUS PEAK STAGE			7.85	Jan 24	a10.95	Jan 1 1997
ANNUAL RUNOFF (AC-FT)	32130		25520		28050	
10 PERCENT EXCEEDS	142		121		108	
50 PERCENT EXCEEDS	11		4.4		9.3	
90 PERCENT EXCEEDS	.94		.81		.76	

a Backwater from debris dam.

11427750 DUNCAN CREEK BELOW DIVERSION DAM, NEAR FRENCH MEADOWS, CA

LOCATION.—Lat 39°07'59", long 120°28'58", in NE 1/4 SE 1/4 sec.23, T.15 N., R.13 E., Placer County, Hydrologic Unit 18020128, Tahoe National Forest, on right bank, 800 ft downstream from unnamed right bank tributary, 1,000 ft downstream from Duncan Creek Diversion Dam, and 20 mi northeast of Foresthill.

DRAINAGE AREA.—10.5 mi^2.

PERIOD OF RECORD.—October 1964 to current year.

GAGE.—Water-stage recorder. Elevation of gage is 5,210 ft above sea level, from topographic map.

REMARKS.—Natural flow affected by transmountain diversion through Duncan Creek Diversion Tunnel to French Meadows Reservoir (station 11427400). Maximum design flow of tunnel is 400 ft^3/s. See schematic diagram of Middle Fork American and Rubicon River Basins.

COOPERATION.—Records provided by Placer County Water Agency, under general supervision of the U.S. Geological Survey, in connection with a Federal Energy Regulatory Commission project.

EXTREMES FOR PERIOD OF RECORD.—Maximum discharge, 3,640 ft^3/s, Dec. 22, 1964, gage height, 8.74 ft, in gage well, 10.0 ft, from floodmarks, from rating curve extended above 400 ft^3/s on basis of computation of peak flow over diversion dam; no flow at times in 1965–66.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.81	1.5	6.1	2.8	14	15	18	14	13	3.8	1.3	1.5
2	.81	1.4	5.4	2.8	14	15	19	14	12	3.7	1.2	7.1
3	.82	1.3	4.5	2.8	15	14	21	14	12	3.6	1.2	2.3
4	.81	1.2	4.4	2.8	15	15	22	14	12	3.5	1.2	1.7
5	.81	1.2	4.7	2.6	15	15	21	14	12	3.4	1.2	1.5
6	1.1	1.2	4.3	2.7	15	15	20	14	12	3.4	1.1	1.4
7	1.2	1.4	4.3	2.6	15	14	19	15	12	3.3	1.0	1.2
8	1.1	4.6	3.7	2.6	15	14	18	52	12	3.2	1.0	1.1
9	1.0	3.2	3.8	2.6	15	14	17	17	12	3.0	1.0	1.1
10	1.0	3.2	3.8	2.8	16	14	17	15	12	2.8	1.0	1.1
11	.95	3.1	3.7	7.3	16	14	17	15	12	2.7	1.0	1.1
12	.95	2.8	3.9	6.1	15	14	16	14	11	2.6	1.0	1.0
13	.94	2.4	4.3	5.4	23	15	20	14	11	2.5	.95	1.0
14	.89	2.2	3.8	6.1	247	16	18	14	11	2.4	.93	.95
15	.88	3.0	3.7	10	35	17	17	14	11	2.3	.89	.95
16	.88	3.3	3.8	12	21	18	17	14	9.7	2.2	.87	.95
17	.88	7.4	3.9	12	18	17	18	14	8.9	2.2	.84	.94
18	.88	4.2	4.5	24	17	18	17	15	8.4	2.1	.83	.87
19	.88	6.8	5.7	23	16	20	17	14	7.9	2.0	.81	.81
20	.88	12	7.1	25	16	19	16	14	7.4	1.9	.84	.81
21	.88	8.6	5.6	18	16	18	16	14	6.9	1.8	.84	.81
22	.88	5.5	4.8	15	15	18	16	14	6.5	1.8	.84	.86
23	.88	4.2	4.4	14	15	18	15	14	6.1	1.7	.83	1.0
24	.88	3.6	4.1	118	14	19	15	14	5.7	1.6	.79	.96
25	.88	3.6	4.0	30	14	20	15	14	5.4	1.6	.78	.93
26	.91	4.1	3.8	19	14	21	15	14	5.1	1.5	.77	.87
27	1.8	3.8	3.6	17	17	22	15	13	4.8	1.5	.77	.81
28	9.3	3.3	3.4	16	15	21	15	13	4.5	1.5	.77	.81
29	2.7	3.2	3.2	15	15	20	14	13	4.3	1.4	.75	.81
30	1.9	6.2	3.0	14	---	19	14	13	4.0	1.3	.85	.80
31	1.6	---	3.1	14	---	18	---	13	---	1.3	.92	---
TOTAL	41.08	113.5	132.4	448.0	708	527	515	474	272.6	73.6	29.07	38.04
MEAN	1.33	3.78	4.27	14.5	24.4	17.0	17.2	15.3	9.09	2.37	.94	1.27
MAX	9.3	12	7.1	118	247	22	22	52	13	3.8	1.3	7.1
MIN	.81	1.2	3.0	2.6	14	14	14	13	4.0	1.3	.75	.80
AC-FT	81	225	263	889	1400	1050	1020	940	541	146	58	75

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1965 - 2000, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	2.12	8.54	21.7	30.6	22.0	19.3	15.7	28.7	13.7	3.99	1.42	1.10
MAX	17.3	76.1	244	225	237	80.3	91.7	149	107	21.9	5.87	3.61
(WY)	1983	1982	1965	1997	1986	1986	1982	1967	1998	1983	1983	1983
MIN	.061	1.15	.76	1.69	2.02	2.63	4.80	3.88	2.15	.44	.28	.090
(WY)	1966	1991	1977	1991	1974	1965	1974	1976	1965	1965	1977	1965

SUMMARY STATISTICS	FOR 1999 CALENDAR YEAR		FOR 2000 WATER YEAR		WATER YEARS 1965 - 2000	
ANNUAL TOTAL	3780.09		3372.29			
ANNUAL MEAN	10.4		9.21		14.1	
HIGHEST ANNUAL MEAN					43.1	1982
LOWEST ANNUAL MEAN					2.16	1977
HIGHEST DAILY MEAN	108	May 25	247	Feb 14	2560	Jan 1 1997
LOWEST DAILY MEAN	.81	Sep 29	.75	Aug 29	.00	Sep 10 1965
ANNUAL SEVEN-DAY MINIMUM	.81	Sep 29	.78	Aug 23	.00	Sep 10 1965
INSTANTANEOUS PEAK FLOW			409	Feb 14	3640	Dec 22 1964
INSTANTANEOUS PEAK STAGE			4.00	Feb 14	8.74	Dec 22 1964
ANNUAL RUNOFF (AC-FT)	7500		6690		10190	
10 PERCENT EXCEEDS	19		18		16	
50 PERCENT EXCEEDS	10		4.8		5.5	
90 PERCENT EXCEEDS	1.0		.88		.74	

11427760 MIDDLE FORK AMERICAN RIVER ABOVE MIDDLE FORK POWERPLANT, NEAR FORESTHILL, CA

LOCATION.—Lat 39°01'31", long 120°35'40", in NW 1/4 NW 1/4 sec.36, T.14 N., R.12 E., Placer County, Hydrologic Unit 18020128, Tahoe National Forest, on right bank, 300 ft upstream from Middle Fork Powerplant, 3.7 mi upstream from Big Mosquito Creek, and 11 mi east of Foresthill.

DRAINAGE AREA.—87.8 mi^2.

PERIOD OF RECORD.—August 1965 to current year.

GAGE.—Water-stage recorder. Elevation of gage is 2,540 ft above sea level, from topographic map. Prior to May 15, 1980, at datum 5.00 ft higher. May 15, 1980, to Oct. 11, 1984, at datum 4.00 ft higher.

REMARKS.—Considerable regulation by French Meadows Reservoir (station 11427400) 11 mi upstream. Transbasin diversions from French Meadows Reservoir to Hell Hole Reservoir (station 11428700) through French Meadows Powerplant (station 11427200). See schematic diagram of Middle Fork American and Rubicon River Basins.

COOPERATION.—Records provided by Placer County Water Agency, under general supervision of the U.S. Geological Survey, in connection with a Federal Energy Regulatory Commission project.

EXTREMES FOR PERIOD OF RECORD.—Maximum discharge, 13,900 ft^3/s, Jan. 2, 1997, gage height, 14.6 ft, from floodmark, from rating curve extended above 4,200 ft^3/s; minimum daily, 5.3 ft^3/s, Sept. 11, 1977.

DISCHARGE, CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1999 TO SEPTEMBER 2000
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	17	18	37	20	113	216	167	94	66	29	19	19
2	17	17	31	20	112	201	169	91	66	29	18	38
3	19	17	29	20	109	189	175	88	64	29	18	24
4	18	17	25	20	125	183	183	85	63	29	18	19
5	18	17	25	19	120	193	182	83	61	28	18	18
6	19	17	24	19	115	187	173	82	60	28	18	18
7	18	19	25	20	109	176	161	108	59	28	17	17
8	18	36	23	19	104	175	156	222	69	27	17	17
9	18	25	24	19	103	171	149	141	62	27	17	17
10	17	21	24	19	134	162	141	123	58	26	17	16
11	17	20	23	31	143	166	136	114	56	26	17	16
12	17	20	23	38	153	166	134	108	55	26	17	16
13	17	19	27	26	255	168	184	103	53	25	17	18
14	17	19	24	26	990	178	176	99	51	25	17	17
15	16	21	23	46	488	189	155	108	49	24	16	17
16	17	22	23	77	346	194	147	123	47	24	16	17
17	17	33	23	64	276	193	167	120	45	24	16	17
18	17	24	23	155	233	194	163	113	44	23	16	17
19	17	27	23	134	206	210	149	105	43	23	16	16
20	17	45	26	177	193	211	142	100	41	23	16	15
21	17	38	25	120	188	196	135	96	40	22	16	15
22	17	27	24	94	191	188	132	91	38	22	16	16
23	17	23	23	102	200	188	126	88	37	22	16	16
24	16	22	22	488	174	190	120	85	36	21	15	16
25	17	21	22	407	161	192	114	82	36	21	15	16
26	17	21	21	230	162	195	111	80	35	21	15	16
27	19	21	21	166	329	202	109	77	34	20	15	15
28	56	21	21	135	259	201	107	74	33	20	15	15
29	24	20	20	116	241	191	102	72	31	20	15	15
30	19	29	20	123	---	185	97	70	30	20	16	15
31	18	---	20	123	---	174	---	68	---	19	15	---
TOTAL	585	697	744	3073	6332	5824	4362	3093	1462	751	510	524
MEAN	18.9	23.2	24.0	99.1	218	188	145	99.8	48.7	24.2	16.5	17.5
MAX	56	45	37	488	990	216	184	222	69	29	19	38
MIN	16	17	20	19	103	162	97	68	30	19	15	15
AC-FT	1160	1380	1480	6100	12560	11550	8650	6130	2900	1490	1010	1040

11427760 MIDDLE FORK AMERICAN RIVER ABOVE MIDDLE FORK POWERPLANT, NEAR FORESTHILL, CA—Continued

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1966 - 2000, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	27.4	46.6	89.6	178	177	212	180	183	98.5	36.8	19.5	17.4
MAX	270	262	446	781	969	696	601	600	451	184	33.2	29.5
(WY)	1966	1984	1997	1997	1986	1986	1982	1982	1995	1983	1983	1982
MIN	7.43	12.9	12.2	15.7	18.4	21.7	19.3	21.5	15.4	8.64	6.35	6.59
(WY)	1978	1978	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977

SUMMARY STATISTICS	FOR 1999 CALENDAR YEAR		FOR 2000 WATER YEAR		WATER YEARS 1966 - 2000	
ANNUAL TOTAL	48938		27957			
ANNUAL MEAN	134		76.4		105	
HIGHEST ANNUAL MEAN					271	1982
LOWEST ANNUAL MEAN					14.3	1977
HIGHEST DAILY MEAN	963	Feb 9	990	Feb 14	7600	Jan 2 1997
LOWEST DAILY MEAN	16	Oct 15	15	Aug 24	5.3	Sep 11 1977
ANNUAL SEVEN-DAY MINIMUM	17	Oct 10	15	Aug 23	5.5	Sep 8 1977
INSTANTANEOUS PEAK FLOW			1340	Feb 14	13900	Jan 2 1997
INSTANTANEOUS PEAK STAGE			8.17	Feb 14	14.60	Jan 2 1997
ANNUAL RUNOFF (AC-FT)	97070		55450		76210	
10 PERCENT EXCEEDS	389		188		252	
50 PERCENT EXCEEDS	43		29		39	
90 PERCENT EXCEEDS	18		17		15	

Water Resources

Data Category: Surface Water | Geographic Area: United States | GO

Calendar Year Streamflow Statistics for the Nation

USGS 11427770 MF AMERICAN R BL INTERBAY DAM NR FORESTHILL CA

Available data for this site: Surface-water: Annual streamflow statistics | GO

Placer County, California
Hydrologic Unit Code 18020128
Latitude 39°01'35", Longitude 120°36'09" NAD27
Drainage area 89.1 square miles

Output formats

- HTML table of all data
- Tab-separated data
- Reselect output format

Year	Annual mean streamflow, in ft^3/s
1966	54.8
1967	119
1968	12.3
1969	109
1970	49.0
1971	28.1
1972	23.9
1973	28.2
1974	37.0

Year	Annual mean streamflow, in ft^3/s
1975	19.6
1976	15.5
1977	9.21
1978	21.9
1979	21.5
1980	104
1981	61.1
1982	310

Year	Annual mean streamflow, in ft^3/s
1983	199
1984	48.3
1985	24.7
1987	21.6
1988	17.0
1989	19.1
1990	21.7
1992	20.8

Questions about data h2oteam@usgs.gov
Feedback on this websitegs-w_support_nwisweb@usgs.gov

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Surface Water data for USA: Calendar Year Streamflow Statistics
http://waterdata.usgs.gov/nwis/annual/calendar_year?

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Water Resources

Data Category: Surface Water
Geographic Area: United States
GO

Calendar Year Streamflow Statistics for the Nation

USGS 11433300 MF AMERICAN R NR FORESTHILL CA

Available data for this site: Surface-water: Annual streamflow statistics GO

Placer County, California
Hydrologic Unit Code 18020128
Latitude 39°00'23", Longitude 120°45'40" NAD27
Drainage area 524 square miles

Output formats

- HTML table of all data
- Tab-separated data
- Reselect output format

Year	Annual mean streamflow, in ft^3/s	Year	Annual mean streamflow, in ft^3/s	Year	Annual mean streamflow, in ft^3/s
1984	1,274	1990	500	1996	2,019
1985	607	1991	552	1997	1,669
1986	1,790	1992	370	1998	1,611
1987	354	1993	1,276	1999	1,327
1988	371	1994	406	2000	1,031
1989	1,002	1995	2,181		

Questions about data h2oteam@usgs.gov
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Surface Water data for USA: Calendar Year Streamflow Statistics
http://waterdata.usgs.gov/nwis/annual/calendar_year?

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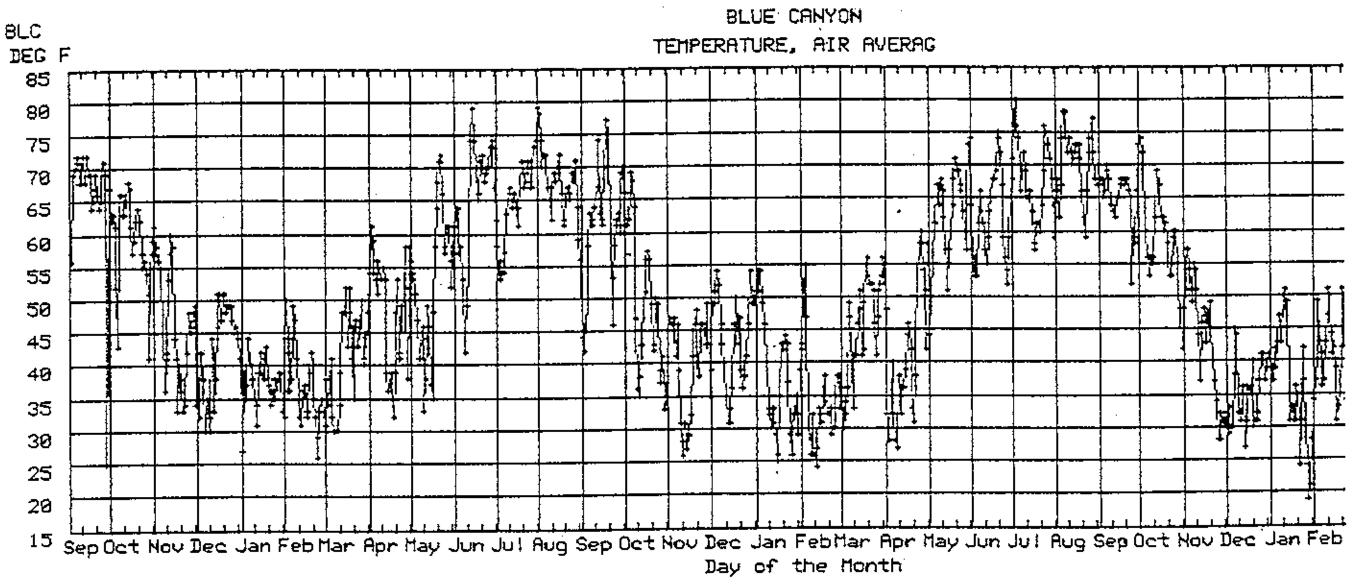
BLUE CANYON *(BLC)*

Elevation: 5280' · AMERICAN R basin · Operator: US Bureau of Reclamation
Sensor ID number *8917*

Plot generated Thursday at 11:25:34



Data from 01/01/1992 00:00 through 06/27/2002 11:25 · Duration: 3830days
Max of period: 80 · Min of period: 19

Show data | Plot earlier | Plot later

Station ID	Sensor Number	Duration Code	Start date	End date	
BLC	30	◉ D ○ H ○ E	01/01/1992 0	now	Get another plot

PRECIPITATION SHEET

FHRD

SEASON	AMOUNT
1939-40	54.14
1940-41	55.10
1941-42	60.82
1942-43	65.50
1943-44	34.49
1944-45	48.17
1945-46	48.34
1946-47	39.03
1947-48	46.09
1948-49	41.16
1949-50	49.08
1950-51	76.26
1951-52	73.52
1952-53	46.45
1953-54	46.75
1954-55	38.45
1955-56	70.78
1956-57	50.32
1957-58	67.66
1958-59	28.50
1959-60	44.51
1960-61	34.60
1961-62	43.67
1962-63	65.50
1963-64	39.92
1964-65	68.82
1965-66	32.37
1966-67	64.82
1967-68	37.37
1968-69	69.86
1969-70	55.95
1970-71	51.81
1971-72	39.54
1972-73	58.33

SEASON	AMOUNT
1973-74	72.42
1974-75	50.89
1975-76	24.41
1976-77	20.91
1977-78	63.13
1978-79	46.80
1979-80	62.88
1980-81	33.17
1981-82	87.43
1982-83	86.37
1983-84	58.22
1984-85	36.45
1985-86	73.51
1986-87	27.76
1987-88	33.14
1988-89	44.77
1989-90	33.34
1990-91	36.32
1991-92	36.34
1992-93	67.44
1993-94	28.34
1994-95	92.27
1995-96	62.01
1996-97	75.91
1997-98	82.20
1998-99	56.27
1999-00	55.87
2000-01	31.95
2001-02	
2002-03	
2003-04	
2004-05	
2005-06	
2006-07	

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PRECIPITATION SHEET

Precipitation Season '39-'40

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	.00	.00
November	.00	.00
December	2.54	2.54
January	20.04	22.58
February	16.96	39.40
March	12.27	51.81
April	1.39	53.20
May	.94	54.14
June	.00	54.14

Precipitation Season '40-'41

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	1.62	1.62
November	4.76	5.38
December	15.83	22.21
January	11.27	33.48
February	9.37	42.85
March	5.53	48.38
April	6.50	54.88
May	.00	54.88
June	.22	55.10

Precipitation Season '41-'42

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	1.82	1.82
November	6.19	8.01
December	15.42	23.43
January	11.44	34.87
February	9.5	44.37
March	2.62	46.99
April	8.81	55.80
May	5.02	60.82
June	.00	60.82

Precipitation Season '42-'43

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	.42	.42
November	14.48	14.90
December	8.92	23.82
January	15.91	39.73
February	4.24	43.97
March	15.34	55.80
April	14.14	58.11
May	1.30	63.25
June	2.25	65.50

Precipitation Season '43-'44

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	1.05	1.05
November	1.52	2.57
December	3.18	5.57
January	8.62	14.37
February	9.38	23.75
March	2.50	24.90
April	4.10	31.76
May	1.70	33.46
June	1.30	34.49

Precipitation Season '44-'45

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.16	.16
October	2.61	2.77
November	11.45	14.22
December	5.25	16.47
January	1.35	20.85
February	12.93	33.75
March	8.61	39.66
April	2.11	42.98
May	2.66	47.75
June	.42	48.17

Precipitation Season '45-'46

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	6.40	6.40
November	8.73	15.13
December	15.59	30.72
January	3.10	33.82
February	4.90	38.72
March	7.91	46.63
April	.41	47.04
May	1.30	48.34
June	.00	48.34

Precipitation Season '46-'47

Month	Inches	To Date
July	.12	.12
August	.00	.12
September	1.01	1.13
October	2.15	3.28
November	9.35	12.63
December	4.77	17.40
January	3.02	20.42
February	4.41	24.83
March	9.08	33.91
April	2.22	36.13
May	.41	36.54
June	2.49	39.03

Precipitation Season '47-'48

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	7.75	7.75
November	2.42	10.17
December	.99	11.16
January	5.40	16.56
February	5.36	21.95
March	8.93	30.85
April	10.93	41.78
May	4.30	46.08
June	.01	46.09

Precipitation Season '48-'49

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	.10	.10
November	5.01	5.11
December	9.04	14.15
January	4.03	18.18
February	7.45	25.63
March	14.34	39.97
April	.20	40.17
May	.99	41.16
June	.00	41.16

Precipitation Season '49-'50

Month	Inches	To Date
July	.00	.00
August	.26	.26
September	.10	.36
October	.26	.62
November	4.85	5.47
December	3.50	8.97
January	18.78	27.75
February	5.84	33.59
March	8.79	42.56
April	4.24	46.80
May	1.96	48.76
June	.32	49.08

Precipitation Season '50-'51

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.51	.51
October	6.35	6.86
November	21.00	27.86
December	15.28	43.14
January	14.33	57.47
Februsry	6.51	63.98
March	6.86	70.84
April	2.20	73.04
May	3.22	76.26
June	.00	76.26

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PRECIPITATION SHEET

Precipitation Season '51-'52

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	6.43	6.43
November	9.25	15.68
December	15.62	31.30
January	19.33	50.63
February	9.42	60.05
March	9.02	69.07
April	1.87	70.94
May	1.46	72.40
June	1.12	73.52

Precipitation Season '52-'53

Month	Inches	To Date
July	.15	.15
August	.00	.15
September	.61	.76
October	.00	.76
November	3.55	4.31
December	12.44	16.75
January	12.88	30.10
February	.14	30.24
March	6.02	36.26
April	6.21	42.47
May	2.57	45.04
June	1.41	46.45

Precipitation Season '53-'54

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	1.77	1.77
November	5.72	7.49
December	4.26	11.79
January	9.13	20.88
February	7.22	28.10
March	11.51	39.61
April	5.10	44.71
May	.56	45.27
June	1.48	46.75

Precipitation Season '54-'55

Month	Inches	To Date
July	.00	.00
August	.51	.51
September	.10	.61
October	.60	1.21
November	4.46	5.67
December	10.32	15.99
January	7.47	23.46
February	4.60	28.06
March	2.24	30.30
April	6.81	37.11
May	1.16	38.27
June	.00	38.27

Precipitation Season '55-'56

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.79	.79
October	.61	1.40
November	5.50	6.90
December	33.78	40.68
January	18.95	59.63
February	6.85	66.48
March	.94	67.42
April	3.36	70.78
May	.00	70.78
June	.00	70.78

Precipitation Season '56-'57

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.56	.56
October	6.35	6.91
November	.08	6.99
December	2.77	9.76
January	5.83	15.59
February	10.84	26.43
March	9.59	36.02
April	5.11	41.13
May	8.78	49.91
June	.41	50.32

Precipitation Season '57-'58

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	1.04	1.04
October	2.89	3.93
November	3.93	7.86
December	8.19	16.05
January	9.22	25.27
February	15.19	40.46
March	15.34	55.80
April	8.94	64.74
May	1.56	66.30
June	1.36	67.66

Precipitation Season '58-'59

Month	Inches	To Date
July	.00	.00
August	.09	.09
September	.73	.82
October	.38	1.20
November	2.91	4.11
December	1.73	5.84
January	5.84	11.68
February	10.72	22.40
March	2.50	24.90
April	2.83	27.73
May	.77	28.50
June	.00	28.50

Precipitation Season '59-'60

Month	Inches	To Date
July	.00	.00
August	.18	.18
September	3.45	3.63
October	.00	3.63
November	.00	3.63
December	3.09	6.72
January	10.27	16.99
February	14.06	31.05
March	8.61	39.66
April	3.09	42.75
May	1.76	44.51
June	.00	44.51

Precipitation Season '60-'61

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.05	.05
October	.47	.52
November	9.28	9.80
December	3.64	13.44
January	2.35	15.79
February	5.52	21.31
March	7.16	28.14
April	3.27	31.74
May	2.35	34.09
June	.51	34.60

Precipitation Season '61-'62

Month	Inches	To Date
July	.00	.00
August	.06	.06
September	.28	.34
October	1.48	1.82
November	3.65	5.47
December	4.65	10.12
January	4.91	15.03
February	18.08	33.11
March	7.64	40.75
April	2.56	43.31
May	.36	43.67
June	.00	43.67

Precipitation Season '62-'63

Month	Inches	To Date
July	.05	.05
August	.17	.22
September	.10	.32
October	18.64	18.96
November	2.62	21.58
December	6.69	28.57
January	5.79	34.06
February	9.10	43.16
March	8.26	51.42
April	10.87	62.29
May	3.02	65.31
June	.19	65.50

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PRECIPITATION SHEET

Precipitation Season '63-'64

Month	Inches	To Date
Jy	.00	.00
A	.00	.00
September	.66	.66
October	3.21	3.87
November	11.77	15.64
December	.97	16.61
January	11.45	28.06
February	1.51	29.57
March	3.71	33.28
April	1.61	34.89
May	3.78	38.67
June	1.25	39.92

Precipitation Season '64-'65

Month	Inches	To Date
July	.00	.00
August	.31	.31
September	.01	.32
October	1.79	2.11
November	10.18	12.29
December	31.39	43.68
January	10.91	54.59
February	2.24	56.83
March	3.66	60.49
April	8.07	68.56
May	.14	68.70
June	.12	68.82

Precipitation Season '65-'66

Month	Inches	To Date
July	.00	.0
August	1.14	1.14
September	.01	1.15
October	.74	1.89
November	9.40	11.29
December	8.68	19.97
January	2.32	22.29
February	4.11	26.40
March	3.10	29.50
April	2.37	31.87
May	.48	32.35
June	.02	32.37

Precipitation Season '66-'67

Month	Inches	To Date
July	.04	.04
August	.00	.04
September	.04	.08
October	.00	.08
November	10.97	11.05
December	8.91	19.96
January	16.30	36.26
February	1.04	37.30
March	13.19	50.49
April	10.54	61.03
May	1.48	62.51
June	2.31	64.82

Precipitation Season '67-'68

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.18	.18
October	2.25	2.43
November	4.02	6.45
December	7.89	14.34
January	8.98	23.32
February	7.37	30.69
March	5.00	35.69
April	.44	36.13
May	1.13	37.26
June	.11	37.37

Precipitation Season '68-'69

Month	Inches	To Date
July	.00	.00
August	1.62	1.62
September	.13	1.75
October	3.13	4.88
November	7.62	12.50
December	9.52	22.02
January	24.37	46.39
February	14.91	61.30
March	2.81	64.11
April	5.45	69.56
May	.00	69.56
June	.30	69.86

Precipitation Season '69-'70

Month	Inches	To Date
July	.10	.10
August	.00	.10
Se[illegible]ber	.02	.12
O[illegible]	4.03	4.15
November	4.00	8.15
December	13.51	21.66
January	22.46	44.12
February	4.05	48.17
March	4.72	52.89
April	1.41	54.30
May	.22	54.52
June	1.43	55.95

Precipitation Season '70-'71

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.00	.00
October	2.89	2.98
November	14.20	17.09
December	14.71	31.80
January	4.50	36.30
February	1.37	37.67
March	8.31	45.98
April	2.61	48.59
May	2.24	50.83
June	.98	51.81

Precipitation Season '71-'72

Month	Inches	To Date
July	.00	.00
August	.14	.14
September	1.00	1.14
October	1.17	2.31
November	5.43	7.74
December	12.85	20.59
January	3.49	24.08
February	6.82	30.90
March	3.07	33.97
April	4.22	38.19
May	.79	38.98
June	.56	39.54

Precipitation Season '72-'73

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	2.27	2.27
October	2.32	4.59
November	10.24	14.83
December	7.55	22.38
January	18.27	40.65
February	11.00	51.65
March	5.53	57.18
April	.90	58.08
May	.25	58.33
June	.00	58.33

Precipitation Season '73-'74

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	1.81	1.81
October	3.56	5.37
November	19.08	24.45
December	12.80	40.94
January	9.88	47.13
February	4.10	51.23
March	15.30	66.53
April	5.33	71.86
May	.00	7.86
June	.56	72.42

Precipitation Season '74-'75

Month	Inches	To Date
July	4.14	4.14
August	.02	4.16
September	.00	4.16
October	3.79	7.95
November	3.20	11.15
December	3.48	14.63
January	5.38	20.01
February	12.72	32.73
March	11.97	44.70
April	4.90	49.60
May	.83	50.53
June	.46	50.89

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PRECIPITATION SHEET

Precipitation Season '75-'76

Month	Inches	To Date
Ju	.03	.03
A	1.08	1.11
September	.06	1.17
October	8.14	9.31
November	3.23	12.54
December	2.17	14.71
January	.46	15.17
February	4.48	19.65
March	2.52	22.17
April	2.21	24.38
May	.00	24.38
June	.03	24.41

Precipitation Season '76-'77

Month	Inches	To Date
July	.00	.00
August	2.90	2.90
September	1.82	4.72
October	.56	5.28
November	2.21	7.49
December	.19	7.68
January	3.63	11.31
February	3.15	14.46
March	3.09	17.55
April	.03	17.58
May	3.33	20.91
June	.00	20.91

Precipitation Season '77-'78

Month	Inches	To Date
July	.17	.17
August	.59	.76
September	.58	1.34
October	.36	1.70
November	5.60	7.30
December	12.64	19.94
January	15.91	35.85
February	7.91	43.76
March	9.36	53.12
April	9.35	62.47
May	.57	63.04
June	.09	63.13

Precipitation Season '78-'79

Month	Inches	To Date
July	.00	.00
August	.02	.02
September	4.20	4.22
October	.00	4.22
November	3.57	7.79
December	3.10	10.89
January	11.24	22.13
February	10.04	32.17
March	7.77	39.94
April	4.40	44.34
May	2.46	46.80
June	.00	46.80

Precipitation Season '79-'80

Month	Inches	To Date
July	.45	.45
August	.18	.63
September	.08	.71
October	5.28	5.99
November	5.25	11.24
December	7.73	18.97
January	19.72	38.69
February	14.58	53.27
March	4.90	58.17
April	3.38	61.55
May	1.00	62.55
June	.33	62.88

Precipitation Season '80-'81

Month	Inches	To Date
July	.99	.99
August	.05	1.04
September	.10	1.14
October	1.64	2.78
November	2.35	5.13
December	3.32	8.45
January	9.54	17.99
February	2.98	20.97
March	9.07	30.04
April	1.47	31.51
May	1.59	33.10
June	.07	33.17

Precipitation Season '81-'82

Month	Inches	To Date
July	.00	.00
August	.00	.00
Se ber	1.07	1.07
O	5.64	6.71
November	16.61	23.32
December	17.34	40.66
January	11.43	52.09
February	9.50	61.59
March	13.20	74.79
April	11.22	86.01
May	.43	86.44
June	.99	87.43

Precipitation Season '82-'83

Month	Inches	To Date
July	.06	.06
August	.05	.11
September	3.83	3.94
October	9.34	13.28
November	11.51	24.79
December	11.00	35.79
January	10.21	46.00
February	12.66	58.66
March	17.84	76.50
April	6.68	83.18
May	2.84	86.02
June	.35	86.37

Precipitation Season '83-'84

Month	Inches	To Date
July	.10	.10
August	.44	.54
September	1.65	2.19
October	2.72	4.91
November	19.79	24.70
December	17.48	42.18
January	.43	42.61
February	6.17	48.78
March	3.21	51.99
April	3.48	55.47
May	1.48	56.95
June	1.27	58.22

Precipitation Season '84-'85

Month	Inches	To Date
July	.00	.00
August	.37	.37
September	.20	.57
October	4.46	5.03
November	12.28	17.31
December	2.53	19.84
January	1.77	21.61
February	4.29	25.90
March	9.32	35.22
April	.68	35.90
May	.00	35.90
June	.55	36.45

Precipitation Season '85-'86

Month	Inches	To Date
July	.00	.00
August	.60	.60
September	2.05	2.65
October	2.06	4.71
November	11.81	16.52
December	5.28	21.80
January	8.79	30.59
February	28.52	59.11
March	10.10	69.21
April	1.89	71.10
May	2.41	73.51
June	.00	73.51

Precipitation Season '86-'87

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	5.34	5.34
October	.30	5.64
November	1.21	6.85
December	1.51	8.36
January	5.07	13.43
February	5.50	18.93
March	7.28	26.21
April	.38	26.59
May	1.07	27.66
June	.10	27.76

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PRECIPITATION SHEET

Precipitation Season '87-'88

Month	Inches	To Date
J[illegible]	.00	.00
A[illegible]	.00	.00
September	.00	.00
October	1.78	1.78
November	4.65	6.43
December	10.25	16.68
January	7.17	23.85
February	.88	24.73
March	2.08	26.81
April	3.94	30.75
May	1.73	32.48
June	.66	33.14

Precipitation Season '88-'89

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.07	.07
October	.02	.09
November	11.42	11.51
December	6.25	17.76
January	2.22	19.98
February	5.13	25.01
March	16.74	41.75
April	1.91	43.66
May	.66	44.32
June	.45	44.77

Precipitation Season '89-'90

Month	Inches	To Date
July	.00	.00
August	.27	.27
September	3.44	3.71
October	4.04	7.75
November	3.30.	11.05
December	.00	11.05
January	6.36	17.41
February	5.03	22.44
March	2.90	25.34
April	2.26	27.60
May	6.75	33.34
June	.00	33.34

Precipitation Season '90-'91

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.24	.24
October	.68	.92
November	1.57	2.49
December	1.32	3.81
January	1.01	4.82
February	3.36	8.18
March	18.89	27.07
April	2.57	29.64
May	3.99	33.69
June	2.27	36.32

Precipitation Season '91-'92

Month	Inches	To Date
July	.00	.00
August	.58	.58
September	.00	.58
October	5.86	6.38
November	2.50	8.88
December	3.69	12.57
January	3.11	15.68
February	11.59	27.09
March	5.35	32.44
April	2.26	34.70
May	.07	34.77
June	1.57	36.34

Precipitation Season '92-'93

Month	Inches	To Date
July	.00	.00
August	Trace	Trace
September	.00	Trace
October	4.86	4.86
November	.90	5.76
December	16.13	21.80
January	16.05	37.85
February	11.51	49.37
March	7.83	57.20
April	3.44	60.64
May	3.90	64.55
June	2.89	67.44

Precipitation Season '93-'94

Month	Inches	To Date
July	.00	.00
August	.00	.00
S[illegible]ber	.00	.00
O[illegible]	1.82	1.82
November	3.40	5.22
December	5.58	10.80
January	2.75	13.55
February	7.64	21.19
March	1.42	22.61
April	2.98	25.59
May	2.30	27.95
June	.39	28.34

Precipitation Season '94-'95

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	1.27	1.27
October	1.27	2.54
November	12.15	14.69
December	10.14	24.83
January	25.76	50.59
February	1.24	51.83
March	24.55	76.38
April	9.51	85.89
May	3.54	89.43
June	2.84	92.27

Precipitation Season '95-'96

Month	Inches	To Date
July	.01	.01
August	.00	.01
September	.00	.01
October	.00	.01
November	.34	.35
December	12.64	12.99
January	15.76	28.75
February	12.06	40.81
March	6.67	47.38
April	6.16	53.64
May	8.13	61.77
June	.24	62.01

Precipitation Season '96-'97

Month	Inches	To Date
July	.04	.04
August	.10	.14
September	1.43	1.57
October	2.11	3.68
November	11.00	14.67
December	28.78	43.49
January	25.26	68.75
February	1.31	70.07
March	1.45	71.52
April	2.65	74.00
May	.59	74.59
June	1.37	75.91

Precipitation Season '97-'98

Month	Inches	To Date
July	.00	.00
August	.57	.57
September	.57	1.14
October	3.86	5.00
November	8.02	13.02
December	4.79	17.81
January	20.26	38.87
February	16.09	54.96
March	6.55	65.44
April	7.75	73.17
May	7.26	81.14
June	1.06	82.20

Precipitation Season '98-'99

Month	Inches	To Date
July	.01	.01
August	.00	.01
September	1.64	1.65
October	.74	2.39
November	8.72	11.11
December	5.32	16.43
January	11.54	27.97
February	17.19	45.16
March	5.39	50.55
April	2.75	54.00
May	2.22	56.22
June	.05	56.27

FHRID

PRECIPITATION SHEET

Precipitation Season '99-'00

Month	Inches	To Date
July	.00	.00
August	.19	.19
September	.00	.19
October	2.31	2.50
November	5.91	8.41
December	1.46	9.87
January	15.61	25.48
February	19.79	45.27
March	2.71	47.98
April	2.27	50.25
May	4.81	55.06
June	.81	55.87

Precipitation Season '00-'01

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	2.66	2.66
October	6.88	9.54
November	2.67	12.21
December	2.56	14.77
January	4.13	18.90
February	5.45	24.35
March	3.29	27.64
April	4.16	31.80
May	.00	31.80
June	.15	31.95

Precipitation Season '01-'02

Month	Inches	To Date
July	.00	.00
August	.00	.00
September	.80	.80
October	1.44	2.24
November	7.43	9.67
December	16.16	25.83
January	5.40	31.23
February	5.73	36.96
March	9.44	46.40
April	1.15	47.55
May	2.96	50.51
June		

Precipitation Season

Month	Inches	To Date
July		
August		
September		
October		
November		
December		
January		
February		
March		
April		
May		
June		

Precipitation Season

Month	Inches	To Date
July		
August		
September		
October		
November		
December		
January		
February		
March		
April		
May		
June		

Precipitation Season

Month	Inches	To Date
July		
August		
September		
October		
November		
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February		
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April		
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June		

Precipitation Season

Month	Inches	To Date
July		
August		
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March		
April		
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June		

Precipitation Season

Month	Inches	To Date
July		
August		
September		
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May		
June		

Precipitation Season

Month	Inches	To Date
July		
August		
September		
October		
November		
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January		
February		
March		
April		
May		
June		

Precipitation Season

Month	Inches	To Date
July		
August		
September		
October		
November		
December		
January		
February		
March		
April		
May		
June		

Precipitation Season

Month	Inches	To Date
July		
August		
September		
October		
November		
December		
January		
February		
March		
April		
May		
June		

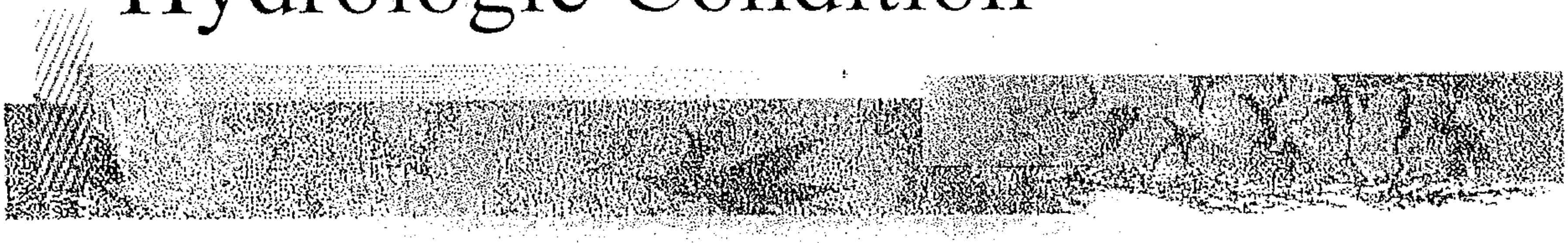
Precipitation Season

Month	Inches	To Date
July		
August		
September		
October		
November		
December		
January		
February		
March		
April		
May		
June		

APPENDIX B – NOTES FROM PUBLIC MEETING

This appendix includes notes taken during an American River Watershed Group meeting to discuss the HCA and Watershed Assessment for the North and Middle Forks of the American River. An interdisciplinary team reviewed this information and those factors that related to the Upper Middle Fork American River watershed were used in this analysis.

A Framework for Assessment of Hydrologic Condition

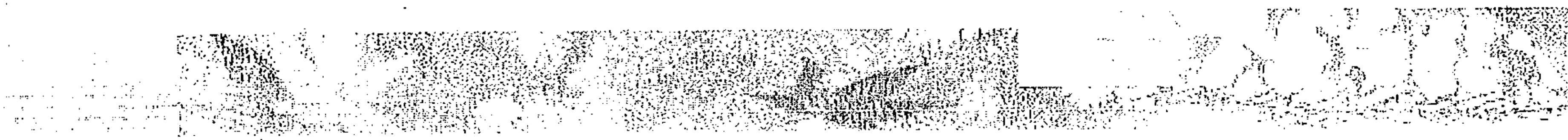


An Assessment of the North and Middle Forks of the American River

Interagency Delineation of Hydrologic Units

- Nested hierarchy
- Scientific Approach
- Topographically based
- Mapped at 1:24,000 or better
- Consistent numbering and naming

1. Region
2. Sub-region
3. Basin
4. Sub-basin
5. Watershed
6. Sub-watershed



Scale Terminology

HUC Level	Name	Average Size
1	Region	183,233 sq. mi.
2	Sub-region	16,844 sq.mi.
3	Basin	10,606 sq.mi.
4	Sub-basin	1,735 sq.mi
5	Watershed	40,000-250,000 ac.
6	Sub-watershed	10,000-40,000 ac.

Hydrologic Condition Assessment

What is it and what does it do?

- Integrates physical, chemical, & biological processes, terrain and land use
- Concentrates on water quality, flow & timing
- Distills and focuses
- Identifies processes, variables and conditions that are of concern
- Quantitative and qualitative
- Provides context and isolates those things which need attention first

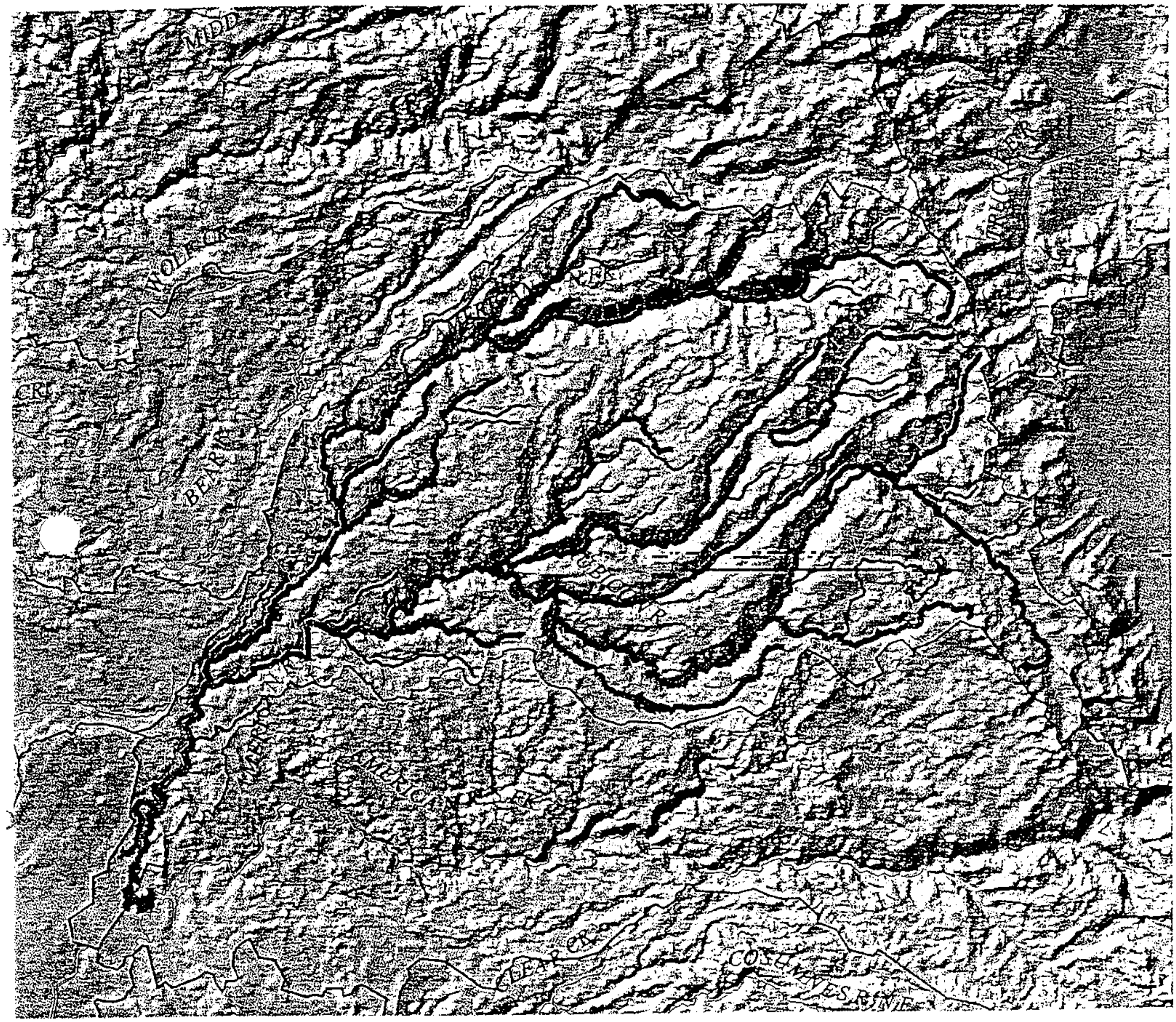
Flow, Quality, & Timing (F, Q, T)

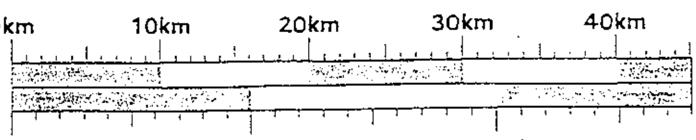
- Flow, Quality, and/or Timing of water
  - Basis of Hydrologic Condition Assessment
- Why
  - Indicative of hydrologic function
  - Barometers of change
  - Intimately linked to well being of ‘dependent” resources, i.e., beneficial uses

ICE MAPS: Information Center for the Environment, UC Davis

American River (North Fork) Basin

Shaded Relief





HCA – Assessment Process

Step 1: Characterize the Watershed

Step 2: Rate Factors

Step 3: Identify Important Factors

Step 4: Establish Current Levels

Step 5: Establish Reference Levels

Step 6: Identify Changes and Interpret Results

Step 1: Characterization

- Discuss and organize existing information
- Document the dominant features of the area that influence water flow, quality or timing (F, Q, T)

Organization of Information

- Physical Features: slope, aspect, geology, soils….
- Climate: temperature, precipitation, wind….
- Vegetation: type, distribution, structure….
- Wetlands: locations, size, type….
- Disturbances: fire, wind, human development….
- Surface Water Characteristics: quality, quantity….
- Groundwater Characteristics: depth, recharge….
- Water Rights/Beneficial Uses: fish, domestic….
- Dominant Processes: erosion, fluvial….

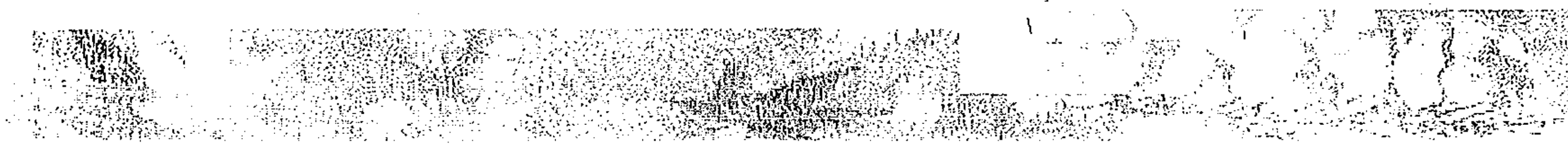
Hydrologic Processes Measures & Metrics

Disturbances

- Harvest
- Grazing
- Mining
- Recreation
- Urbanization

Processes

- Infiltration
- Evapotranspiration
- Interception
- Erosion
- Runoff



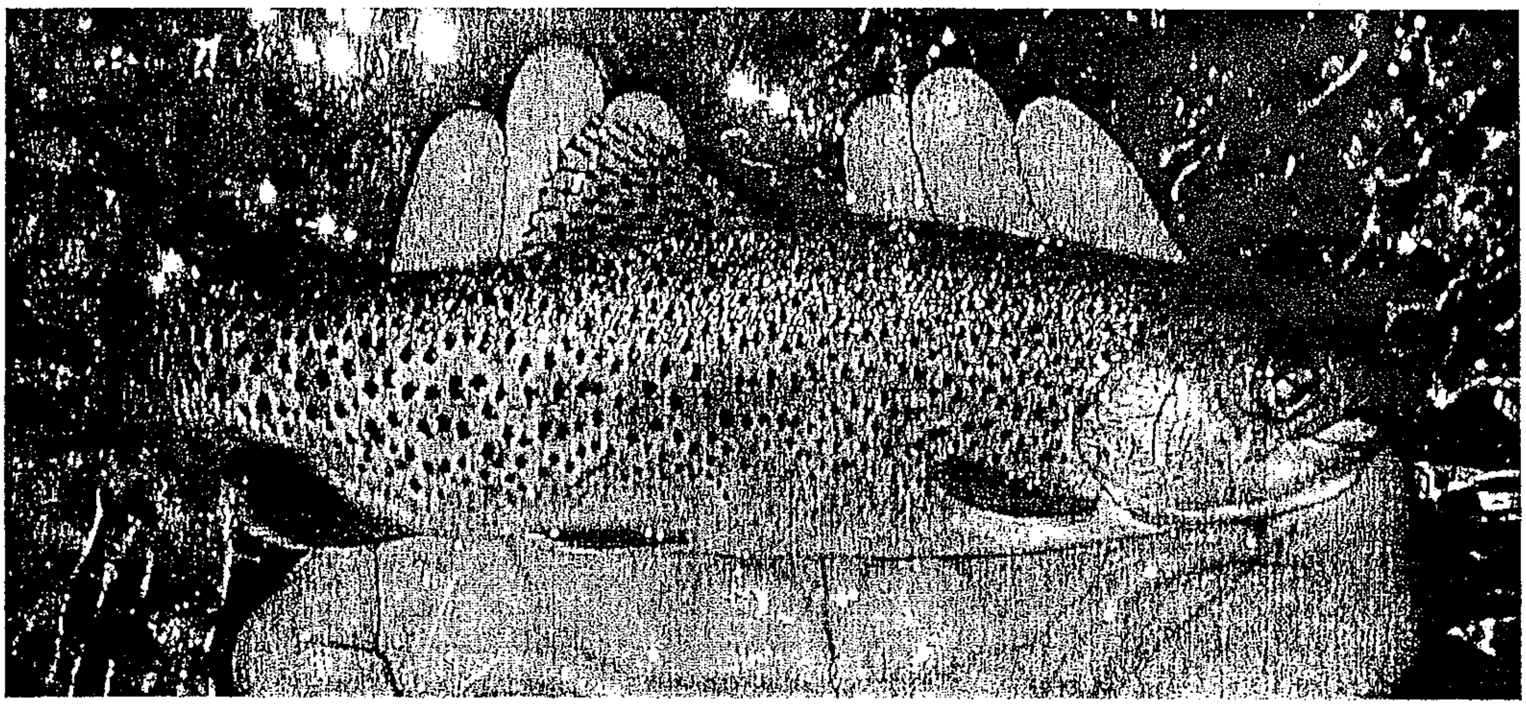
Characterization of the North Fork of the American River Watershed

- **Watershed Name**: North Fork American.
- **Ownership**: BLM, Private, USFS.
- **Size** : 652,805 acres.
- **Precipitation**: Average Annual Precipitation 58.72 inches, occurring mostly during winter months as snow..
- **Vegetation**: Mixed conifer, mixed conifer-hardwood, hardwood, shrub, herbaceous.
- **Geology**: Metasedimentary (or marine origin) volcanic, and granitic rocks. Glacial Deposits un upper parts of watershed.
- **Soils**: Soils range from shallow (<20 inches)to very deep (>60 inches).
- **Dominant Processes**: Fluvial and colluvial processes.

Characterization (continued)

- **Basin Shape/relief**: Elevation range from 225 – 10,380 feet. Landscape is steep and dissected with many sharp ridges and bedrock confined streams generally oriented southwest.
- **Lakes**: Numerous lakes and reservoirs.
- **Wetlands & Riparian Zones:** Wetlands and meadows generally are found in the headwaters, exhibiting diverse vegetative communities. This is a data gap.
- **Surface Water**: See list of Gauges.
- **Quantity**: See gauge information.
- **Quality**: The North Fork American River is a Wild and Scenic River. There are no TMDL water bodies in the basin. Beneficial water uses include: Cold water fisheries, spawning habitat, wildlife habitat, and contact and non-contact water sports. Other downstream uses include municipal and domestic water supply, irrigation, and power generation and water storage in down-stream reservoirs.

Beneficial Uses



Step 2: Rate the Factors

- To organize and rate the relative importance of the factors from the characterization
- Rating applies to:
  - Flow,
  - Quality, and
  - Timing of water

Ratings

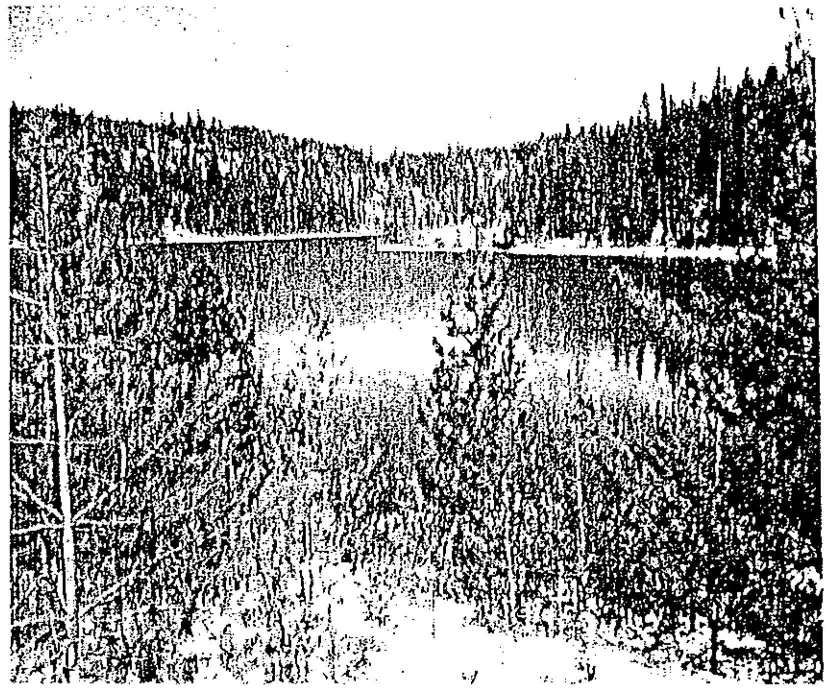
- Relative rating: 1-3
  (1= greatest influence, 3= least)
- A rating is assigned for F, Q, and T
- Rating is subjective and based on professional judgment

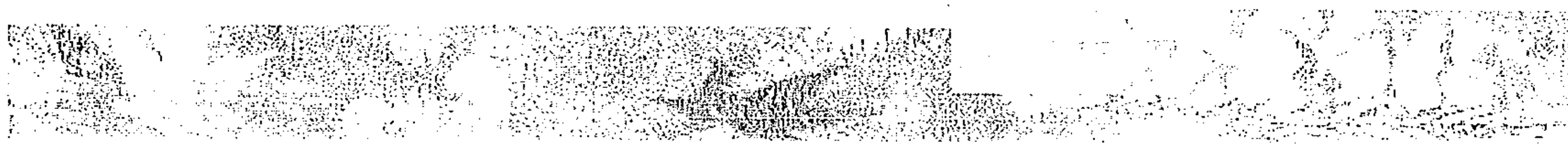
Meteorology

		Flow	Quality	Timing
Rain	Amount:	1	2	1
	Duration	1	2	1
	Frequency	1	2	1
Snow:	Water Equivalent	1	3	1
Temperature		2	3	2

Surface Water

	Flow	Quality	Timing
Natural Lakes	3	3	3
Reservoirs	1	2	1





Soils and Geology

		Flow	Quality	Timing
Soils:	Depth:	2	2	1
	Infiltration:	2	1	1
Geology:	Lithology:	2	1	1

Basin Characteristics

	Flow	Quality	Timing
Channel Type	3	3	3
Drainage Density	3	3	3
Basin Topography	3	3	2

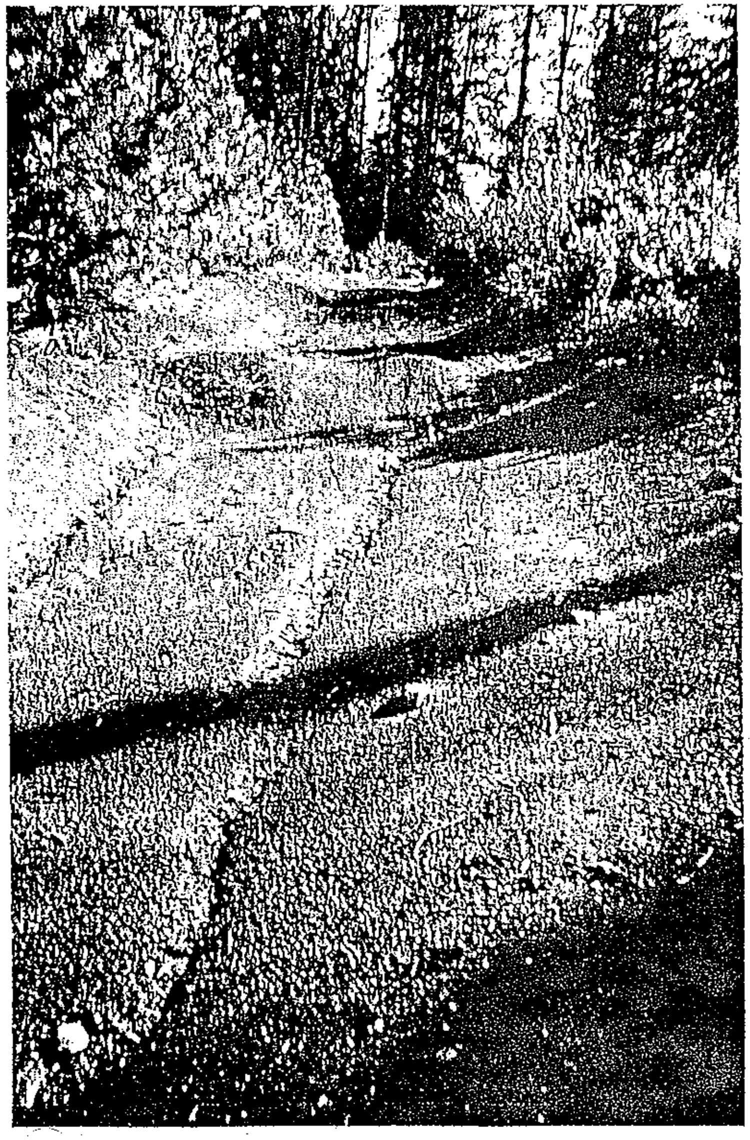
Vegetation and Wetlands

	Flow	Quality	Timing
Vegetation Type	2	2	2
Wetlands/ Riparian Areas	2	1	2

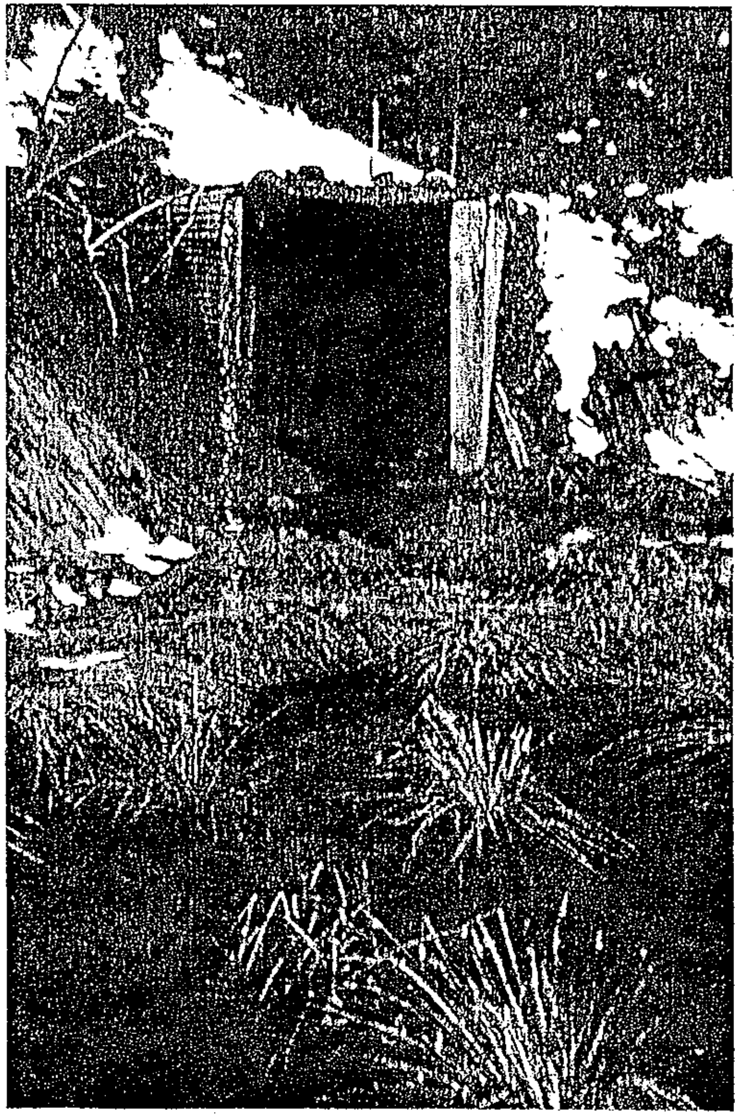
Disturbances

	Flow	Quality	Timing
Roads	1	1	1
Dams	1	2	1
Urbanization	1	1	1
Harvest	2	2	2
Grazing	3	1	3
Mining	2	1	3
Agriculture	2	1	3
Recreation	3	1	3
Fire	2	2	2

Roads Disturbance

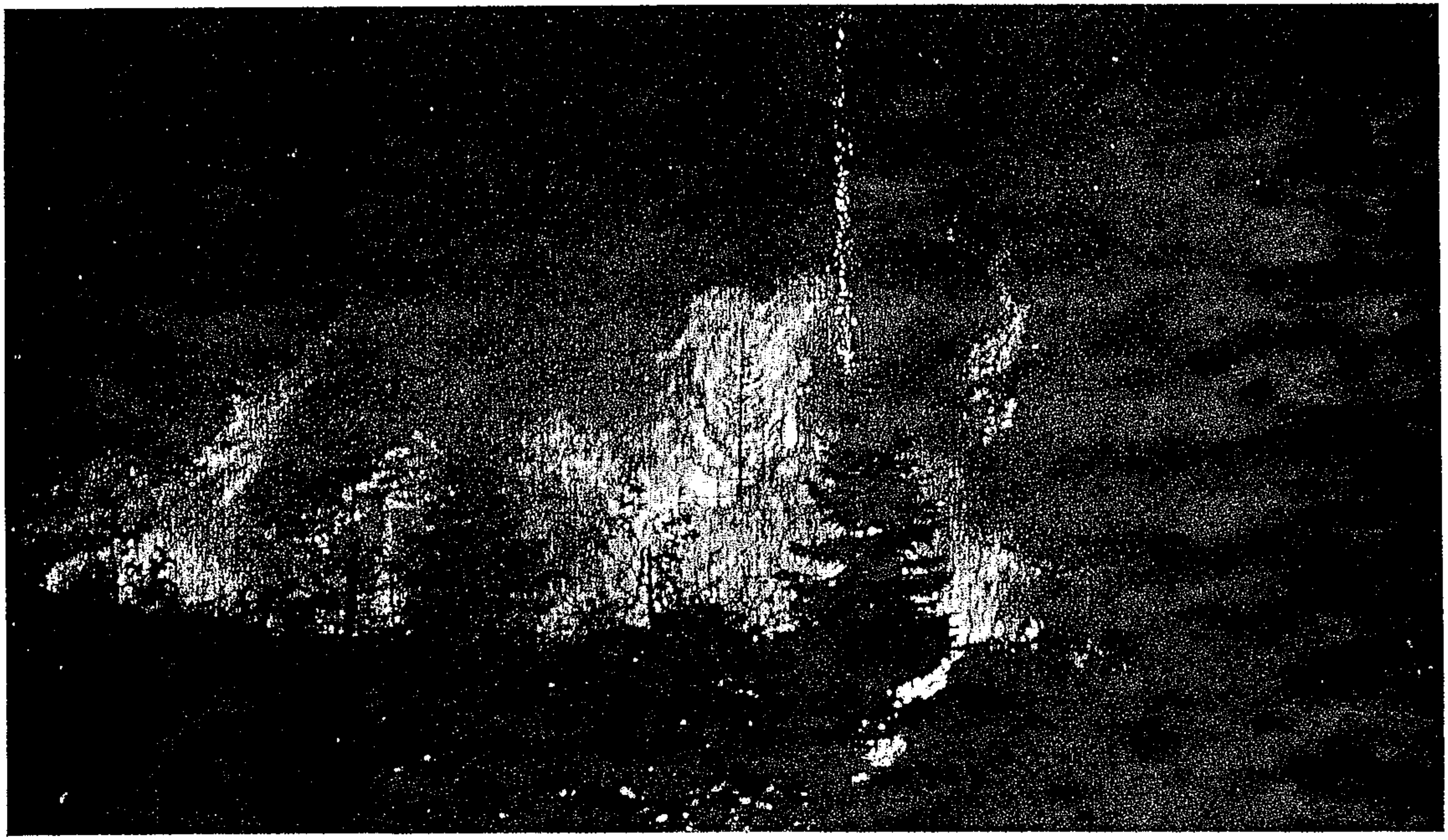


Mining Disturbance



Recreation Disturbance

Wildfire



Step 3: Identify Important Factors

- Objectives:
  - To identify the primary factors that influence flow, quality or timing
  - To identify the best measure and an appropriate metric to be used to express each factor

Use of ratings

- Select factors with a rating of "1" for F, Q, or T
- Factors rated as 2 or 3 or combinations may be retained to:
  - Provide context
  - Interpret or define factors rated "1"

Selection Guidance

Considerations:

- Directly linked/ greatly influence F, Q, T
- Influenced by human activity
- Obtainable, quantifiable and/or qualifiable
- Reflective of dominant physical, chemical, or biological processes
- Definable with a reference or range of variation over time

Step 1: Characterization of the Watershed

Watershed Name: North Fork American River

Ownership: BLM, Private, US Forest Service

Size: 652,805 acres

Precipitation: Average annual precipitation 58.72 inches. Precipitation occurs mostly during winter months in the form of rain and snow.

Vegetation: Mixed conifer, mixed conifer-hardwood, hardwood, shrub, herbaceous

Geology: Metasedimentary (of marine origin), volcanic, and granitic rocks. Glacial deposits in upper part of watershed.

Soils: Soils range from shallow (<20 inches) to very deep (>60 inches)

Dominant Processes: Fluvial and colluvial processes.

Basin shape/relief: Elevations range from 225 to10,380 feet. Landscape is steep and dissected with many sharp ridges and bedrock confined stream generally oriented southwest.

Lakes: Numerous lakes and reservoirs in the basin.

Wetlands & Riparian Zones: Wetlands and meadows generally are found in the headwaters, exhibiting diverse vegetative communities. This is a data gap.

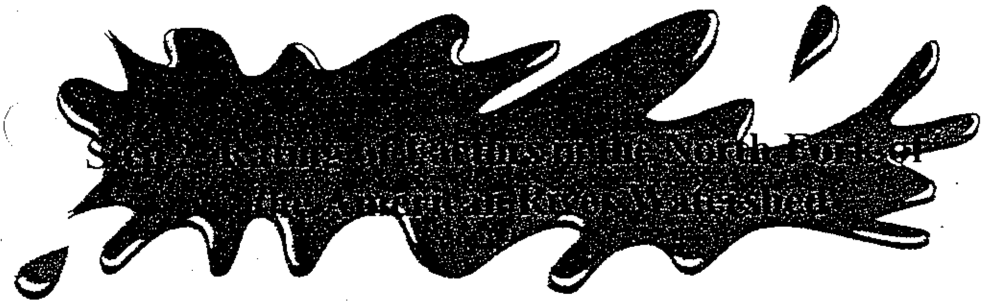
Surface Water: See list of gauges.

Quantity: See gauge information.

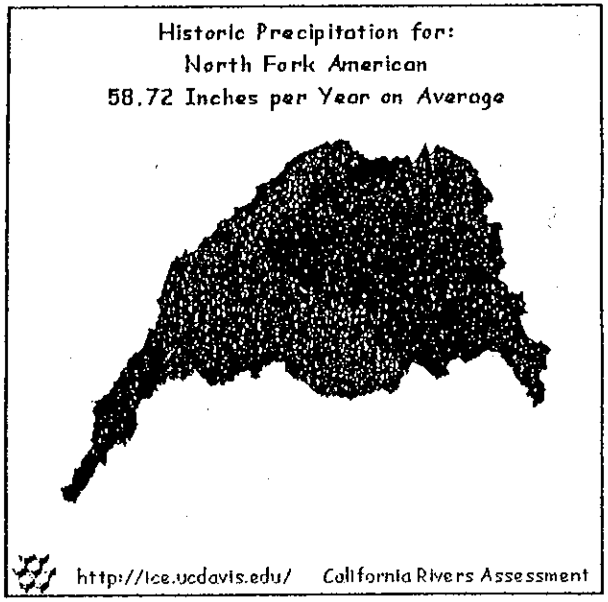
Quality: The North Fork American River is a Wild and Scenic River. There are no TMDL water bodies in the basin. Beneficial water uses include: cold water fisheries spawning habitat, wildlife habitat, and contact and non-contact water sports. Other downstream uses include municipal and domestic water supply, irrigation, and power generation and water storage in downstream reservoirs.

Dominant Processes: Fluvial and colluvial processes.

Disturbances: GROUP EXERCISE



Feature			Flow	Ranking Quality	Timing
Meterology:					
	Rain:	Amount:	1	2	1
		Duration:	1	2	1
		Frequency:	1	2	1
	Snow:	Water Equiv:	1	3	1
	Temperature:		2	3	2
Surface Water:					
	Natural Lakes:		3	3	3
	Reservoirs:		1	2	1
Soils:					
	Depth:		2	2	1
	Infiltration:		2	1	1
Geology:					
	Lithology:		2	1	1
Basin Characteristics:					
	Channel Type:		3	3	3
	Drainage Density:		3	3	2
	Basin Topography:		3	3	2
Vegetation Type:			**2**	**2**	**2**
Wetlands & Riparian Areas:			**2**	**1**	**2**
Disturbances:					
	Roads:		1	1	1
	Dams:		1	2	1
	Urbanization:		1	1	1
	Harvest:		2	2	2
	Grazing:		3	1	3
	Mining:		2	1	3
	Agriculture:		2	1	3
	Recreation:		3	1	3
	Fire:		2	2	2



Precipitation by Weighted Average

Average Rainfall Amount per Isohyetal Unit	Area	Relative Contribution
22.5 inches	6231.06 acres	0.01
27.5 inches	18500.29 acres	0.03
35 inches	18902.78 acres	0.03
45 inches	99827.39 acres	0.15
55 inches	145856.14 acres	0.23
65 inches	271367.51 acres	0.42
75 inches	81388.33 acres	0.13
85 inches	5095.48 acres	0.01

Historic Climate Data from Western Regional Climate Center

General Climate Summary Tables

Temperature
Precipitation
Heating Degree Days
Cooling Degree Days
Growing Degree Days

Temperature

Daily Extremes and Averages
Spring 'Freeze' Probabilities
Fall 'Freeze' Probabilities
'Freeze Free' Probabilities

Precipitation

Monthly Average
Daily Extreme and Average
Daily Average

Average Precipitation per Year

Levels of precipitation play a huge role in many factors affecting watershed health. Precipitation levels affect water levels, temperatures and velocity. Reservoir levels, erosion levels and pollution runoff also fluctuate with the levels of rainfall. The following process was used to determine the average precipitation per year. The precipitation coverage represents lines of equal rainfall, isohyets, based on long-term mean annual precipitation data compiled from USGS, California Department of Water Resources, and California Division of Mines map and information sources. Source maps are based primarily on U.S. Weather Service data for approximately 800 precipitation stations throughout California collected over a sixty-year period (1900-1960). The minimum mapping unit is 1000+ acres and the isohyetal contour intervals are variable due to the degree of variation of annual precipitation with horizontal distance. The CARA database utilizes a weighted average to determine a single value of mean annual precipitation; the isohyetal areas, after intersection, are multiplied by the average rainfall for each isohyet-derived polygon and divided by the total area of the CARA watershed.

BLUE CANYON, CALIFORNIA

Period of Record General Climate Summary - Temperature

Station:(040897) BLUE CANYON														
From Year=1948 To Year=2000														
	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days
January	43.5	30.7	37.1	71	31/1962	5	10/1949	45.5	61	26.3	49	0.0	4.6
February	45.1	31.5	38.3	73	08/1954	6	13/1949	46.6	54	30.1	69	0.0	2.9
March	45.5	31.6	38.5	72	31/1966	9	06/1956	45.5	86	31.5	52	0.0	3.0
April	52.2	36.2	44.2	82	13/1985	17	02/1955	53.4	85	29.6	67	0.0	1.4
May	60.7	43.3	52.0	88	28/1984	21	03/1950	57.5	73	42.2	77	0.0	0.1
June	69.6	51.4	60.5	92	29/1950	28	06/1950	67.1	60	53.5	53	0.1	0.0
July	77.4	58.7	68.0	95	14/1972	36	17/1987	72.8	59	62.0	83	0.4	0.0
August	76.7	57.5	67.1	97	08/1978	35	31/1964	72.6	67	60.0	76	0.6	0.0
September	72.0	53.2	62.6	93	01/1950	27	30/1971	70.2	74	52.6	86	0.3	0.0
October	62.8	45.8	54.3	88	02/1980	17	28/1971	63.1	88	46.8	84	0.0	0.0
November	51.2	37.3	44.2	78	01/1949	14	29/1975	54.5	59	34.9	73	0.0	1.0
December	45.8	32.7	39.3	75	02/1958	3	09/1972	48.7	58	30.1	71	0.0	3.5
Annual	58.5	42.5	50.5	97	19780808	3	19721209	52.6	81	48.3	71	1.3	16.6
Winter	44.8	31.7	38.2	75	19581202	3	19721209	43.9	63	29.7	49	0.0	11.0
Spring	52.8	37.0	44.9	88	19840528	9	19560306	49.7	66	39.2	67	0.0	4.5
Summer	74.6	55.9	65.2	97	19780808	28	19500606	69.2	60	61.4	63	1.0	0.0
Fall	62.0	45.4	53.7	93	19500901	14	19751129	58.2	99	48.1	85	0.3	1.1

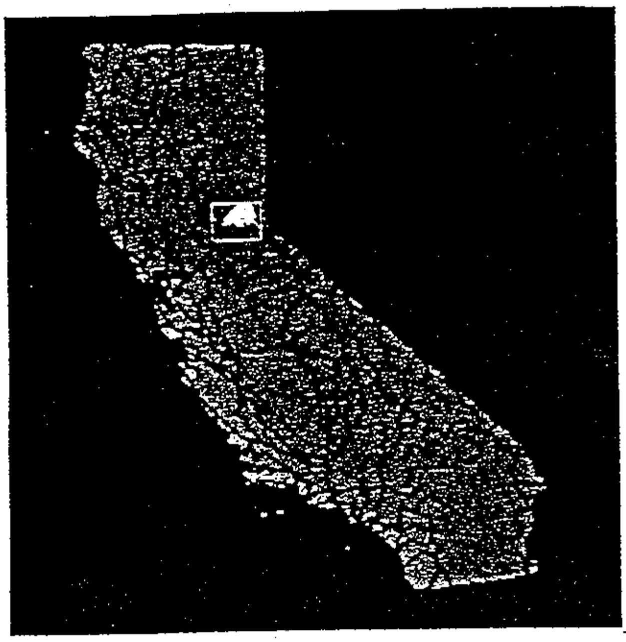
Table updated on Jul 10, 2000
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

BLUE CANYON, CALIFORNIA

Period of Record General Climate Summary - Precipitation

Station:(040897) BLUE CANYON															
From Year=1948 To Year=2000															
	Precipitation											Total Snowfall		
	Mean	High	Year	Low	Year	1 Day Max.		>= 0.01 in.	>= 0.10 in.	>= 0.50 in.	>= 1.00 in.	Mean	High	Year
	in.	in.	-	in.	-	in.	dd/yyyy or yyyymmdd	# Days	# Days	# Days	# Days	in.	in.	-
January	13.02	33.86	70	0.74	84	8.70	31/1963	13	11	7	5	50.9	176.3	52
February	10.52	37.71	86	0.82	64	8.57	17/1986	11	9	6	4	44.6	128.6	69
March	9.27	22.25	83	1.67	88	5.21	07/1986	13	11	6	3	52.5	146.8	52
April	5.14	14.20	63	0.67	68	3.95	11/1982	10	7	3	2	26.6	81.2	55
May	2.68	10.87	57	0.06	85	5.13	18/1957	7	5	2	1	7.6	26.1	53
June	0.80	2.72	64	0.00	49	1.96	26/1971	3	2	1	0	0.7	8.0	54
July	0.27	5.86	74	0.00	48	4.59	08/1974	1	0	0	0	0.0	0.1	55
August	0.45	3.68	76	0.00	50	2.59	19/1968	2	1	0	0	0.0	0.0	48
September	1.12	7.05	86	0.00	74	3.06	24/1986	3	2	1	0	0.4	7.4	71
October	3.93	22.32	62	0.00	66	7.37	13/1962	5	4	2	1	2.9	22.0	56
November	9.59	28.36	73	0.00	59	8.56	20/1950	11	8	6	3	24.6	69.9	84
December	11.67	45.12	55	0.36	76	9.33	22/1964	12	10	6	4	41.1	154.1	52
Annual	68.44	121.71	83	23.48	76	9.33	19641222	90	69	41	24	251.8	591.1	52
Winter	35.21	77.34	56	9.18	77	9.33	19641222	36	30	20	13	136.6	332.2	52
Spring	17.09	34.02	82	5.51	76	5.21	19860307	30	22	12	6	86.6	201.6	58
Summer	1.52	6.39	74	0.00	51	4.59	19740708	6	3	1	0	0.7	8.0	54
Fall	14.63	36.96	50	3.85	59	8.56	19501120	19	14	9	5	27.9	84.7	84

Table updated on Jul 10, 2000
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.



Search by Basin | Search by County
Search by Assembly District | Search by Congressional District

General Information

Basin Name:	North Fork American
Area:	647154.9 acres

Watershed Statistics

Naturally Occurring Waterways:	1317.6 miles
Percentage of Free Flowing River Miles:	84 %
Percentage of River Miles in Protected Lands:	5 %
Protected Lands:	7 %
Number of Dams:	28
Number of Selected Watershed Projects:	11
Number of Stream Crossings:	809
Near-Stream Roads:	395.59 miles
Average Precipitation per Year:	58.72 inches
Percentage Area above 15% Slope:	39.07 %
Number of CalWater Units:	78
WBS TMDL Rivers	0
Number of Special Status Species:	13
Number of Holland Communities:	50

Maps Available

Dynamic, Interactive Map Systems

- ICEMAPS2 new
- ICEMAPS

Static, Pre-defined Maps

--->Select Standard Data Maps<---

View | Download

Additional Information from "AIM"

County	Congressional District	State Assembly District
El Dorado	2	3
Nevada	4	4
Placer		5
Sacramento		

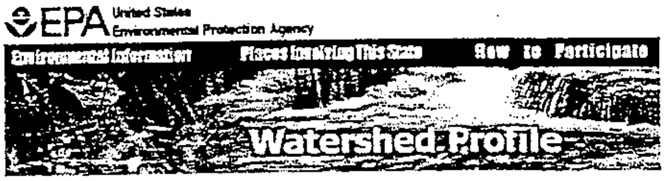
Internet Resources

Dynamic River Basin Information

USGS Gaging Stations
USGS Water Use Data for 1990
EPA Surf Your Watershed

Web Sites of Interest

American River Basin Cooperating Agencies
American River Conditions
American River Conservancy



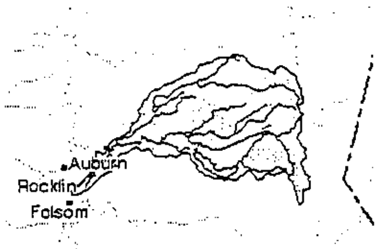
Locate Your Watershed

Atlas

News Flashes:

North Fork American

USGS Cataloging Unit: 18020128



Places Involving this Watershed

States:

- California

Counties:

- El Dorado
- Nevada
- Placer
- Sacramento

Metropolitan Areas:

- Sacramento

Nominated

Environmental Profile

Find general information integrated for this specific watershed

Assessments of Watershed Health

Index of Watershed Indicators (provided by EPA)

Unified Watershed Assessments (UWA) (provided by States and Tribes)

1998 Impaired Water (provided by EPA / State partnership)

Environmental Information

River Corridors and Wetlands Restoration Efforts

Environmental Web Sites:

- Real Time

Facilities regulated by EPA (provided by Envirofacts)

- Toxic releases (Source:TRI - Toxic Release Inventory)

American Heritage Rivers:

- None

Other Watersheds:

upstream

- South Fork American

downstream

- Lower American

Tribes

- None Known

Large Ecosystems:

- San Francisco Bay/Sacramento -San Joaquin Delta Estuary

- Hazardous Wastes (Source: RCRA - Resource Conservation Recovery Act)
- Superfund Sites (Source: CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act)

EnviroMapper for Watersheds- (interactive mapping tool)

Water

Find information focused on water for this specific watershed

Rivers and Streams in this Watershed: 11 (provided by EPA's first River Reach File)
Lakes in the watershed: 67 Total number of watershed acres: 7972.6
River and stream miles:

- 1519.8 total river miles
- 1213.6 perennial river miles
- No data available :% of total rivers and streams have been surveyed
- No data available :miles meet all designated uses

The following aquifer's are in this huc: (Source: USGS Principal Aquifers of the 48 Contiguous United States 1998)

Aquifer	Square Miles	Rock Type
No Principal Aquifer	1011	N/A

Facilities regulated by EPA (provided by Envirofacts)

- Community Water Sources (Source: SDWIS Safe Drinking Water Information System)
- Water Dischargers (Source: PCS - Permit Compliance System)

Information provided by the United States Geological Survey (USGS): EXIT EPA

- Stream Flow (Source: USGS)
- Science in Your Watershed
- Historical Water Data
- Water use (1990): Information about the amount of water used and how it is used
- Selected USGS Abstracts

Land

Find watershed information focused on land characteristics

Area: 1009.83 sq mi; perimeter: 190.02 mi
Habitat:

- Forest Riparian Habitat
- Agricultural/Urban Riparian Habitat

People

Find out about local actions in this watershed:

Citizen-based Groups at work in this Watershed
(Provided by Adopt Your Watershed)
Join now (Adopt Your Watershed)
National Watershed Network (provided by Conservation Technology Information Center)
Exit EPA

Air

Find information focused on air for this watershed:

Facilities regulated by EPA (provided by Envirofacts)

- Air (Source: AIRS)

EPA United States Environmental Protection Agency

Surf Your Watershed

Locate Your Watershed

Facilities for:
North Fork American

USGS Cataloging Unit: 18020128

Facility ID	Facility Name	Facility Address
CA3100041	Alpine Meadows Poa	CA
CA3100049	Aurora Mobile Home Park	Placer, CA
CA3100098	Baxter Campground Enterprises	CA
CA3100100	Baxter Ranch Holding Co	CA
CA3103206	Caltrans - Gold Run Rest Stop	Placer, CA
CA3100112	Capeview Ban	CA
CA3100005	Central Eden Valley	CA
CA3103218	Community Of The Great Commiss	Placer, CA
CA3100103	Dingus Mc Gee'S	Placer, CA
CA3103234	Everybody'S Inn	Placer, CA
CA3110003	Foresthill Public Utility Dist	Placer, CA
CA3100043	Gold Hill Mobile Park	CA
CA3100106	Gold Run Recreation Ent.	CA
CA3100015	Gold Run Village	Placer, CA
CA3100013	Iowa Hill Water Cooperative	Placer, CA
CA3100099	Just Out Of Town Water System	CA
CA3103664	Kaspian Point Picnic Area	Placer, CA
CA3100051	Majestic Mountain Resort	Placer, CA
CA3100093	Mexican Villa Restaurant	Placer, CA
CA2900623	Nid - Peninsula Campground-Rollins Lake	Placer, CA
CA0900405	Northridge Elementary School	El Dorado, CA
CA2900615	P G & E Bear Valley	Placer, CA
CA3103244	Parker Flat Ohv Staging Area	Placer, CA
CA3100039	Ponderosa Terrace Mhp	Placer, CA
CA2900559	Prairie Creek Homeowners Assn	Nevada, CA
CA3103260	Robinson Flat	Placer, CA
CA3103283	Rollins Lake Resort, Long Ravi	Placer, CA
CA3100048	Salvation Army	CA
CA3100040	Shady Glen Comm Water System	CA

CA3100094	Sierra Nevada Grange	Placer, CA
CA3100096	Sons Of Norway Rec Center	CA
CA3103261	Sugar Pine Reservior	Placer, CA
CA3100092	Tee Pee Restaurant	Placer, CA
CA3100001	Timberhills Water Association	Placer, CA
CA3100073	Weimar Institute	CA
CA3110035	Weimar Water Company	Placer, CA

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May 23, 2001 @11:57

Glossary

Base Flow - Streamflow, or runoff, which results from precipitation which infiltrates into the soil and eventually moves through the soil to the stream channel. Also known as dry-weather flow and groundwater flow.

Basin Topography – The predominant slope and aspect of a watershed.

Channel Type – A Channel classification system based on a number of stream parameters including slope, width-depth ratio, and sinuosity.

Drainage Density – A measure of the number of stream miles per acre.

Erosion – Wearing away of the lands by running water, glaciers, winds, and waves, can be subdivided into three process: corrasion, corrosion, and transportation. Weathering, although sometimes included here, is a distant process that does not imply removal of any material.

Evapotranspiration – Water withdrawn from a land area by evaporation from water surfaces and moist soil and by plant transpiration.

Geomorphology – A natural physical process that is responsible for the movement and deposition of organic and inorganic materials through a watershed under the influence of gravity or water.

Hydrologic Condition – The current state of the processes controlling the yield, timing and quality of water in a watershed. Each physical and biological process that regulates or influences stream flow and groundwater character has a range of variability associated with the rate or magnitude of energy and mass exchange. At any point in time, each of these processes can be described by their current rate or magnitude relative to the range of variability associated with each process. Integration of all processes at one time represents hydrologic condition.

Hydrologic Unit – A level of a hierarchal system to describe geographic areas Hydrologic units are used for the collection and organization of hydrologic data.

Infiltration (soils) – Movement of water through the soil surface into the soil.

Interception – The process by which precipitation is caught and held by foliage, twigs, and branches of trees, shrubs, and other vegetation, and lost by evaporation, never reaching the surface of the ground. Interception equals the precipitation on the vegetation minus streamflow and through fall.

Lithology – the underlying bedrock geology that is responsible for soil formation.

Potential – The difference between current factor values and the capability to adjust toward reference condition values is the potential. Also referred to as operating range or management decision space.

Professional Judgment – Intuitive conclusions and predictions dependant upon analyst's training; interpretation of facts, information and observations; a personal knowledge of the watershed being analyzed.

Reference – The range of a factor that is representative of its recent historical values prior to significant alteration of its environment. The reference could represent conditions found in a relic site or a site having had little significant disturbances, but does not necessarily represent conditions that are attainable.

Reliability – A statistical value for the quality of a measurement process.

Reservoir – A man made lake or pond.

Runoff - That part of precipitation that flows toward the streams on the surface of the ground or within the ground. It is composed of baseflow and surface runoff.

Watershed – A geomorphic area of land and water within a drainage divide. The total area above a given point on a stream that contributes to flow at that point.

HCA Steps 2 & 3

The group identified items that they considered important disturbances in the watershed. The following were identified:

Urbanization:
Grading
Construction
Parking Lots
Housing
Business/Industry
Landscaping
Population Distribution
Regulatory Actions
Interstate 80
Transcontinental Railroad
Gas Line
Power Transmission Lines
Air Pollution

Extreme Processes:
Drought
Torrential Rain Events
Flood Events
Fire Frequency/Catastrophic Fire
Radical Wind Storms

Dams/Diversions:
Water Diversions
Water Storage Facilities
Water Conveyance Facilities
Hydro Generations Facilities

Mining:
Historic Mining
Current Mining
Reservoir Sediment

Recreation:
Water Contact Sports
Campgrounds
OHV
Hunting (including poaching)
Hiking
Mountain Biking
Car Daytrips
Equestrian Use

Miscellaneous:
Timber Harvest
Harvest of Other Forest Products
Roads
Trails
Prescribed Fire
Landslides
Grazing
Timber Land Management
Exotic Invasive Plants
Pot Farms
Hazardous Materials Dumping
Agricultural Land Conversion
Waste Water Disposal
Storm Water
Agricultural Practices

The following items were selected as priorities for analysis and rated according to flow, quality and timing:

Disturbance	Flow	Quality	Timing
Grading	1	1	2
Urbanization	1	1	1
Business/Industry	1	1	1
Urban Landscaping	3	1	2
Interstate 80	2	1	3
Transcontinental Rail Road	2	1	3
Gas Line	3	3	3
Power Transmission	3	3	3
Air Pollution	3	1	3
Water Diversions	1	3	1
Water Storage Facilities	1	1	1
Historic Mining	1	1	3
Current Mining	3	1	3
Reservoir Sediment	3	2	3
Harvest of Special Forest Products	3	3	3
Roads	1	1	1
Trails	2	2	3
Fire	1	1	1
Landslide	3	1	2
Timber Land Management	2	2	2/3
Exotic Invasive Plants	2	2-3	2
Agricultural Land Conversion	2	2	3
Waste Water Disposal	3	1	3
Storm Water	1	1-2	1
Agricultural Practices	3	1	3
OHV	2	1	3

APPENDIX B –MIDDLE FORK AMERICAN RIVER HYDROLOGIC CONDITION ASESSMENT

HYDROLOGIC CONDITION ASSESSMENT OF THE MIDDLE FORK OF THE AMERICAN RIVER

The Hydrologic Condition Assessment (HCA) systematic analysis that identifies the physical processes that drive flow, quality and timing of water and the human and natural disturbances that alter them. The six-step analysis is based upon basic principles of hydrology, knowledge of the watershed and an interdisciplinary approach to judging driving processes and disturbances. The end result is an understanding of the major hydrologic condition of a watershed that can be integrated into a larger watershed analysis.

In 2002, the Foresthill Ranger District conducted an HCA for the Middle Fork of the American River. The following information is a summary of that analysis. The casefile is attached in Appendix A. Appendix B includes information obtained from a public meeting discussing the hydrologic condition in the North and Middle Forks of the American River.

STEP 1 – CHARACTERIZATION OF THE WATERSHED

Meteorology

Precipitation

- 53.1 inches (average annual precipitation 1990-2002 at FHRD)
- Rain on snow occurs in the 3,500 – 6,000 feet elevation range

Air Temperature

- 19 – 80° F at 5,000 feet. Temperatures would be slightly warmer at lower elevations and slightly cooler at higher elevations (+/- 10-15 degrees).

Surface and Ground Water

Quantity

- Diversions:
  - Flow in the MFAR is regulated by French Meadows Reservoir, Hell Hole Reservoir, Loon Lake (stations 11427400, 11428700, and 11429350), Stumpy Meadows Lake, several smaller reservoirs, and Oxbow Powerplant. Water is diverted out of the basin from French Meadows Reservoir to Hell Hole Reservoir (station 11428700) and from Interbay Reservoir to Ralston Powerplant (station 11427765). Water is diverted into the basin from Hell Hole Reservoir to Middle Fork Powerplant (station 11423080) and through South Fork and North Fork Long Canyon Creek Diversion Tunnels (stations 11433060 and 11433080). Robbs Peak Powerplant (station 11429300) and Georgetown Divide Ditch divert water out of the basin. See schematic diagram of Middle Fork American and Rubicon River Basins.
- Streams:
  - Duncan Canyon (upstream of dam) (#11427700): 38.7 cfs (annual mean for 1960-2000)
  - Duncan Canyon (downstream of dam) (#11427750): 14.1 cfs (annual mean for 1965-2000)
  - MFAR (downstream of French Meadows) (#11427500): 21.9 cfs (annual mean for 1965-2000)
  - MFAR (upstream of Interbay) (#11427760): 105 cfs (annual mean for 1966-2000)
  - MFAR (below Interbay Dam, near Foresthill) (#11427770): 66 cfs (annual mean for 1966-1985
  - MFAR (near Foresthill) (#11433300): 1142 cfs (annual mean for 1959-2001)
- Reservoirs:
  - French Meadows Reservoir (#11427400) – 136,400 acre-feet
  - Duncan Diversion Dam -- 1,750 cubic yards
- Springs: A number of springs exist throughout the watershed. Some have been modified as water sources for drafting, mining and grazing.

Quality

- No TMDLs exist
- Beneficial uses include cold-water fisheries, livestock watering, wildlife habitat, contact water sports, non-contact water sports, power generation and water storage.
- Water quality is fishable, swimmable and suitable for drinking after normal treatment

<u>Drainage Basin Characteristics</u>

Morphometry

- Size: 130,067 acres
- Elevation Range: Approximately 1,070 to 9,000 feet.
- Slope: 80% of the watershed is greater than 16% slope.
- Aspect: Southwest
- Miles of Perennial Channels: 326 miles
- Miles of Seasonal Channels: 1043 miles
- Drainage Pattern: Dendritic

Geology

- Predominant Types: Metasedimentary, volcanic, granitic with some glacial deposits in high elevation areas (primarily Granite Chief Wilderness)
- Predominant Processes: Fluvial and colluvial

Soils

- Predominant Types: Soils are formed on volcanic mudflow, meta-sedimentary rock, and glacial deposits
- Depth: Highly variable, ranging from 10 to 60 inches
- Erosion Hazard Ratings: High to very high
- Erosion present: gully erosion is common throughout watershed
- Productivity: Moderate over majority of area

Vegetation

- Forest types:
  - Westside mixed conifer below 5,000 feet elevation (ponderosa pine, incense cedar, white fir, Douglas fir, black oak, live oak)
  - Upper montane above 5,000 feet elevation (white fir, red fir, Jeffery pine)
- A number of plantations exist and are managed throughout the watershed
- The 2001 Star Fire resulted in the burning of approximately 17,500 acres in the watershed

Wetland Areas

- Three meadows are mapped in the WAA: a 6-acre meadow in the Secret Canyon subwatershed, a 20- acre meadow in the Duncan Canyon subwatershed and a 121-acre meadow near the Middle Fork American River in the French subwatershed.
- A number of springs exist throughout the watershed.

- Several known fens exist in the watershed. All of the known fens need some protection and/or restoration.
  - The fen in the Mosquito Creek drainage has been severely disturbed due to grazing and a drainage ditch that has de-watered the fen.
  - A fen in upper Spruce Creek has been moderately disturbed by grazing.
  - A fen in upper Mosquito Creek is on unstable ground and shows signs of moderate to severe degradation.

<u>Human Influences</u>

Ownerships/designations (some acreages overlap)

- USFS – 100,849 ac
  - TNF – 94,238 ac
  - ENF – 6,611 ac
- Private – 28,965 ac
- Game refuge – 35,954 ac
- Roadless – 17,219 ac
- Wilderness – 6,694 ac

Land Uses

- Mining
- Grazing
- Timber harvest
- Recreation
- Hydroelectric
- Roads:
  -
  - Total roads in WAA - 647.4 miles
    - Dirt – 522.6 miles
    - Improved – 78.8 miles
    - Secondary Highway – 46 miles
  - Total road density - 3.2 miles/ square mile
  - Roads in Riparian Conservation Areas – 78.3 miles
    - Dirt – 59.8 miles
    - Improved – 14.3 miles
    - Secondary Highway – 4.2 miles
  - RCA road density – 1.9 miles/ square mile

STEP 2 – RATE THE FACTORS

The purpose of this step is to identify the factors that influence the flow, quality and/or timing of water within a watershed. The factors identified in Step 1 are rated based according to how they influence flow quality and/or timing of water on a scale of 1 (high influence) to 3 (low influence). All factors are rated relative to each other.

Table 1. Relative Importance Scale

RATING	RELATIVE INFLUENCE ON FLOW, QUALITY OR TIMING
1	HIGH
2	MODERATE
3	SLIGHT/NONE

Table 2. Ratings of factors that characterize the watershed

Factors	Flow	Quality	Timing
Meteorology			
Precipitation			
Amount	1	2	1
Duration	1	2	1
Frequency/Intensity	1	2	1
Air Temperature	2	3	2
Surface and Ground Water			
Reservoirs	1	2	1
Springs	1	2	1
Drainage Basin Characteristics			
Morphometry			
Channel Type	3	3	3
Drainage Density	3	3	2
Basin Topography	3	3	2
Geology	2	1	1
Soils			
Depth	2	2	1
Infiltration	2	1	1
Vegetation	2	2	2
Special Aquatic Features	2	2	2
Disturbances			
Mining	2	2	3
Grazing	3	2	3
Vegetation Management	2	2	2
Recreation	3	2	3
Hydroelectric	1	2	1
Roads	1	1	1
Fire	1	1	1

STEP 3 – IDENTIFY IMPORTANT FACTORS

Table 3 was completed based on information from Step 1 to show the relative importance of the meteorological, surface-water, ground-water and drainage basin factors to flow, quality and timing of water in the watershed. Considering the relative ratings in Table 3, several factors have been identified as the most important for the watershed.

Factors with ratings of 1 for flow, quality <u>and</u> timing of water:

- Roads
- Fire

Factors with ratings of 1 for flow, quality <u>or</u> timing of water:

- Precipitation amount, duration and frequency
- Reservoirs
- Springs
- Geology
- Soil depth and infiltration
- Special aquatic features
- Hydroelectric

Factors with ratings other than 1 that the analysts have determined are relevant to the analysis:

- Vegetation Management

Of the factors selected, the following cannot be influence by management, but will be important descriptors to supplement and support conclusions about hydrologic conditions. Quantification of the following factors will not be necessary. Without human influence, there is no variation between current and reference levels (Steps 4 and 5) that allow interpretation (Step 6):

- Precipitation, amount, duration and frequency
- Geology

Factors that management will affect include:

- Roads
- Fire
- Reservoirs
- Special aquatic features
- Soil depth and infiltration
- Hydroelectric
- Vegetation management

Factors that have little or no existing data for analysis:

- Special aquatic features

Table 3. Summary of important hydrologic condition factors and selected measures.

Factor	Flow	Quality	Timing
Roads	Annual runoff (ac-ft) Mean annual flow (cfs)	Sediment yield (tons/year)	Time to peak (hr)
Fire	Annual runoff (ac-ft) Mean annual flow (cfs)	Sediment yield (tons/year)	Time to peak (hr)
Reservoirs	Annual runoff (ac-ft) Mean annual flow (cfs)	Not significant	Time to peak (hr)
Soil Depth	Not significant	Not significant	Time to peak (hr)
Soil Infiltration	Not significant	Sediment yield (tons/year)	Time to peak (hr)
Hydroelectric	Mean annual flow (cfs) Annual peak flow (cfs)	Not Significant	Time to peak (hr)
Vegetation Management	Mean annual flow (cfs) Annual runoff (ac-ft) Annual peak flow (cfs)	Sediment yield (tons/year)	Time to peak (hr)

STEP 4 – ESTABLISH CURRENT LEVELS

The next step in the process is to quantify the current range and status of the primary factors influencing flow, quality and timing of water, as identified in Step 3.

Data used in the following data was collected on the Middle Fork American River near Foresthill (USGS gage 114333000). This gage was selected because it is the lowest gage in the WAA.

Table 4. Current range of variability for primary factors

Factor	Value	Reliability
Flow		
• Annual runoff (ac-ft) *	748,200	Medium*
**	427,900	
***	827,000	
• Peak Flow (cfs) **	1710	High
***	18 – 310,000	
• Average Flow (cfs) *	1031	High
**	591	
***	1142	
Quality		
• Sediment yield	No data available	NA
Timing		
• Time to peak (hr)	No data available	NA

*Runoff information for WY2000
**Runoff information for WY2001
***Runoff information for Period of Record – 1959-2001

Another gage of interest is the gage below French Meadows Reservoir (USGS gage 11427500). This gage was selected because the greatest amount of data is recorded at this site and because it was in place prior to the construction of the Middle Fork hydroelectric system. Measurements are done over a Water Year (WY) that begins in October and concludes in September.

Table 4. Current range of variability for primary factors

Factor	Value	Reliability
Flow		
• Annual runoff (ac-ft)	8,310	Medium*
• Peak Flow (cfs)	18 – 6,050	High
• Average Flow (cfs)	9.25 - 51.3	High
Quality		
• Sediment yield	No data available	NA
Timing		
• Time to peak (hr)	No data available	NA

*Runoff information for WY2000

While information about and analysis of water quality and timing data would be very useful in this analysis, no data exists for the current range of these factors in the Upper Middle Fork American River watershed. Some data exists over the past 10 years for the amount of sediment removed from various reservoirs within the watershed, but no historic data about sedimentation exists to form a useful comparison. A water quality study was completed in 1979, and included dissolved solids, but the measures are not comparable to tons of sediment removed from a reservoir. None of the flow data collected at the various gages in the watershed is reported on an hourly basis, so time to peak information is not available.

STEP 5 – ESTABLISH REFERENCE LEVELS

The next step in the process is to quantify the historic range and status of the primary factors influencing flow, quality and timing of water, as identified in Step 3.

Data used in the following data was collected on the Middle Fork American River downstream from French Meadows Reservoir (USGS gage 11427500). This gage was selected because the greatest amount of data is recorded at this sight and because it was in place prior to the construction of the Middle Fork hydroelectric system. Measurements are done over a Water Year (WY) that begins in October and concludes in September. Two sets of data will be used for comparisons of historic data. The first set of data used for this historic range is from 1952-1964 (prior to the construction of French Meadows Reservoir). The second set of data is for 1965-1989.

Table 5. Historic values of factors prior to the construction of French Meadows Reservoir

Factor	Value	Reliability
Flow		
• Mean annual runoff (ac-ft)	108,000	High
• Mean peak flow (cfs)	11,300	High
• Mean annual flow (cfs)	149	High
Quality		
• Sediment yield	No data available	NA
Timing		
• Time to peak (hr)	No data available	NA

Table 6. Historic values of factors after to the construction of French Meadows Reservoir

Factor	Value	Reliability
Flow		
• Mean annual runoff (ac-ft)	15,870	High
• Mean peak flow (cfs)	3,430	High
• Mean average flow (cfs)	21.9	High
Quality		
• Sediment yield	No data available	NA
Timing		
• Time to peak (hr)	No data available	NA

STEP 6 – IDENTIFY CHANGES AND INTERPRET RESULTS

Once the current range of values and the corresponding reference level of each specific factor has been documented, the significance and causes of any observed differences between the two sets of information and the potential for recover is evaluated.

Significance is an interpretation by the interdisciplinary team based on an evaluation of the magnitude, direction and rate of change between current and reverence values (Table 7). Ratings are subjective and based on professional judgment and knowledge of the watershed.

Table 7. Relative significance scale

RATING	RELATIVE SIGNIFICANCE
1	SIGNIFICNAT DIFFERENCE
2	MODERATE DIFFERENCE
3	SLIGHT/NO DIFFERENCE

Each factor can also be rated according to the potential for recovery (Table 8) when the cause-effect relationships for the differences between current and reference levels are understood. Statements of cause and effect relationships are documented prior to rating the recovery potential. Recovery potential ratings area based on the knowledge of physical capability of the watershed to respond when considered in the context of social, economic and technical feasibility and the need for recovery.

Table 8. Recovery potential scale

RATING	RECOVERY POTENTIAL
1	HIGH POTENTIAL
2	MODERATE POTENTIAL
3	SLIGHT/NO POTENTIAL

Table 9. Summary of current and reference conditions and ratings of significance and recovery

Factor	Current	Reference Pre/Post Hydroprojects	Significance	Recovery Potential
• Mean annual runoff (ac-ft)	8,310	108,000/15,870	2	3
• Mean peak flow (cfs)	18 - 6,050	11,300/3,430	2	3
• Mean average flow (cfs)	9.25 – 51.3	149/21.9	2	3

Logic for Subjective Ratings

The current ranges of mean annual runoff, peak flow and average flow are within the post hydroelectric project construction historic range. This suggests that no significant changes within the watershed have occurred over the past 10 years that would impact water flows. However, when compared to the pre-construction historic range, the current levels for these factors are significantly lower, indicating that the projects construction has impacted the amount of water moving through the watershed. A score of two was selected for each of these factors to represent a middle score between the significant impacts from the pre-construction comparison and no/little impacts from the post-construction comparison. Based on the comparison of pre-/post- construction scores, it was apparent that the greatest impact on flows within the watershed has been the construction of the Middle Fork hydroelectric project and that the opportunities for potential recovery are low.

APPENDIX C – UPPER MIDDLE FORK AMERICAN RIVER ROADS ANALYSIS

2002
ROADS ANALYSIS
TAHOE NATIONAL FOREST
FORESTHILL RANGER DISTRICT
UPPER MIDDLE FORK AMERICAN RIVER

UPPER MIDDLE FORK AMERICAN RIVER
FORESTHILL RANGER DISTRICT
TAHOE NATIONAL FOREST
ROADS ANALYSIS
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Upper Middle Fork American River Roads Analysis

The Analysis Setting

The Context of the Analysis

The setting of this analysis is the Upper Middle Fork of the American River watershed. It is a 70,891-acre, fifth field watershed. This area includes: a portion of the Granite Chief Wilderness, the Duncan Creek Inventoried Roadless Area, the French Meadows Reservoir and recreation area, the French Meadows State Game Refuge, the Placer County Big Trees Redwood Grove, and the Middle Fork of the American River Development Project administered by the Placer County Water Agency. About one sixth of the Middle Fork American River watershed is within the El Dorado National Forest boundary. The El Dorado National Forest is preparing a Roads Analysis for the roads in the portion of the watershed that is on their forest. This roads analysis covers roads in the majority of the watershed that is on the Tahoe National Forest.

The Star Fire burned approximately 16,000 acres of the watershed in the fall of 2001. The Roads Analysis will have more focus the on roads within the burn. The first goal is complement the fire restoration efforts. The forest has completed the landscape analysis and the watershed assessment for the Upper Middle Fork of the American River. The second goal is to compliment work of the American River Watershed Group's focus on water quality and yield and the Forest's priority watershed with opportunities to improve the transportation system opportunities to reduce the negative effects of the roads in the watershed.

The Tahoe National Forest recently completed two environmental assessments within the Middle Fork of the American River watershed. The French EA and Decision Notice were signed on August 1999. The End of the World EA and Decision Notice were signed in March 2000. In both of these documents, the road system was analyzed and the Road Management Objectives (RMO's) were determined. In the Road Management Objectives process for both of these project areas, all unclassified road were identified. These roads were either determined to be excess and scheduled to be decommissioned or were added to the system as National Forest Service Roads. Additionally, The minimum road system was determined and all excess roads were scheduled for decommissioning. The RMO's, for both projects, also document opportunities to minimize the negative effects on the environment. This Roads Analysis will not revisit those signed decisions. A summary of the roads in the two project areas is located in the RMO Appendix. Additional opportunities may be identified in these areas. The analysis will use the Ecosystem Management Decision Support (EMDS) model to determine and document the potential benefits and risks for all of the roads in the watershed. Site-specific information would be used where available.

The Objectives

To manage the forest transportation system to:

1. Provide sustainable access in a fiscally responsible manner to National Forest System lands for administration, protection, and utilization of these lands and resources consistent with Tahoe National Forest Land and Resource Management Plan.
2. Manage a forest transportation system within the environmental capabilities of the land.
3. Manage forest transportation system facilities to provide user safety, convenience, and efficiency of operations in an environmentally responsible manner and to achieve road related ecosystem restoration within the limits of current and likely funding levels.
4. Coordinate access to National Forest System lands with national, regional, statewide, local, and tribal government transportation needs.
5. Identify the minimum road system needed for safe and efficient travel and for the administration, utilization, and protection of National Forest System lands. The minimum system is the road system needed to meet resource and other management objectives adopted in the Forest Plan, to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, and to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.

How Roads Analysis Will Achieve These Objectives

Roads analysis will be conducted on the watershed scale. The outcomes of this analysis, in terms of the issues directly addressed, the information sources used, and the specificity of the recommendations offered, will vary in detail. The Roads Analysis will provide a context for road management in the broader framework of managing all forest resources. It will require close coordination with the land management direction contained in the TNF Forest Plan and Forest level Roads Analysis. The Upper Middle Fork American River watershed assessment, the Red Star Restoration landscape analysis and E.I.S. will provide further refinement of that direction. The key issues, concerns, and recommendations identified will provide the general context and direction for achieving the desired transportation system. The following will be considered:

1. Environmental issues potentially affected by road management proposals, such as soil and water resources, ecological processes, invasive species spread, and biological communities.
2. Social issues potentially affected by road management proposals, such as socio-economic impacts, public access, community protection, and accessibility for handicapped persons.
3. An evaluation of the transportation rights-of-way acquisition needs.
4. The interrelationship of State, County, Tribal, and other Federal agency transportation facility effects on land and resource management plans and resource management programs.
5. Transportation investments necessary for meeting resource management plans and programs.
6. Current and likely funding levels available to support road construction, reconstruction, maintenance, and decommissioning.

Benefits, problems, and risks associated with individual routes will be identified, and recommendations will be made relative to the investments needed to properly manage each road in the transportation system. Road management recommendations for individual routes will most likely be limited to changes in maintenance level, the identification of reconstruction needs, and the recommended access and travel management strategy. Roads analysis conducted at the watershed scale will incorporate the issues and concerns identified in the forest scale analysis. The information used at this scale of analysis will be more refined or detailed, and will include local knowledge and information specific to particular landscapes and road segments. The outcomes of the analysis at the project scale will include:

1. Identification of needed and unneeded roads.
2. Identification of road associated environmental and public safety risks, including fire protection.
3. Identification of site-specific priorities and opportunities for road improvements and decommissioning.
4. Identification of areas of special sensitivity, unique resource values, or both.
5. Any other specific information that may be needed to support project-level decisions.

Roads analysis will include methods for identifying opportunities for increasing benefits of road systems and reducing existing problems and risks. It will provide a framework for examining important issues and developing relevant information before managers enter into a formal (NEPA) decision process.

Those who participated in the Roads Analysis

The following list of Forest Service people on the Tahoe National Forest participated in the Roads Analysis and offered expertise in their fields:

Carol Kennedy	EMDS and overall risk assessment
Mary Grim	Fisheries, riparian, aquatic habitats, and watershed assessment
Matt Triggs	Wildlife and rare and sensitive plants
Slim Stout	Timber management and harvest systems
Bill Davis	Landscape architect and roadless area values
Tara Curren	Geology and soils
Tim Biddinger	Hydrology
Marvin Currey	Fire suppression and fuels management
Mo Tebbe	Recreation, special uses, and mining interests
Tony Rodarte	Range management
Blaze Baker	Noxious weeds
Bob McChesney	Road management and operations
Scott Husmann	Transportation Planning

Scoping for public comments

The analysis is intended to be an iterative and on going process. Project specific public input will be sought on the project level making processes. New information would be incorporated into the project file for this analysis.

Public participation in the Roads Analysis was invited through the Red Star Restoration EIS scoping processes. To date, those comments have centered on roads in the Duncan Inventoried Roadless Area

Public input will also be sought from the major landowners and government agencies with jurisdictions in the watershed, Sierra Pacific Industries, Placer County Water Agency and members of the American River Watershed Group. Comments were received on September 17, 2002

The Tahoe National Forest responsible official

The responsible line officer for the Middle Fork of the American River Roads Analysis is:

Richard A. Johnson
Foresthill District Ranger
Tahoe National Forest
22830 Foresthill Road
Foresthill, CA 95631
Phone 530-367-2224

The Existing Situation

See the road base map in appendix for the watershed and road analysis boundary. The table with all of the roads and the management attributes for each road in the analysis area is also in the appendix. The lists of roads and the maps are divided into two sections at this time. One section is the overall Upper Middle Fork of the American River. The other section is the Red Star Restoration, which is currently the only project level roads analysis. Subsequent project level roads analysis in the Upper Middle Fork American River Watershed will be tiered to this analysis.

Development and History

Most of the roading began in the 1950's after the Mosquito Ridge Road was constructed across the North Fork of the Middle Fork American River. At the time it was built, it was referred to as the "access road". This opened up the country to an era extensive timber harvest and road construction on private as well as on national forest lands that lasted to the middle of the 1980's. Prior to this period there were very few roads. Gold mining access was the primary purpose for most roads and trails. The construction of the Middle Fork of the American River Project in the 1960's brought along many new recreational opportunities. It created new access to the Duncan Canyon Creek and the Middle Fork of the American River. Recreational facilities and campgrounds were constructed around French Meadows Reservoir.

The Circle Bridge over the North Fork of the Middle Fork of the American River was completed in 1949. This unique bridge is old enough to have historic and special interest value. Evidence of the wagon train route used by early settlers can still be found in the upper reaches of the watershed.

Wilderness Areas

The headwaters of the Upper Middle Fork of the American River Watershed are located in the 6,694-acre Granite Chief Wilderness. There are two trailheads into the wilderness located in this watershed. One is the Picayune trailhead at Talbot Campground. The other is an informal trailhead on private land in section 29 for the Tevis Cup Trail. Traffic is very light at these trailheads. There are seldom more than just a few cars in the parking areas. The main wilderness accesses are from roads originating in the Truckee River Watershed.

Roadless Areas

The Duncan Canyon IRA was inventoried and evaluated during the Forest Service Roadless Area Review and Evaluation process (RARE II) in 1979 and again during the development of the California Wilderness Act in 1984. Based on the results of the study and legislation, the Duncan area was designated non-wilderness and made available for multiple use land allocation. The TNF Land and Resource Management Plan (MA 091-Sunflower) has assigned regulated intensive timber management as the major resource emphasis for the released roadless area. The Plan also designates that the released roadless area be managed for Roaded Natural recreation opportunities (LRMP standard and guideline 11). The 9,253-acre Duncan Canyon IRA is entirely within the Upper Middle Fork American River Watershed. 4,363 acres of the IRA burned in the Star Fire, 2001.

About 539 acres have been substantially altered by road construction and timber harvest in association with the Red Star Ahart timber sale in the 1980s and access into section 8. Three hundred ninety five of the 539 acres are located outside of Duncan Canyon along the south-facing slopes of Red Star Ridge. One hundred forty four of 539 acres fall on Mosquito Ridge, above Duncan Creek. Nine roads totaling about 4.0 miles of road were constructed the timber sales. Harvest activities were a combination of clear cuts and thinning/salvage treatments. As a result of these past management activities, these 539 acres contain characteristics that are consistent with roaded character.

Functional Class, Road Maintenance Levels, Surface Types and Closure Status

The Forest road system is planned, operated, and maintained on the basis of a system of Road Management Objectives. Road Management Objectives are established by interdisciplinary teams and approved by Line Officers through the NEPA process. They are incorporated into the transportation inventory database and provide the basis for the planning, construction, reconstruction, operation, and maintenance of the Forest road system. They establish the specific intended purpose of a road based on management needs as determined through land and resource management planning. They contain design criteria as well as operation and maintenance criteria for new roads. They contain operation and maintenance criteria for existing roads. Road Management Objectives may need to be reevaluated over time in response to changes in land management objectives or user needs.

Road maintenance levels are determined from information provided in the Road Management Objectives. Maintenance levels are divided into operational maintenance levels and objective maintenance levels. Roads may be currently maintained at one level, while planned for maintenance at a different level at some future date. The operational maintenance level is the maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. In other words, it defines the level to which the road is currently being maintained. The objective maintenance level is the maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may be the same as, or higher or lower than, the operational maintenance level. The transition from operational maintenance to objective maintenance level may depend on reconstruction or disinvestments.

Maintenance Level of National Forest System Roads

Maintenance Level 5 – High degree of user comfort	58.7 miles
Maintenance Level 4 – Moderate degree of used comfort	1.9 miles
Maintenance Level 3 – Suitable for passenger cars	60.6 miles
Maintenance Level 2 – Maintained for high clearance vehicles	115.1 miles
Maintenance Level 1 – Managed as a closed road	38.3 miles
Total	274.6 miles

Road maintenance costs are placed into two categories. There are the costs to maintain the road each year. These are the recurring or annual maintenance cost. The other cost is for maintenance work that is deferred to such a time when it can be done efficiently and economically without losing the serviceability of the road. An example of deferred maintenance is pavement replacement. Rather than to replace one-tenth on an inch of pavement each year, it is more efficient to place 2 inches of pavement every 20 years. This deferred maintenance. The table below shows the average costs to maintain roads on the Tahoe National Forest by the surface type.

Surface Types of National Forest System Roads

Surface Type	Annual costs per mile	Deferred costs per mile
Native	$3450	$3450
Aggregate	$5450	$3450
Paved	$8750	$6050

Functional class is three categories of roads that define the roads hierarchy in the transportation network. The three categories are arterial, collector and local. An arterial road provides access to large land areas and usually connects with other arterial roads or public highways. A collector road provides access to smaller land areas than an arterial road. It usually connects forest arterials to local forest roads and terminal facilities. Local roads connect terminal facilities with forest collector or arterial roads or public highways. Usually local roads are single purpose transportation facilities.

Functional Classification of National Forest System Roads

Arterial Roads – All purpose roads, largest land areas	71.2 miles
Collector Roads – Multi purpose roads, large land areas	40.2 miles
Local Roads – Single purpose road, specific sites/areas	163.2 miles
Totals	274.6 miles

Forest Service Road maintenance levels characterize roads in terms of their basic accessibility, user comfort, and safety. Maintenance Level 1 roads are designed and maintained primarily for short term and intermittent use and are placed in a closed condition during periods of non-use. Maintenance Level 2 roads are intended for use by high-clearance vehicles, such as pickup trucks. User comfort is ordinarily not a consideration, user safety is the minimum required for the safe operation of the design vehicle, and roads are often subject to at least seasonal closure to reduce maintenance costs and resource impacts that may stem from use. Maintenance Level 3, 4 and 5 roads are designed and maintained to accommodate passenger car use. Maintenance Level 3 roads provide minimal consideration for user comfort; while Maintenance Level 4 and 5 roads are characterized by increasing levels of user comfort and safety.

Road surface type is also an indicator of user comfort and, to a lesser degree, user safety. Road surface treatment may consist; of pavement, bituminous chip seal, crushed aggregate, improved native materials (pit-run aggregate or cinders), or composed of native materials. Roads may be surfaced with other than native material for a variety of reasons. These include providing increased user comfort or safety, enhancing economy of operations, minimizing the potential for surface erosion and sediment production, or any combination of the above.

Surface type of National Forest System Roads

Asphalt or Bituminous Chipseal Surface	67.1 miles
Crushed Aggregate or Gravel	36.5 miles
Native Material	171.0 miles
Totals	274.6 miles

Road closures and road use restrictions are employed only when resource-use conflicts exist. These conflicts may include road surface damage and road maintenance cost, special wildlife considerations, erosion related water quality concerns, or fire and safety concerns. Closure periods may last anywhere from a few hours to permanent closures. Maintenance Level 1 roads, which are associated with intermittent periods of use, are typically closed year-round with gates or earthen barriers between periods of use. Maintenance Level 2 roads are often closed year-round or seasonally through the use of gates. Maintenance Level 3, 4 and 5 roads may be closed seasonally during the winter months.

In general, the four principal characteristics correspond with each other. Arterial roads are usually maintenance level 5, paved roads that are open. At the other end of the scale, maintenance level 1, local roads are usually closed native surfaced roads.

There are three road maintenance zones on the forest. This roads analysis area in located entirely within the South Zone Engineering district Tahoe National Forest. The three zones equally divide the funding available for road maintenance. Those funds are supplemented with the maintenance deposits collected from the commercial road users.

Road System Physical and Administrative Characteristics

The current road maintenance emphasis is on the main roads in system and the roads within the recreational facilities. The main roads are the arterial and collector roads, road numbers 16, 22, 23, 43, 44, 48, 51, 57, and 96. All of these roads are under Forest Service jurisdiction. The Forest Service is the primary maintainer, operator and enforcement agency on all of the primary roads in the Upper Middle Fork of the American River watershed except for the Soda Springs Road. The Soda Springs Road, County Road 6001, which runs along the watershed boundary on the north side of Duncan Canyon, is under Placer County jurisdiction. The agency with the jurisdiction is ultimately responsible for the maintenance of each of the roads listed. Placer County and the Forest Service will require certain commercial user or large events to do the actual maintenance commensurate with the activity. Examples of the activities would be commercial timber haul or wildland fire suppression.

All of the other roads in the watershed 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 water and power facilities.

Current Maintenance Priorities and Emphasis

Current road maintenance focuses mainly safety and upkeep on the arterial roads, collector roads and the local roads in high use areas such as campgrounds and administrative sites around French Meadows and Big Trees. Local roads in the general forest areas receive only custodial care. Here, repairs are done only to correct problems causing resource problems. There is no routine maintenance schedule. Local roads with little or no use may become overgrown or blocked by fallen trees.

The Mosquito Ridge Road, Forest Highway 96, is the primary access road in the watershed and is the costliest to maintain. It is kept open year around to the Interbay turnoff. Almost daily maintenance is required in the winter. The remainder of the collector and arterial roads is reviewed annually for repair and maintenance needs. The work is then scheduled as needed. Most of these roads often go several years without needing work.

Forest plan management areas:

Eight Management Areas (MA's) of the Tahoe National Forest Land and Resource Management Plan, 1991, are located within the analysis area. They are:

- MA 080, Granite Chief
- MA 083, Wabena Steamboat
- MA 089, French
- MA 091, Sunflower
- MA 099, Mosquito
- MA 102, End of the World
- MA 107, Big Trees
- MA 108, Little Oak

Management area direction, issues and concerns along with the available road management practices are indicated in the individual MA's.

Road system benefits and identified users

The road system benefits and users are shown in the Road Management Objectives Considerations table in the appendix. The table, at this time, contains only the roads in the Red Star Restoration project area. Destinations, inholdings, and points of interests are indicated on the base Road System Map using USGS features. The same destination points are used to assess benefits with the EMDS.

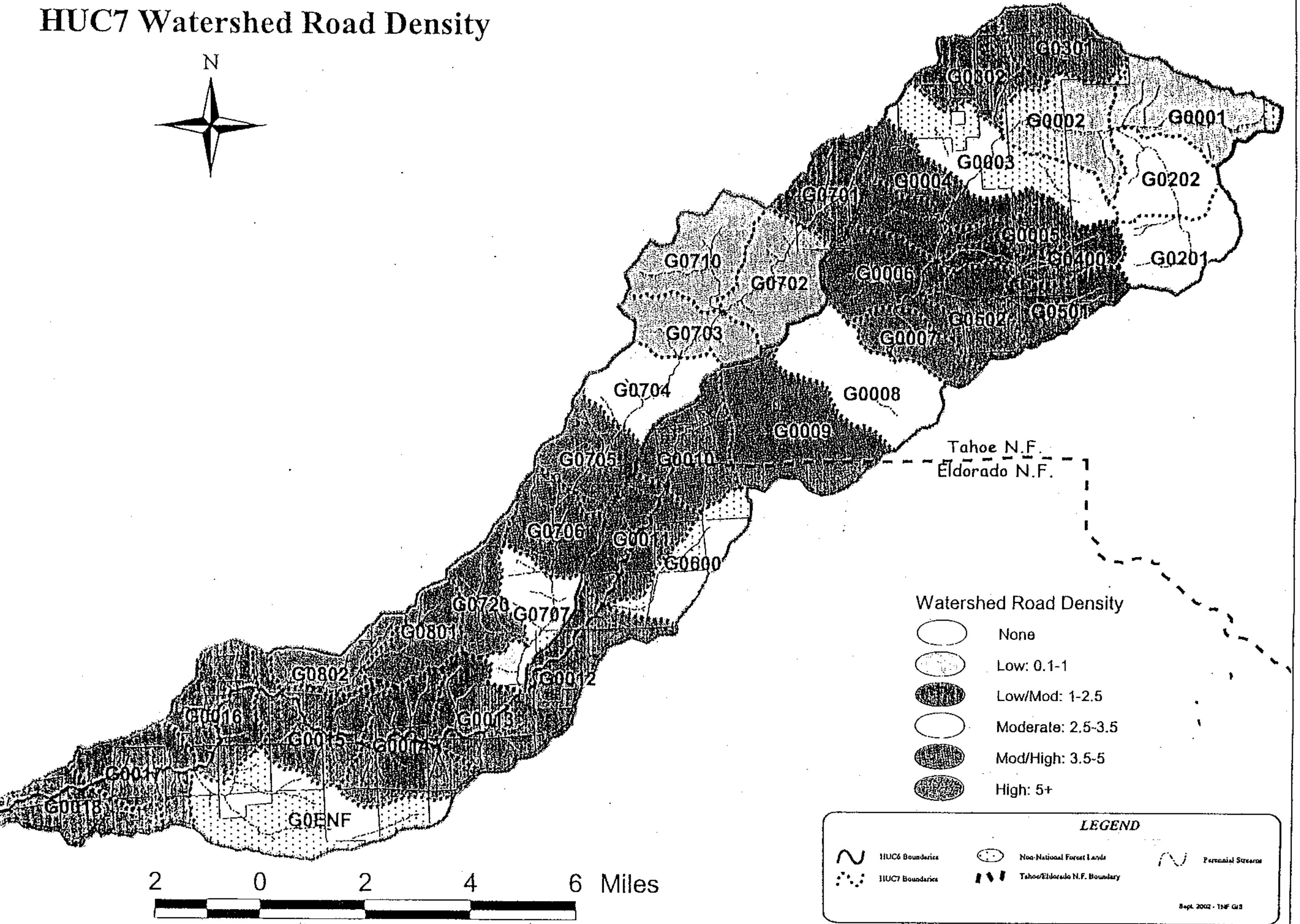
Road Density and Stream Crossings

The density of roads and the number stream crossing are good indicators of potential negative effects. Road density is represented by the average miles of road per square mile of land of a given unit or feature. For this level of analysis the seventh field watershed unit was selected to display road density. The table below shows road densities in each of the seventh field sub-watersheds and the number of road crossing of perennial and intermittent stream courses in each of those watersheds. The information to indicate the number of ephemeral stream crossings is not available at this scale. Ephemeral steam crossings should be considered at project level roads analysis.

Subwatershed Identifier	*Size Acres*	*Density Mi./Sq.mi.*	*Total Road miles*	*Number of Stream X-ings*
G0001	2330	0.08	0.31	0
G0002	2058	0.58	1.86	2
G0003	2651	2.72	11.26	4
G0004	1500	4.60	10.77	20
G0005	1742	3.66	9.96	11
G0006	1976	3.66	11.29	7
G0007	1145	5.53	9.90	1
G0008	2757	3.00	12.92	14
G0009	3469	3.31	17.95	26
G0010	1900	4.50	13.37	10
G0011	1905	3.64	10.84	6
G0012	1922	1.98	5.94	1
G0013	2043	2.57	8.19	2
G0014	2438	2.33	8.89	5
G0015	2199	1.81	6.22	4
G0016	2059	1.25	4.01	0
G0018	1707	2.15	5.72	1
G0202	1704	0.00	0.00	0
G0202	1669	0.00	0.00	0
G0301	1531	5.21	12.47	7
G0302	1676	1.23	3.21	5
G0400	1314	1.32	2.72	2
G0501	1269	1.90	3.77	1
G0502	1394	3.44	7.49	9
G0600	1557	3.26	7.93	4
G0701	1565	1.45	3.55	0
G0702	2108	0.44	1.45	1
G0703	1467	0.75	1.73	3
G0704	1758	3.34	9.19	8
G0705	1685	5.80	15.28	8
G0706	1553	3.94	9.57	8
G0707	1509	2.65	6.24	5
G0710	2046	0.88	2.82	0
G0720	1312	5.53	11.33	10
G0801	1387	6.69	14.50	8
G0802	1155	5.12	9.24	7

Upper Middle Fork of the American River

HUC7 Watershed Road Density



Soil and geology:

Predominate types are meta-sedimentary, volcanic, and granitic with some glacial deposits in high elevations. The predominate processes are fluvial and colluvial. The soils are formed on volcanic mudflow, meta-sedimentary rock and glacial deposits. Erosion ratings range from high to very high. Gully erosion is found throughout the watershed.

Ownership and jurisdiction:

The size of the watershed is 70,891 acres, 45,536 acres in the Tahoe National Forest and 6,611 acres in the El Dorado National Forest. 18,742 acres are privately owned. The two largest landowners are Sierra Pacific Industries and Lone Star Timber.

The Issues Relating to Roads

This section discusses how the issues relating to Roads Analysis arose and how they have been addressed in the past. It discusses the social component of issues. The first eight issues detailed below come from the Forest Level Roads Analysis.

1. **The effect of roads on terrestrial species** has long been identified as an issue in project analyses. It has been identified by members of the public, other agencies, and by Forest specialists. It is national, regional, and local in scope and of fairly high intensity. At the local project level, it is usually addressed by estimating the effects of the proposed activity on specific species. Road density, habitat fragmentation, and noise due to road activities are the specific issues explored most often in project analyses. Project analyses follow Forest Plan standards and frequently incorporate additional resource protection measures, such as limited operating periods. The Forest has reduced open road density by permanently or seasonally closing roads. In the past five years, road decommissioning has become more prevalent reducing total road density in some areas.

Roads in the Upper Middle Fork of the American River watershed are closed for some portion of the winter by snow. The upper three quarters of watershed are snowed in for four to five months of the year. The Little Oak Flat area is generally free of snow year around. Road 96-10 into Little Oak Flat is gated from November to May to minimize traffic disturbance. Essentially, the only open roads in the watershed during winter are Mosquito Ridge Road up to the Interbay turnoff, the road down to Interbay on the Middle Fork, and the road down to Ralston Afterbay at the confluence of the Rubicon and Middle Fork of the American Rivers.

Road densities are patchy in this watershed. Approximately half of the watershed is roaded and has moderate to high road densities. The other half is almost completely unroaded. The biological evaluation for the proposed Red Star Restoration EIS, 2002, is incorporated by reference. In summary, disturbances from vehicle traffic and habitat fragmentation caused by roads are important but not overriding issues in the Upper Middle Fork of the American River watershed

2. **The effect of roads on aquatic species and water quality** also has a long history as an intense issue at the national, regional, and local levels. It has been identified by the public, other agencies, and by Forest specialists in both the Forest Plan and in projects. The most frequently identified issues involving roads are cumulative effects, road crossings of streams, and sediment production. Numerous standards and guidelines, including the Aquatic Conservation Strategy, were developed for the Forest Plan to address this issue. Project analyses follow Forest Plan standards and incorporate additional resource protection measures, such as limited operating periods, wet weather operations standards, and road design features to minimize road effects on water quality. Road decommissioning to improve watershed condition has become common in the last five years.

Within the Upper Middle Fork American Watershed, roads are the primary producer of fine sediment, especially where they run parallel to streams within RCAs and at stream crossings. At these locations there is little distance available between the road and the stream to act as a buffering filter strip and roadside ditches sometimes discharge runoff directly into the stream. The native surfaced roads in the analysis area are on soils that are highly compressible and have low bearing strength when wet which makes the subgrade highly susceptible to rutting. Ruts disrupt the engineered drainage structures designed into the road and channel water. The ruts can eventually turn into gullies if not corrected. Cut banks have interrupted subsurface waterflow, which has resulted in springs and wet areas on roads, and, in some cases, has caused gully erosion.

There are five crossings on the two major streams in this watershed, Duncan Canyon and the Middle Fork of the American River. Mosquito Ridge Road crosses Duncan Canyon with a bridge. There is a large culvert in Duncan Canyon where road 96-52 crosses the creek for access to the diversion tunnel. Mosquito Ridge Road goes on to cross the Middle Fork of the American River over the French Meadows Dam and again with a bridge at the upper end of the reservoir. There is a river ford on private property just after the river leaves Granite Chief Wilderness. Big Mosquito, Dolly Rice and Talbot creeks have numerous road crossings. Most roads and crossings occur in the upper reaches of these drainages. The main sediment delivery and impairment to aquatic resources, in the drainages mentioned above, occurs to the intermittent streams from the local roads and to the main stems of those streams from the collector roads. The same situation applies to the Chipmunk Creek and Brushy Canyon drainages in the El Dorado N.F. portion of the watershed.

3. **The relationship of roads and the spread of undesirable exotic species** has been a minor issue identified by Forest specialists for a number of years. In the last several years, it has become fairly important at the national and regional levels. The Forest's proposal to treat noxious weeds has brought this issue to the foreground, as has the Sierra Nevada Forest Plan Amendment. Generally, this issue is addressed by applying standard protective measures of requiring steam cleaning of

machinery entering a project area. These measures have been found to be effective in preventing the spread of invasive plants on Forest Service projects.

Mosquito Ridge Road and the Blacksmith Flat Road are the main vectors for the introduction and spread of undesirable exotic species by road.

4. Fire specialists have long acknowledged the value of roads in altering wildland fire behavior and in contributing to a fuel break system. Road use for fire suppression planning has been a management consideration in Access and Travel Management planning. Maintaining roads for fire access in otherwise unroaded areas became a controversial issue locally in at least one recent project.

Critical road access for fire suppression, fuel reduction, and escape routes became elevated as an intense national, regional, and local public issue and management concern as a result of the severe wildland fires across the nation in the summer of 2000 and the resulting National Fire Plan. Historically, after each catastrophic fire on the Forest, this public issue becomes elevated locally. The Forest has addressed it in the past by considering the needs of fire management in Access and Travel Management planning and in project proposals. This analysis area is fairly isolated location. Response time can be more than an hour and a half to the upper reaches of the area from where the nearest fire suppression resources are stationed.

5. The contribution of the road system to air pollution is increasing as management concern. It is usually addressed through resource protection measures such as requiring dust abatement and has been included in project level air quality analyses. There are no communities within or adjacent to the watershed, however, the airshed is in non-attainment for ozone and PM-10 by State standards in the past. Limits are placed on the size and scope of projects as an emissions control measure. A threshold project size of 25 MMBF per year has been established for tree harvesting projects to limit emissions from the logging trucks and logging equipment. Projects under this size are considered to be within the historic background emissions range and require no additional mitigation measures. Larger projects require consulting with the local air quality control district to manage vehicle emissions.

6. Administration of the road system has long been a management concern. The cost of maintaining the existing Forest Service road system has become an intense national, regional, and local public issue in the last 5 years. Administrative uses are one of the considerations in Access and Travel Management planning and in project proposals. Road decommissioning as a means to reduce overall maintenance costs of the Forest road system has become a common practice in the last five years.

Safety on roads from hazards and user conflicts is another management concern. Mosquito Ridge road is the main road into the area, and because it is double lane, it normally doesn't have user conflicts. Exceptions occur when land management activities take place adjacent to the road. An example is roadside salvage sales, where dead and other high-risk trees along the route are cut and harvested to prevent their falling on the roadway and possibly injuring a traveler. The Star Fire killed trees along many roads. This has left the Forest with a safety issue on roads in the burn area. Roads must remain closed to the public until the hazards are removed.

The Sierra Nevada Forest Plan Amendment shifted the management direction, goals, and desired conditions away from extensive timber management on large tracts of land within the watershed. This shifts the purpose of many of the roads from access for extraction of forest resources to access for protecting those resources. Roads that were once valued for timber access are no longer needed. Roads that provide access to implement fuel management strategies or recreational opportunities have increased value and importance. This has resulted in the need to reevaluate the administration of the road system.

7. The affects of roads on roadless areas and unroaded characteristics have recently come to the forefront of managing National Forest system lands. New rules have been adopted for managing Inventoried Roadless Area's and the roads within them. On January 12, 2001 the Department of Agriculture published a final rule entitled 36 CFR Part 294, Special Areas; Roadless Area Conservation. The Duncan Canyon IRA is widely recognized as a very important unroaded area on the Forest. Roads were constructed in the IRA along the southern slope of Red Star Ridge shortly after the area was released from wilderness study in 1984.

8. All issues have a social component. There may be a number of key questions surrounding values relating to each issue. Whenever possible, it is helpful to identify a quantifiable indicator that directly or indirectly serves as a monitoring reference point to provide insight on the degree and magnitude of change in system function related to implementation of policies. In this way, the cumulative effects of proposed actions over time can be determined, as can the incremental effect of a single action. Background information at the Forest, and sometimes the regional or national scale, on the indicators related to identified issues could provide the context within which to make decisions at other scales. This is especially true in identifying supply and demand issues, sense of place issues, and cumulative effects. The indicators may change at different scales, but the issue runs throughout. Identifying an analysis framework including issues, indicators, current system functioning and the cumulative situation across the Forest is the value-added portion of assessment on larger geographic areas. Socioeconomic issues surround sustainability of unique forest features and values, sustainability of forest uses, and the equitable distribution of these among population groups. Evaluating changes in access related to road construction, reconstruction, decommissioning, road maintenance, and road closures will help determine the existing degree and magnitude of effect on values associated with key questions.

Additional issues are found in the Tahoe National Forest Land and Resource Management Plan. They are:

9. MA 080, Granite Chief; The use of motorized vehicles to facilitate search and rescue in the wilderness
10. MA 083, Wabena Steamboat; Road improvements generating additional traffic and public use
11. MA 089, French; Resource management potential to degrade water quality
12. MA 091, Sunflower; Road construction intercepting water at geologic contact zones
13. MA 099, Mosquito; Maintaining visual quality from Mosquito Ridge Road
14. MA 102, End of the World: Vehicle traffic adversely affecting deer in holding areas
15. MA 107, Big Trees; The management strategy for the entire area is still an issue
16. MA 108, Little Oak; Vehicle traffic disturbance in deer wintering area

Specific Issues that were identified by the Red Star Restoration E.I.S. team:

17. Managing access to roads in the French Meadows Basin to help control dispersed camping.
18. Maintaining access to water sources for fire suppression.
19. Managing traffic to minimize users conflicts on multi-resource roads.
20. Stream crossings are susceptible to increased negative impacts after fire.
21. Ditches and roads surfaces increase sediment transport to streams after fire.
22. Some culverts are under-sized increasing water velocities causing scouring and channel instability.
23. Insufficient number of adequate cross-drains are diverting water out of natural drainage channels, diverting it at higher flows out in the burn or overloading smaller stream channels.
24. Several roads in the basin are on roads with low bearing strength that are easily rutted. Road 42, 96-63, 48-2.
25. Road 57 and several spur roads cross the main deer migration route.
26. Need to mitigate road impacts in the watersheds over threshold of concern because of fire.
27. Insufficient funds and resources are available to properly maintain all the roads in burn on regular basis.
28. Roads 96-63, 96-67 and 48-2 intercept valley spring complexes.
29. Arch sites are visible from roads after the fire, especially from road 96-57-18.
30. Hazard trees will make road maintenance dangerous.
31. Falling trees and debris movement will block or alter road drainage structures.

Additional issues raised by public scoping or future project level proposals..

32. Maintenance of roads and management of traffic on power line access roads. Placer County Water Agency
33. Discharge from road culverts causing gully erosion and channel instability. Placer County Water Agency
34. Maintenance and safety of roads used continuously by maintenance workers. Placer County Water Agency
35. Vandalism of water facilities by people accessing sites by open Forest Service roads. Placer County Water Agency
36. Sediment production from forest roads accumulating in facilities reservoirs. Placer County Water Agency
37. Increasing day use visitation on forest. Visitors need guides to help direct them to sites prepared to accommodate users.
38. Managing road system to retain access to private property for future fire suppression. Red Star EIS
39. Remove all roads from the Duncan IRA. Red Star EIS
40. High cost of managing roads disproportionately high compared to value of resources accessed. Red Star EIS

Assessing the Problems, Benefits and the Risks

A number of sources are used to assess the problems, benefits, and risks with each road individually and cumulatively. The Table below indicates where, in the analysis, the 71 guiding questions are addressed. All of the questions are addressed in the Forest Level Roads Analysis. Several of the sources that directly relate to the Red Star Fire Restoration EIS are incorporated by reference. This would include the biological evaluations, economic analysis, historical reports and the EIS. The EMDS analysis tool displays the risk level to both the aquatic and terrestrial wildlife habitats. Those risk ratings can be found in the EMDS Appendix. The RMO Consideration Table specifically addresses benefits, problems and risk in the Star Fire area. It can be found in the RMO appendix.

Question	Topic	Addressed In Analysis, Where?	Rational For Not Addressing in Analysis
AQ1	Hydrology	EMDS, RMO Consideration Tables	
AQ2	Surface erosion	EMDS, RMO Consideration Tables	
AQ3	Mass wasting	EMDS, RMO Consideration Tables	
AQ4	Crossings	EMDS, RMO Consideration Tables	
AQ5	Chemical effects	EMDS	
AQ6	Hydro connections	EMDS, RMO Consideration Tables	
AQ7	Beneficial uses	EMDS, RMO Consideration Tables	
AQ8	Wetlands	EMDS, RMO Consideration Tables	
AQ9	Channel dynamics	EMDS, RMO Consideration Tables	
AQ10	Aquatic organisms	EMDS, RMO Consideration Tables, Red Star BE	
AQ11	Riparian / litterfall	EMDS, RMO Consideration Tables	
AQ12	At-risk species	EMDS, RMO Consideration Tables	
AQ13	Non-native aquatic	EMDS, RMO Consideration Tables	
AQ14	Unique Species	EMDS, RMO Consideration Tables	
TW1	Terrestrial habitat	EMDS, RMO Consideration Tables, Red Star BE	
TW2	Human activities	EMDS, RMO Consideration Tables	
TW3	Legal / illegal activities	EMDS, RMO Consideration Tables	
TW4	Unique communities	EMDS, RMO Consideration Tables, Red Star BE	
EF1	Exotics	EMDS, RMO Consideration Tables, Red Star BE	
EF2	Pest management	EMDS	
EF3-EF4	Disturbances	EMDS, RMO Consideration Tables, Red Star BE	
EF5	Noise	EMDS	
EC1	Financial efficiency	No	Forest Level Question
EC2	Economic efficiency	No	Forest Level Question
EC3	Distribution	No	Forest Level Question
TM1	Logging system	EMDS, RMO Consideration Tables	

TM2	Suitable base	EMDS, RMO Consideration Tables	
TM3	Silvicultural treatment	EMDS, RMO Consideration Tables	
MM1	Minerals	EMDS, RMO Consideration Tables	
RM1	Range management	EMDS, RMO Consideration Tables	
WP1	Water facilities	EMDS, RMO Consideration Tables	
WP2	Municipal watershed	EMDS, RMO Consideration Tables	
WP3	Hydroelectric	EMDS, RMO Consideration Tables	
SP1	Special products	EMDS, RMO Consideration Tables	
SU1	Special uses	EMDS, RMO Consideration Tables	
GI1	Access	EMDS, RMO Consideration Tables	Forest Level Question
GI2	Other owners	EMDS, RMO Consideration Tables	
GI3	Shared ownership	EMDS, RMO Consideration Tables	
GI4	Safety	EMDS, RMO Consideration Tables, Red Star EIS	
AU1	Research, M&I	No	Forest Level Question
AU2	Law Enforcement	No	Forest Level Question
PT1	Fuels	EMDS, RMO Consideration Tables, Red Star EIS	
PT2	Safety	EMDS, RMO Consideration Tables, Red Star EIS	
PT3	Wildfires cooperators	EMDS, RMO Consideration Tables, Red Star EIS	
PT4	Air quality	EMDS, RMO Consideration Tables, Red Star EIS	
UR1	Supply / demand	EMDS, RMO Consideration Tables, Red Star EIS	
UR2	Unroaded opportunities	EMDS, RMO Consideration Tables, Red Star EIS	
UR3	Noise	EMDS, RMO Consideration Tables, Red Star EIS	
UR4	Who participates	EMDS, RMO Consideration Tables, Red Star EIS	
UR5	Attachments	EMDS, RMO Consideration Tables, Red Star EIS	
RR1	Supply / demand	EMDS, RMO Consideration Tables, Red Star EIS	
RR2	Roaded opportunities	EMDS, RMO Consideration Tables, Red Star EIS	
RR3	Noise	EMDS, RMO Consideration Tables, Red Star EIS	
RR4	Who participates	EMDS, RMO Consideration Tables, Red Star EIS	
RR5	Attachments	EMDS, RMO Consideration Tables, Red Star EIS	
[illegible]	Unique characteristics	EMDS, RMO Consideration Tables, Red Star EIS	

PV2	Unique cultural	EMDS-RMO Consideration Tables-Red Star EIS	
PV3	Groups	EMDS-RMO Consideration Tables-Red Star EIS	
PV4	Passive use value	EMDS-RMO Consideration Tables-Red Star EIS	
SI1	Needs / values roads	No	Forest Level Question
SI2	Needs / values access	No	Forest Level Question
SI3	Historical	EMDS-RMO Consideration Tables-Red Star EIS	
SI4	Cultural	EMDS-RMO Consideration Tables-Red Star EIS	
SI5	Historic roads	EMDS-RMO Consideration Tables-Red Star EIS	
SI6	Economic health	No	Forest Level Question
SI7	Community dependence	Red Star EIS	
SI8	Wilderness attribute	No	Forest Level Question
SI9	Traditional uses	Red Star EIS	
SI10	Sense of place	No	Forest Level Question
CR1	Civil rights	No	Forest Level Question

Summary of EMDS potential risk ratings:

	Aquatic Risk	Terrestrial Risk	Total Environmental
Miles in highest third of risk category	107.30	38.30	39.24
Miles in middle third of risk category	102.21	37.02	58.98
Miles in lowest third of risk category	65.13	199.32	176.42
Total Miles	274.63	274.63	274.63

The potential risks of each road to the aquatic, terrestrial and combined environmental indicators are displayed in the Appendix. The potential risks are also summarized in tables by the seventh field watershed in the Appendix.

The Opportunities and the Priorities

Opportunities to address the key issues are:

1. Maintain high quality habitats and Old Forest Emphasis values by decreasing road densities, regulating traffic in key areas, and eliminating excess roads. Fragmentation....

2. Reduce the negative impacts of the road system on hydrological functions and storm discharge by eliminating excess roads, reconnecting natural drainage patterns where disrupting by roads by surfacing, out-slope roads, remove inside ditches, reduce diversion potentials, reconstructing roads to minimize damage from major storm events

3. Reduce the negative impacts of road on water quality and aquatic habitats from major storm events, mass wasting, and erosion by surfacing, out-sloping the road prisms, removing inside ditches, reducing diversion potentials, relocating roads out of RCA's, closing roads, and decommissioning excess roads.

4. Reduce the risks of damage to roads and the costs of repairs from major storm events, mass wasting, and erosion by surfacing, out-sloping the road prisms, removing inside ditches, reducing diversion potentials, closing roads, and decommissioning excess roads.

5. Maintain critical and important fire suppression access roads

6. Protect and restore roadless area values by eliminating excess roads in the IRA

7. Reduce the spread of undesirable exotic plants by??

8.

9.

10.

11.

Opportunities to address other issues are:

1. Developed recreation guides to help direct visitors to sites that are developed for their use and traffic.

2. Form partnerships with Placer County Water Agency to; explore funding of mutual beneficial road projects, share information on road maintenance needs, share road maintenance costs, manage traffic and forest visitors at water agencies facilities.

3. Study watershed to determine actual origins of large sediment sources.

4. Study traffic patterns and collect road use information.

5.

6.

7.

8.

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

And the priority of these opportunities is:

1. aquatic
2. terrestrial
3.
4.
5.
6.
7.

Individual road opportunities and priorities: Table with roads number, specific opportunities, and priority ranking (needs to be done by team