HYDROLOGY REPORT

Sugarberry Project

Feather River Ranger District
Plumas National Forest

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BMPs = Best Management Practices

CRWQCB = California Regional Water Quality Control Board

CWE = Cumulative Watershed Effects

CWHR = California Wildlife Habitat Relationships

DFPZ = Defensible Fuel Profile Zone

EPA = Environmental Protection Agency

ERA = Equivalent Roaded Area

FRA = Forest Recovery Act

FSEIS = Final Supplemental Environmental Impact Statement

GIS = Geographic Information System

HFQLG = Herger-Feinstein Quincy Library Group

HUC = Hydrologic Unit Code

ITS = Individual Tree Selection

LRMP = Land Resource Management Plan

PNF = Plumas National Forest

RHCA = Riparian Habitat Conservation Area

RMO = Riparian Management Objectives

ROD = Record of Decision

SAT = Scientific Analysis Team

SMZ = Streamside Management Zone

SNFPA = Sierra Nevada Plan Amendment

TMDL = Total Maximum Daily Load

TOC = Threshold of Concern

USDA = United States Department of Agriculture

1. REGULATORY FRAMEWORK

1.1 Sierra Nevada Forest Plan Amendment – Final Supplemental Environmental Impact Statement – Record of Decision *(SNFPA FSEIS and ROD, USDA Forest Service 2004)*

Table 2 of the 2004 *Record of Decision on the Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement* (SNFPA FSEIS) describes standards and guidelines applicable to the Herger-Feinstein Quincy Library Group (HFQLG) Pilot Project area for the life of the Pilot Project (USDA Forest Service 2004). No standards and guidelines specific to riparian areas, hydrology, or water resources are mentioned in Table 2. The Record of Decision (ROD) directs that vegetation management projects in the Pilot Project area follow the direction of the *Herger-Feinstein Quincy Library Group Forest Recovery Act* (HFQLG Act) in the application of Scientific Analysis Team guidelines (Thomas *et al*, 1993).

1.2 Herger-Feinstein Quincy Library Group Forest Recovery Act and Record of Decision *(HFQLG Act and ROD)*

The HFQLG Act gives direction to apply the Scientific Analysis Team guidelines for riparian system protection to all resource management activities specified by the Act and all timber harvesting activities that occur in the Pilot Project area during the term of the Pilot Project. The prescribed minimum widths of “interim boundaries” of Riparian Habitat Conservation Areas (RHCAs) are as follows:

- 300 feet (perennial fish-bearing streams and lakes);
- 150 feet (perennial non-fish-bearing streams, ponds, wetlands greater than 1 acre, and lakes); and
- 100 feet (intermittent and ephemeral streams, wetlands less than 1 acre, and landslides).

RHCA widths are to be determined by the greatest extent of (1) the top of the inner gorge, (2) the 100-year floodplain, (3) the outer edge of riparian vegetation, or (4) a distance equal to one or two site-potential tree heights, depending on the feature class. The site-potential tree height for the Feather River Ranger District is 150 feet. This means that on the Feather River District, a 150-foot RHCA buffer width is applied to seasonally flowing streams (intermittent or ephemeral) that have a definable channel and evidence of annual scour and deposition, instead of a 100-foot RHCA buffer. These guidelines supersede other direction, unless that direction (for example, mitigation measures or project design features) would provide greater protection to riparian and fish habitat or would better achieve Riparian Management Objectives (RMOs). For more detailed information, refer to Appendix A.

The HFQLG Record of Decision (USDA Forest Service, 1999) directs the Plumas National Forest to include provisions for accommodating at least a 100-year flow, including associated bedload and debris, at new stream crossings and existing crossings where resources are degraded. The Forest is required to meet RMOs during the development and implementation of a road management plan.

The Plumas National Forest is required to provide specific direction for management of fire and fuel treatment to meet RMOs and minimize disturbance of riparian ground cover and vegetation. The Forest is required to design prescribed burn projects to include the identification of objectives and risks in the RHCAs. To meet these requirements, an RMO report has been included and is part of the project file and labeled as Appendix A to this Hydrology Report.

1.3 Plumas National Forest Land and Resource Management Plan

The 1988 *Plumas National Forest Land and Resource Management Plan* (commonly referred to as the "Forest Plan") has been amended by more recent programmatic documents, including the 2004 SNFPA Record of Decision and the HFQLG Act Record of Decision. The Forest Plan still provides management direction where not amended. As described below, some goals, policies, and guidelines still apply to streamside management (USDA Forest Service 1988).

Forest Plan guidelines are applied to ephemeral channels with no evidence of annual scour and deposition where Scientific Analysis Team guidelines from the HFQLG Act are not applicable. The west side of the Forest contains ephemeral channels with no evidence of annual scour and deposition. The Glossary for the HFQLG Act Final EIS defines these channels as ephemeral swales. These channels may only flow during large magnitude flow events (such as the 2-year or 10-year events), and may represent alteration of the natural channel network related to past management activities. Ephemeral swales are not protected under HFQLG Act guidelines; however, ground-based equipment restrictions are necessary to help prevent further alteration. For these types of streams, Streamside Management Zone (SMZ) widths defined in the Forest Plan are applied. SMZ widths for ephemeral streams may range from 25 to 50 feet, with widths defined by stream bank and channel gradient and stability. Within these protection zones, proposed DFPZ treatment may still occur; however, ground-based equipment is excluded.

The Forest Plan requires the implementation of an SMZ plan for any activity within an SMZ. While the Sugarberry Project is designed to restrict activities in SMZs and RHCAs, there are exceptions when treatments are proposed in these protection areas. In accordance with the Forest Plan requirement, a “Streamside Management Zone Plan” has been prepared and is included as Appendix B. It describes in more detail the application of Management Mitigation Measures (MMMs), Best Management Practices (BMPs), and standards and guidelines applicable to activities within riparian areas of the Sugarberry Project.

1.4 California State Water Resources Control Board and Federal Clean Water Act - Porter-Cologne Water Quality Control Act

The *Porter-Cologne Water Quality Control Act*, which is contained in Division 7 of the California Water Code, establishes the responsibilities and authorities of the State Water Resources Control Board (SWRCB). The SWRCB is mandated to balance, to the extent possible, all uses of California's water resources for domestic, agricultural, or environmental uses. Each Regional Water Quality Control Board has the authority and responsibility for regional water quality control and planning (State Water Resources Control Board, 2006).

The *Clean Water Act of 1972*, as amended in 1977 and 1980, establishes goals, policies, and procedures for the maintenance and improvement of the nation’s waters. It addresses both point and nonpoint sources of pollution and establishes or requires programs for the control of both sources of pollution. Land management activities have been recognized as potential sources of nonpoint sources of water pollution. By definition, nonpoint source pollution is not controllable through conventional treatment plant means. Nonpoint source pollution is controlled by containing the pollutant at its source, thereby preventing delivery of pollutants to surface water. Sections 208 and 319 of the *Clean Water Act* (Public Law 92-500), as amended, acknowledge land treatment measures as being effective means of controlling nonpoint sources of water pollution and emphasize their development. Working cooperatively with the SWRCB, the Forest Service has developed and documented nonpoint source pollution control measures applicable to National Forest System lands. These measures have been certified by the state and approved by the US Environmental Protection Agency (EPA) as the most effective means the Forest Service could use to control nonpoint source pollution. These measures were termed “Best Management Practices” (BMPs). BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after nonpoint source pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. BMPs are usually applied as a system of practices rather than as a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility. BMPs are basically a preventive rather than an enforcement system. BMPs relating to water quality are included in the handbook “Water Quality Management for National Forest System Lands in California – Best Management Practices” (USDA Forest Service 2000). The BMPs that apply to the Sugarberry Project are included in Appendix B.

1.5 Section 303(d) of the Clean Water Act

Section 303(d) of the *Clean Water Act* requires the identification of water bodies that do not meet, or are not expected to meet, water quality standards or are considered impaired. The list of affected water bodies, and associated pollutants or stressors, is provided the State Water Resources Control Board and approved by the US EPA. The most current list available is the 2006 303(d) list (SWRCB, 2006). Englebright Reservoir, situated downstream of the Sugarberry project area, is listed as impaired for mercury, and the source of mercury is listed as resource extraction related to abandoned mines. A Total Maximum Daily Load (TMDL) of mercury for Englebright Reservoir is projected to be developed by 2012. The Feather River downstream of Oroville Dam is listed as impaired by Diazinon™, an agricultural pesticide, with a TMDL estimated to be developed by 2019. There are no sources of Diazinon™ located upstream of the dam, and no restrictions or TMDLs are currently assigned within the project area or cumulative off-site watershed effects analysis area. A TMDL for methylmercury is currently under development for the Sacramento-San Joaquin River Delta, with a draft issued in 2005 that recommends inorganic mercury load reductions for the tributary watersheds that export large volumes of highly contaminated sediment, including the Feather-Yuba River basins (CRWQCB, 2006).

1.6 Regional Water Quality Control Board – Central Valley Region - Beneficial Uses and State Water Quality Objectives

Beneficial uses are defined under California State law in order to protect against degradation of water resources and to meet state water quality objectives. The Forest Service is required to protect and enhance existing and potential beneficial uses during water quality planning (California Regional Water Quality Control Board [CRWQCB] 1998). The Cumulative Off-site Watershed Effects analysis of the Sugarberry Project is designed to include all effects on beneficial uses of water that occur away from locations of actual land use and are transmitted through the fluvial system (USDA Forest Service 1990). Beneficial uses of surface water bodies that may be affected by activities on the Plumas National Forest are listed in Chapter 2 of the *Central Valley Region's Water Quality Control Plan* (hereinafter referred to as the "Basin Plan") for the Sacramento and San Joaquin River basins (CRWQCB 1998). Existing and potential beneficial uses are defined for Lake Oroville, for the Feather River from the fish barrier dam in Oroville to the Sacramento River, for the watershed areas that are sources to Englebright Reservoir on the Yuba River, and for the Yuba River downstream of Englebright Reservoir. Beneficial uses are not defined for the South Fork Feather River but are assumed to include all the same beneficial uses as the others listed.

The defined existing beneficial uses are:

1. Municipal and domestic water supply include the uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply (Lake Oroville, Feather River and Englebright Reservoir).

2. Agricultural supply includes the uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing (Lake Oroville, Feather River , Englebright Reservoir, and Yuba River).

3. Hydropower generation includes the uses of water for hydropower generation (Lake Oroville, Englebright Reservoir, and Yuba River).

4. Water contact recreation includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skiing and scuba diving, surfing, white water activities, fishing, or use of natural hot springs (Lake Oroville, Feather River, Englebright Reservoir, and Yuba River).

5. Non-contact water recreation includes uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities (Lake Oroville, Feather River, Englebright Reservoir, and Yuba River).

6. Commercial and sport fishing includes uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes (Not listed as an existing or potential beneficial use for the affected water bodies in the Basin Plan, but is an existing use in these water bodies).

7. Warm freshwater habitat includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates (Lake Oroville, Feather River and Yuba River).

8. Cold freshwater habitat include uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates (Lake Oroville, Feather River, Englebright Reservoir, and Yuba River).

9. Wildlife habitat includes uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources (Lake Oroville, Feather River, Englebright Reservoir, and Yuba River).

10. Spawning, reproduction, and/or early development include uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish (Lake Oroville, Feather River, Englebright Reservoir, and Yuba River).

1.7 Timber Harvest Activities Waiver Program

On April 28, 2005, the Regional Board adopted the Conditional Waiver of Waste Discharge Requirements for Discharges Related to Timber Harvest Activities in Resolution R5-2005-0052 (Waiver). The Waiver specifies eligibility criteria and conditions that must be met by dischargers engaged in timber harvest activities on private and Forest Service lands in order to qualify for a waiver of waste discharge requirements. Dischargers submit Waiver Applications prior to commencement of timber harvest activities and Waiver Certifications at the conclusion of those activities. The waiver also imposes conditions and requirements for agency monitoring. Implementation monitoring is required for all projects and consists of non-random pre- and post-winter inspection of project BMPs during the course of timber harvest activities. It should be designed to focus on portions of the project that have the highest risk to water quality. Forensic and effectiveness monitoring are required for Federal projects only if “the discharger’s cumulative off-site watershed effects analysis indicates that the project, combined with other Forest Service projects conducted in the watershed over the past 10 years, may cause any watershed or sub-watershed to exceed a threshold of concern” (CRWQCB, 2005). Forensic and effectiveness monitoring consist of winter inspection of sediment sources and BMPs to detect significant sources of pollution, to determine whether project-specific BMPs are effective in protecting water quality, and to assist in evaluating the overall effectiveness of the waiver program in protecting water quality and beneficial uses. Additional monitoring may be required if water quality protection measures fail or there are threats to water quality or beneficial uses from project activities. Detailed monitoring requirements and plans for the Sugarberry project are located in Appendix C.

2. ANALYSIS METHODS

2.1 Indicators

Indicator 1: Watershed Condition

Watershed condition represents the overall state of disturbance within a watershed, integrating upland factors influencing hydrologic response with the observed condition of the channel network. The condition of the channel network results from previous flow regimes and cycles of erosion and deposition. Upland influences include vegetative cover and the extent of impervious surfaces such as roads and urban infrastructure. Upland watershed condition is evaluated primarily through the equivalent roaded area (ERA) model for cumulative off-site watershed effects (CWE), which sums the amount of disturbance in upland and near-stream (sensitive) watershed areas and compares it to a threshold of concern (TOC). Channel condition is observed in the field and interpreted in relation to watershed history, including past management disturbances and natural watershed processes.

Measure 1 - Cumulative Off-Site Watershed Effects Analysis. The following definitions apply when assessing the direct, indirect, and cumulative effects:

Direct effects on watershed condition result when activities occur in and deposit sediment or pollutants directly into aquatic areas. Increased erosion and sedimentation directly into streams and other water bodies may result from road construction or maintenance, fire line construction and reconstruction for prescribed burning, wildland fires, and timber management activities, such as construction of skid trails, temporary roads, and log landings.

Indirect effects can occur when watershed areas are disturbed by roads and timber harvest or associated activities. Disturbances may include soil compaction, removal of vegetation canopy, and removal of effective soil cover. These disturbances can cause hillslope destabilization and/or detachment and mobilization of sediment that will eventually reach streams. Such activities may therefore become nonpoint sources of pollution. Increased erosion and sedimentation may result in increased peak channel flows, alteration of annual flow distribution, stream channel geometry alteration, and degradation or aggradation of channel beds. Indirect effects of project activities could occur to the channel network that is within or adjacent to the proposed treatment units. When not properly mitigated, indirect effects can result in an adverse effect on water quality and quality of stream and riparian habitat.

Cumulative effects – Cumulative off-site watershed effects (CWE) include any changes that involve watershed processes and are influenced by multiple land use activities (Reid 1993). They do not represent a new type of impact. Changes that accumulate in time or space are considered CWEs. The definition of a cumulative effect from the Council on Environmental Quality Regulations (40 CFR 1508.7) states:

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Land use activities may alter environmental parameters—they may modify topography; change the character of soil and vegetation; import or remove water, chemicals, and fauna; and they may introduce pathogens and heat. Changes in these parameters can cause changes in watershed processes. As the watershed changes in response to the altered environmental parameters, changes in production and transport of water, sediment, organic matter, chemicals, and heat can occur (Reid 1993). Land use can cause on-site CWEs that result directly from on-site changes in environmental parameters or off-site CWEs that are the result of changes in watershed transport processes.

Measure 2 - Fungicides and Water Quality. Direct, indirect and cumulative effects on water quality and beneficial uses are analyzed related to proposed application of a fungicide (Sporax®) to prevent spread of a root pathogen (*Heterobasidion annosus*) in portions of the Sugarberry project area. These analyses are presented following discussion of the potential effects of proposed hand, mechanical and thermal treatments for the existing condition and various alternatives within the CWE analysis area defined below.

2.2 Equivalent Roaded Area (ERA) Model for CWE Analysis

The CWE analysis includes all effects on beneficial uses of water that occur away from the locations of actual land use and that are transmitted through the fluvial system. Effects may be either beneficial or adverse and are a result of additive effects of multiple management activities within a watershed. The CWE analysis is based on the guidance from Forest Service Handbook FSH 2509.22-Soil and Water Conservation (USDA Forest Service 1990). The method of analysis uses the "Equivalent Roaded Area" (ERA) model, where ERAs are measured in acres. The ERA model serves as an index to measure the potential impact of past, present, and future land management activities on downstream water quality. More specifically, the ERA model describes these off-site impacts in relation to the roaded area within a watershed. It assumes that the more densely a watershed is roaded, the greater the impacts will be to water quality downstream. Impact potential is defined in terms of “disturbance coefficients” indexed by relating the degree of impact expected from each type of activity to that expected from roads. The sum of indices for a watershed represents the percentage of basin in road surface that would produce the same effects as the existing or planned distribution of management activities (Berg et al, 1996). The following land disturbing activities are evaluated in the ERA model for the Sugarberry Project: roads, landings, off-highway vehicle (OHV) trails, timber harvesting activities on public and private lands, urbanization, wildland fire, and legacy mining disturbance. For the present analysis, these land-disturbing effects are assessed for the past 25 years, the present, and the foreseeable future. The analysis is based on geographic and land use information compiled from Forest Service, CDF and county databases, aerial photographic interpretation and field observations.

The response of landscapes to land disturbances is influenced by climate, physiographic, geologic, and ecologic conditions (USDA Forest Service 1990). Therefore, recovery coefficients are assigned based on local conditions. The western slope of the Sierra Nevada, in the Plumas National Forest area, has a high rate of vegetative establishment and growth due to high annual precipitation quantities and the presence of highly productive forest soils. On the Feather River Ranger District, 25 years is used as the average recovery period for disturbed sites. Disturbance from vegetation management is assumed to have no effect on hydrologic processes after 25 years have passed since the last major site disturbance. Other activities, such as mining or urbanization, recover more slowly or not at all, and no recovery coefficient is assigned for such disturbances. For a list of disturbance coefficients used in the CWE analysis refer to Appendix D - CWE Analysis Methods.

Watersheds and stream channels have natural capacity to absorb various levels of land disturbance without major adjustment to their function and condition, but when this capacity is exceeded, the effects of land disturbances begin to substantially impact downstream channel stability and water quality. This upper estimate of watershed “tolerance” to land use is described as the threshold of concern (TOC). When the sum of disturbances exceeds the TOC, water quality may be impaired for established beneficial uses, such as municipal water supplies, irrigation, or fish habitat. Stream channels can deteriorate to the point where adjacent riparian and meadowland areas become severely damaged.

As outputs of the ERA model, the ERA total of each subwatershed is compared to the TOC and reported as percent of disturbed area and percent of TOC. The TOCs used in the CWE analysis area and rationale for their assignment, are listed in Appendix D (CWE Analysis Methods). ERA totals in the range of 80 to 99 percent of TOC are considered to be approaching TOC, while those that are 100 percent or greater equal or exceed the TOC. The TOC does not represent an exact level of disturbance where cumulative off-site watershed effects will begin to occur. Rather, it serves as a “yellow flag” indicator of increased risk of significant adverse CWEs occurring within a watershed.

For a detailed discussion on the methodology and parameters of the CWE analysis and ERA model refer to Appendix D (CWE Analysis Methods).

2.3 Scope of the CWE Analysis

The scope of the CWE analysis includes 44 subwatersheds with areas that range from 510 acres to 2,350 acres, with a total analysis area of 58,088 acres (see Table 1). The locations of subwatersheds with respect to treatment units are displayed in Figure 1. Subwatersheds 1, 2, and 35 are located in the CWE analysis area and may contribute to cumulative off-site watershed effects; however, there are no treatments proposed within these subwatersheds. The major streams in the CWE analysis area include Slate Creek, Canyon Creek, and the North Yuba River. A small portion of the analysis area (4,016 acres or 7%) drains to the South Fork Feather River and subsequently to Lake Oroville, the Feather River, the various conveyances of the State Water Project, and via the Sacramento River to the Sacramento-San Joaquin River Delta, emptying to San Francisco Bay and the Pacific Ocean. Subwatersheds 13, 14, and 20 drain to the South Fork Feather River and eventually to Lake Oroville. The remainder of the analysis area is tributary to the North Yuba River and New Bullard’s Bar Reservoir, either directly or via Slate and Canyon Creeks. The outflow of New Bullard’s Bar Reservoir joins sequentially the main stem Yuba River, the Feather River and the Sacramento River, also ultimately reaching the Pacific Ocean through San Francisco Bay. Subwatersheds 1–8, 10–12, 15-19 21, 22, 24-28, 29, 30, 32, 33, 35, 36 39, and 41–43 drain to Slate Creek. Subwatersheds 9, 23, 29, 31, 34, 37, 38 and 42 drain to Canyon Creek. Subwatersheds 40 and 44 drain directly to the North Yuba River upstream of New Bullard’s Bar Reservoir (Figure 1).

Table 1: Subwatersheds Located In Cumulative Off-Site Watershed Effects Analysis Area

HFQLG[a] Number	HUC6 Name	HUC6 ID Number	Subwatershed Name	Subwatershed Label	Subwatershed Total Area (acres)
110043	New Bullard's Bar Reservoir	180201250202	Whiskey Creek	1	1,025
110043	New Bullard's Bar Reservoir	180201250202	Headwaters East Branch Slate Creek	2	831
110043	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 1 - Upper Slate Creek	3	2,224
110043	New Bullard's Bar Reservoir	180201250202	Gibson Creek	4	1,186
110043	New Bullard's Bar Reservoir	180201250202	East Branch Slate Creek	5	2,082
110042	New Bullard's Bar Reservoir	180201250202	Wallace Creek	6	1,306
110043	New Bullard's Bar Reservoir	180201250202	Potosi Creek	7	2,270
110042	New Bullard's Bar Reservoir	180201250202	Sacketts Gulch	8	767
110022	New Bullard's Bar Reservoir	180201250201	Upper Canyon Creek 1	9	1,802
110042	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 2 - St. Louis	10	2,076
110041	New Bullard's Bar Reservoir	180201250202	East Branch Rabbit Creek	11	760
110042	New Bullard's Bar Reservoir	180201250202	Cedar Grove Ravine	12	1,602
110040	Ponderosa Reservoir	180201230601	Unnamed tributary S Little Grass Valley Reservoir	13	585
110024	Lewis Flat	180201230602	Upper Lost Creek	14	1,717
110041	New Bullard's Bar Reservoir	180201250202	Rabbit Creek	15	1,408
110041	New Bullard's Bar Reservoir	180201250202	Unnamed tributary Rabbit Creek	16	577
110042	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 3 - French Camp	17	1,295
110042	New Bullard's Bar Reservoir	180201250202	Wisconsin Ravine	18	596
110042	New Bullard's Bar Reservoir	180201250202	Deacon Long Ravine	19	752
110024	Ponderosa Reservoir	180201230602	Valley Creek	20	1,714
110023	New Bullard's Bar Reservoir	180201250202	Clarks Ravine	21	1,355
110023	New Bullard's Bar Reservoir	180201250202	Pats Gulch	22	1,051
110022	New Bullard's Bar Reservoir	180201250201	Upper Canyon Creek 2	23	2,343
110023	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 4 - Lucky Hill	24	1,300
110023	New Bullard's Bar Reservoir	180201250202	American House Ravine	25	685
110023	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 5	26	1,698
110023	New Bullard's Bar Reservoir	180201250202	Onion Creek	27	1,294
110023	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 6	28	1,138
110021	New Bullard's Bar Reservoir	180201250201	Upper Rock Creek	29	2,178
110023	New Bullard's Bar Reservoir	180201250202	Gold Run Creek	30	1,618
110022	New Bullard's Bar Reservoir	180201250201	Canyon Creek - Sawmill Ravine	31	844
110023	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 7 - Diversion Dam	32	1,052
110020	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 8 - Stowman Ravine	33	1,164
110021	New Bullard's Bar Reservoir	180201250201	Lower Rock Creek	34	2,350

HFQLG[a] Number	HUC6 Name	HUC6 ID Number	Subwatershed Name	Subwatershed Label	Subwatershed Total Area (acres)
110020	New Bullard's Bar Reservoir	180201250202	Buckeye Creek	35	568
110020	New Bullard's Bar Reservoir	180201250202	Brushy Creek	36	1,868
none	New Bullard's Bar Reservoir	180201250201	Middle Canyon Creek	37	830
110021	New Bullard's Bar Reservoir	180201250201	Unnamed tributary Rock Creek	38	655
110020	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 9 - North Star	39	1,416
110019	Dobbins Creek	180201250203	Upper Deadwood Creek	40	2,045
110020	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 10 - Oak Flat	41	510
none	New Bullard's Bar Reservoir	180201250201	Lower Canyon Creek	42	730
110020	New Bullard's Bar Reservoir	180201250202	Slate Creek Canyon 11 - Lower Slate Creek	43	1,904
110019	Dobbins Creek	180201250203	Lower Deadwood Creek	44	919

**Note: ***HFQLG = Herger-Feinstein Quincy Library Group watershed.

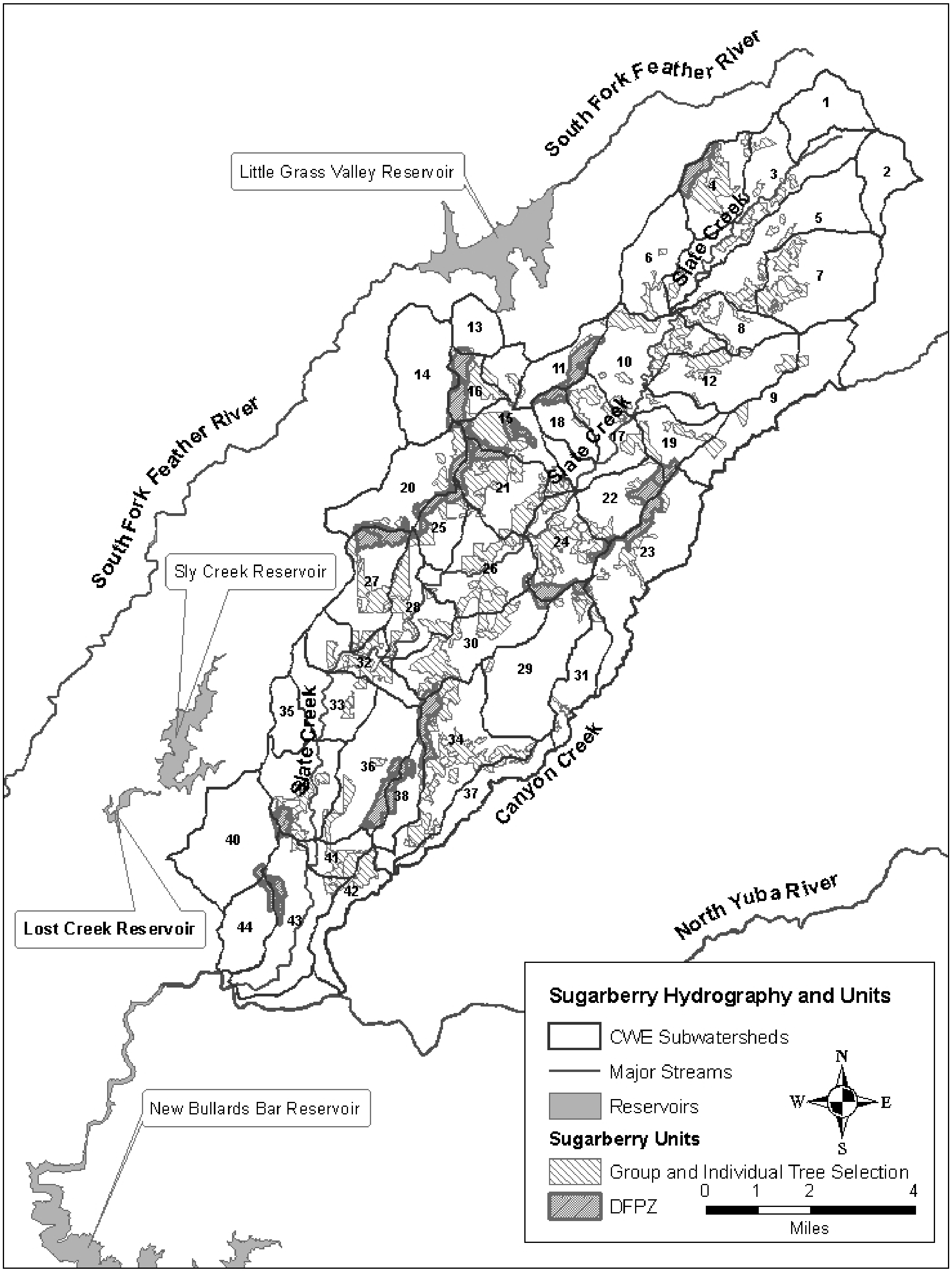

Figure 1: Locations of Subwatersheds With Respect to Treatment Units

2.4 Field Methods

General watershed and riparian conditions within the Sugarberry CWE analysis area were evaluated during site visits by the hydrologist/soil scientist, botanist, fisheries biologist, and wildlife specialist and by aerial photo interpretation, interpretation of data from fisheries and stream crossing surveys, and professional judgment based on the best available scientific literature. Streams located within proposed DFPZ treatment units were previously field checked for the Lower and Upper Slate DFPZ Environmental Assessments. Information gathered for the Slate Creek Landscape Analysis (Slate Creek LA, USDA Forest Service, Plumas National Forest 1999) was compiled and examined for accuracy and relevance. Relevant results are discussed in the Sugarberry Watershed Analysis (in the Sugarberry project file). Observed field conditions were compared with ERA model results, and related to known past management activities and disturbances (see Environmental Effects below).

Stream channels located within DFPZ treatments units were previously identified and flagged in the field as RHCAs for the Upper and Lower Slate DFPZ projects. These demarcations will be used as stream protection zones for the Sugarberry Project. The RHCAs marked for these projects extend the full 150 to 300 foot distance from all observed channels. It is not necessary to provide additional SMZ protection for ephemeral channels without annual scour (ephemeral swales) in DFPZ units, because these features were delineated as RHCAs for the Slate projects, providing more extensive buffers than SMZs would. (Refer to Regulatory Framework above.) During on-the-ground layout of treatment units, the RHCA posting will be refreshed, and RHCA demarcation will be added for any new features identified during Sugarberry field surveys or unit layout. Specifically, springs and seeps identified by botany survey crews will be flagged as RHCAs with 150-foot radii. In units where mechanical treatment in RHCAs is proposed, site visits were made to assess the proposed treatments for consistency with RMOs, and to ensure compliance with HFQLG FEIS direction for RHCA treatments. Activities within RHCAs must contribute to improving or maintaining watershed and aquatic habitat conditions as described in the RMOs (Appendix A). RHCAs were not identified on the ground in areas where group selection or ITS harvest is proposed. Group selection and ITS areas will be laid out so no mechanical activities occur within RHCAs. SMZ demarcations will be posted in group selection and ITS harvest units where ephemeral channels without annual scour occur within harvest unit boundaries. Travel by mechanical equipment will be excluded from these SMZs; “reaching in” with equipment booms for harvest may be permitted upon approval of the timber sale administrator and the advice of hydrologists.

2.5 Scope and Methods for the Fungicide Effects Analysis

The analysis area for the potential hydrologic effects of fungicides (Sporax®) is the same as the CWE analysis area, and consists of the subwatersheds listed above (Table 1). The discussion in the Existing Condition and Environmental Effects sections below is based on information from the available literature.

3. EXISTING CONDITION

3.1 Overview

The subwatersheds included in the Sugarberry CWE analysis area are listed above in Table 1 and displayed in Figure 1. The existing condition information for these subwatersheds is based on site visits, historical references, aerial photography, Forest Service corporate GIS data, corporate GIS data provided by Butte, Yuba, Plumas and Sierra Counties, and private land timber harvest plans (THPs) filed with the California Division of Forestry and Fire Protection (CDF).

3.1.1 Land Ownership

The subwatersheds lie within a mostly forested rural landscape on the western slope of the northern Sierra Nevada of California. Overall, 75 percent of the CWE analysis area is National Forest System lands, and 25 percent is privately owned. The percentage of National Forest and private land by subwatershed is displayed in Table 2. Over three-quarters of the subwatersheds in the analysis area are over 50 percent National Forest lands. Land ownership in subwatersheds, 6, 11, 13, 19, 29, 33, 35, 38, 39 and 40 is greater than 50 percent private.

Table 2: Land Base Ownership of Subwatersheds within the CWE Analysis Area

Subwatershed Label	Percent of Land Managed by PNF	Percent of Private Land
1	93	7
2	100	0
3	86	14
4	69	31
5	100	0
6	39	61
7	94	6
8	100	0
9	90	10
10	89	11
11	43	57
12	96	4
13	12	88
14	90	10
15	69	31
16	82	18
17	76	24

Subwatershed Label	Percent of Land Managed by PNF	Percent of Private Land
18	98	2
19	39	61
20	67	33
21	85	15
22	89	11
23	100	0
24	96	4
25	78	22
26	86	14
27	80	20
28	83	17
29	15	85
30	59	41
31	87	13
32	53	47
33	46	54
34	87	13
35	1	99
36	54	46
37	100	0
38	43	57
39	49	51
40	49	51
41	72	28
42	94	6
43	94	6
44	84	16

3.1.2 Climate

The productive nature of forest soils in the area and the seasonally moist climatic conditions have ensured that forest vegetative cover remains dense and vigorous. The western slope of the northernmost Sierra Nevada, which includes the Feather River Ranger District, receives the greatest amounts of mean annual precipitation in the range. The climatic regime is Mediterranean, with precipitation events concentrated between November and April and drought conditions generally prevailing the remainder of the year. The main factors that account for the precipitation conditions include the southwesterly aspect of the drainage network, which favorably intercepts Pacific storm energy; and the orographic influence of the rise of the western slope of the Sierra Nevada. The Sugarberry Project area is centrally located in the main precipitation belt of the northern Sierra, with mean annual precipitation of 75 inches to 80 inches. Approximately 34 percent of the annual precipitation at La Porte falls as snow (California Department of Water Resources [CDWR] 1978). The mean annual runoff exceeds 50 inches per year (CDWR 1978), and 70 percent of annual precipitation appears as stream runoff (Benoit 1980). Streamflow is typically storm flow-dominated in the fall and early winter, with snow pack accumulation and decreased runoff in mid-winter, and the spring melt beginning in April to May. The average monthly runoff peaks generally occur in December through February and again in April and May, declining to a monthly low in September. However, there is high variability in the seasonality, magnitude and intensity of precipitation/runoff events on an annual and inter-annual basis. Rain-on-snow or rain-on-frozen-ground events occur infrequently over the analysis area but have a high potential for destructive flooding.

3.1.3 Channel Network

In the CWE analysis area, there are 102 miles of fish-bearing streams; 57 miles of perennial non-fish-bearing streams, 132 miles of intermittent non-fish-bearing streams, and 341 miles of ephemeral streams. For the purposes of the stream channel network analysis and definition of near-stream sensitive areas for the CWE analysis, ephemeral streams were not treated as RHCAs. Overall stream network density is 7.0 miles per square mile (Table 3).

Table 3: Length in Miles and Drainage Density of the Channel Network in the Sugarberry CWE Analysis Area

Subwatershed Label	Fish-Bearing Streams (Miles)	Non-Fish Bearing Perennial and Intermittent Streams (Miles)	Ephemeral Streams (Miles)	Total Channel Network Length (Miles)	Drainage Density (Miles/Square Mile)
1	1.9	2.6	7.8	12.3	7.7
2	0.0	3.9	7.3	11.2	8.7
3	6.0	6.6	12.2	24.9	7.2
4	1.9	5.1	9.1	16.1	8.7
5	5.3	5.6	12.8	23.8	7.3
6	1.5	3.8	10.0	15.2	7.5
7	6.9	6.9	14.5	28.4	8.0
8	0.7	3.1	3.3	7.1	5.9
9	4.1	7.3	14.4	25.9	9.2
10	3.3	6.3	7.0	16.6	5.1
11	1.3	0.8	3.1	5.3	4.4
12	0.9	5.8	7.5	14.2	5.7
13	0.0	1.8	1.8	3.7	4.0
14	0.6	7.5	7.9	15.9	5.9
15	2.6	3.2	6.5	12.3	5.6
16	0.0	3.7	2.2	5.9	6.6
17	3.2	2.7	6.4	12.3	6.1
18	1.8	0.6	3.5	5.8	6.3
19	0.0	2.8	2.6	5.3	4.5
20	2.6	7.2	11.3	21.1	7.9
21	1.1	4.4	7.0	12.5	5.9
22	0.0	5.1	7.1	12.2	7.4
23	7.9	7.9	17.5	33.4	9.1
24	1.5	5.1	6.2	12.8	6.3
25	0.0	4.5	3.8	8.3	7.8
26	2.9	5.9	7.2	16.0	6.0
27	2.3	5.4	6.0	13.6	6.7
28	2.2	3.0	7.9	13.1	7.4

Subwatershed Label	Fish-Bearing Streams (Miles)	Non-Fish Bearing Perennial and Intermittent Streams (Miles)	Ephemeral Streams (Miles)	Total Channel Network Length (Miles)	Drainage Density (Miles/Square Mile)
29	4.5	4.3	6.8	15.6	4.6
30	3.7	1.7	8.8	14.1	5.6
31	1.6	3.0	4.7	9.3	7.1
32	1.6	3.7	4.6	9.9	6.0
33	1.7	3.5	6.7	11.9	6.5
34	4.0	9.8	12.0	25.7	7.0
35	0.0	2.7	3.2	5.9	6.7
36	2.6	6.5	12.1	21.1	7.2
37	4.7	0.9	8.5	14.1	10.9
38	2.5	0.7	4.1	7.3	7.1
39	2.3	3.6	10.3	16.2	7.3
40	1.6	8.0	13.1	22.6	7.1
41	0.7	1.7	4.3	6.6	8.3
42	3.3	2.1	6.6	12.0	10.5
43	3.6	5.3	14.9	23.9	8.0
44	1.6	3.2	6.8	11.6	8.1
Total Miles	**102.3**	**189.2**	**341.3**	**632.8**	**7.0**

Stream conditions in the CWE analysis area were field-inspected during site visits to proposed restoration projects, road construction sites, and selected stream crossings and reaches. Channel and riparian conditions are observably and substantially influenced by past management activities, particularly the legacy of hydraulic mining in the area. Timber harvest and associated road construction have also impacted tributary channels, particularly on heavily managed private timberlands. Persistent upland effects of mid-19th- to early 20th-century hydraulic mining include denuded areas with complete loss of the soil profile, steep eroding scarps of pit faces and walls, and large accumulations of frequently unstable tailings and waste rock. Persistent effects to the channel network include: alteration of drainage from mined areas, including artificial channel realignment; aggradation of channel reaches downstream of mines, including impoundment of large quantities of sediment behind historic and sometimes failing debris dams; impoverished riparian vegetation related to historic channel scour; interception of hillslope and headwater channel flow by an extensive network of historic flume ditches; and persistence of mercury and other toxic materials used in mining in drainage structures and stream beds. This legacy of effects unquestionably represents large-scale CWE with resultant changes in channel morphology, channel stability, water quality, and aquatic and riparian habitat quality. At a number of specific sites, disturbances related to mining or to other activities are continuing to adversely affect streams. In some cases specific site disturbances are associated with poorly engineered or maintained roads and stream crossings. Some of these locations include:

- Failing crossing of Potosi Creek on Sierra County Road 800.

- Unstable crossings of Road 20N20XA near La Porte which were upgraded in 2006.
- Erosion of the hydraulic pit face and drainage diversion in the Upper Dutch Diggings hydraulic mine site.
- Erosion of the pit face at the Nugget Bowl hydraulic mine site.
- Backwearing and mass wasting of the face of the Pioneer Pit
- Failing debris dam on Gold Run Creek and associated channel diversion.
- Erosion and the landslide on the Scales road (20N35) near the Slate Creek bridge.

Some of these problems are currently being addressed under categorical exclusions for road maintenance by the Feather River Ranger District or are proposed for restoration as part of the Sugarberry Project.

Stream crossings that are in degraded condition or that present barriers to migration of aquatic organisms are present at:

- Outlet of Fish Meadow on Road 20N20,
- Potosi Creek at SC800,
- Pearson Ravine at SC800,
- Rock Creek at 20N95, and
- Gold Run Creek at 21N90.

These crossings are planned for replacement or upgrade with the Sugarberry Project.

Despite the noted lack of riparian cover in a number of channels, the Slate Creek LA found that summer stream temperatures were generally within the range of the desired condition for maximum temperatures (54° to 66°F.). Temperatures in excess of this range were recorded in lower Slate Creek and Cedar Grove Ravine.

The Slate Creek LA indicates that approximately half of streambeds sampled for pool-tail fines exceeded the desired condition of zero to 5 percent. Silt from mining was described as frequently observed, although survey data suggest its presence may be localized and ephemeral.

3.1.4 Road Network

The Sugarberry Project CWE analysis area has a high road density and a high stream crossing density under the existing condition. Road development has occurred for the following reasons: timber harvesting activities on public and private lands, urban development, mining, and OHV recreation. Roads modify drainage networks and accelerate erosion processes, resulting in the alteration of physical processes in streams. These changes can be dramatic and long lasting and can degrade water quality and aquatic habitat (Hagans et al. 1986). Roads can directly affect water quality and aquatic habitat by altering flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, and riparian conditions in watersheds (Gucinski et al. 2001; Trombulak and Frissell 2000). Common hydrologic problems originating at roads include: rutting and road surface erosion; poorly placed or inadequate stream crossings and surface drains that may fail, divert drainage from its natural course or block passage for fish and other aquatic organisms; and over-steepened cut-and-fill slopes prone to erosion and mass wasting. Other hydrologic influences from roads identified in the watersheds include:

- Roads that cross areas with slope gradients greater than 60 percent, and roads that cross inner-gorge landslide-prone areas. Slope stability problems and excessive sediment production are associated with roads in these areas.

- Inadequately engineered stream crossings. Hydrologic problems are associated with undersized, improperly located, damaged or failed culverts, including bedload interception, ponding or plugging which can lead to drainage diversion and/or culvert and fill failure, and channel instability. Inadequate culverts form barriers to fish migration (See Wildlife and Fish BA/BE). Low-water crossings can affect hydrologic regimes and create fish barriers (USDA Forest Service 1991). Stream crossing repairs proposed as part of the Sugarberry Project are mentioned above.

- Recreation impacts in RHCAs. OHV trails in riparian areas have resulted in soil compaction, stream bank instability, channel incision and increased width, sedimentation, riparian and meadow vegetation loss, sanitation problems, and increased stream temperatures. High OHV traffic volumes have been particularly damaging in some areas.

Studies have indicated that as road and stream crossing densities increases, so do negative effects on aquatic habitat parameters and fish populations (Eaglin and Hubert 1993). The Slate Creek LA recommends a road density of no more than 2 miles per square mile, and recognizes that the existing condition of road density exceeds this recommendation in several watersheds. The road density of a majority of subwatersheds in the Sugarberry CWE analysis area exceeds the desired density for minimizing road impacts on aquatic and riparian environments and associated terrestrial wildlife. Table 4 list miles of road and road densities for the near-stream sensitive areas (all RHCAs identified in the CWE analysis area) and for subwatersheds as a whole. There are 396 miles of roads, including classified National Forest system roads, county and private roads and unclassified roads in the analysis area. The road densities for near-stream sensitive areas range from 0.8 to 9.9 miles per square mile, with an average of 4.3 miles per square mile. The road densities of the subwatersheds as a whole range from 0.7 to 8.0 miles per square mile, with an average road density of 4.5 miles per square mile.

Table 4: Existing Condition Miles of Road and Road Density for each Subwatershed

Subwatershed Label	Miles of Road		Road Density	
	Near-Stream Sensitive Area	Subwatershed Area	Near-Stream Sensitive Area	Subwatershed Area
1	4.1	7.1	4.6	4.4
2	1.1	3.2	1.7	2.5
3	5.1	11.4	3.2	3.3
4	2.8	6.9	3.2	3.7
5	1.2	4.5	0.8	1.4
6	4.2	10.3	4.8	5.1
7	3.5	6.4	2.0	1.8
8	0.8	2.2	2.0	1.8
9	1.0	2.1	0.8	0.7
10	3.5	11.5	3.3	3.6
11	3.5	8.2	9.7	6.9
12	2.6	6.7	3.2	2.7
13	2.0	6.4	8.4	7.0
14	2.8	10.2	3.3	3.8
15	3.8	11.5	4.4	5.2
16	1.4	3.9	4.1	4.3
17	4.3	9.5	5.5	4.7
18	1.9	5.4	5.0	5.8
19	2.2	6.4	6.2	5.5
20	5.7	13.3	4.8	5.0
21	3.6	11.6	5.0	5.5
22	2.1	6.7	3.3	4.1
23	5.7	17.6	4.0	4.8
24	1.5	7.4	2.0	3.6
25	1.5	5.7	3.6	5.4
26	2.5	8.8	2.5	3.3
27	5.7	14.8	7.3	7.3
28	3.0	8.0	3.8	4.5
29	5.8	18.7	5.1	5.5
30	5.3	14.3	5.5	5.7
31	2.0	6.1	4.0	4.6
32	2.3	7.3	3.6	4.4
33	5.0	14.6	6.9	8.0

Subwatershed Label	Miles of Road		Road Density	
	Near-Stream Sensitive Area	Subwatershed Area	Near-Stream Sensitive Area	Subwatershed Area
34	9.0	23.6	6.0	6.4
35	2.8	7.0	8.4	7.9
36	9.0	18.5	7.7	6.3
37	0.9	2.9	1.4	2.2
38	4.7	8.0	9.9	7.9
39	3.8	11.2	3.8	5.1
40	8.4	21.2	6.6	6.6
41	0.7	3.1	1.8	3.9
42	0.7	1.5	1.1	1.3
43	1.8	6.5	1.0	2.2
44	1.7	4.1	2.7	2.9
Total Miles	**147.2**	**396.4**	**4.3**	**4.5**

3.1.5 Meadow Condition

The existing condition of meadows in the CWE analysis area ranges from good to adversely affected, depending on meadow location, degree of disturbance, and previously accomplished restoration activities. Adverse effects to meadows in the analysis area include stream destabilization and surface degradation related to OHV use and past timber harvests, invasion by conifers due in part to suppressed fire frequency and settlement-related disturbance, and soil deposition from road-related erosion. The Slate Creek LA recognizes that meadow area has declined compared to the reference condition, and recommends enhancing meadow area where possible. Approximately seven acres of meadow restoration is proposed as part of the Sugarberry Project.

3.1.5 Slope Instability

Unstable terrain occurs in several landscape settings within the Sugarberry project area. Natural hillslope instability includes active and dormant landslides, and landslide-prone ground. According to SAT guidelines, landslides and landslide-prone areas are defined as RHCA's. Ground-disturbing activity, especially road construction in unstable areas, but also including timber harvest that can reduce evapotranspiration substantially in areas where vegetation is removed, can initiate or accelerate landslide activity. During the project planning phase, the risk of operating on unstable grounds was evaluated and that risk was minimized by avoiding those areas or by designing project mitigations to prevent destabilizing them. Planning considerations and mitigations, including Best Management Practices, are described in the Environmental Effects section and are also listed in Appendix E of the FEIS.

Existing landslide mapping (King and Keller, 1981), aerial photo interpretation, and field reconnaissance were used to locate unstable ground within the Sugarberry CWE analysis area. Naturally unstable areas are concentrated in the inner canyons of Slate Creek and to a lesser extent Canyon Creek, which exhibit oversteepened inner gorge topography and abundant shallow rapid landsliding. The most extensive area of instability is located in the southern portion of the Sugarberry project, south of the Slate Creek Bridge (Road 20N35). Inner gorge instability in this area is superimposed on extensive deep-seated landsliding that consists of rotational-translational and slump-earthflow slide complexes. The largest deep-seated landslide complex occurs on the west side of Slate Creek canyon south of the 20N04/20N35 road junction on Peterson Ridge. This is a zone of broad geologic instability, related to broken and highly sheared metamorphic rock in the actively downcutting Slate Creek gorge. The slides are most active in their well-watered toe zones, and tend to be less so with distance upslope. No timber harvest or other ground disturbance associated with the Sugarberry project is planned in this area due to the landslide hazard. Road 20N35, west of the Slate Creek Bridge, failed due to landslide activity during the winter of 2005-2006, and is currently under repair with engineering upgrades designed to reduce the risk of future failures.

Additional areas of ground instability are associated with historic mining activities, particularly in the St. Louis and Howland Flat areas. Oversteepened pit walls and areas of unstable tailings present risks of hillslope failure and sediment delivery. Planned timber harvest and road construction activities that might affect these areas have also been curtailed, re-designed or mitigated to reduce or eliminate the risk of destabilizing them.

3.2 Subwatershed History of Disturbance

Timber harvesting, road construction, and mining have been the major recent land-disturbing activities in the subwatersheds. Historic gold mining, unmanaged timber harvest, grazing of both cattle and sheep, and an increase in fire frequency and magnitude all produced changes on the landscape prior to Forest Service management of the area. Some of these changes included: decrease in canopy cover of mature timber and replacement with brush fields or denuded areas; alteration of channel networks dismantling of hillslopes; and redistribution of large quantities of soil and Tertiary gravels. As a combined consequence, these activities, particularly hydraulic mining, severely altered hydrologic response and accelerated erosion and sedimentation during this era. Construction of debris dams in several higher-order channels, including Slate Creek, following passage of the *Caminetti Act* in 1893 (see the Sugarberry “Heritage Report”), further increased channel storage of sediment, elevated base levels, and prolonged and increased the aggraded condition of channels downstream of hydraulic mine pits.

The legacy of the hydraulic mining era also includes mercury that was used to extract gold from the hydraulically mobilized materials, and which is still found in mined areas, drainage structures and streambed gravels within the area, and poses potential threats to water quality and beneficial uses including aquatic ecosystems and human health.

Following National Forest proclamation in the early 1900s, a period of hydrologic recovery ensued, concurrent with land and resource management and fire suppression. Extensive logging and road building began in the 1950s and 1960s, on both National Forest System lands and private lands in the analysis area. Routine road location and logging practices of that time resulted in extensive watershed damage that required 20 to 30 or more years to recover. Changes in timber practices alleviated disturbance to a degree by the 1970s, although large volumes of timber continued to be harvested on the National Forest into the 1980s and early 1990s, and substantial private timber harvest continues today. Until recently, most logging activities have occurred on the gently to moderately sloping ground that occupies broad ridgetop areas in the CWE analysis area. Most of the very steeply sloping areas were not historically harvested, but recent harvest activities using cable and helicopter logging systems have begun removing timber on steeper ground where land management treatments are needed. For more information refer to the Sugarberry “Vegetation, Fire, and Fuels Analysis”.

There have been a number of timber sales and vegetation management projects on National Forest System lands within the CWE analysis area during the past 25 years. However, their total contribution to disturbance as measured in ERA values totals about one-third that of private timber harvest, which is concentrated on one-quarter of the total land base of the CWE analysis area (Table 5).

Table 5. Land ownership and disturbance by vegetation management in the Sugarberry CWE analysis area.

Ownership	Acres	Square Miles	Percent of Analysis Area	Acres of Vegetation Management	ERA	ERA/ Square Mile
Federal	43,650	68.2	75%	4,785	332	4.9
Private	14,430	22.6	25%	9,805	999	44.2

Recent Forest Service projects have incorporated stream protection and erosion prevention measures specified in the Forest Plan or the HFQLG ROD, effectively reducing impacts to riparian and aquatic systems. Private timber harvest also employs watercourse protection and erosion control measures specified by the state Forest Practice Rules; however, in some instances these stipulations are less stringent and provide narrower stream buffers than the Forest Service regulations.

Fire suppression and reduced vegetation management have resulted in extensive fuel accumulations, which the Sugarberry Project is designed to alleviate. While stand-replacing fire has been relatively uncommon on the western slope of the Plumas National Forest, several historic stand-replacing fires have occurred in the subwatersheds. Fire history for the area is described in the Sugarberry "Vegetation, Fire, and Fuels Analysis".

Other influences that have affected the subwatersheds include grazing, urban development, modern small-scale placer and suction dredge mining, and water diversion associated with the South Feather Water and Power water supply and hydroelectric project.

Watershed restoration projects have been performed within the Sugarberry CWE analysis area on Plumas National Forest lands. These restoration projects were designed to reduce and restore stream destabilization from past management activities and benefit ecosystem structure and function. A list of these projects is located in Appendix E.

3.3 Existing Condition of Indicator 1 - Watershed Condition

3.3.1 Measure 1: CWE Analysis

3.3.1.1 Results of ERA Model and Comparison to the TOC

Table 6 displays the ERA totals for each type of disturbance assessed by subwatershed, for the near-stream sensitive areas and for the subwatersheds as a whole. Table 7 displays summations of the ERA scores for each subwatershed, represented as percent disturbed and percent of TOC, for both near-stream sensitive areas (all RHCAs within the analysis area) and for subwatersheds as a whole. Table 8 shows the percentage contribution of each type of disturbance to the total ERA of the subwatershed, again both for near-stream sensitive areas and for the subwatersheds as a whole. Subwatersheds approaching or exceeding TOC are highlighted in Tables 7 and 8.

For the near-stream sensitive areas there are 6 subwatersheds approaching the TOC and 14 exceeding the TOC under the existing condition. Possible reasons for this include: (1) private land has smaller stream protection zones than public lands; (2) urban development and historic mining impinge on near-stream areas; (3) road development has occurred in near-stream sensitive areas, and (4) prior to SAT guidelines, stream protection zones were based on Forest Plan SMZ guidelines, so more land area received treatment than under current RHCA guidelines.

Of the subwatersheds as a whole, three are approaching TOC (Subwatersheds 11, 13, and 35) and two exceed TOC (Subwatersheds 19 and 38). Subwatershed 35 approaches the TOC, but does not have any present or future proposed Forest Service activities. However, activities within this subwatershed may contribute to cumulative off-site watershed effects (Figure 1). Table 8 displays the proportion of each disturbance type in relation to the total ERA, thus providing an analysis of the principal disturbances affecting each subwatershed. In each of the four subwatersheds that approach or exceed TOC (subwatersheds 11, 13, 19, 35 and 38), private land timber harvest is the chief source of landscape disturbance (50 to 73 percent of the total disturbance), followed by hydraulic mining (up to 40 percent of the total disturbance) or roads (up to 26 percent). In the five subwatersheds approaching or exceeding the TOC, the past 25 years of Forest Service land management activities contribute from 0 to 3 percent of the total disturbance.

Stream conditions were examined in a number of the RHCAs in the analysis area. No formal channel condition surveys were conducted, because RHCAs in proposed DFPZ treatment units were previously delineated in the Lower and Upper Slate project areas. Little mechanical treatment and no ground-based yarding in RHCAs are proposed for the Sugarberry project. Observations were made where temporary roads or other activities, such as aspen or meadow restoration, are proposed in or near RHCAs. Observed conditions were compared with the ERA model results, as described below.

Table 6: Existing Condition ERA (acres) for Each Disturbance Type

Subwatershed Label	Subwatershed Acres		ERA Mines		ERA Roads and Landings		ERA Private Timber Harvest		ERA PNF Harvest		ERA Urban Development		ERA OHV Trails	
	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
1	571	1025	7.9	8.0	9.7	17.0	6.8	12.1	0.00	0.0	0.0	0.0	0.3	0.3
2	414	831	0.0	0.0	3.0	7.7	0.0	0.0	0.70	1.2	0.0	0.0	0.4	0.8
3	1003	2224	18.7	27.4	12.9	28.6	16.4	34.4	1.99	5.4	0.0	0.0	0.6	1.6
4	569	1186	8.7	18.0	8.2	18.5	11.5	26.5	7.64	15.3	0.0	0.0	0.4	0.9
5	950	2082	14.5	37.2	2.9	11.0	0.0	0.0	0.24	3.1	0.0	0.0	0.5	1.5
6	562	1306	0.0	0.0	10.2	26.2	20.4	46.7	2.86	9.3	0.0	0.0	0.8	2.4
7	1117	2270	10.9	21.9	8.6	15.8	9.7	23.0	0.19	1.7	0.0	0.0	0.7	1.5
8	258	767	14.0	38.8	1.9	5.3	0.0	0.0	1.36	8.6	0.0	0.0	0.3	1.0
9	832	1802	1.4	2.9	3.2	7.2	3.9	17.4	0.47	1.3	0.0	0.0	0.3	1.0
10	689	2076	19.9	74.3	9.0	30.0	16.9	34.4	2.00	11.7	0.0	0.0	0.8	3.7
11	230	760	2.6	6.1	9.1	21.3	15.5	56.8	0.33	2.7	0.5	4.7	0.3	1.2
12	523	1602	5.9	30.2	6.7	16.2	4.2	11.5	0.93	5.4	0.0	0.0	1.0	2.6
13	151	585	0.0	0.0	5.1	16.3	12.5	46.1	0.11	0.7	0.0	0.0	0.0	0.0
14	547	1717	0.0	0.0	6.9	24.9	5.2	11.8	12.17	58.3	0.0	0.0	0.0	0.3
15	553	1408	26.3	60.5	9.3	28.2	8.2	31.6	1.60	4.1	6.9	16.7	0.6	1.3
16	220	577	0.2	0.2	3.4	9.4	2.8	8.1	1.11	5.2	0.5	1.8	0.5	1.4
17	498	1295	5.2	13.7	12.0	24.7	13.6	23.1	0.29	1.0	0.0	0.0	0.1	0.8
18	247	596	0.3	1.1	4.6	13.3	0.0	1.8	0.19	2.0	0.0	0.0	0.3	0.5
19	224	752	42.6	55.4	5.6	18.4	16.4	63.5	0.06	0.4	0.0	0.0	0.2	0.4
20	768	1714	0.0	0.0	14.8	33.2	21.1	36.6	13.36	35.9	0.0	0.0	0.0	0.1
21	460	1355	21.9	46.9	9.2	28.9	5.8	14.3	2.19	5.4	0.0	0.0	0.7	1.8
22	412	1051	5.7	18.5	4.9	15.7	0.3	0.6	0.39	1.6	0.0	0.0	0.1	0.5
23	914	2343	0.0	0.0	13.6	42.3	0.0	0.3	4.22	12.3	0.0	0.0	0.1	0.4
24	482	1300	0.0	0.0	3.7	17.8	0.4	0.4	5.79	20.5	0.0	0.0	0.0	0.5
25	275	685	0.0	0.0	4.0	14.6	1.6	10.3	3.84	14.0	0.0	0.0	0.0	0.0
26	651	1698	7.0	23.0	6.2	21.8	3.4	15.2	1.31	5.5	0.0	0.0	0.5	0.7
27	499	1294	0.0	0.0	13.8	36.0	3.1	19.2	1.16	8.6	0.0	1.5	0.3	0.4
28	507	1138	0.0	0.0	7.4	19.7	8.8	21.3	1.42	3.6	0.0	0.0	0.1	0.5
29	719	2178	8.0	13.7	14.8	51.0	35.4	95.4	0.44	4.0	0.6	0.7	0.0	0.3
30	619	1618	17.8	33.9	14.0	38.0	15.6	41.7	2.96	14.9	0.0	0.0	0.2	0.9

Subwatershed Label	Subwatershed Acres		ERA Mines		ERA Roads and Landings		ERA Private Timber Harvest		ERA PNF Harvest		ERA Urban Development		ERA OHV Trails	
	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
31	312	844	0.0	0.0	4.6	15.4	1.7	5.3	4.89	14.2	0.0	0.0	0.1	0.5
32	402	1052	0.0	0.0	5.7	18.4	12.8	42.5	2.74	9.0	0.0	0.2	0.2	0.2
33	458	1164	0.0	0.0	12.3	36.4	9.6	34.6	1.81	5.2	0.0	0.0	0.0	0.0
34	959	2350	8.4	19.3	22.1	57.5	5.3	16.0	11.53	35.1	0.2	0.2	0.6	1.2
35	216	568	0.0	0.0	6.8	18.5	14.8	45.7	0.00	0.2	0.0	0.0	0.0	0.0
36	750	1868	0.0	0.0	22.0	46.7	18.0	63.5	7.10	16.8	0.0	0.0	0.8	1.3
37	421	830	0.4	3.9	2.2	7.0	0.0	0.1	1.18	4.5	0.0	0.0	0.0	0.0
38	302	655	0.0	0.0	12.0	20.9	39.5	67.2	3.24	7.7	0.0	0.0	0.1	0.1
39	644	1416	0.0	0.0	9.8	28.5	10.4	27.5	1.34	4.7	0.0	0.0	0.1	0.5
40	809	2045	0.0	0.0	19.8	50.7	7.1	28.5	3.60	8.9	1.8	4.4	0.0	0.4
41	258	510	0.0	0.0	1.8	8.2	3.2	11.8	1.43	3.4	0.0	0.0	0.1	0.1
42	405	730	0.0	0.0	1.7	3.6	0.9	2.5	0.24	1.1	0.0	0.0	0.0	0.0
43	1204	1904	0.0	0.0	4.4	15.6	6.4	15.5	0.31	3.6	0.0	0.0	0.0	0.3
44	403	919	0.0	0.0	4.0	10.2	0.7	4.9	0.82	4.2	0.0	0.0	0.1	0.3

Table 7: Existing condition ERA compared to TOC by Subwatershed
Highlighted rows represent entire subwatersheds approaching or exceeding TOC.

Subwatershed Label	TOC of Near-Stream Areas	TOC of Entire Watershed	Total ERA (Acres)		Percent Disturbed		Percent of TOC	
			Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
1	6%	14%	24.8	37.5	4%	4%	72%	26%
2	6%	14%	4.1	9.7	1%	1%	16%	8%
3	6%	14%	50.6	97.5	5%	4%	84%	31%
4	6%	14%	36.5	79.3	6%	7%	107%	48%
5	6%	14%	18.1	52.7	2%	3%	32%	18%
6	6%	12%	34.3	84.5	6%	6%	102%	54%
7	6%	14%	30.1	63.9	3%	3%	45%	20%
8	6%	12%	17.6	53.7	7%	7%	114%	58%
9	6%	12%	9.3	29.9	1%	2%	19%	14%
10	6%	12%	48.6	154.2	7%	7%	118%	62%
11	6%	13%	28.4	92.8	12%	12%	206%	94%
12	6%	12%	18.8	65.9	4%	4%	60%	34%
13	6%	13%	17.7	63.0	12%	11%	196%	83%
14	6%	13%	24.3	95.4	3%	6%	74%	43%
15	6%	13%	52.9	142.4	10%	10%	159%	78%
16	6%	13%	8.5	26.1	4%	5%	64%	35%
17	6%	12%	31.2	63.3	6%	5%	104%	41%
18	6%	12%	5.4	18.7	2%	3%	36%	26%
19	6%	12%	64.8	138.0	31%	18%	482%	153%
20	6%	13%	49.3	105.9	5%	6%	107%	48%
21	6%	13%	39.8	97.2	9%	7%	144%	55%
22	6%	13%	11.4	36.8	3%	4%	46%	27%
23	6%	12%	17.9	55.2	2%	2%	33%	20%
24	6%	13%	9.8	39.2	2%	3%	34%	23%
25	6%	13%	9.5	39.0	3%	6%	57%	44%
26	6%	13%	18.4	66.1	3%	4%	47%	30%
27	6%	13%	18.4	65.7	4%	5%	61%	39%
28	6%	13%	17.7	45.2	3%	4%	58%	31%
29	6%	13%	59.2	165.1	8%	8%	137%	58%
30	6%	13%	50.6	129.3	8%	8%	136%	61%
31	6%	12%	11.3	35.4	4%	4%	60%	35%
32	6%	13%	21.5	70.4	5%	7%	89%	51%
33	6%	13%	23.7	76.2	5%	7%	86%	50%
34	6%	13%	48.1	129.3	5%	6%	84%	42%
35	6%	13%	21.7	64.5	10%	11%	167%	87%
36	6%	13%	47.9	128.3	6%	7%	106%	53%
37	6%	12%	3.8	15.4	1%	2%	15%	15%
38	6%	13%	54.8	95.8	10%	15%	303%	113%
39	6%	13%	21.7	61.3	3%	4%	56%	33%
40	6%	14%	32.3	92.8	4%	5%	67%	32%
41	6%	13%	6.5	23.5	1%	5%	42%	35%
42	6%	12%	2.9	7.3	1%	1%	12%	8%
43	6%	13%	11.1	34.9	0%	2%	15%	14%
44	6%	14%	5.6	19.6	1%	2%	23%	15%

Table 8: Existing Condition - Percentage of Each Disturbance Compared to the Near-Stream and Total ERA for the Subwatershed Highlighted rows represent entire subwatersheds approaching or exceeding the TOC.

Subwatershed Label	Roads and Landings ERA as Percentage of Total ERA		Mines ERA as Percentage of Total ERA		Urbanization ERA as Percentage of Total ERA		PNF Vegetation Management ERA as Percentage of Total ERA		Private Timber Harvest ERA as Percentage of Total ERA		OHV Trails ERA as Percentage of Total ERA	
	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
1	39%	45%	32%	21%	0%	0%	0%	0%	27%	32%	1%	1%
2	73%	79%	0%	0%	0%	0%	17%	12%	0%	0%	10%	8%
3	26%	29%	37%	28%	0%	0%	4%	6%	32%	35%	1%	2%
4	22%	23%	24%	23%	0%	0%	21%	19%	31%	33%	1%	1%
5	16%	21%	80%	71%	0%	0%	1%	6%	0%	0%	3%	3%
6	30%	31%	0%	0%	0%	0%	8%	11%	60%	55%	2%	3%
7	28%	25%	36%	34%	0%	0%	1%	3%	32%	36%	2%	2%
8	11%	10%	79%	72%	0%	0%	8%	16%	0%	0%	2%	2%
9	35%	24%	15%	10%	0%	0%	5%	5%	42%	58%	4%	4%
10	19%	19%	41%	48%	0%	0%	4%	8%	35%	22%	2%	2%
11	32%	23%	9%	7%	2%	5%	1%	3%	55%	61%	1%	1%
12	36%	25%	32%	46%	0%	0%	5%	8%	22%	17%	5%	4%
13	29%	26%	0%	0%	0%	0%	1%	1%	70%	73%	0%	0%
14	28%	26%	0%	0%	0%	0%	50%	61%	21%	12%	0%	0%
15	18%	20%	50%	42%	13%	12%	3%	3%	16%	22%	1%	1%
16	39%	36%	2%	1%	6%	7%	13%	20%	33%	31%	6%	5%
17	38%	39%	17%	22%	0%	0%	1%	2%	44%	36%	0%	1%
18	85%	71%	6%	6%	0%	0%	4%	11%	0%	9%	5%	3%
19	9%	13%	66%	40%	0%	0%	0%	0%	25%	46%	0%	0%
20	30%	31%	0%	0%	0%	0%	27%	34%	43%	35%	0%	0%
21	23%	30%	55%	48%	0%	0%	6%	6%	15%	15%	2%	2%
22	43%	43%	50%	50%	0%	0%	3%	4%	3%	2%	1%	1%
23	76%	77%	0%	0%	0%	0%	24%	22%	0%	1%	1%	1%
24	37%	45%	0%	0%	0%	0%	59%	52%	4%	1%	0%	1%
25	42%	38%	0%	0%	0%	0%	41%	36%	17%	26%	0%	0%
26	34%	33%	38%	35%	0%	0%	7%	8%	18%	23%	3%	1%
27	75%	55%	0%	0%	0%	2%	6%	13%	17%	29%	2%	1%

Subwatershed Label	Roads and Landings ERA as Percentage of Total ERA		Mines ERA as Percentage of Total ERA		Urbanization ERA as Percentage of Total ERA		PNF Vegetation Management ERA as Percentage of Total ERA		Private Timber Harvest ERA as Percentage of Total ERA		OHV Trails ERA as Percentage of Total ERA	
	Near-Stream	**Total**	**Near-Stream**	**Total**	**Near-Stream**	**Total**	**Near-Stream**	**Total**	**Near-Stream**	**Total**	**Near-Stream**	**Total**
28	42%	44%	0%	0%	0%	0%	8%	8%	50%	47%	0%	1%
29	25%	31%	13%	8%	1%	0%	1%	2%	60%	58%	0%	0%
30	28%	29%	35%	26%	0%	0%	6%	12%	31%	32%	0%	1%
31	41%	43%	0%	0%	0%	0%	43%	40%	15%	15%	1%	1%
32	27%	26%	0%	0%	0%	0%	13%	13%	59%	60%	1%	0%
33	52%	48%	0%	0%	0%	0%	8%	7%	41%	45%	0%	0%
34	46%	44%	18%	15%	0%	0%	24%	27%	11%	12%	1%	1%
35	32%	29%	0%	0%	0%	0%	0%	0%	68%	71%	0%	0%
36	46%	36%	0%	0%	0%	0%	15%	13%	38%	49%	2%	1%
37	58%	45%	11%	25%	0%	0%	31%	29%	0%	0%	0%	0%
38	22%	22%	0%	0%	0%	0%	6%	8%	72%	70%	0%	0%
39	45%	47%	0%	0%	0%	0%	6%	8%	48%	45%	0%	1%
40	61%	55%	0%	0%	6%	5%	11%	10%	22%	31%	0%	0%
41	27%	35%	0%	0%	0%	0%	22%	14%	49%	50%	1%	1%
42	60%	50%	0%	0%	0%	0%	8%	16%	32%	35%	0%	0%
43	39%	45%	0%	0%	0%	0%	3%	10%	58%	44%	0%	1%
44	71%	52%	0%	0%	0%	0%	15%	22%	12%	25%	2%	1%

3.3.1.2 General Comparison of ERA Model Results to Observed Watershed and Stream Conditions

As noted previously, there is a substantial legacy of landscape disturbance and lingering stream channel effects in the Sugarberry CWE analysis area, largely related to historic mining activities and associated unregulated timber harvest. In general, observable evidence of persisting cumulative off-site watershed effects, reflected by stream channel condition, is apparent in most higher-order channels downstream of hydraulic mine sites. Cumulative off-site watershed effects are less evident elsewhere, even where substantial recent timber harvest has occurred. Streams such as Potosi Creek, Rabbit Creek, Gold Run Creek, Whiskey Creek, Pine Grove Creek, Deacon Long Ravine and Slate Creek have been affected by aggradation, riparian denudation, impoverishment of large woody debris, and/or mercury pollution. A substantial amount of sediment is stored behind debris dams and in mining reservoirs in Slate Creek, Rock Creek, Gold Run Creek, and elsewhere in the subwatersheds. This impoundment and sediment storage creates discontinuities in channel profiles and hydraulics, and presents the risk of large sediment releases to the channel network when the dams eventually fail. Studies elsewhere in the Yuba River watershed indicate that erosion and transport of stored sediments generated by historic hydraulic mining continue to affect channel morphology and aquatic habitat, and that channel adjustment and sediment release is likely to continue for some time to come (James 1999; James 2005).

Road-related increases in runoff and poor road drainage have resulted in road surface erosion, which has compromised stream crossings and increased fine sediment input to streams. Road-related stream impacts are evident on both National Forest System and private timberlands within the CWE analysis area, but are more concentrated on the heavily managed private lands. Road density is significantly higher on private lands (Table 9).

Table 9: Road mileage and density compared by land ownership in the Sugarberry CWE analysis area.

Ownership	Acres	Square Miles	Percent of Analysis Area	Road Miles	Miles/ Square Mile
Federal	43,650	68.2	75%	247	3.6
Private	14,430	22.6	25%	150	6.6

The Sugarberry subwatersheds experienced approximately 200 percent of normal precipitation and runoff during winter of 2005–2006 (CDWR 2006). Many drainages experienced high peak flows during the late December-early January flood event and during the spring snowmelt period. Numerous stream crossings were eroded and mass movements were initiated in landslide-prone areas. Crossings and road segments in the CWE analysis area failed and some have been repaired under the Emergency Relief for Federally Owned Roads (ERFO) program. These sites include those on East Branch Rabbit Creek, Clarks Ravine, and the landslide on the Scales road (20N35). These failures in combination with sediment delivery from other engineered and natural sources delivered a pulse of sediment to the Slate Creek channel network in excess of background average sedimentation rates. A geomorphic signature of this event will probably be detectable in the system for a number of years. The previous high-flow event in the area was the flood of January 1, 1997, which had an estimated recurrence interval between 64 and 82 years at Goodyears Bar on the North Yuba River, just downstream of the analysis area (Hunrichs et al. 1998). Sediment, channel adjustments and floated debris from this event are evident in channels in the CWE analysis area as of summer 2006.

Most of the stream reaches observed in the analysis area that are not experiencing legacy mining impacts are in stable condition and have largely recovered from past cumulative off-site watershed effects. In general, the quantity of large woody debris present is noticeably deficient throughout the subwatersheds, both in the channel and available for recruitment. Exceptions were noted in the Valley Creek and Gold Run Creek subwatersheds. In the Valley Creek Special Interest Area, a relict riparian and lower hillslope old-growth mixed-conifer stand is preserved. In this area, an abundance of large woody stems is available for recruitment, exceeding in size and number the general availability throughout the remainder of the subwatersheds. In Gold Run Creek bank erosion associated with the channel diversion at the Gold Run dam has toppled numerous tree trunks into the channel, creating debris jams.

3.3.1.3 Conclusions of Comparison of ERA Model Results to Stream Condition Survey Data

Watershed, stream channel, and riparian area conditions were observed throughout the Sugarberry project area. These observations were compared to the ERA model results. The majority of the stream reaches surveyed in the proposed treatment units are in stable condition and have recovered from past cumulative off-site watershed effects. However, portions of the CWE analysis area remain highly disturbed. The subwatersheds that approach or exceed the TOC are primarily subject to these disturbances: (1) timber harvesting activities on private land; (2) legacy mining impacts, and (3) high road density. The East Branch of Rabbit Creek (subwatershed 11), Deacon Long Ravine (subwatershed 19), and an un-named tributary of Rock

Creek (subwatershed 38) each exceed TOC in their existing condition and have noticeable cumulative effects to channel and riparian condition.

Some subwatersheds that do not exceed TOC in their existing condition display evidence of cumulative effects in stream channels and riparian areas. These include Whiskey Creek (Subwatershed 1), Potosi Creek (Subwatershed 7), the main stem of Slate Creek (Subwatersheds 3, 10, 17, 24, 26, 28 and 32), and Rock Creek (Subwatersheds 25 and 34). This evidence includes aggradation of coarse bed materials and woody debris deficiency. Streams that show evidence of cumulative off-site watershed effects are mostly downstream of large historic hydraulic mines, mining reservoirs or debris dams. Some of the streams reaches examined are impacted by current direct and cumulative impacts from roads adjacent to or crossing these stream reaches, where fine sediment intrusion and bank erosion are evident. The intensity of timber harvest and road construction on private timberlands is much higher than on National Forest System lands. Effects of the large runoff events of 1997-1998 and 2005-2006, including accelerated bank erosion and denudation are evident in many areas of the road and channel networks. Chronic road-related impacts are associated with unstable stream crossings and roads crossing steep, landslide-prone inner gorge hillslopes.

3.3.2 Measure 2 – Fungicides and Water Quality.

It is presently unknown if the fungicide (Sporax®) proposed for use in portions of the Sugarberry Project area has recently been applied on private timberlands within the analysis area. No recent use of the product has occurred on National Forest System lands in the area. The product has a low overall risk, and minimal aqueous concentrations are likely to result from application of this product, as described in “Environmental Effects” section below. It is thus assumed that, even if the product has been used on adjacent private timberlands, there is a negligible likelihood of detectable presence of Sporax™ or related degradates within the project area, and no contribution of legacy or proximal use to cumulative effects on water quality or beneficial uses.

4. PAST, PRESENT AND REASONABLY FORESEEABLE FUTURE ACTIONS

All known future proposals for land-disturbing activities in the CWE analysis area are included in the summation of ERAs for the final cumulative effects assessment. Table 10 presents the Plumas National Forest proposed future activities in the Sugarberry CWE analysis area.

Table 10: Plumas National Forest future foreseeable actions in the Sugarberry CWE analysis area.

Project	Activity	Acres	Subwatersheds
Lexington Sanitation Salvage Timber Sale	Salvage harvest; Tractor yarding	55	25, 27
Devils Gap Sanitation Salvage Timber Sale	Salvage harvest; Tractor yarding	316	14, 16, 20, 27
South Fork DFPZ Unit 30	Commercial thinning; Underburn; Hand cut pile burn	111	13, 14, 16

The DFPZ treatments for the Sugarberry Project would be connected to other DFPZ projects currently being implemented, including the adjacent Slapjack and South Fork DFPZs.

The Plumas National Forest is currently analyzing the Forest road system and OHV route network in the Travel Management EIS process. At the conclusion of the analysis, it is likely that a number of roads and OHV trails would not be designated to remain open, including roads and trails in the Sugarberry CWE analysis area. The analysis presented in this report reflects the full extent of the existing and proposed OHV route network, and therefore represents a conservative or worst-case estimate of the possible impact of the trail system. Specific roads and trails to be designated are not finally established at the present time.

There are numerous timber harvest plans (THPs) filed on private timber lands. All known past, present and reasonably foreseeable future private timber harvest in the CWE analysis area is listed in Appendices E and F. Subwatersheds 7, 20, 21, 25, 26, 27, 28, 32, 33, 34, 35, 36, 38, 39, 40, 42, 42 and 43 have proposed future private land management activities.

A complete list of known past, present and future foreseeable actions within the Sugarberry analysis area is presented in Appendices E and F.

5. ENVIRONMENTAL EFFECTS

5.1 Alternative A – No Action

Under the no-action alternative, defensible fuel profile zone (DFPZ) treatments, individual tree selection (ITS), group selection, transportation improvements (road reconstruction, closure, decommissioning, and restoration), wildlife restoration, and watershed restoration would not occur. There would be no direct, indirect, and cumulative effects on the channel network from the Sugarberry Project.

Vegetation density and accumulation of fuels would continue to increase under Alternative A. Absent the proposed vegetation management, the potential for stand-replacing fire and associated effects on near-stream sensitive areas would remain similar or increase compared to the existing condition.

5.1.1 Direct Effects – Measure 1: CWE Analysis

While burn severity and the effects of wildfire disturbance are often limited in near-stream sensitive areas compared to upland areas, the effects of fire adjacent to channels would adversely affect the integrity of proper stream function and condition. Channel degradation, erosion and sedimentation, and resulting effects on stream and riparian habitats and water quality would likely increase following a stand-replacing fire (Neary et al. 2005).

Under the no-action alternative, beneficial changes in stream and meadow conditions from proposed transportation improvements, aspen stand enhancement and watershed restoration would not occur. Sediment would continue to be deposited directly into affected water bodies and riparian areas, and channel and meadow surface conditions would continue to deteriorate. Fish barriers would remain and would continue to obstruct potential aquatic habitat (see "Existing Condition" above).

5.1.2 Indirect and Cumulative Effects – Measure 1: CWE Analysis

As described in the Sugarberry "Vegetation, Fire, and Fuels Analysis", portions of the project analysis area are at high risk of severe wildfire. ERA values following a stand-replacing fire in any subwatershed would greatly exceed the TOC and greatly exceed increases in ERA values associated with implementation of proposed treatment activities under the action alternatives. Following a severe wildfire, proper stream function and condition of streams and the quantity and quality of aquatic habitat might remain compromised for decades to centuries (Neary et al. 2005).

Opportunities to improve upland watershed condition by enhancing organic matter content would not be realized under the no-action alternative. Proposed treatment units where large woody debris components do not meet Region 5 recommended thresholds are present within the proposed treatment area for the Sugarberry Project. The condition of this soil quality indicator could be improved, thereby enhancing the available organic matter in the units, by the application of mitigations and vegetation management methods proposed under the Sugarberry Project. Continued management of timber stands as part of the Sugarberry Project would accelerate the diameter and height growth of residual trees, provide periodic inputs of woody debris from thinning operations, and provide for future opportunities for recruitment of snags and down woody material (for details, see the Sugarberry "Soils Report").

Group selection and ITS treatments are designed to promote the HFQLG Act desired condition of uneven-aged (all-age), fire-resilient, multistoried stands, while maintaining a healthy forest. These treatments would provide seral stage diversity by adding patches of the youngest seral stages to portions of larger CWHR Size Class 4 and 5 stands. Under the no-action alternative, these stand structure improvements would not occur. In the long term, possible benefits to aquatic and riparian systems associated with the fire resiliency of these stand improvements would not occur. Possible short-term increases in runoff and erosion related to these treatments would also not occur.

Under the no-action alternative, beneficial changes in stream and meadow conditions from proposed transportation improvements and watershed restoration would not occur. Sediment originating from upland erosion sources would continue to deposit into affected water bodies and riparian areas, and channel and meadow surface conditions would continue to deteriorate. Fish barriers would remain and the total available potential aquatic habitat would remain restricted (see “Existing Condition” above).

5.1.3 Direct, Indirect, and Cumulative Effects – Measure 2: Herbicides and Water Quality

Under Alternative A, the proposed Sugarberry Project would not be implemented, and there would be no fungicide treatments. Thus, no environmental effects associated with the application of herbicides would occur, including any that might affect water quality or be transmitted through the hydrologic system. Also, the benefits from the use of Sporax®, which would help prevent the spread of *Heterobasidion annosum* (annosus) root disease, would not occur.

5.2 Alternative B

5.2.1 Direct Effects – Measure 1: CWE Analysis

The proposed action has potential to directly affect hydrologic function during implementation of prescribed vegetation management activities, transportation improvements, aspen stand enhancement, and wildlife habitat and watershed restoration projects. Providing adequate protection buffers to headwater streams and higher-order tributary channels, as well as implementation of effective nonpoint source pollution prevention measures (BMPs), would provide protection from direct effects to streams in the proposed treatment units. Implementation of BMPs would greatly reduce any potential of sedimentation of channels within and downstream of proposed treatment units.

Proposed DFPZ treatments include 650 acres of underburning, 370 acres of thinning, 1,075 acres of mastication, 375 acres of hand cutting, tractor piling and burning, 30 acres of hand cutting, piling and burning, and 100 acres of wildlife habitat improvements (hand cut pile burn). RHCAs were previously posted in DFPZ units for the Lower and Upper Slate projects; these demarcations will be refreshed and observed for the Sugarberry Project.

In general, by following the SAT guidelines as required by the HFQLG Act, mechanical treatment would be excluded from RHCAs within the proposed DFPZ treatment units. In two proposed DFPZ treatment units (904 and 907a), limited mechanical treatment (mastication) of RHCAs would be permitted to improve riparian habitat conditions. Channels in the areas of these units where mastication of RHCAs is proposed are ephemeral headwater streams lacking riparian character, with excessive accumulation of small woody debris that contributes to fuel loading and fire risk without enhancing riparian structure or function. Treatments in these areas would be consistent with RMOs, as required by the HFQLG ROD (see Appendix A).

As noted in “Section 2.4: Field Methods”, SMZ designation for ephemeral channels without annual scour would only be necessary in group selection and ITS harvest units. SMZ demarcations would be posted prior to timber operations; mechanical travel would be excluded except for approved stream crossings. Equipment could reach a maximum of 18 feet into SMZs with the approval of the sale administrator and consultation with hydrologists. Limiting equipment “reach” to a maximum of 18 feet ensures trees along streambanks would not be removed. Group selection and ITS harvest units will be laid out to avoid RHCAs, therefore no direct effects to channels in RHCAs would occur.

Where underburns are proposed, fires could be ignited in RHCAs, but burn plans and prescriptions would be written to assure that burn intensities would remain low in order to retain riparian values. A study of prescribed burning in riparian areas in the Sierra Nevada suggests that effects of underburning to riparian conditions are limited in intensity and duration (Beche et al. 2005). If there is a need to reduce fuel loads conditions prior to underburn treatments, hand treatment would be used.

There is the potential for short-term direct effects (such as increased sedimentation) on hydrologic function from transportation system improvements (reconstruction, decommissioning, and restoration) and watershed restoration activities, especially from in- or near-stream activities like culvert improvement, streambank stabilization, meadow restoration, and fish barrier removal. However, long-term benefits to watershed condition would occur from transportation system improvements that would reduce effects on streams, especially where roads are adjacent to or cross streams. A net reduction in direct effects would occur after the completion of restoration activities. Short-term direct effects to watercourses are possible from temporary road construction. Temporary stream crossings may cross stream banks and channel substrates without modification, or temporary fill could be placed in seasonal channels. In all cases, temporary roads would be closed and restored following project activities. Temporary stream crossings would be restored, and any fill would be removed from the channel and floodplain area so that it is not available for sediment delivery. Proposed temporary road locations were reviewed in the field by the hydrologist, and recommendations about road locations and closure requirements are described in "Temporary Road Mitigations" available in the project file for consultation during project implementation.

There is potential for direct effects on hydrologic function from proposed aspen stand enhancement. Unlike proposed harvest treatments, tree removal would occur in RHCAs. This activity would be designed to conform to RMOs, and to improve the structure and function of the RHCAs (see Appendix A). Ground disturbance would be minimized by helicopter yarding. Selection of trees for removal would be made with direct involvement and approval of hydrologists. Trees that are necessary for streambank and riparian area stability would be retained. Potential direct effects include localized erosion and sedimentation as stumps decay and root strength declines, and local increases in water table elevation due to loss of transpiration from the trees that are removed. Long-term benefits could include the development of a more complex riparian ecosystem associated with an increase in aspen stems and greater water availability, and reductions in surface erosion from a combination of high herbaceous cover and woody-stemmed root systems in aspen-dominated ecosystems (Shepperd et al. 2006). Such changes in ecosystem structure and function in response to aspen enhancement may begin become apparent within 3–5 years following treatment (Jones pers. comm.).

5.2.2 Indirect Effects – Measure 1: CWE Analysis

Under the existing condition, portions of the CWE analysis area are highly disturbed. In order to reduce the potential for the Sugarberry Project to affect water quality and beneficial uses, BMPs and MMMs have been prescribed, and are included in the Streamside Management Zone Plan (Appendix B). These practices would be used to reduce sediment delivery and possible water contamination related to proposed activities or existing conditions. The BMPs and MMMs are site specific to the Sugarberry Project area. The potential for sedimentation and stream degradation of the immediate channels and the channels downstream from the project area would be minimal with the implementation of BMPs.

There would be long-term benefits to aquatic ecosystems from reduction of high fuel loads, related to a reduced probability of stand-replacing fires and associated CWEs. The DFPZ network is designed to reduce the spread of stand-replacing fire and provide zones from which firefighters may safely defend areas from advancing fires.

Although intensive mechanical treatment would occur during group selection treatments, the proposed group selection units would mostly be situated in upland positions away from channels, and full RHCA and SMZ protection would apply. Consequently, the risk of indirect watershed effects on streams would be low.

The proposed road work or stream channel restoration work could result in short-term negative effects from increased sedimentation to streams. These improvements would, in the long-term, benefit the hydrologic function and condition of the subwatersheds, and aid in restoration of habitat connectivity of stream systems. Road drainage improvement would cause a net reduction in sediment mobilization and delivery.

Short-term indirect effects to watercourses are possible from temporary road construction. Temporary stream crossings could cross stream banks and near-stream hillslopes at natural grade, or temporary cut-and-fill slopes could be constructed. In all cases, temporary roads would be closed and restored following project activities. Temporary cut-and-fill slopes would be restored, and any fill would be removed from the streambank and near-stream hillslope area so that it is not available for sediment delivery. Steep road grades would be obliterated and water-barred to recommended waterbar spacing guidelines to prevent runoff and erosion.

Aspen stand enhancement treatments could cause indirect effects to hydrologic function. As described above, direct effects could include elevated water tables due to transpiration loss from conifer removal. This would possibly result in increased baseflow, and consequently increased streamflow year-round. This would possibly serve to enhance riparian characteristics of near-stream areas. Stream crossings downstream of aspen enhancement treatments may experience minor changes in channel characteristics as a consequence, but should retain function and capacity.

5.2.3 Cumulative Effects

5.2.3.1 Measure 1: CWE Analysis

The results of the CWE analysis for Alternative B include the sum of ERA values for the existing condition, reasonable foreseeable future activities, and for the proposed action. Table 11 displays the ERA totals for each type of project-related disturbance and summations of the total ERA for each subwatershed, for the both the near-stream sensitive areas and the subwatersheds as a whole. A comparison of ERAs to the TOC, represented as percent disturbed and percent of TOC, is displayed in Table 12. Table 13 shows the percentage contribution of each type of disturbance to the total ERA of the subwatershed, for near-stream sensitive areas and for the subwatersheds as a whole. Subwatersheds approaching or exceeding TOC are highlighted in Tables 11, 12 and 13.

With implementation of activities proposed under Alternative B, ERA values for 20 subwatershed near-stream sensitive areas that approach or exceed the TOC under the existing condition would remain near or above TOC with the proposed action. Some subwatershed near-stream sensitive areas would experience a slight increase in ERA from the proposed DFPZ treatments, or a slight decrease from the proposed road decommissioning.

Under the existing condition, three subwatersheds approach the TOC (Subwatersheds 11, 13, and 35) and two exceed the TOC (19 and 38). In the subwatersheds that exceed the TOC under the existing condition, private timber harvest or legacy mining activities are the primary contributors to the high ERA scores, followed by roads.

The ERA model shows that Alternative B and other future land management activities have the potential to increase the risk of CWEs in several subwatersheds. Among all subwatersheds, the past 25 years of harvest activities on the Plumas National Forest plus the proposed Sugarberry Project activities would contribute anywhere from 0 to 70 percent of the total ERA score, with an average contribution of 25 percent. In the subwatersheds that approach or exceed the TOC, the past 25 years of past activities on the Plumas National Forest combined with the proposed Sugarberry Project activities would contribute between 0 and 36 percent of the total ERA score. In 3 of the 7 subwatersheds that would approach or exceed TOC, the past and future activities on the Plumas National Forest would contribute in excess of 20 percent to the total ERA score. The largest such contribution in these subwatersheds would be in subwatershed 21, where 36 percent of the total ERA would be a result of past activities and future activities on the Forest, followed by subwatershed 11 with 23 percent.

The following is a summary of the ERA results:

- Two subwatersheds (15 and 21) approach TOC with Alternative B but do not under the existing condition or with Alternative A.
- Three subwatersheds exceed the TOC (11, 19 and 38). Subwatersheds 19 and 38 exceed the TOC under the existing condition, and their ERA values increase under Alternative B compared to Alternative A. Subwatershed 11 approaches the TOC under the existing condition and would exceed the TOC under Alternative B compared to Alternative A.
- Subwatershed 11 would exceed TOC as a result of the Sugarberry proposed action combined with the past ten years of Forest Service activities.

The Central Valley RWQCB could require forensic and effectiveness monitoring in subwatershed 11 in order to issue a waiver of waste discharge requirements for the Sugarberry Project under Alternative B. (see “Regulatory Framework” Section above).

Table 11: Alternative B: The ERA for Each Project Related Disturbance and Total ERA for Each Subwatershed Highlighted rows represent entire subwatersheds approaching or exceeding TOC.

Subwatershed Label	ERA Group Selection	ERA Individual Tree Selection	ERA DFPZ Treatments		ERA Aspen Enhancement		ERA Wildlife Habitat Improvement		ERA Decommissioned Roads		ERA Total	
	Total	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.8	37.5
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	9.7
3	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.6	102.0
4	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-0.7	36.1	90.3
5	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	18.1	58.9
6	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-1.2	34.1	87.8
7	10.4	0.0	0.0	0.0	1.5	1.5	0.0	0.0	-0.9	-1.6	30.7	72.9
8	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	17.6	57.6
9	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	31.0
10	16.8	4.3	0.0	0.5	0.0	0.0	0.0	0.0	-0.1	-0.3	48.5	173.8
11	6.6	0.0	0.4	17.9	0.0	0.0	0.0	0.0	0.0	0.0	28.8	117.0
12	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	18.8	72.0
13	1.1	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	17.7	65.5
14	0.4	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	24.3	97.8
15	16.9	2.5	0.5	15.6	0.0	0.0	0.0	0.0	0.0	0.0	53.4	174.9
16	10.3	0.0	3.2	21.5	0.0	0.0	0.0	0.0	0.0	0.0	11.7	56.4
17	7.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.2	71.8
18	2.5	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	5.4	20.9
19	2.8	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	64.8	144.6
20	8.6	0.0	0.1	6.2	0.0	0.0	0.0	0.0	-0.1	-0.4	49.3	119.5
21	18.8	6.5	0.2	24.0	0.0	0.0	0.0	0.0	0.0	-0.7	40.1	143.0
22	4.5	1.1	1.0	9.2	0.0	0.0	0.2	0.3	-0.2	-1.0	12.2	50.7
23	3.7	0.0	2.0	8.1	0.0	0.0	0.2	0.2	0.0	0.0	20.1	67.1
24	11.0	2.3	0.1	11.9	0.0	0.0	0.0	0.0	0.0	-0.9	9.9	62.4
25	6.4	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	9.5	45.5

Subwatershed Label	ERA Group Selection	ERA Individual Tree Selection	ERA DFPZ Treatments		ERA Aspen Enhancement		ERA Wildlife Habitat Improvement		ERA Decommissioned Roads		ERA Total	
	Total	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
26	5.8	2.7	0.0	0.9	0.0	0.0	0.0	0.0	-0.8	-0.9	17.6	74.1
27	16.8	0.0	2.2	8.6	0.0	0.0	0.0	0.0	-2.7	-4.3	17.8	83.9
28	10.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-1.1	17.4	53.6
29	2.0	0.0	0.0	2.8	0.0	0.0	0.3	0.4	0.0	0.0	59.3	170.0
30	10.4	0.0	0.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	50.8	143.1
31	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.3	36.7
32	6.1	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	21.6	76.8
33	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.7	78.4
34	27.0	0.0	2.7	19.3	0.0	0.0	0.0	0.0	-1.3	-2.3	49.5	170.9
35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7	64.5
36	8.3	0.0	0.4	9.8	0.0	0.0	0.0	0.0	0.5	-0.6	47.7	144.8
37	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	17.7
38	2.5	0.0	0.6	7.1	0.0	0.0	0.0	0.0	-0.8	-0.9	54.6	104.5
39	7.2	0.0	0.5	3.3	0.0	0.0	0.0	0.0	0.0	0.0	22.2	71.3
40	0.0	0.0	0.1	3.1	0.0	0.0	0.0	0.0	0.0	0.0	32.4	95.9
41	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-1.3	5.9	27.0
42	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	12.1
43	2.3	0.0	0.0	4.0	0.0	0.0	0.0	0.0	-0.6	-1.1	10.5	39.9
44	0.0	0.0	0.1	6.9	0.0	0.0	0.0	0.0	0.0	0.0	5.7	26.5

Table 12: Alternative B: ERA Compared to TOC by Subwatershed
Highlighted rows represent entire subwatersheds above or approaching the TOC.

Subwatershed Label	TOC of Near-Stream Areas	TOC of Entire Subwatershed	Percent Disturbed		Percent of TOC	
			Near-Stream	Total	Near-Stream	Total
1	6%	14%	4	4	72	26
2	6%	14%	1	1	16	8
3	6%	14%	5	5	84	33
4	6%	14%	6	8	106	54
5	6%	14%	2	3	32	20
6	6%	12%	6	7	101	56
7	6%	14%	3	3	46	23
8	6%	12%	7	8	114	63
9	6%	12%	1	2	19	14
10	6%	12%	7	8	118	70
11	6%	13%	13	15	209	118
12	6%	12%	4	4	60	37
13	6%	13%	12	11	196	86
14	6%	13%	4	6	74	44
15	6%	13%	10	12	161	96
16	6%	13%	5	10	88	75
17	6%	12%	6	6	104	46
18	6%	12%	2	4	36	29
19	6%	12%	29	19	482	160
20	6%	13%	6	7	107	54
21	6%	13%	9	11	145	81
22	6%	13%	3	5	49	37
23	6%	12%	2	3	37	24
24	6%	13%	2	5	34	37
25	6%	13%	3	7	57	51
26	6%	13%	3	4	45	34
27	6%	13%	4	6	60	50
28	6%	13%	3	5	57	36
29	6%	13%	8	8	137	60
30	6%	13%	8	9	137	68
31	6%	12%	4	4	60	36
32	6%	13%	5	7	89	56
33	6%	13%	5	7	86	52
34	6%	13%	5	7	86	56
35	6%	13%	10	11	167	87
36	6%	13%	6	8	106	60
37	6%	12%	1	2	15	18
38	6%	13%	18	16	302	123
39	6%	13%	3	5	57	39
40	6%	14%	4	5	67	34
41	6%	13%	2	5	38	41
42	6%	12%	1	2	12	14
43	6%	13%	1	2	15	16
44	6%	14%	1	3	24	21

Table 13: Alternative B - Percentage of Each Disturbance Compared to the Near-Stream and Total ERA for the Subwatersheds ('A' represents near-stream areas and 'B' represents the total subwatershed). Highlighted rows represent entire subwatersheds above or approaching the TOC.

Sub-watershed Label	Percent That Roads, Landings and OHV Trails Contribute to Total ERA (Includes Road Decommissioning)		Percent That Mines Contribute to Total ERA		Percent That Urbanization Contributes to Total ERA		Percent That PNF Past Harvest Activities Contribute to Total ERA		Percent That Private Timber Harvest Activities Contribute to Total ERA		Percent That DFPZ Treatments Contribute to Total ERA		Percent That Individual Tree Selection Treatment Contributes to Total ERA	Percent That Group Selection Treatment Contributes to Total ERA	Percent That Wildlife Habitat Improvement Contributes to Total ERA Score		Percent That Aspen Enhancement Contributes to the Total ERA	
	A	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**B**	**B**	**A**	**B**	**A**	**B**
1	41	46	32	21	0	0	0	0	27	32	0	0	0	0	0	0	0	0
2	83	88	0	0	0	0	17	12	0	0	0	0	0	0	0	0	0	0
3	27	30	37	27	0	0	4	5	32	34	0	0	0	5	0	0	0	0
4	23	21	24	20	0	0	21	17	32	29	0	0	0	15	0	0	0	0
5	19	21	80	63	0	0	1	5	0	0	0	0	0	13	0	0	0	0
6	32	31	0	0	0	0	8	11	60	53	0	0	0	6	0	0	0	0
7	27	22	36	30	0	0	1	2	32	32	5	2	0	14	0	0	5	2
8	13	11	79	67	0	0	8	15	0	0	0	0	0	8	0	0	0	0
9	39	26	15	9	0	0	5	4	41	56	0	0	0	4	0	0	0	0
10	20	19	40	43	0	0	4	7	36	20	0	0	2	10	0	0	0	0
11	33	19	9	5	2	4	1	2	54	49	1	15	0	6	0	0	0	0
12	41	26	32	42	0	0	5	8	22	16	0	0	0	10	0	0	0	0
13	29	25	0	0	0	0	1	1	70	70	0	2	0	2	0	0	0	0
14	42	26	0	0	0	0	27	60	31	12	0	2	0	0	0	0	0	0
15	18	17	49	35	13	10	3	2	15	18	1	9	1	10	0	0	0	0
16	33	19	2	0	5	3	9	9	24	14	27	38	0	18	0	0	0	0
17	39	36	17	19	0	0	1	1	44	32	0	0	2	10	0	0	0	0
18	90	66	6	5	0	0	4	10	0	8	0	0	0	12	0	0	0	0
19	8	13	62	38	0	0	0	0	30	44	0	1	1	2	0	0	0	0
20	36	28	0	0	0	0	12	30	52	31	0	4	0	7	0	0	0	0
21	25	21	55	33	0	0	5	4	15	10	1	16	5	13	0	0	0	0

Sub-watershed Label	Percent That Roads, Landings and OHV Trails Contribute to Total ERA (Includes Road Decommissioning)		Percent That Mines Contribute to Total ERA		Percent That Urbanization Contributes to Total ERA		Percent That PNF Past Harvest Activities Contribute to Total ERA		Percent That Private Timber Harvest Activities Contribute to Total ERA		Percent That DFPZ Treatments Contribute to Total ERA		Percent That Individual Tree Selection Treatment Contributes to Total ERA	Percent That Group Selection Treatment Contributes to Total ERA	Percent That Wildlife Habitat Improvement Contributes to Total ERA Score		Percent That Aspen Enhancement Contributes to the Total ERA	
	A	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**B**	**B**	**A**	**B**	**A**	**B**
22	39	30	47	37	0	0	3	3	2	1	8	19	2	9	1	1	0	0
23	68	64	0	0	0	0	21	18	0	0	11	12	0	5	1	<1	0	0
24	37	28	0	0	0	0	59	33	4	1	1	19	4	18	0	0	0	0
25	47	32	0	0	0	0	34	31	19	23	0	1	0	14	0	0	0	0
26	34	29	40	31	0	0	7	7	19	20	0	1	4	8	0	0	0	0
27	64	38	0	0	0	2	6	10	18	23	12	5	0	20	0	0	0	0
28	41	36	0	0	0	0	8	7	51	40	0	0	0	19	0	0	0	0
29	25	30	13	8	1	0	1	2	60	56	0	2	0	1	0	<1	0	0
30	28	27	35	24	0	0	6	10	31	29	0	2	0	7	0	0	0	0
31	41	43	0	0	0	0	43	39	15	14	0	0	0	4	0	0	0	0
32	28	24	0	0	0	0	13	12	59	55	0	1	0	8	0	0	0	0
33	52	46	0	0	0	0	8	7	41	44	0	0	0	3	0	0	0	0
34	43	33	17	11	0	0	23	21	10	9	6	5	0	16	0	0	0	0
35	32	29	0	0	0	0	0	0	68	71	0	0	0	0	0	0	0	0
36	51	33	0	0	0	0	16	12	31	44	1	6	0	6	0	0	0	0
37	58	39	11	22	0	0	31	25	0	0	0	0	0	15	0	0	0	0
38	36	19	0	0	0	0	11	7	51	64	1	6	0	2	0	0	0	0
39	45	41	0	0	0	0	6	7	47	39	2	5	0	10	0	0	0	0
40	68	53	0	0	6	5	12	9	14	30	0	3	0	0	0	0	0	0
41	46	26	0	0	0	0	53	12	1	44	0	0	0	19	0	0	0	0
42	60	30	0	0	0	0	8	9	32	21	0	0	0	43	0	0	0	0
43	91	37	0	0	0	0	8	9	2	39	0	10	0	6	0	0	0	0
44	72	40	0	0	0	0	14	16	12	18	2	26	0	0	0	0	0	0

As described in the Sugarberry "Vegetation, Fire, and Fuels Analysis", the DFPZ treatments would be effective if a wildland fire at or below the 90th percentile fire weather conditions were to occur. An effective DFPZ may not entirely eliminate the possibility of high-severity wildfire affecting some subwatersheds, particularly where there is heavy fuel loading on steep canyon slopes. The DFPZ would, however, provide firefighters an opportunity to contain the fire and prevent it from spreading across larger portions of the landscape. Proposed future projects would similarly treat other portions of the landscape, and over time, the aggregate risk of stand-replacing fires would be further reduced. The potential risk of CWEs from stand-replacing wildfire in the long term would greatly exceed the short-term increased risk of CWEs related to the proposed DFPZ treatments under the Sugarberry Project. For example, in subwatershed 15, the proposed action would result in a 23 percent increase in calculated ERA values compared to the existing condition. However, if the entire area of subwatershed 15 were to experience a high-intensity wildfire, the TOC would increase a predicted 98 percent using a conservative estimate of wildfire effects on ERA values.

Group selection and ITS treatments are designed to promote the HFQLG Act desired condition of uneven-aged, multistoried, fire-resilient stands, while maintaining a healthy forest. These treatments would provide seral stage diversity by adding patches of the youngest seral stages to portions of larger CWHR Size Class 4 and 5 stands. These stand structure improvements would occur under Alternative B, and in the long term, benefits to aquatic and riparian systems associated with the fire resiliency of these stands would also occur.

Improvements to the transportation system, streambank stabilization projects, fish barrier removal, and meadow enhancement projects would have long-term benefits for the subwatersheds, especially in the near-stream sensitive areas. Benefits would include reduced road- and bank-related erosion, drainage diversion and sediment deposition to channels; improved function and condition of channels and improved aquatic and riparian habitat, and increased availability of aquatic habitat to mobile species of fish, amphibians, and invertebrates due to restoration of habitat connectivity. Short-term sediment increases may result from these restoration activities. However, the impacts would be mitigated by BMPs and would be offset by the ecological benefits and enhanced beneficial uses that are the intent of these restoration activities.

Long-term benefits to riparian habitat and ecosystems would occur if proposed aspen enhancement occurs, as described above. Elevated water tables and temporary increases in bank and channel erosion associated with conifer removal may occur, and slightly increased levels of disturbance may slightly and temporarily increase the risk of cumulative effects in the affected subwatershed (7 - Potosi Creek). The ERA total in this subwatershed is low compared to TOC under the existing condition and Alternative B, so the increased risk of cumulative effects from this activity is also low.

As described in “Section 3.1: Existing Condition - Overview”, most of the subwatersheds have road densities that do not meet the desired condition for minimizing road impacts on aquatic and riparian environments as well as associated terrestrial wildlife. The proposed road decommissioning and natural rehabilitation that would occur under Alternative B would reduce road mileage and road density slightly. (See the Sugarberry “Roads Analysis” and associated maps of the proposed road changes on file in the project record.) The post-project road densities of the subwatersheds would range from 0.7 to 8.0 miles per square mile, with an average of 4.4 miles per square mile, representing an approximately 2 percent reduction in total road miles (Table 14).

Table 14: Existing Condition and Alternative B and C Miles of Road and Road Density

Subwatershed Label	Existing Condition Miles of Road		Existing Condition Road Density (miles per square mile)		Post-Project Miles of Road		Post-Project Road Density (miles per square mile)	
	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
1	4.1	7.1	4.6	4.4	4.1	7.1	4.6	4.4
2	1.1	3.2	1.7	2.5	1.1	3.2	1.7	2.5
3	5.1	11.4	3.2	3.3	5.1	11.4	3.2	3.3
4	2.8	6.9	3.2	3.7	2.7	6.6	3.0	3.5
5	1.2	4.5	0.8	1.4	1.2	4.5	0.8	1.4
6	4.2	10.3	4.8	5.1	4.1	9.8	4.7	4.8
7	3.5	6.4	2.0	1.8	3.2	5.8	1.8	1.6
8	0.8	2.2	2.0	1.8	0.8	2.2	2.0	1.8
9	1.0	2.1	0.8	0.7	1.0	2.1	0.8	0.7
10	3.5	11.5	3.3	3.6	3.5	11.4	3.2	3.5
11	3.5	8.2	9.7	6.9	3.5	8.2	9.7	6.9
12	2.6	6.7	3.2	2.7	2.6	6.6	3.2	2.6
13	2.0	6.4	8.4	7.0	2.0	6.4	8.4	7.0
14	2.8	10.2	3.3	3.8	2.8	10.2	3.3	3.8
15	3.8	11.5	4.4	5.2	3.8	11.5	4.4	5.2
16	1.4	3.9	4.1	4.3	1.4	3.9	4.1	4.3
17	4.3	9.5	5.5	4.7	4.3	9.5	5.5	4.7
18	1.9	5.4	5.0	5.8	1.9	5.4	5.0	5.8
19	2.2	6.4	6.2	5.5	2.2	6.4	6.2	5.5
20	5.7	13.3	4.8	5.0	5.7	13.2	4.8	4.9
21	3.6	11.6	5.0	5.5	3.6	11.3	5.0	5.3
22	2.1	6.7	3.3	4.1	2.0	6.3	3.2	3.8

Subwatershed Label	Existing Condition Miles of Road		Existing Condition Road Density (miles per square mile)		Post-Project Miles of Road		Post-Project Road Density (miles per square mile)	
	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
23	5.7	17.6	4.0	4.8	5.7	17.6	4.0	4.8
24	1.5	7.4	2.0	3.6	1.5	7.0	2.0	3.5
25	1.5	5.7	3.6	5.4	1.5	5.7	3.6	5.4
26	2.5	8.8	2.5	3.3	2.2	8.4	2.2	3.2
27	5.7	14.8	7.3	7.3	4.5	13.0	5.8	6.4
28	3.0	8.0	3.8	4.5	2.9	7.6	3.6	4.3
29	5.8	18.7	5.1	5.5	5.8	18.7	5.1	5.5
30	5.3	14.3	5.5	5.7	5.3	14.3	5.5	5.7
31	2.0	6.1	4.0	4.6	2.0	6.1	4.0	4.6
32	2.3	7.3	3.6	4.4	2.3	7.3	3.6	4.4
33	5.0	14.6	6.9	8.0	5.0	14.6	6.9	8.0
34	9.0	23.6	6.0	6.4	8.4	22.6	5.6	6.2
35	2.8	7.0	8.4	7.9	2.8	7.0	8.4	7.9
36	9.0	18.5	7.7	6.3	8.8	18.2	7.5	6.2
37	0.9	2.9	1.4	2.2	0.9	2.9	1.4	2.2
38	4.7	8.0	9.9	7.9	4.3	7.7	9.2	7.5
39	3.8	11.2	3.8	5.1	3.8	11.2	3.8	5.1
40	8.4	21.2	6.6	6.6	8.4	21.2	6.6	6.6
41	0.7	3.1	1.8	3.9	0.5	2.6	1.2	3.2
42	0.7	1.5	1.1	1.3	0.7	1.5	1.1	1.3
43	1.8	6.5	1.0	2.2	1.5	6.0	0.8	2.0
44	1.7	4.1	2.7	2.9	1.7	4.1	2.7	2.9
Total Miles	**147.2**	**396.4**	**4.3**	**4.5**	**143.3**	**388.2**	**4.2**	**4.4**

5.2.3.2 Potential Cumulative Effects

As described in the "Existing Condition" section, most channels that are not affected by legacy mining activities are in stable condition and have recovered from past cumulative effects. Some channels that do show lingering effects of past mining activities are in subwatersheds that approach or exceed TOC under the existing condition or with the proposed action. These include East Branch Rabbit Creek, Rabbit Creek, Gold Run Creek and Deacon Long Ravine. These streams are at some risk of compounded cumulative effects from contemporary activities added to past disturbance effects. Streams in subwatersheds with concentrated private timber harvest are also possibly at higher risk of new cumulative effects, due to the high ERA values and road densities described in the "Existing Condition" section.

If CWEs were to occur, their most likely expression would be increased channel erosion and chronic sedimentation related to increases in runoff and peak flow during high-intensity rain events. Peak flow changes, in particular, could cause increased sedimentation, changes in bed load transport, altered flow regimes, channel incision, undercuts and unstable banks, and channel morphology changes (Reid 1993). If a CWE were to occur from the Sugarberry Project, it would most likely occur within low-gradient, third-order or greater reaches of the channel network and/or at major confluences.

Slope instability and active landsliding are present in the analysis area in the inner gorges of Slate Creek and Canyon Creek. These streams would likely not experience measurable peak flow alteration related to proposed activities of the Sugarberry Project. Chronic mass wasting on these inner canyon slopes is accelerated by high flows. However, high-magnitude, low-frequency events such as the 1997 and 2006 floods that trigger landslide toe erosion and increase activity of these deep-seated features are more influenced by the scale of the event than the condition of the landscape. As the return interval of a storm increases, the influence of vegetation losses on peak flows becomes much lower (Rowe et al. 1949). Therefore it is unlikely that loss of vegetation from Sugarberry activities in the upper watershed would influence the rate or frequency of landslide activity in the Slate and Canyon Creek inner gorges.

There are areas of unstable ground associated with legacy mining activities in a number of subwatersheds. These include the eroding pit faces described in the “Existing Condition,” section, and areas of unstable tailings and waste rock in the vicinity of many hydraulic mine sites, including in the Howland Flat, St. Louis and Pioneer Pit areas where group selection and ITS harvest units are located. There is potential to destabilize unconsolidated mine waste by mechanical activity, and potential for delivery to channels where temporary road or skid trails cross streams in these areas. However, as described in the “Existing Condition” section, these areas have been avoided or mitigations and restrictions on activities have been designed to reduce or eliminate these risks.

Where an increased risk of CWEs related to the proposed Sugarberry activities has been identified, the risk would be mitigated during project planning, design, and implementation by:

- adoption of unit-by-unit Forest Plan standards and guidelines to protect water quality (RHCAs and SMZs, RMOs, temporary road design and obliteration, etc. See Appendices A and B for additional site-specific mitigations);
- use of applicable BMPs;
- inventory, funding, and completion of land restoration activities throughout the watershed; and

- scheduling of future harvests to facilitate vegetative recovery.

Protection of headwaters and tributaries to larger watersheds, along with implementation of effective nonpoint source conservation measures (the BMPs), would provide protection for the entire watershed. The implementation of BMPs would ensure minimal delivery of project-related sediment to stream channels. Impacts on water quality in the analysis area could potentially occur from

- failure to implement BMPs, riparian and wetland standards and guidelines, and other required mitigation;
- extreme water yields resulting from abnormally high-intensity magnitude and duration storm events; and
- removal of vegetative matter and ground cover resulting from wildfire.

5.2.3.3 Potential Risk of CWEs to Beneficial Uses

As described previously, a number of subwatersheds in the analysis area approach or exceed the TOC. The proposed Sugarberry Project, combined with future foreseeable private land and Forest Service activities would increase the level of disturbance in most subwatersheds. All defined beneficial uses of the South Fork Feather River and the Yuba River could experience some increased risk from water quality degradation due to the combined effects of the Sugarberry Project and other activities on public and private lands in the CWE analysis area.

CWEs result from nonpoint source pollution caused by land disturbance related to timber harvest and other activities. Possible effects could be defined in relation to the following categories of state water quality objectives as defined in the Basin Plan (CRWQCB 1998):

- *Sediment*—The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
- *Turbidity*—Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. (Specific allowable increases in turbidity levels are defined as natural turbidity levels measured in nephelometric turbidity units.)
- *Temperature*—The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses. At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5°F above natural receiving water temperature.

- *Pesticides*—(1) No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses; (2) Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial use; (3) Pesticide concentrations shall not exceed those allowable by applicable antidegradation policies; (4) Pesticide concentrations shall not exceed the lowest levels technically and economically achievable; (5) Waters designated for use as domestic or municipal supply shall not contain concentrations of pesticides in excess of the Maximum Contaminant Levels set forth in California Code of Regulations, Title 22, Division 4, Chapter 15.

Environmental analysis and proposed mitigations for fungicide use are described below in the section on fungicides and water quality. It is not projected that fungicide application would affect beneficial uses of water in these subwatersheds or any other portion of the analysis area.

If cumulative effects on the subwatersheds were to occur, they could increase sediment, turbidity, and temperature. The beneficial uses at risk if this were to occur include warm and cold freshwater habitat, spawning habitat, wildlife habitat, commercial and sport fishing, and noncontact water recreation. There would likely be minimal or no risk to domestic and municipal water supplies, agricultural uses, hydropower generation, and water contact recreation, although increased sedimentation in Lake Oroville and New Bullards Bar Reservoir would slightly shorten the expected usable lifespan of these reservoirs. The greatest risk would likely be to those uses associated with habitat. The bulk of this risk from CWEs is associated with the existing condition of a disturbed landscape and the future foreseeable disturbance of that landscape from private timber operations and the release of stored legacy mining sediment and chemicals.

As described above, in most subwatersheds, the additional disturbance from the Sugarberry Project proposed activities would contribute only a minor percentage of the total risk of CWEs, and most subwatersheds have low to moderate risk of CWE with or without the proposed action. However, in several subwatersheds, a substantial proportion of the disturbance that would cause them to approach or exceed TOC is related to the proposed action. The application of BMPs and MMMs, including riparian buffers, is designed to reduce the risk that proposed activities under Alternative B could induce CWEs and affect beneficial uses of water. Measures to protect headwater and low-order tributaries would minimize effects to higher-order channels and protect downstream watershed values and beneficial uses. These measures would control sedimentation, and the potential for project-related sediment delivery to the immediate channel and channels downstream would be small, even where the overall state of disturbance of the watershed is high.

5.2.4 General Effects – Measure 2: Fungicides and Water Quality

The proposed fungicide treatment to deter the spread of *Heterobasidion annosum (*annosus) root disease would be performed by manual application of Sporax® to freshly-cut stump surfaces. Sporax® is the trade name for borax ($Na_2B_4O_7 \cdot 10H_2O$ or sodium tetraborate decahydrate). It is typically applied at a rate of one pound per 50 square feet of stump surface. This is equivalent to one pound of borax on 60 twelve-inch stumps (Sporax label, Wilbur-Ellis Company). Borax as used in forestry is identical to the material sold throughout North America as a household cleaning agent (Dost et al. 1996). Borate salts are rapidly converted to boric acid under conditions typically found in the environment. The equivalent quantity of elemental boron [B] is used for risk assessment. At physiologic pH and in most surface waters, exposure of organisms is primarily to boric acid. Risk assessments performed on this product indicate that it is of low toxicity to aquatic organisms, and that concentrations of borax or boric acid in runoff or spill scenarios are generally substantially lower than levels that would cause toxic effects or mortality in most organisms (USDA Forest Service 2006). Rapid dilution as well as the localized area and small quantities proposed for use would assure that no detectable quantities of borax would be present to affect water supplies, or any other beneficial uses of water.

5.2.5 Direct Effects – Measure 2: Herbicides and Water Quality

Buffer strips for streamside protection are prescribed in BMP 5-12 (Streamside Wet Area Protection During Pesticide Application), which would be observed by not applying Sporax® in RHCAs. Direct effects of Sporax® to aquatic and riparian systems would be prevented by observing RHCAs as no treatment areas. An accidental spill of Sporax® into a small water body is the only scenario that could result in concentrations that approach levels of observable effects to aquatic organisms, and this would be prevented by observing RHCAs and by the implementation of a spill plan (available in the Sugarberry project file). There is considered to be no risk of direct effects to beneficial uses of water from the proposed Sporax® application.

5.2.6 Indirect Effects - Measure 2: Herbicides and Water Quality

Indirect effects of Sporax® use for DFPZ maintenance under Alternative B would also be prevented by applying BMPs and HFQLG Act standard riparian buffers. Riparian buffers and BMPs would adequately protect all known beneficial uses of water, and water quality objectives would be achieved.

Sporax® is proposed for use in DFPZ thinning and ITS units in the Lexington Hill area (units 7, 33, 905 and 909). Application would occur at an average rate of approximately one pound per acre in unit 909, and at lower rates between one-quarter pound and two-thirds pound per acre in the other units. These ranges of application rates are based on the estimated number of large stumps per acre requiring treatment to prevent annosus spread.

Units 7 and 905 are within 300–600 feet of domestic water supplies for the communities of La Porte and La Porte Pines, respectively. These are shallow groundwater systems that could conceivably be affected by runoff from proposed Sporax® application areas. However, surface runoff and groundwater modeling indicate that concentrations delivered would be undetectable, and that any exposure through consumption of water from these sources would be far below the level of concern for any adverse health effects. Boron is a naturally occurring trace element that occurs at relatively high concentrations in some common agricultural products such as lemons and red cabbage. US EPA exempts agricultural commodities from tolerances for borate levels. Environmental background rates of boron exposure exceed levels that would be experienced from consumption of contaminated water by 125 to 625 times (USDA Forest Service 2006). Additionally, the La Porte water supply is located upslope of unit 7, so there is no plausible surface or groundwater flow path from the proposed Sporax® application area to the well. Therefore there is considered to be no risk of indirect effects to domestic water supplies from the proposed Sporax® application.

As noted above, levels of borates that could be present in runoff water from Sporax® application areas are well below any that could produce observable effects in aquatic organisms. Therefore there is considered to be no risk of indirect effects to aquatic and riparian habitat from the proposed Sporax® application.

5.2.7 Cumulative Effects – Measure 2: Herbicides and Water Quality

As described in the “Existing Condition” section, it is presently unknown if Sporax® has been applied on private timberlands within the analysis area. However, given the low toxicity and low ambient concentrations of Sporax® that could result from the proposed Sporax® application, it is implausible that there could be observable cumulative effects from the proposed action in combination with any other use of Sporax® in the area. Expected quantities of boron added to soil or water via runoff from Sporax® application areas are considerably lower than average background levels in soil and water (USDA Forest Service 2006), therefore there is considered to be no risk of cumulative effects to beneficial uses of water from the proposed Sporax® application.

5.3 Alternative C

Alternative C was developed in order to reduce the risk of CWE in subwatersheds that approach or exceed the TOC, either in the existing condition or with the proposed action (Alternative B). The focus of the alternative is to reduce the risk of possible CWEs in subwatersheds where either:

1. The Sugarberry proposed action, future foreseeable actions and the past ten years of Forest Service activities will cause the subwatershed ERA total to exceed TOC (subwatershed 11); or

2. Under the existing condition, the subwatershed ERA total exceeds TOC, and proposed activities appear to have the potential to cause direct, indirect, or cumulative effects to local or downstream values and beneficial uses (subwatershed 19).

Compared to Alternative B:

1. Mechanical treatments for DFPZ implementation would be reduced in subwatershed 11. 125 acres of tractor piling would be hand piled instead in unit 901A.

2. Mechanical treatments for group selection would be eliminated in subwatershed 11 and reduced in subwatershed 19. A total of 20 acres of group selection treatments would be dropped in subwatershed 11, and 3.5 acres of group selection would be yarded by helicopter rather than ground-based logging systems in subwatershed 19.

3. Mechanical treatments for ITS would be eliminated in subwatershed 11 and reduced in subwatershed 19. In subwatershed 11, 3.5 acres of ITS would be dropped. In subwatershed 19, 13 acres of ITS would be yarded by helicopter rather than ground-based logging systems.

4. Temporary road construction would be reduced by 0.7 miles.

5. There would be no differences in aquatic and wildlife habitat restoration and aspen enhancement.

5.3.1 Direct Effects - Measure 1: CWE Analysis

Mechanical DFPZ Treatment—No mechanical treatment is proposed in RHCAs in the affected units under Alternative B, so there would be no difference in direct effects between Alternatives B and C.

Group Selection—No group selection harvest would occur in RHCAs and SMZs under Alternative B, so there would be no difference in direct effects between Alternatives B and C.

Individual Tree Selection—Limited reaching into SMZs would be permitted under Alternative B, so there would be a slight reduction in possible direct effects under Alternative C.

Transportation Improvements—Reduced mileage of temporary roads would reduce the short-term risk of erosion and sedimentation related to construction activities and road use.

Aquatic and Wildlife Habitat Restoration and Aspen Enhancements—Since there is no difference in these proposed activities between Alternative B and Alternative C, there would also be no difference in direct effects.

5.3.2 Indirect Effects – Measure 1: CWE Analysis

Mechanical DFPZ Treatment—Because there is a reduction in mechanical activity in upland areas in the affected units between Alternative B and Alternative C, there would be a slight to moderate reduction in possible indirect effects between Alternatives B and C.

Group Selection—Because there is a reduction in the total area of group selection harvest between Alternative B and Alternative C, and a reduction in the area of ground-based yarding, there would be a moderate reduction in possible indirect effects between Alternatives B and C.

Individual Tree Selection—Because there is a reduction in the total area of ITS harvest between Alternative B and Alternative C, and a reduction in the area of ground-based yarding, there would be a slight to moderate reduction in possible indirect effects under Alternative C.

Transportation Improvements—Reduced mileage of temporary roads would reduce the short-term risk of erosion and sedimentation related to construction activities and road use.

Aquatic and Wildlife Habitat Restoration and Aspen Enhancements—Since there is no difference in these proposed activities between Alternative B and Alternative C, there would also be no difference in direct effects.

5.3.3 Cumulative Effects – Measure 1: CWE Analysis

Cumulative Effects on Measure 1 – CWE Analysis. Table 15 compares percent of TOC for those subwatersheds with differences in treatment between Alternative B and Alternative C.

The reduction in area of group selection harvest, ITS harvest, and mechanical DFPZ treatment between Alternative B and Alternative C would decrease the short-term risk of additional cumulative effects, but the potential long-term benefits of these treatments would also be reduced. In the long term, possible benefits to aquatic and riparian systems associated with the reduced fire risk from fuels reduction and increased fire resiliency from stand improvements would be reduced compared to Alternative B.

Table 15. Percent TOC for Sugarberry subwatersheds with differing treatments between Alternative B and Alternative C.

Subwatershed	Percent of TOC	
	Alternative B	Alternative C
11	118	<100
19	160	158

5.3.3 Direct, Indirect, and Cumulative Effects - Measure 2: Fungicides and Water Quality.

Under Alternative C, there would be a slight reduction in the quantity of fungicides applied to reduce the risk of spread of annosus fungi, because approximately 5 acres where Sporax® application is proposed under Alternative B would not be harvested under Alternative C. As stated above, no negative environmental effects are anticipated from Sporax® application with the proposed action, therefore, under Alternative C, there are likewise no anticipated direct, indirect or cumulative effects from Sporax® application.

5.4 Alternative G

Alternative G was developed in part to increase the amount of road decommissioning in the Sugarberry project, in order to:

- reduce or eliminate resource impacts associated with unnecessary roads, especially hydrologic connectivity and erosion potential, and
- to reduce road density to reduce risk of cumulative watershed effects and improve wildlife habitat and migration routes.

Alternative G is identical to Alternative C, except that an additional 6.8 miles of National Forest System roads are proposed for decommissioning. It also includes provisions for more oak retention in proposed timber harvest units (see the Sugarberry Wildlife PA/BE and Chapters 2 and

3.11 of the Sugarberry FEIS for description and analysis of the oak retention provisions). The post-project road densities of the subwatersheds would range from 0.7 to 8.0 miles per square mile, with an average of 4.4 miles per square mile, representing an approximately 3 percent reduction in total road miles (Table 16).

Table 16: Existing Condition and Alternative G Miles of Road and Road Density

Subwatershed Label	Existing Condition Miles of Road		Existing Condition Road Density (miles per square mile)		Post-Project Miles of Road		Post-Project Road Density (miles per square mile)	
	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
1	4.1	7.1	4.6	4.4	4.1	7.1	4.6	4.4
2	1.1	3.2	1.7	2.5	1.1	3.2	1.7	2.5
3	5.1	11.4	3.2	3.3	5.1	11.4	3.2	3.3
4	2.8	6.9	3.2	3.7	2.7	6.6	3.0	3.5
5	1.2	4.5	0.8	1.4	1.2	4.5	0.8	1.4
6	4.2	10.3	4.8	5.1	4.1	9.8	4.7	4.8
7	3.5	6.4	2.0	1.8	3.2	5.8	1.8	1.6
8	0.8	2.2	2.0	1.8	0.8	2.2	2.0	1.8
9	1.0	2.1	0.8	0.7	1.0	2.1	0.8	0.7
10	3.5	11.5	3.3	3.6	3.5	11.4	3.2	3.5
11	3.5	8.2	9.7	6.9	3.5	8.2	9.7	6.9
12	2.6	6.7	3.2	2.7	2.6	6.6	3.2	2.6
13	2.0	6.4	8.4	7.0	2.0	6.4	8.4	7.0
14	2.8	10.2	3.3	3.8	2.8	10.2	3.3	3.8
15	3.8	11.5	4.4	5.2	3.8	11.5	4.4	5.2
16	1.4	3.9	4.1	4.3	1.4	3.9	4.1	4.3
17	4.3	9.5	5.5	4.7	4.3	9.5	5.5	4.7
18	1.9	5.4	5.0	5.8	1.9	5.4	5.0	5.8
19	2.2	6.4	6.2	5.5	2.2	6.4	6.2	5.5
20	5.7	13.3	4.8	5.0	5.7	13.2	4.8	4.9
21	3.6	11.6	5.0	5.5	3.6	11.3	5.0	5.3
22	2.1	6.7	3.3	4.1	2.0	6.3	3.2	3.8
23	5.7	17.6	4.0	4.8	4.3	13.0	3.0	3.6
24	1.5	7.4	2.0	3.6	1.5	7.0	2.0	3.5
25	1.5	5.7	3.6	5.4	1.5	5.7	3.6	5.3
26	2.5	8.8	2.5	3.3	2.2	8.4	2.2	3.2
27	5.7	14.8	7.3	7.3	4.5	13.0	5.8	6.4
28	3.0	8.0	3.8	4.5	2.9	7.6	3.6	4.3
29	5.8	18.7	5.1	5.5	5.8	18.7	5.1	5.5
30	5.3	14.3	5.5	5.7	5.3	14.3	5.5	5.7
31	2.0	6.1	4.0	4.6	1.8	5.8	3.8	4.4
32	2.3	7.3	3.6	4.4	2.3	7.3	3.6	4.4
33	5.0	14.6	6.9	8.0	5.0	14.6	6.9	8.0
34	9.0	23.6	6.0	6.4	7.3	21.1	4.9	5.7
35	2.8	7.0	8.4	7.9	2.8	7.0	8.4	7.9
36	9.0	18.5	7.7	6.3	8.8	18.2	7.5	6.2

Subwatershed Label	Existing Condition Miles of Road		Existing Condition Road Density (miles per square mile)		Post-Project Miles of Road		Post-Project Road Density (miles per square mile)	
	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total	Near-Stream	Total
37	0.9	2.9	1.4	2.2	0.8	2.5	1.2	1.9
38	4.7	8.0	9.9	7.9	4.3	7.7	9.2	7.5
39	3.8	11.2	3.8	5.1	3.8	11.2	3.8	5.1
40	8.4	21.2	6.6	6.6	8.4	21.2	6.6	6.6
41	0.7	3.1	1.8	3.9	0.5	2.6	1.2	3.2
42	0.7	1.5	1.1	1.3	0.7	1.5	1.1	1.3
43	1.8	6.5	1.0	2.2	1.5	6.0	0.8	2.0
44	1.7	4.1	2.7	2.9	1.7	4.1	2.7	2.9
Total Miles	**147.2**	**396.4**	**4.3**	**4.5**	**140.5**	**381.5**	**4.1**	**4.4**

5.4.1 Direct, Indirect and Cumulative Effects

Transportation Improvements – Increased mileage of road decommissioning would in the short term increase the risk of erosion and sedimentation to streams and associated negative effects to channel form, function and habitat quality. This risk would be mitigated by the application of BMPs during and immediately following the decommissioning activities. The improvements associated with road decommissioning would, in the long term, benefit the hydrologic function and condition of the subwatersheds, and aid in restoration of habitat connectivity of stream systems. Road drainage improvement or obliteration would cause a net reduction in sediment mobilization and delivery. Road decommissioning would result in a reduction in ERA values in the affected subwatersheds, resulting in lower risk of CWE in those watersheds and downstream. The total percents of TOCs for all subwatersheds for each alternative are displayed in Table 17. The percent reductions in proportion to the watershed areas are small; the greatest percent decrease (4%) would occur in subwatershed 23 (Upper Canyon Creek 2). However, reductions in road mileage and area will produce proportionately greater hydrologic benefits where road drainage is directly affecting stream courses or where the risk of road surface erosion or fill failure is high.

6. SUMMARY OF CUMULATIVE EFFECTS

A comparison of ERA scores in relation to the TOC for each alternative is displayed in Table 17.

Table 17: Comparison of Percent of TOC for Each Alternative
Highlighted cells represent subwatersheds approaching or exceeding TOC for each alternative.

Subwatershed Number	Subwatershed Name	Percent of TOC			
		Alternative A (No-Action)	Alternative B (Proposed Action)	Alternative C	Alternative G
1	Whiskey Creek	26%	26%	26%	26%
2	Headwaters East Branch Slate Creek	8%	8%	8%	8%
3	Slate Creek Canyon 1 - Upper Slate Creek	31%	33%	33%	33%
4	Gibson Creek	48%	54%	54%	54%
5	East Branch Slate Creek	18%	20%	20%	20%
6	Wallace Creek	54%	56%	56%	56%
7	Potosi Creek	20%	23%	23%	23%
8	Sacketts Gulch	58%	63%	63%	63%
9	Upper Canyon Creek 1	14%	14%	14%	14%
10	Slate Creek Canyon 2 - St. Louis	62%	70%	70%	70%
11	East Branch Rabbit Creek	94%	118%	<100%	<100%
12	Cedar Grove Ravine	34%	37%	37%	37%
13	Unnamed tributary S Little Grass Valley Reservoir	83%	86%	86%	86%
14	Upper Lost Creek	43%	44%	44%	44%
15	Rabbit Creek	78%	96%	96%	96%
16	Unnamed tributary Rabbit Creek	35%	75%	75%	75%
17	Slate Creek Canyon 3 - French Camp	41%	46%	46%	46%
18	Wisconsin Ravine	26%	29%	29%	29%
19	Deacon Long Ravine	153%	160%	158%	158%
20	Valley Creek	48%	54%	54%	54%
21	Clarks Ravine	55%	81%	81%	81%
22	Pats Gulch	27%	37%	37%	37%
23	Upper Canyon Creek 2	20%	24%	24%	20%

Subwatershed Number	Subwatershed Name	Percent of TOC			
		Alternative A (No-Action)	Alternative B (Proposed Action)	Alternative C	Alternative G
24	Slate Creek Canyon 4 - Lucky Hill	23%	37%	37%	37%
25	American House Ravine	44%	51%	51%	51%
26	Slate Creek Canyon 5	30%	34%	34%	34%
27	Onion Creek	39%	50%	50%	50%
28	Slate Creek Canyon 6	31%	36%	36%	36%
29	Upper Rock Creek	58%	60%	60%	60%
30	Gold Run Creek	61%	68%	68%	68%
31	Canyon Creek - Sawmill Ravine	35%	36%	36%	36%
32	Slate Creek Canyon 7 - Diversion Dam	51%	56%	56%	56%
33	Slate Creek Canyon 8 - Stowman Ravine	50%	52%	52%	52%
34	Lower Rock Creek	42%	56%	56%	55%
35	Buckeye Creek	87%	87%	87%	87%
36	Brushy Creek	53%	60%	60%	60%
37	Middle Canyon Creek	15%	18%	18%	17%
38	Unnamed tributary Rock Creek	113%	123%	123%	123%
39	Slate Creek Canyon 9 - North Star	33%	39%	39%	39%
40	Upper Deadwood Creek	32%	34%	34%	34%
41	Slate Creek Canyon 10 - Oak Flat	35%	41%	41%	41%
42	Lower Canyon Creek	8%	14%	14%	14%
43	Slate Creek Canyon 11 - Lower Slate Creek	14%	16%	16%	16%
44	Lower Deadwood Creek	15%	21%	21%	21%

6.1 Existing Condition.

1. Portions of the CWE analysis area are a highly disturbed. Under the existing condition, 3 subwatersheds (11, 13, and 35) approach the TOC and two (19 and 38) exceed the TOC. Subwatersheds 13 and 35 approach the TOC but are almost entirely

privately owned. However, activities within these watersheds contribute to the risk of CWEs (Figure 1). The subwatersheds that approach or exceed the TOC do so because of: (1) timber harvesting practices on private land; (2) legacy mining activities; and (3) the high-density road network.

2. Stream conditions in the CWE analysis area were field-inspected during site visits to proposed restoration projects, road construction sites and selected stream crossings and reaches. Channel and riparian conditions in a number of subwatersheds are observably and substantially influenced by past management activities, particularly the legacy of hydraulic mining in the area. Most of the stream reaches observed in the analysis area that are not affected by legacy mining impacts are in stable condition and have largely recovered from past cumulative effects, although a deficiency of large woody debris is noticeable throughout the watersheds. At a number of specific sites, disturbances related to mining or to other activities continue to adversely affect streams, in some cases associated with poorly engineered or maintained roads and stream crossings. The road density of a majority of subwatersheds in the Sugarberry CWE analysis area exceeds the desired density for minimizing road impacts on aquatic and riparian environments and associated terrestrial wildlife.

6.2 Alternative A (No Action Alternative)

1. Under the no-action alternative, DFPZ treatments, ITS, group selection, transportation improvements (road reconstruction, closure, and decommissioning), wildlife habitat restoration, aspen stand enhancement, and watershed restoration would not occur; consequently there would be no added risk of cumulative effects to watershed conditions from the Sugarberry Project.

2. Under the no-action alternative, long-term benefits to watershed condition that the proposed action and other action alternatives would provide through vegetation management would not occur, including reductions in fuel loads, increased soil cover and organic material in areas deficient in ground cover or large woody material; and enhancement of seral-stage diversity.. Other benefits of the action alternatives that would promote beneficial changes in stream and meadow conditions would also not occur, including those that that would result from proposed transportation improvements, aspen stand enhancement and watershed restoration. Sedimentation in

water bodies and riparian areas, degraded channels and meadow surfaces, limited ecosystem diversity, and impaired aquatic habitat connectivity would persist.

3. Under the no-action alternative, there would be no fungicide application, and no environmental effects associated with the application of fungicides would occur.

6.3 Alternative B (Proposed Action)

1. In most subwatersheds, the additional disturbance from the Sugarberry Project proposed activities would contribute only a minor percentage of the total risk of CWEs, and most subwatersheds have low to moderate risk of CWE with or without the proposed action.

2. The ERA model indicates that the proposed action has the potential to increase the risk of CWE in portions of the CWE analysis area. Under Alternative B (the proposed action), 4 subwatersheds (13, 15, 21 and 35) approach and 3 subwatersheds (11, 19 and 38) exceed the TOC.

3. For all subwatersheds, the past 25 years of harvest activities on the Plumas National Forest plus the proposed Sugarberry Project activities contribute anywhere from 0 to 70 percent of the total ERA score, with an average contribution of 25 percent. In the subwatersheds that currently approach or exceed the TOC, past activities on the Plumas National Forest combined with the proposed Sugarberry Project activities contribute between 0 and 36 percent of the total ERA score. In three of the six subwatersheds that approach or exceed TOC, the past and future activities on the Plumas National Forest would contribute in excess of 20 percent to the total ERA score. The largest contribution in these subwatersheds would be in subwatershed 21, where 36 percent of the total ERA would be a result of past and future activities on the Forest, followed by subwatershed 11 with 23 percent.

4. The proposed DFPZ, group selection, and ITS treatments are designed to promote the HFQLG Act desired condition of uneven-aged, multistoried, fire-resilient stands, while maintaining a healthy forest. An effective DFPZ would not entirely eliminate the possibility of high-severity wildfire affecting some watersheds, however, it would provide firefighters an opportunity to contain the fire and prevent it from spreading across larger portions of the landscape. DFPZ projects across the HFQLG Pilot Project region would treat other portions of the landscape, and over time, the

aggregate risk of stand-replacing fires would be reduced. The potential risk of CWEs from stand-replacing wildfire in the long term would greatly exceed the short-term increased risk of CWEs related to the proposed DFPZ treatments under the Sugarberry Project. Over time, implementation of these DFPZ, group selection, and ITS treatments across the landscape would provide seral stage diversity by adding patches of the youngest seral stages to portions of larger CWHR Size Class 4 and 5 stands. Under Alternative B, , these stand structure improvements would occur, and in the long term, provide possible benefits to aquatic and riparian systems associated with the fire resiliency of these stand improvements. Possible short-term increases in runoff and erosion related to these treatments could also occur.

5. Transportation system improvements, streambank stabilization projects, fish barrier removal, aspen stand and meadow enhancement projects would have long-term benefits for the subwatersheds, especially in the near-stream sensitive areas. Benefits would include reduction in road- and bank-related erosion, drainage diversion and sediment deposition to channels; improved function and condition of channels and improved aquatic and riparian habitat; and increased availability of aquatic habitat to mobile species of fish, amphibians, and invertebrates from restoration of habitat connectivity. Short-term sediment increases that could result from these restoration activities would be outweighed by the ecological benefits and enhanced beneficial uses that are their objectives.

6. It is assumed that measures to protect headwater and low-order tributaries, including riparian buffers and implementation of effective nonpoint source conservation measures (BMPs), would minimize effects to higher-order channels and protect downstream watershed values and beneficial uses. These measures would control sedimentation, and the potential for project-related sediment delivery to the immediate channel and channels downstream would be small, even where the overall state of disturbance of the watershed is high.

7. If CWEs were to occur, their most likely expression would be increased channel erosion and chronic sedimentation related to increases in runoff and peak flow during high-intensity rain events. Peak flow changes, in particular, may cause increased sedimentation, changes in bedload transport, altered flow regimes, channel incision, undercuts and unstable banks, and channel morphology changes (Reid 1993). If a

CWE were to occur as a result of the Sugarberry Project, it would most likely occur within low-gradient, third-order or greater reaches of the channel network and/or at major confluences.

6.4 Alternative C

Alternative C was designed to reduce the risk of CWE in subwatersheds that approach or exceed the TOC, either in the existing condition or with the proposed action (Alternative B). The focus of the alternative is to reduce the risk of possible CWEs in subwatersheds where either: (1) the Sugarberry proposed action, future foreseeable actions and the past ten years of Forest Service activities will cause the subwatershed ERA total to exceed TOC (subwatershed 11); or (2) under the existing condition, the subwatershed ERA total exceeds TOC, and proposed activities appear to have the potential to cause direct, indirect or cumulative effects to local or downstream values and beneficial uses (subwatershed 19).

Under Alternative C (compared to Alternative B):

- Mechanical treatments for ITS and/or group selection would be eliminated or reduced in subwatersheds 11 and 19.
- Mechanical DFPZ treatments would be reduced in subwatershed 11.
- Temporary road construction would be reduced by 0.7 miles.
- There would be no differences in aquatic and wildlife habitat restoration and aspen enhancement.

The reductions in proposed mechanical treatments between Alternatives B and C would lower the ERA total of subwatersheds 11 to TOC or below, and would reduce the ERA total in subwatershed 19. CWE risks for sensitive and unstable sites and downstream resources would be reduced by the proposed changes.

The reduction in area of group selection harvest, ITS harvest, and mechanical DFPZ treatment between Alternative B and Alternative C would decrease the short-term risk of additional cumulative effects, but the potential long-term benefits of these treatments would also be reduced. In the long term, possible benefits to aquatic and riparian systems associated with the reduced fire risk from fuels reduction, increased fire resiliency from stand improvements would be reduced slightly compared to Alternative B.

6.5 Alternative G

Under Alternative G, an additional 6.8 miles of National Forest System road decommissioning would occur in addition to the activities proposed under Alternative C. This would slightly to moderately reduce ERA values in 3 subwatersheds (Table 17). The reduction in risk of CWEs in those subwatersheds would exceed the proportion of ERA reduction, however, because roads have a disproportionate effect on stream water quality and downstream beneficial uses, due to the high risk of sedimentation associated with road surfaces and road fill, especially where they are hydrologically connected with channel networks such as near stream crossings and where roads are located in riparian corridors.

7. IRREVERSIBLE, IRRETRIEVABLE EFFECTS

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. There would be no project-related direct, indirect, or cumulative effects under Alternative A (the no-action alternative), therefore there would be no irreversible commitments of riparian or water resources. It is not projected that Alternatives B or C would cause irreversible commitments of riparian or water resources, because project-related effects would be short-term.

Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road. There would be no project-related direct, indirect, or cumulative effects under Alternative A (the no-action alternative), therefore there would be no irretrievable commitments of riparian or water resources. While there would be short-term effects to hydrologic response in the affected watersheds under Alternatives B, C and G, it is not expected that they would cause irretrievable commitments of riparian or water resources.

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