Salt Timber Harvest and Fuel Hazard Reduction Project

Hydrology Report

Prepared by:

Jenny Fryxell
Chad Hermandorfer
TEAMS Planning Enterprise Unit

February 1, 2009

for:

South Fork Management Unit
Shasta-Trinity National Forest

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Table of Contents

Introduction 1
Overview of Issues 1
Regulatory Framework 1
Methodology for Analysis 5
Affected Environment 5
Project Location 5
Desired Condition 17
Project Design Features, Mitigation and Monitoring 17
Project Design Features and Mitigation 18
Monitoring 18
Environmental Consequences 18
Analysis of Direct and Indirect Effects 18
Alternative 1 – No Action 22
Alternative 2 – Proposed Action 22
Alternative 3 29
Compliance with Regulatory Direction 35
References 36
Appendix A – Project Design Features for the Salt Project: Best Management Practices, General Project Design Measures, and Design Measures for Riparian Reserves (USDA Forest Service, 2000) 39
General Project Design Features 44
Project Design Features for Riparian Reserves 46

List of Tables

Table 1: Watersheds associated with the Salt Project 6
Table 2: Characteristics of Watersheds Associated with Salt Project 8
Table 3: Existing Road Density by Watershed 8
Table 4: 2008 Telephone Burn Severity Acres in the 6th Level Salt Creek-Upper Hayfork Creek watershed and in the Project Area 9
Table 5: Watersheds in the Salt Project Area and summary of existing ERA data and resulting watershed condition class 11
Table 6: Watershed Condition Classes and Relative to Threshold of Concern (TOC) 12
Table 7: Designated beneficial uses for the Hayfork Valley Hydrologic Sub-Area 13
Table 8: Comparison of action alternatives, Alternative 2 and 3 19
Table 9: Comparison of road densities by alternative by 7th level watershed 20
Table 10: Road densities within 300 feet of streams 21
Table 11: Road densities within Riparian Reserves 21
Table 12: Estimates of total erosion rates by soil family, by alternative, as determined by WEPP modeling 21
Table 13: Potential effects of Alternatives 2 and 3 on sedimentation and stream crossings 24
Table 14: Equivalent roaded acres (ERA) for existing conditions and by alternative 33

List of Maps and Figures

Map 1. Project area watershed and stream location maps, Salt Project, Yolla Bolla Ranger District, Shasta-Trinity National Forest 7
Map 2. Location of 2008 Wildfire in the Salt Creek-Upper Hayfork Creek Watershed 10
Figure 1 Threshold of concern and watershed condition class 12
Map 3: Locations and relationship of the South Fork, Trinity River, to drainages within the Salt Project Analysis Area 14
Figure 2: Typical stream channel in the Salt Project Area 16

Introduction

Hydrology is one of the primary parts of a forest's ecosystem. This report documents the analysis of existing conditions, and the analysis of potential environmental consequences to hydrologic resources, related to the proposed Salt Timber Harvest and Fuels Hazard Reduction Project. The report also includes recommended project design features, and specific Best Management Practices, that would be required to be implemented as part of this project.

Overview of Issues

The following watershed issues were identified by input received during the scoping process for this proposed project. These issues were considered in this analysis.

- Thinning within riparian reserves may have unintended effects on the watershed, fisheries and wildlife
- Construction of new temporary roads may negatively impact hydrology and soil health and could impacts wildlife
- Landings and use of roads for this project could contribute sedimentation and cumulative impacts leading to degradation of riparian areas and the watershed

Regulatory Framework

Shasta Trinity Forest Plan and Northwest Forest Plan

Forest Goals, Standards and Guidelines are derived both from the Shasta-Trinity Forest Plan (USDA Forest Service, 1995) and from the Record of Decision for Amendments to the Forest Service and Bureau of Land Management planning Documents within the Range of the Northern Spotted Owl, commonly referred to as the Northwest Forest Plan (USDA Forest Service, 1994).

Many of the goals tier to riparian-dependent resources. The Northwest Forest Plan defines a Riparian Reserve as the portion of a watershed where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply (USDA Forest Service, 2004b). These areas include those portions of a watershed directly tied to streams and rivers; that are required in order for proper hydrologic, geomorphic and ecologic processes to be maintained; and that directly affect standing and flowing waterbodies such as lakes, ponds, wetlands and streams. The special standards and guidelines are documented in the Aquatic Conservation Strategy Objectives (ACSO) and are listed below. All projects must achieve ACS Objectives in Riparian Reserves (USDA Forest Service, 2004b).

Goals Pertinent to the Project Scope (Northwest Forest Plan)

- The Aquatic Conservation Strategy's Goal is to "maintain and restore the ecological health of watersheds and aquatic ecosystems contained within them on public lands" and to "prevent further degradation and restore habitat over broad landscapes as opposed to individual projects or small watersheds". Over the short term (10-20 years) the goals is to halt declines of watershed condition and to protect watersheds that had good-quality habitat and healthy fish populations" (FEMAT, 1993).

- Over the long term the goal (100 years +) is to develop a network of functioning watersheds that supported populations of fish and other aquatic and riparian dependent organisms across the NWFP area (USDA FS & BLM 1994)
- Aquatic Conservation Strategy Objectives

  1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.
  2. Maintain and restore spatial and temporal connectivity within and between watersheds.
  3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.
  4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.
  5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements include timing, volume, rate and character of sediment input, storage, and transport
  6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.
  7. Maintain and restore timing variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.
  8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration, and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.
  9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

Standards and Guidelines (Shasta-Trinity Forest Plan)

- Water 39: Maintain or improve water quality and quantity to meet fish habitat requirements and domestic use needs.
- Water 40: Maintain water quality to meet or exceed applicable standards and regulations.

<u>Riparian Areas</u>

- 17a: The Riparian Reserve Standards and Guidelines (Management Prescription section, Riparian Reserves) apply to all 2.1 million acres of the Shasta-Trinity

National Forests. These requirements are included as Appendix A due to their length.

- 17b: Maintain riparian area values, particularly when locating and constructing new roads and trails.
- 17c: Identify and treat riparian areas that are in a degraded condition.

Soils and Water

- 18a: Analyze each land disturbing project for its effect on the appropriate 2nd or 3rd order watershed (average size about 1,000 acres), to prevent excessive cumulative impacts on stream channel and condition.
    - 18a1: Determine the sensitivity of each 2nd or 3rd order watershed using soil, geologic, and streamflow characteristics.
    - 18a2: The threshold of concern (TOC) for a watershed is expressed as the percentage of disturbed or compacted soil area within a total watershed, as measured by Equivalent Roaded Area (ERA). The Equivalent Roaded Area (ERA) threshold equals 18% in low sensitivity watersheds, 16% in moderate sensitivity watersheds, and 14% in high sensitivity watersheds and 12% in extremely sensitive watersheds.
    - 18a3: Projects on National Forest lands should not increase the ERA above the proportional share (depending on land ownership) of the TOC unless, as part of the project, existing ERAs' would be reduced or the ERA recovery factor would be improved.
    - 18c: Implement Best Management Practices (BMPs) for protection or improvement of water quality, as described in "Water Quality Management for National Forest System Lands in California" for applicable management activities. Determine specific practices or techniques during project-level planning using information obtained from onsite soil, water, and geology investigations. This direction conforms and complies with Sections 208 and 319 of the Federal Clean Water Act (PL 92-500), EPA's Guidance for the Coastal Zone Act Reauthorization Amendment, and the guidelines established by the North Coast Regional Water Quality Control Board (USDA Forest Service, 2000).

Existing Laws, Executive Orders, and Memorandums of Understanding (MOUs)

- National Forest Management Act 1976: The objectives of this act ensure that Forest planning and management activities provide for the conservation and sustained yield of soil and water resources.
- Clean Water Act of 1972 and related amendments: The objective of the Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. (Section 101(a)). It also regulates discharge of dredged or fill material into navigable waters (waters of the U.S.) (Section 404). Key sections to this law, and related amendments include: Section 208 requiring states to develop and use Best Management

Practices (BMPs) for managing non-point source pollution; Section 305(b) requiring states to generate a biennial report to Congress on water quality; Section 303(d) requiring that waterbodies that are repeatedly out of compliance with the applicable water quality standards be subject to a Total Maximum Daily Load or TMDL.

- Executive Order 11990, 1977; Wetlands Management: This Executive order requires Federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands. To comply with Executive Order 11990, the Federal agency would coordinate with the ACOE, under Section 404 of the Clean Water Act, and mitigate for impacts to wetland habitats. There are no known wetlands in the project area.

- Executive Order 11998, 1977; Floodplain Management: This Executive order requires all Federal agencies to take actions to reduce the risk of flood loss, restore and preserve the natural and beneficial values in floodplains, and minimize the impacts of floods on human safety, health, and welfare. There are no stream channels with floodplain characteristics that would be affected by this project. All stream channels that cross or are immediately adjacent to project activities are intermittent and do not have floodplain features.

- EPA's Guidance for the Coastal Zone Act Reauthorization Amendment Section 6217 - requires the states with approved Coastal Zone Management Programs (Coastal Zone Management Act 1990) to develop Coastal Nonpoint Pollution Control Programs. In its program, a state describes how it will implement nonpoint source pollution controls, known as management measures, that conform to those described in Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. This program is administered jointly with the National Oceanic and Atmospheric Administration (NOAA).

Other Applicable Laws and Regulations

- The State Porter-Cologne Water Quality Act designates regional boards within the state. Each board is required to publish and update a regional basin plan complete with water quality goals and objectives. Duties also include compiling the biennial 303(d) list of Impaired Waterbodies.

- North Coast Regional Water Quality Control Board Basin Plan and Water Quality Objectives

    - Each basin plan provides a definitive program of actions designed to preserve and enhance water quality and to protect beneficial uses of water in the North Coast Region.

    - Each water board also must develop plans to improve water in identified "impaired waterbodies" that can not meet the standards set forth in each basin plan. Typically a Total Maximum Daily Loads (TMDLs) process is utilized to reduce pollution sources to improve and restore water quality to meet basin plan standards.

    - The South Fork of the Trinity River has an established TMDL for sedimentation and water temperature. The TMDL (http://www.waterboards.ca.gov/tmdl/303d_lists2006approved.html EPA

1998) calls for a 30% reduction in sediment load for the SF of the Trinity River and Hayfork Cr (into which the Salt Project Area drains). The segment is listed for both sedimentation and water temperature.

- Categorical Waiver for Discharges Related to Timber Activities on Federal Lands Managed by the USDA Forest Service in the North Coast Region, Order No. R1-2002-0015.

Methodology for Analysis

Field reconnaissance was conducted in the fall of 2007 by a TEAMS hydrologist to evaluate existing hydrologic conditions and potential effects to this resource related to the proposed action (Hermandorfer, 2007). Literature reviews, field notes, Forest monitoring reports, Geographical Information System (GIS) data, and professional judgment were used to support report conclusions. Field notes and photographs are in the project file.

Sediment delivery modeling was conducted using the Forest Service interface for the Water Erosion Prediction Project computer model (WEPP). Modeling was conducted for the proposed action and no-action alternatives. Modeling was done on the 7th level Upper Salt Creek-Hayfork Creek and Ditch Gulch-Salt Gulch watersheds, as the majority of the proposed project are in these two watersheds. WEPP modeling was not done on the Upper Rattlesnake Creek watershed as less than 0.7% of the watershed area was involved under both Alternatives 2 and 3. In Alternative 2 unit 45 would have 52 acres and in Alternative 3 it would have 51 acres. The proposed activity is thinning an existing fuel break. No temporary road construction is proposed. No hauling over roads in the Upper Rattlesnake Creek watershed is proposed and no road decommissioning would be implemented. As a result, there would be no discernible direct, indirect or cumulative effects for Upper Rattlesnake Creek. Results for the other two watersheds were then used to compare potential effects for each alternative.

The model incorporates input of five elements to estimate erosion: climate, soil texture, local topography, residual plant community, and residual surface cover. The accuracy of predicted erosion numbers is highly variable at ±50% (Elliot et al., 2000), and very dependant on precipitation. The model does, however, allow comparison between alternatives (Elliot et al., 2000). Copies of the modeling results, including assumptions used in WEPP modeling are found in the project file (Fryxell, 2008).

The Equivalent Roaded Area (ERA) model was also utilized to evaluate existing and potential project-related changes in existing cumulative effects, as required in the Region 5 Soil and Water Conservation Handbook, Chapter 50 (USDA Forest Service, 1990; Amendment 2). Thresholds of concern, established in Forest LRMP in standard 18a2 as described above.

Affected Environment

Project Location

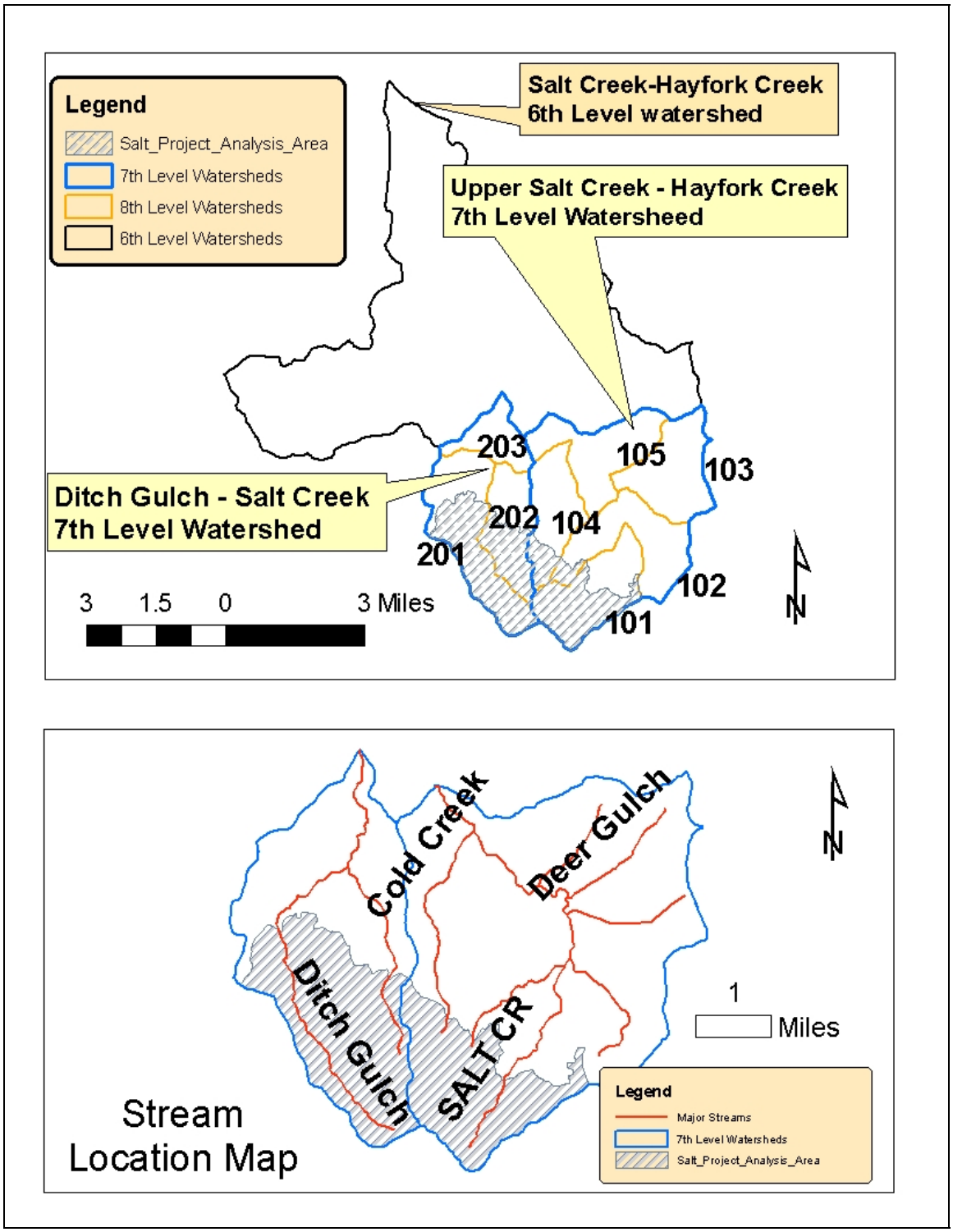
The project area is located within the portion of the Klamath River Basin drained by the South Fork of the Trinity River via Lower Hayfork Creek. More specifically it is located in the upper reach of the Salt Creek-Hayfork Creek 6th field (HUC6) Watershed. Salt Creek Headwaters, Cold Creek, Bule, Ditch and Deer Gulches are the named drainages within the project area.

These streams flow north to northeast to join Hayfork Creek; about 9 miles starting from the head of Salt Creek (see Map 1). Roughly 21 miles downstream of the Salt Creek/Hayfork Creek confluence, Hayfork Creek flows into the South Fork of the Trinity River (Table1).

Table 1: Watersheds associated with the Salt Project

HUC4	HUC5	HUC6	HUC7	HUC8*
SF Trinity R	L Hayfork Cr	Salt Cr-Hayfork Cr	Ditch Gulch-Salt Cr	1801021204010**201(Upper Ditch)**
				1801021204010**202 (Bule)**
				1801021204010**203 (Lower Ditch)**
			U Salt Cr-Hayfork Cr	1801021204010**101 (Upper Salt)**
				1801021204010**102 (Middle Salt)**
				1801021204010**103(Lower Salt)**
				1801021204010**104 (Upper Cold)**
				1801021204010**105 (Lower Cold)**

* HUC8 watersheds are depicted on Map 1 by the last 3 HUC digits (displayed in bold above). The names Upper Ditch, Lower Ditch, Upper, Middle and Lower Salt, and Upper and Lower Cold Creek are not formalized in the Forest's GIS layer for 8th level HUCS. The names come from Christine Mai, Forest Hydrologist.



Map 1. Project area watershed and stream location maps, Salt Project, Yolla Bolla Ranger District, Shasta-Trinity National Forest

State Highway 36 is the northern boundary of the project area. The proposed project includes treatment areas in T29N, R11W, sections 4–9; T29N, R12W, sections 1, 2, and 12; T30N, R11W, sections 32 and 32; and T30N, R12W, sections 25, 26, 35, and 36, M.D.M.

The project area is within the Hayfork Adaptive Management Area (AMA) as identified in the Northwest Forest Plan and Management Area 19 (Indian Valley Rattlesnake) of the Shasta-Trinity Forest Plan. Adaptive management areas were created to encourage new approaches and creative innovative methods of management, however if new approaches are not implemented, then by default these areas utilize the same standards and guidelines that apply to matrix lands.

Watershed Description and Condition

Streams in the headwaters of the 6th level Salt Creek-Hayfork Cr Watershed generally function to transport sediment and large woody debris (LWD). Channels are typically low-order streams with high-gradient (10% or greater) having hillside slopes that often range from 70% or greater. Hence, there is limited residence time in the channels and material is easily transported during high flows (URS et al., 2000; Ratcliff, 2007; Table 2).

Table 2: Characteristics of Watersheds Associated with Salt Project

HUC6	HUC7	Ephemeral Stream Miles	Intermittent Stream Miles	Perennial Stream Miles
Salt Cr-Hayfork Cr		144.3	99.0	56.1
	Upper Salt Cr-Hayfork Cr	39.7	22.9	15.7
	Dutch Gulch-Salt Cr	12.8	14.5	6.6

Overall road densities for the Salt Creek-Hayfork Creek, Ditch Gulch-Salt Creek and Upper Salt Creek-Hayfork Creek watersheds are shown below in Table 3. Road densities were determined by clipping road layers to watershed boundaries. Unclassified roads U29N55A, U29N31EA and U29N31E, located within the Upper Salt Creek-Hayfork Creek 7th level watershed, were noted as actively eroding (Foss, 2008).

Table 3: Existing Road Density by Watershed

6th Level Huc	7th Level HUC	Existing Road Density (mi/sq.mi0
Salt Creek-Hayfork Creek		3.6
	Ditch-Salt Creek	6.8
	Upper Salt Creek-Hayfork Creek	3.7

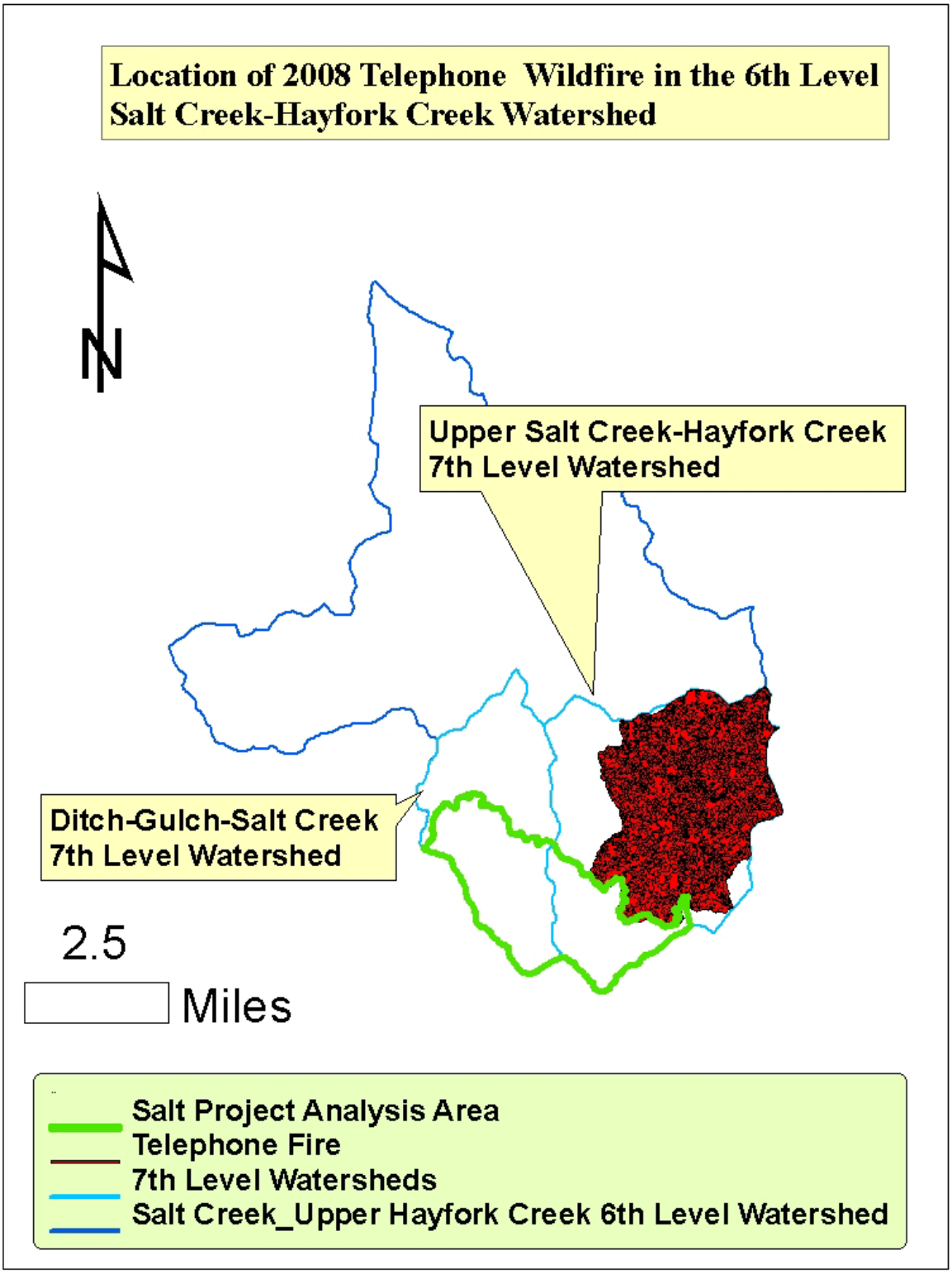
An estimated 5,727 acres, or 15.5 %, of the Salt Creek-Hayfork Creek watershed were burned by the 2008 Telephone wildfire (Table 4). Approximately 124 acres were rated as high severity burns and 1,423 acres were rated as moderate in severity. Approximately 3, 150 acres had a low severity burn rating. 124 acres were categorized as having experienced high fire severity within the project area, and 1, 432 acres were rated as having moderate burn severity.

The fire burned 30 acres within the project, most of which was categorized as low severity. 0.3 acres, within the project area, had a moderate burn severity rating. No acres within the project

area were rated as having a high burn severity. Areas of low fire severity are actually beneficial at the watershed level, by promoting the sprouting of new vegetation, while retaining protective soil ground cover. Only an estimated 0.7 percent of the project analysis area itself was impacted by the Telephone fire. Based on the acreages burned within the project area effects are not likely to be evident other than very locally.

Table 4: 2008 Telephone Burn Severity Acres in the 6th Level Salt Creek-Upper Hayfork Creek watershed and in the Project Area

Salt Creek-Upper Hayfork Creek 6th Level Watershed				
Watershed Acres	**Burn Severity (Acres)**	**Acres Burned**	**% of Burn**	**% of Watershed**
36,881	Low	3, 150	69	8.5
	Moderate	1, 423	31	3.9
	High	124.0	3	3.0
	Unburned/Patchy Burn Areas	32,130.3	0	87
Salt Project Area				
4, 278.6	Low	29.5	39.1	0.7
	Moderate	0.3	0.4	0
	High	0.0	0	0
	Unburned/Patchy Burn Areas	4, 248.8	0	0



Map 2. Location of 2008 Wildfire in the Salt Creek-Upper Hayfork Creek Watershed

Table 5: Watersheds in the Salt Project Area and summary of existing ERA data and resulting watershed condition class

Salt Project	Acres	Pre-fire ERA			2008 Telephone Fire					Pre and Postfire Watershed Rating for Watershed Condition Class/Potential for adverse cumulative watershed effects
		ERA	% ERA	% of TOC	# Acres Burned High Severity	# Acres Burned Moderate Severity	Postfire ERA Acres	Postfire % ERA	Postfire % of TOC	
Upper Salt Crk - Hayfork Creek	9766	236.6	2.4	17	124	1423	236.6	2.4	17	I/low
Ditch Gulch-Salt Gulch	5081	191.1	3.8	27	0.0	0.0	191.1	3.8	27	I/low

Historically the area was heavily grazed; used for timber harvest; and placer, dragline, and hardrock mined. Roads were developed for these uses, and water diversions, still in use today, were developed for domestic and agricultural uses (URS et al., 2000).

Existing disturbance levels within these watersheds are evaluated onsite and by using the ERA process (as required by FSH 2509.18, Soil and Water Conservation Practices, Chapter 50 – Soil Erosion and Hazard Rating). In calculating ERA's, all documented ground-disturbing activities such as roads, vegetation treatments, and grazing, are entered into the model. The model then calculates a percent disturbance for that watershed, which is the percent existing ERA. This number is compared to a pre-determined TOC; and when the ERA percentage equals 80% or greater of TOC, further analysis is triggered to determine if water yield, erosion, or sedimentation are of concern. Watershed Condition Class (WCC) is defined as an indicator of cumulative watershed risk (Table 5, 6 and Figure 1).

The TOC for the 7th field watersheds in this project area are 14% (Overland, 2008a).

ERA analysis of existing conditions for the Upper Salt Creek-Hayfork Creek Watershed has the existing percent ERA calculated at 2.4%. This includes accounting for the 2008 Telephone wildfire. Other disturbance activities included in the ERA analysis were roads, timber harvest, fire and grazing (Overland, 2008b).

The TOC for Upper Salt Creek-Hayfork Creek Watershed 14%; therefore, the current disturbance level is at 17% of the TOC for this watershed; resulting in a low level of concern and a Watershed Condition Class 1 rating.

Existing ERA values for the 7th level Ditch Gulch-Salt Gulch Watershed were calculated to be 3.8%; with the same associated activities as mentioned above, except this watershed was not involved with the wildfires of 2008. The calculated ERA value of 3.8% represents 27% of the TOC for this watershed; again resulting in a low level of concern and a Watershed Condition Class 1 rating.

There are no key watersheds (NWFP ACS 1994) with a key role in the conservation of at-risk salmonids, bull trout, and resident fish species (USDA Forest Service, 1995) within the project area.

Table 6: Watershed Condition Classes and Relative to Threshold of Concern (TOC)

Watershed Condition Class	Forest Service Manual Definitions 2521.1	WCC & TOC
WCC I	Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. The drainage network is generally stable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are predominantly functional in terms of supporting beneficial uses	Less than 40% TOC
WCC II	Watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the drainage network may be unstable. Physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems are at risk in being able to support beneficial uses.	Between 40% and 80% TOC
WCC III	Watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. A majority of the drainage network may be unstable physical, chemical, and biologic conditions suggest that soil, aquatic, and riparian systems do not support beneficial uses.	Greater than 80% TOC

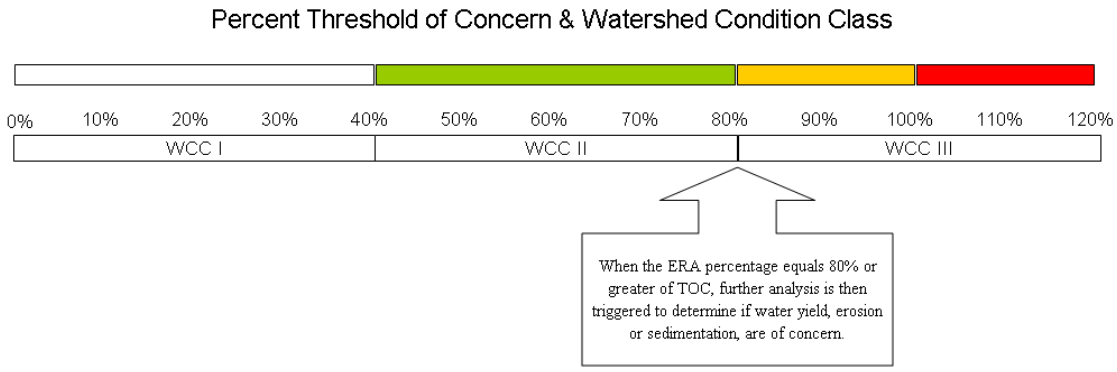


Figure 1 Threshold of concern and watershed condition class

Water Quality

The 2007 Water Quality Control Plan for the North Coast Region defines the following beneficial uses for Hayfork Valley Hydrologic Sub-area which includes the project area (see Table 7).

Table 7: Designated beneficial uses for the Hayfork Valley Hydrologic Sub-Area

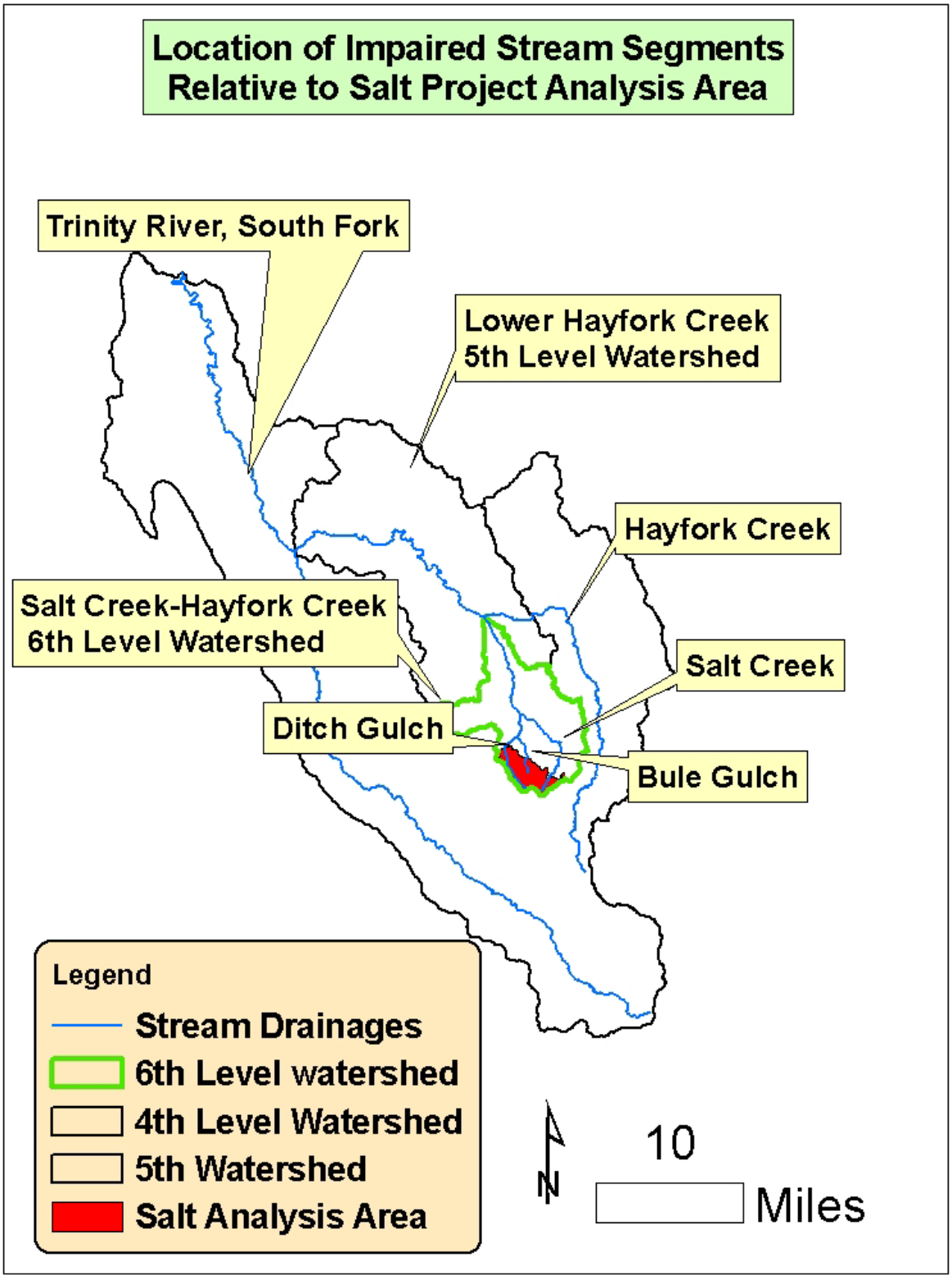
Designated Beneficial Use	Established Use (E) / Potential Use (P)
Municipal or domestic	E
Agricultural supply	E
Industrial service supply	E
Industrial process supply	E
Groundwater recharge	E
Freshwater replenishment	E
Water contact recreation	E
Non-contact recreation	E
Commercial and sport fishing	E
Cold freshwater habitat	E
Wildlife habitat	E
Rare, threatened or endangered species	E
Migration of aquatic organisms	E
Spawning	E
Hydropower generation	P
Aquaculture	P

There are no defined municipal watersheds within the 6th level Salt Cr-Hayfork Cr Watershed, but downstream waters are used for domestic water supplies after treatment.

The Clean Water Act directs States to develop total maximum daily load (TMDL) where water quality is limited. The 2006 listing for California was reviewed for TMDL limited streams in context of the project area boundary and proposed treatment units. The TMDL (http://www.waterboards.ca.gov/tmdl/303d_lists2006approved.html EPA 1998) calls for 30% reductions in sediment load for the SF Trinity and Hayfork Creek, into which the Salt Project Area drains. There are no listed stream segments located within the project boundary.

However, the project area contains some of the headwaters for the South Fork of the Trinity River which is listed (http://www.waterboards.ca.gov/tmdl/303d_lists2006approved.html, http://www.epa.gov/region09/water/tmdl/final.html; Map 3). Beneficial uses in this area are considered to be impacted from sedimentation and water temperatures within the entire SF Trinity River Watershed. Sedimentation rates within Hayfork Creek are considerably lower than that coming from within the gorge areas of the South Fork Trinity River. However the sediment derived in Hayfork Creek is more controllable as it comes from, roads, range, and timber management. Potential sources for temperature increases are water diversions, habitat modification, removal of riparian vegetation, grazing in riparian areas, and stream bank disturbances.

Fecal coliform and pH levels were found to be within acceptable ranges for primary contact recreation waters URS et al., (2000).



Map 3: Locations and relationship of the South Fork, Trinity River, to drainages within the Salt Project Analysis Area

Temperature is variable and location dependent, with stream reaches lower in the watershed tending to have higher water temperatures, which may be due to several factors (URS, et al, 2000). Data was collected in 1995 and 1996 between June and October.

Low water temperatures ranged from 61-64° F during the summer months and daily high water temperatures exceeding 68° F were common during both years when data was collected (URS, 2000).

URS et al., (2000) also indicates that the pH levels have not been impacted by acid mine drainage related to old mining sites.

Municipal Watersheds

There are no defined municipal watersheds within the 6th level Salt Creek Watershed.

Water Quantity

There are no dams or diversions within the project area. Limited stream flow measurements from within the project analysis area show flows from June through August of 1989 ranging from 3 to 7 (cfs) cubic feet per second (URS et al., 2000).

The watershed analysis indicated that minimum flows are comparatively low for a forested watershed. November through January receives the highest mean precipitation for the year with 2.5 to 3.6 inches a month (Custom Climate, 2008). Areas found within the project area between 4,000 to 5,000 feet elevation are susceptible to rain on snow events, especially during December and January. These events occur during wet and warm winter storms which saturate existing snow packs, resulting in greater than normal peak runoff (URS et al, 2000).

Elevation is a dominant predictor for precipitation levels. In this relatively low elevation area precipitation tends to fall as rain and runoff is fairly quick, leaving little for groundwater storage and low flows (URS, 2000). Precipitation is lowest during June, July, and August, resulting in hot and dry summers (Custom Climate, 2008). As a result, there is little recharge to supply low flows during the late summer and early fall.

Stream Channel Conditions

Headwater channels in the 6th level Salt Creek Watershed are classified as Rosgen “A” type channels. These are high energy, low order streams with gradients greater than 10% and sideslopes which can exceed 70%. These channels function largely as transport channels, which transport large woody debris (LWD), fine sediment and organic material to downstream portions of the channel system. Slope instability can occur because of the steep hillside slopes; this is the primary disturbance associated with LWD and sediment delivery into these headwater channels. Where stream channel gradients range from 0.5% to less than 10%, Rosgen “B” channel types dominate. These higher order stream channels are moderately to highly entrenched and sinuosity is typically low to moderate (URS et al., 2000) (see Figure 2 for a typical stream channel).

Figure 2: Typical stream channel in the Salt Project Area

During the past 100 years, channel conditions in the project area were affected by road building, timber harvest, grazing, wildfires, and salvage logging, and mining within riparian areas. These activities are believed to have increased overland flow and sediment loads compared to pre-development conditions. Drainage density is considered to have increased due to associated inside road ditches (URS et al., 2000). However, recent data indicates most stream banks and substrate are stable, channel width-to-depth ratios are within expected ranges and streams are considered to be properly functioning (Ratcliff, 2007).

Riparian Reserves

Within the project analysis area, there are about 381.2 acres of Riparian Reserve. Ditch Gulch-Salt Creek Watershed has an estimated 156.9 acres; the Upper Salt Creek-Hayfork Creek Watershed has an estimated 224.2 acres. As mentioned earlier under “Stream Channel Conditions”, these riparian areas have been impacted by historical placer and hydraulic mining. In addition, historical grazing along Salt Creek and its tributaries resulted in bank trampling and a loss of riparian vegetation (URS et al., 2000). However, currently these Riparian Reserves are generally densely vegetated, intact, and considered to be functioning properly (Ratcliff, 2007).

Water Rights

There are three springs in the project area. A review of the eWRIMS database indicates water rights are held by the Shasta Trinity N.F(http://www.swrcb.ca.gov/ewrims/). Additional information on the land management uses associated with these springs was not available at the time this report was written.

Wetlands

A review of the National Wetlands Inventory database is incomplete for this area; however, the data that was available did not show any wetlands.

Floodplains

Due to the nature of the stream channel types within the project area, floodplain development is limited. Those that are present are generally well connected to their streams and are functioning (Ratcliff, 2007).

Desired Condition

The 1995 Shasta-Trinity Land and Resource Management Plan states that the desired future condition (DFC) is embodied in the Forest goals and objectives. Additional direction for the DFC is stated in management area direction.

DFC for the Hayfork AMA is for maintaining and enhancing late-successional and old-growth forests and aquatic ecosystems within the Late-Successional and Riparian Reserve systems in over half of the areas. Additional acres are managed for late-successional status within the lands designated as AMA.

DFC’s in the Indian Valley/Rattlesnake MA are for late-successional and Riparian Reserves, key watersheds, and unroaded recreation again in over half of the MA. Late-Successional Reserves are to be managed to maintain the health and diversity components through the use of prescribed fire and thinning from below.

DFC’s in key watersheds are to restore and protect watershed health and water quality, especially for anadromous fish habitat. DFC’s are expected to be achieved through watershed restoration, road maintenance, fish habitat improvement and road obliteration.

Project Design Features, Mitigation and Monitoring

This section includes details on project design features, mitigation, and subsequent project monitoring. Project design features are BMPs and other measures incorporated during project design to prevent or substantially minimize resource issues.

Project Design Features and Mitigation

Project Design Features, including BMPs, site-specific mitigations, and Forest Plan Standards and Guidelines, are incorporated into the action alternatives of this project to ensure compliance with Section 208 of the Clean Water Act, the Porter-Cologne Water Quality Control Act, the North Coast Regional Water Quality Control Board's Basin Plan, as well as to met the intent of the North Coast Regional Board Silvicultural Waiver Order No. R1-20044-00015.

Forest Service Soil and Water Conservation Practices, or BMPs, are designed to protect and restore watershed resources (USDA Forest Service, 1990). BMPs are certified by the State Water Quality Resources Control Board and approved by the Environmental Protection Agency (EPA) as the most effective way to protect water quality from impacts stemming from nonpoint sources of pollution. BMP effectiveness is evaluated through the use of the R5 BMPEP Program, which has been on-going since 1990. Shasta Trinity National Forest's random BMP evaluations over the last 18 years indicate that BMP measures have been **effective 86**% of the time.

Additional research, monitoring, and modification of BMPs ensure the measures are effective (Burroughs and King, 1985; Burroughs and King, 1989; Burroughs, 1990; Seyedbagheri, 1996; Schuler and Briggs, 2000; USDA Forest Service, 2002; and Briggs, 2000).

The following BMPs and other measures, derived from timber sale "B" and "C" clauses, comprise the Design Features for this project. By incorporating these measures, substantial conflicts with hydrologic resources would be avoided, and potential impacts either eliminated or mitigated so that effects are within acceptable levels. Where appropriate, the corresponding timber sale "B" or "C" clause is referenced, creating a bridge to the timber sale contract that would be generated with project implementation. These BMPs, and other measures, are detailed in Appendix B.

Monitoring

Implementation monitoring of Project Design Features and BMPs is completed by project administrators. BMP monitoring that includes both implementation and effectiveness is conducted and reported on annually by forest staff. This monitoring is used to determine how well the recommended design feature, mitigation measure, or BMP worked (Mai, 2008b).

Environmental Consequences

Analysis of Direct and Indirect Effects

Table 8 summarizes the differences between the two action alternatives, Alternatives 2 and 3. Tables 9-12 summarize and display data related to the three alternatives

Table 8: Comparison of action alternatives, Alternative 2 and 3

Timber Stand Activity	Alt. 1	Alt. 2	Alt. 3	Difference between 2 & 3
Proposed Vegetation Treatments (acres)				
Intermediate Thinning*	0	963	850[1]	113
Shelterwood – Green Tree Retention	0	31	30	1
Shaded Fuel Break Thin*	0	103	100	3
Regeneration Harvest Green Tree Retention	0	27	0	27
Hand Fuel Treatment*	0	14	14	0
Precommercial Thin	0	481	421	60
Total Proposed Treatments (acres)	**0**	**1,619**	**1,415**	204
Yarding Systems (acres)				
Tractor Yarding	0	986	867	119
Helicopter Yarding	0	138	113	25
Sub-merchantable Fuel Treatment				
Treat on Site	0	1,306	1,158	148
Tractor Site Prep and Burn Piles	0	58	30	28
Handpile, Burn Piles	0	152	127	25
Tractor Jackpot Pile and Burn Piles	0	103	100	3
Tree Planting	0	27	0	27
Landings Constructed (and existing landings used)	0	38 (19)	9 (11)	29 (8)
Temporary Road Constructed (miles)	0	0.3	0	0.3
Road constructed (miles)	0	0	0	0
Roads reconstructed (miles)	0	17.1	17.1	0
Miles of road maintained	0	5.0	5.0	0
Miles of unclassified road decommissioned	0	9.5	9.5	0
Miles of classified road decommissioned	0	4.3	4.3	0
Total Miles of Decommissioned road	0	13.8	13.8	0

[1] A change was made to Alternative 3 after the watershed modeling was completed that reduced Intermediate thinning by 31 acres (was 881 acres, now 850 acres are planned in Alternative 3). This reduction is small enough that it would not significantly change the assessment for Alternative 3 or the comparison of potential effects with Alternative 2.

Table 9: Comparison of road densities by alternative by 7th level watershed

Alternative 1-No Action					
	Ditch Gulch-Salt Creek	**Lower Salt Creek-Hayfork**	**Philpot Creek**	**Salt Gulch-Salt Creek**	**Upper Salt Creek-Hayfork Creek**
Existing Road Density (mi/mi^2)	6.6	3.4	5.3	2.6	3.9
Miles of Existing Road to Be Decommissioned (Both System and Unclassified)	0	0	0	0	0
Miles of New Temporary Roads To be Constructed	0	0	0	0	0
Miles of Temporary Road to be Decommissioned	0	0	0	0	0
Project Road Density after Project Completion	6.6	3.4	5.3	2.6	3.9
Miles of Road Reconstruction	0	0	0	0	0
Alternative 2-Proposed Action					
Existing Road Density (mi/mi^2)	6.6	3.4	5.3	2.6	3.9
Miles of Existing Road to Be Decommissioned System/Unclassified (Total)	3.3/6.5 (9.8)	0	0	0	1.0/3.0 (4.0)
Miles of New Temporary Roads To be Constructed	0.3	0	0	0	0
Miles of Temporary Road to be Decommissioned	0.3	0	0	0	0
Project Road Density after Project Completion	5.4	3.4	5.3	2.6	3.6
Miles of Road Reconstruction	10.9	6.2	0	0	0
Alternative 3					
Existing Road Density (mi/mi^2)	6.6	3.4	5.3	2.6	3.9
Miles of Existing Road to Be Decommissioned System/Unclassified (Total)	3.3/6.5 (9.8)	0	0	0	1.0/3.0 (4.0)
Miles of New Temporary Roads To be Constructed	0	0	0	0	0
Miles of Temporary Road to be Decommissioned	0	0	0	0	0
Project Road Density after Project Completion	5.4	3.4	5.3	2.6	3.6
Miles of Road Reconstruction	10.9	6.2	0	0	0

Table 10: Road densities within 300 feet of streams

	Ditch Gulch-Salt Creek	Lower Salt Creek-Hayfork	Philpot Creek	Salt Gulch-Salt Creek	Upper Salt Creek-Hayfork Creek
Existing Road Density (mi/mi^2)	6.0	3.3	4.1	2.9	2.5
Post-Project Road Density (mi/mi^2)	4.9	3.3	4.1	2.9	2.3

Table 11: Road densities within Riparian Reserves

	Ditch Gulch-Salt Creek	Lower Salt Creek-Hayfork	Philpot Creek	Salt Gulch-Salt Creek	Upper Salt Creek-Hayfork Creek
Existing Road Density (mi/mi^2)	6.2	2.4	3.9	5.7	2.4
Post-Project Road Density (mi/mi^2)	5.0	2.4	3.9	5.7	2.3

Table 12: Estimates of total erosion rates by soil family, by alternative, as determined by WEPP modeling

Alternative 2			
Soil (Name/Soil#)	**Number of Acres of Soil Family within Proposed Treatment Units***	**Alternative 2 (average tons/acre)**	**Total Estimated Erosion Rate by Soil Family (tons/acre)**
Beaughton Family (#13)	125	0.2	25.0
Holland Family (#'s 106 and 107)	202	0.3	61.0
Marpa Family (#182)	175	0.5	87.5
Neuns Family (#206)	172	1.4	241.0
Neuns Family, Deep (#227)	244	0.2	49.0
Alternative Estimated Average (tons/acre) (441 tons/1, 619 acres)			**0.3**
Alternative 3			
Beaughton Family (#13)	117	0.2	23.4
Holland Family (#'s 106 and 107)	179	0.3	54
Marpa Family (#182)	141	0.3	42
Neuns Family (#206)	159	1.0	159
Neuns Family, Deep (#227)	196	0.2	39
Alternative Estimated Average (tons/acre) (317 tons/1,415 acres)			**0.2**

*Rounded to nearest whole number

Alternative 1 – No Action

Direct and Indirect Effects

Under the no-action alternative, no timber harvest or fuel reduction activity would occur. There would be no road construction, maintenance, reconstruction or road closures. Existing conditions in the watersheds associated with this project would continue including present conditions for water quality, water quantity, riparian areas, floodplain and flood-prone area function, and stream channels. As a result, there would be no change to existing levels of direct or indirect impacts under this alternative.

Alternative 2 – Proposed Action

This alternative was designed to improve forest health and resiliency and reduce hazardous fuel conditions to reduce the potential for adverse effects related to wildfire, and decommission roads not needed for future management. This alternative proposes to treat 1,124 acres via tractor and helicopter yarding. Twenty-four landings would be constructed and 22 existing landings used. About 0.3 miles of temporary road would be constructed, 13.8 miles of road would be decommissioned, and 5.0 miles of road would be maintained (Tables 8, 9).

Direct and Indirect Effects

Watershed Condition

Potential impacts and consequences to overall watershed health are briefly discussed below. Detailed discussions on potential impacts and associated mitigations related to the proposed action follow in subsequent sections.

Road-related activities and timber harvest would have short-term impacts to overall watershed condition. Ground disturbance associated with road reconstruction and decommissioning would result in increased potential sediment generation where these activities involve stream channels. Upland disturbance would occur with timber harvest, mechanical piling and jackpot burning. However, there would be minimal increases in vegetation-related upland sediment sources due to the implementation of BMPs, project-specific resource protection measures, and project-specific riparian restrictions.

Vegetation treatments would also occur in Riparian Reserves, associated with intermittent and ephemeral streams, to reduce stocking density, which is suppressing the growth, vigor and resiliency of riparian trees. BMPs would be implemented, as required, for preventing, or mitigating impacts to hydrologically-related resources.

Overall and long-term watershed condition would be expected to improve. Vegetation treatments would reduce the potential for hazardous fuel conditions and adverse impacts to hydrologic conditions within the watershed. Depending on wildfire severity, hydrologic resources can be substantially affected when severity is high. This occurs through the loss of vegetation, the development of hydrophobic soils, and increased surface runoff and sedimentation, which can lead to alteration of channel morphology, aquatic habitat, and water quality. Thinning in the Riparian Reserves would improve overall reserve health.

Closing roads would reduce overall road densities. Road densities would be reduced in the 7th level Ditch Gulch-Salt Gulch and Upper Salt Creek-Hayfork Creek Watersheds, as would the road densities calculated for Riparian Reserves and road densities within 300 feet of streams

(Tables 8. 9 and 10). Such reductions would reduce road-related amounts of surface runoff and erosion entering stream channel systems. Closures of roads would include U29N55A, U29N31EA and U29N31E, which are rutted and gullied.

Implementation of Alternative 2 would result in improved overall watershed condition.

Sediment and Water Quality

Potential effects to water quality would be increased sediment generation associated with vegetation treatments, skid trail and landing construction and use, temporary road construction, road reconstruction, and decommissioning.

To evaluate potential sediment generation "Disturbed WEPP" and "WEPP: Roads" were used to evaluate and conduct a relative comparison between the two proposed action alternatives. Disturbed WEPP modeling was used in both action alternatives to assess the potential for upland sediment generation due to ground disturbance caused by proposed vegetation treatments. WEPP: Road was then used to evaluate potential sediment generation caused by temporary road construction and proposed decommissioning. Major soils in the project area were modeled for potential sediment generation and an average annual value for each soil type was then determined. Subsequently, an overall average for tons per acre of sediment for Alternative 2 was determined, based on all the soils analyzed. Assumptions used in running WEPP are found in the project file, under "Salt WEPP Modeling Process and Assumptions".

WEPP modeling indicates that on the average, there is the potential for 0.3 tons per acre per year of sediment, caused by timber harvest would be generated and delivered to streams under this alternative, compared to 0.2 tons per acre for Alternative 3 (Table 12). However, this number is a "maximum potential situation" and would not be expected to occur, or reach streams, for several reasons.

In conducting WEPP modeling runs were done where slopes were steep and adjacent to streams. As discussed above, an average annual value was then determined for each soil type. Obviously, not all of the acres for a given soil type are adjacent to a stream drainage. In addition, WEPP modeling requires a vegetation calibration run to ensure that the final desired vegetative cover is actually used in calculating erosion rates and sediment output. A final calibration value of 75% was not obtainable in this project area even when the value of 100% cover was entered into the data field. Typical calibration results, with a value of 100% entered into the data field, were generally 20 to 30% less. Consequently the results for potential average annual amounts for erosion and sediment generation, that could reach a stream channel, have been over estimated (Table 12).

When WEPP modeling is conducted the estimated output results also do not account for BMPs being incorporated into a project's design and their implementation on the ground. As discussed under the "Project Design and Features and Mitigation" section, BMP measures have been shown to be 86% effective on the average. This includes the use of "buffer strips" which act as sediment filters adjacent to stream. It should be noted that field observations by Hermandorfer, in the fall of 2007, showed a very well established and consistent groundcover, with no evidence of sediment transport through the groundcover, to streams.

Based on these factors, it is expected that the potential average annual amount of sediment available for reaching drainages, within the project area, would be substantially less than predicted by WEPP. Combined with the application of BMPs and buffer strips, which have been proven effective, it is anticipated that no measurable increases, in the amount of sediment

entering a stream, would occur. As a result, no exacerbation to the TMDL limited stream segment on the South Fork of the Trinity River would be expected.

In addition, project-specific riparian restrictions have been developed. No thinning would occur in Riparian Reserves associated with perennial streams; in intermittent and ephemeral streams there would be equipment exclusion zones of 50 and 25 feet, respectively. No treatments would occur in these zones, adding additional sediment filtering capabilities.

Also, the amount of 0.3 tons per acre per year would steadily decline in the years following harvest. As a result, there would be no measurable increases in sediment load associated with vegetation treatment under the proposed action

Table 13: Potential effects of Alternatives 2 and 3 on sedimentation and stream crossings

Action	Alternative 2 Tons Annually	Alternative 3 Tons Annually
Harvest Activities (i.e., skidding, landings)	+ 0.3**	+0.2**
Temporary Road Construction	+ 1.6 (Range of 0.8 – 2.4)	0
Road Decommissioning	- 45.9 (Range of 22.9 – 68.9)	- 45.9 (Range of 22.9 – 68.9)
Number of Road/Stream Crossings	- 27 crossings	- 27 crossings

** The difference between 0.3 tons and 0.2 tons would not be a detectable or measurable difference in the field

Roads intercept both surface and ground water, and waters running down and off road surfaces can enter directly into a creek or through associated road ditches emptying into streams. These factors can result in increased sediment delivery to streams as well as higher peak flows and accelerated timing of peak flows (Nelson, 2002).These alterations to a channel's flow volume can also lead to alterations in channel morphology and aquatic habitat. Increased sediment loads can alter sediment-related water quality analytes such as turbidity, suspended sediment, and bed load, and they too can also modify aquatic habitat. Roads also result in lower infiltration rates after rainfall and can affect groundwater flow when they are located near springs.

Accurately monitoring and estimating the amount of sediment delivery is very difficult due to the large number of variables involved. To estimate the amount of sediment generation associated with roads in this project WEPP: Roads was used and three units of measure, focusing on road density, were used to help evaluate potential impacts related to the proposed action. Effects to the affected environment, particularly potential sediment sources, will also be discussed. Units of measure for roads are overall road density, road density within 300 feet of stream, and road density within Riparian Reserves.

A distance of 300 feet was selected to ensure that the effect of all potential runoff was evaluated (Burroughs and King, 1989; Nelson, 2002). Road densities within 300 feet of streams, and within that of project area Riparian Reserves, are especially important, because they are the single largest source and delivery system of sediment to channels (USDA Forest Service, 1996a). Road density (miles of road/square mile) within 300 feet of streams provides a relative measure of road-stream interaction and the relative risk for increased flows and sediment input into the

hydrologic system (Boroughs and King, 1989). It also allows comparison between watersheds within the project area. Areas with higher road densities within 300 feet of streams are at greater risk for modification of flow and sediment loading.

The proposed action would construct four temporary roads totaling 0.3 miles. None of the proposed temporary roads involve Riparian Reserve areas or areas delineated as an “active” feature in GIS, denoting unstable or landslide prone areas.

In the Upper Salt Creek-Hayfork Creek Watershed the existing road density is approximately 2.5 miles/square mile. Alternative 2 proposes to decommission 13.8 miles of road and reconstruct an additional 17.1 miles (Table8). A decommissioned road is defined as one that has been removed from the Forest Service transportation system after it was effectively closed. Decommissioning includes culvert removal, ripping road surfaces and/or tank trapping, as well as other measures needed to meet site-specific conditions. All measures have the goal to control surface runoff, erosion, and mass failure (USDA Forest Service, 2007). Reconstruction is defined as “an improvement required due to an anticipated increase in traffic, service level, or haul capacity. Reconstruction activities may include culvert upgrades, grading, rocking, paving, and draining (USDA Forest Service, 2007).

During road decommissioning and reconstruction, short-term impacts to sediment would be expected due to ground disturbance where culvert upgrades, grading, rocking paving and/or draining occur. WEPP road modeling also indicated a potential increase in sediment associated with the construction of temporary roads.

None of the proposed temporary roads are directly associated with streams, wetlands, or riparian areas. BMPs and project design features would be implemented during the construction and use of these temporary roads.

Although there would be short-term increases in sediment associated with reconstruction and decommissioning, WEPP: Road modeling indicated that for either Alternative 2 or 3 there would be an overall reduction in sediment and surface runoff to associated stream drainages (Tables 10, 11, 13). This model, however, was not used to estimate potential sediment volume for road reconstruction, as it is not designed for that purpose.

The ground disturbance following road reconstruction and decommissioning would increase the potential for impacting water quality. Increased sediment loads can alter sediment-related water quality analytes such as turbidity, suspended sediment, and bed load; and they too can modify aquatic habitat. Since there is a potential for increased sediment and impacts to water quality, BMPs, project-specific resource protection measures, and project-specific riparian restrictions would be implemented. These measures have been proven effective in maintaining water quality and protecting beneficial uses, and are in conformance with water quality objectives delineated in the NCRWQCB basin plan (see Appendix B; Project Design Features and Mitigation section). Although localized increases in sediment-related water quality analytes may occur, exceedances of water quality criteria are not expected due to the implementation of BMPs and associated measures.

Roads also result in lower infiltration rates after rainfall and can affect groundwater flow when located near springs. Decommissioning would be expected to improve infiltration rates locally. No direct or indirect effects to springs would be expected.

Although there would be short-term increases in sediment generation, in the long term, reconstruction and decommissioning would lower the amount of road-related sediment entering

the hydrologic system. Alternative 2 proposes that 9.5 miles of unclassified road and 4.3 miles of classified road would be decommissioned under this alternative (for a total of 13.8 miles) (Table 8).

WEPP road modeling estimated that decommissioning would reduce sediment input into the project area hydrologic system by 22.9 to 68.9 tons annually, with an annual average of 45.9 tons (Table 11). In addition, decommissioning would also reduce the number of stream crossings by roads. In the Ditch Gulch-Salt Creek Watershed 20 stream crossings would be eliminated; in the Upper Salt Creek-Hayfork Creek Watershed, 7 stream crossings would be eliminated (Table 13).

Decommissioning would reduce overall road densities in the Ditch Gulch-Salt Creek Watershed from 6.6 to 5.4 miles/square mile. In the Upper Salt Creek-Hayfork Creek Watershed, overall road density would be reduced from 3.9 to 3.6 miles/square mile (Table 9). Preliminary GIS analysis determined that existing road densities within 300 feet of streams in the project area is 6.0 miles/square mile in the Dutch Gulch-Salt Creek Watershed and 2.5 miles/square mile in the Upper Salt Creek-Hayfork Creek Watershed (Table 10). After project completion and implementation of road decommissioning, road densities within 300 feet of streams would drop to 4.9 and 2.3 miles/square mile, respectively, for each watershed, reducing the amount of sediment available to drainage networks within the project area (Table 10). As a result, water quality would be improved.

Short-term increases in sediment load are not expected to exacerbate conditions in the TMDL limited segment of the South Fork of the Trinity River. Sediment increases are expected to be within the natural range of variability due to the implementation of BMPs and project design features. Such a minimal increase would not be reflected in the limited stream segment, which is over 9 miles downstream of the northern margin of the project area boundary. Overall, sediment input into project area stream channels would be expected to be reduced, thereby improving water quality.

Municipal Watersheds

There are no municipal watersheds within the project area; therefore there would be no direct or indirect effects.

Water Quantity

Natural flow in a wildland watershed can be impacted by anthropogenic activity, including timber harvest and road building. Although any disturbance that reduces the density of live vegetation cover will locally increase runoff from forested watersheds, flow increases are generally not measurable until about 25 percent of the basal area of a forested watershed has been harvested (this viewpoint is supported by Grant et al., 2008 and Ziemer, 1986).

Alternative 2 proposes to treat less than 1% of the area in both the Ditch Gulch-Salt Creek and Upper Salt Creek-Hayfork Watersheds. As a result, no measurable increases in water yield would be expected.

Stream Channel Conditions

Streams represent systems that are complex and dynamic. The channel morphology, including streambed and streambank stability, reflects the existing balance between streamflow, sediment input, and substrate/bank composition. If one of these components varies, then there is a corresponding change results in the other two. As a result, changes in channel morphology (shape), stability, and changes in the streambed or streambank are often seen, especially over

time. Increases in peak flow increases the energy available for sediment transport and bank erosion.

Increases in sediment input result in a decrease of energy available for erosion, deposition of sediment, channel widening, and a decrease in bankfull depth. These changes in turn can potentially result in modifications to water quality and aquatic habitat.

No significant changes in flow volume, or alteration to timing of peak flows are expected related to timber harvest due to the small percentage of the watershed being treated.

BMPs and resource protection measures are incorporated into designing Alternative 2 to protect soil and water resources. Soil mitigation measures minimize impacts to soil hydrology and nutrient cycling. They also protect soil stability and prevent or limit any sediment increases related to uplands. Hydrologically related BMPs and resource protection measures were also selected and designed to prevent, or limit upland sediment introduction into streams (refer to Appendices A and B for details to these protective measures).

Included in these protection measures are project-specific riparian restrictions, which are essentially buffer strip requirements. On perennial streams with fish, the minimum Riparian Reserve width would be 300 feet and there would be no thinning in these areas. For perennial streams without fish, the minimum Riparian Reserve width would be 225 feet, and there would be no thinning in these areas. These areas would effectively function as sediment filter strips, preventing sediment introduction into the streams. Research by Burroughs and King (1989) and Burroughs (1990) supports this conclusion (refer to the Project Design Features and Mitigation section). As result, no measurable amounts of additional sediment would be expected to enter these stream channels, and no measurable change to channel morphology would be expected.

Adjacent to intermittent and ephemeral streams there would be up to a 50 foot equipment exclusion zone (EEZ) where no treatments would occur. The EEZ would also function as a sediment filter or buffer. However, on both intermittent and ephemeral streams between the edges of the equipment exclusion zone at 50 feet out to 150 feet, both thinning and mechanical treatments would be allowed. Measurable increases in sediment contribution to these streams would not be expected due to the combination of the EEZ and BMP and project design effectiveness. As a result, implementation of this alternative would result in no changes to bank integrity or composition, as would be the case for the buffers associated with perennial streams.

Road decommissioning would consist of removing culverts, ripping road surfaces, and out-sloping the roads to control surface runoff, minimize and or prevent erosion and mass failure. Roads would be seeded as needed, further reducing sources of additional water quantity and sediment.

WEPP modeling estimated that the four new temporary roads would generate between 0.8 to 2.4 tons of sediment annually (1.6 tons average) over the project life of 3 to 4 years (Table 13). This amount was calculated without considering BMPs and project resource protection measures; hence, it is anticipated that the actual amount of sediment generated annually during the project would be less when BMPs and project resource protection measures are implemented. None of the proposed temporary roads are within a Riparian Reserve or cross a stream channel. After decommissioning, the proposed temporary roads would no longer be a source of potential sediment source.

WEPP modeling indicated that by decommissioning both the classified and unclassified roads, road-related sediment would be decreased by 45.9 tons annually. Under the worse-case scenario, the subtraction of 2.4 tons from 45.9 tons would still be a net reduction of road-related sediment potentially entering drainages in the project area.

With the decommissioning of roads under this alternative, potential increases in water flow, due to road-related runoff, would also be reduced. This is especially important on unclassified roads that have not been designed to control surface runoff and erosion.

Two of the unclassified roads proposed for decommissioning under this proposed action were observed to be actively eroding (see page 9, this report). Along with the other roads proposed for decommissioning (see Chapter 2 of the EIS), these problem roads (U29N55A and U29N31E) would be decommissioned under this alternative. Decommissioning of the 13.8 miles of both classified and unclassified roads under Alternative 2 would be expected to improve stream channel conditions, because road-related sediment and surface runoff would be removed.

Hand piling and burning are proposed within Riparian Reserves associated with intermittent and ephemeral streams, but outside of EEZs. No measurable increases in sediment to adjacent streams would be expected in connection with this action. Resource protection measures require that piles be burned so that at least 50% of the localize area remains unburned at any given time. Hand piles would also be placed in a checkerboard pattern where possible, preventing piles from merging as they burn. This would also ensure an adequate vegetation cover surrounding a burn area, which would act as a sediment filter. Pile burning would take place when air temperatures are cool and soils moist to limit burn severity and sediment generation.

Riparian Reserves

Alternative 2 proposes to thin 41 acres of dense vegetation in the portion of ephemeral and intermittent Riparian Reserves furthest away from the steam course. Selective commercial thinning would be accomplished through a combination of mechanical operations and hand thinning. This treatment is proposed to reduce the number of trees competing for limited water, sunlight, and nutrients in Riparian Reserve areas and improve the condition of desired riparian vegetation and composition. Such thinning would also improve the resistance of these areas to fire hazards.

Ground disturbance and sediment generation would occur with mechanical harvest using tractors. Hand thinning would have less ground disturbance than mechanical methods. Although short-term disturbance would be expected, treatment would be expected to improve Riparian Reserve vegetation health and vigor. Implementation of BMPs and project resource protection measures would be expected to result in non-measurable increases in potential sediment generation. Implementations of EEZs are expected to provide sediment filter strips which would prevent any measurable sediment increases entering a given drainage.

Project resource protection measures state that prescribed fire ignitions would not be set within Riparian Reserves, but would be allowed to back burn into these areas. As stated above under “Stream Channel Conditions” burning would take place under cool and moist conditions, minimizing burn intensity to soils and the potential for sediment generation. No activities will occur in the area of known springs, and therefore there will be no direct effect to them.

Wetlands

There are no wetlands within the proposed project area; hence, there would be no direct or indirect effects under this alternative.

Floodplains

Floodplain development within the project area is limited. Implementation of project-specific riparian restrictions, BMPs, and project resource protection measures, would be expected to protect any of the very limited floodplain development within the project area. Hence, there would be no direct or indirect effects to floodplains under this alternative.

Alternative 3

From a hydrology perspective, Alternative 3 differs from Alternative 2 in two ways: a total of 60 acres in pre-commercial thinning and 41 acres in other thinning units would not be thinned in Riparian Reserves associated with intermittent and ephemeral streams, and no temporary roads would be constructed. A total of 17.1 miles of road would be reconstructed and 9.5 miles of unclassified road and 4.3 miles of classified road would be decommissioned (totaling 13.8 miles, the same as in Alternative 2)(Table 8). Alternative 3 was developed to address concerns that thinning within Riparian Reserves may have unintended effects on the watershed, fisheries, and wildlife.

Watershed Condition

Short-term impacts to overall watershed condition would be the same as in Alternative 2, with the following exceptions:

1. Under Alternative 3 no temporary roads would be constructed. Consequently, the 1.6 tons of sediment (estimated by WEPP) caused by temporary road construction, would not be generated.

2. Upland disturbances from timber harvesting would also occur; however, potential impacts would be slightly less as 204 fewer acres are proposed for treatment. This difference totals 4.0 % of the project area, and modeling shows only a 0.1 difference in tons of sediment annually produced. As a result, any potential difference in effects between alternatives would be un-measurable.

3. No treatments would occur within Riparian Reserves associated with intermittent and ephemeral streams. Under this alternative there would be no treatment within the entire width of a Riparian Reserve area. As a result, the existing potential for increased wildfire severity would remain. Any impacts to the Riparian Reserve due to wildfire would be expected to be greater than under Alternative 2, because under Alternative 2, BMPs and project specific resource protection measures would both be implemented, and these measures are expected to be effective in preventing or limiting any impacts, to acceptable levels.

Sediment and Water Quality

Potential impacts to sediment and water quality would be the same as under Alternative 2, although the magnitude would be slightly lower.

As with Alternative 2, Disturbed WEPP modeling was used to estimate the potential amount of sediment Alternative 3 would generate. WEPP modeling, using the same assumptions as

Alternative 2, predicted 0.2 tons per acre per year (Table 12). As discussed on pg. 27, the actual amount generated is expected to be considerably less.

This 0.1 ton per acre per year difference in sediment generation would not be measurable under field conditions, so essentially there is no difference between alternatives in terms of potential upland sediment generation. BMPs and project specific resource protection measures would be implemented as under Alternative 2, and the same effectiveness is assumed.

With a negligible difference in sediment generation, and the application of the mitigative measures, there would likely be no discernable difference in the level of potential impacts between alternatives.

There is only one difference between Alternatives 2 and 3 regarding road-related potential sediment sources. No temporary roads are proposed for construction under Alternative 3 (Tables 8, 9). Under Alternative 2 WEPP: Road modeling estimated that 0.8-2.4 tons, with an average of 1.6 tons of sediment would be produced annually in association with the proposed temporary roads (Table 12)

Since no roads are proposed for construction under Alternative 3, there would be no short-term increases in potential sediment sources caused by temporary road construction. However, there would be short-term increases in potential sediment generation associated with the 17.1 miles of road reconstruction and the 13.8 miles of proposed road decommissioning. Potential effects would be associated with ground disturbance when culverts are replaced or put in and grading occurs, etc. As discussed under Alternative 2, WEPP road is not used to estimate potential sediment outputs in a reconstruction scenario; however, these effects would be expected to be short term as the associated activity is limited in time duration.

The amount of unclassified and classified road would be the same as in Alternative 2: 9.5 miles of unclassified road and 4.3 miles of classified road (totaling 13.8 miles)(Tables 8, 9). As with Alternative 2, there would be short-term increases in potential sediment generation as culverts are pulled, road surfaces ripped, and tank traps installed, etc. However, these effects are expected to be limited and of short duration as disturbed surfaces recover after road are decommissioned. The implementation of BMPs and project specific resource protection measures would also limit or prevent any effects. Long-term decreases in sedimentation would also be the same for both alternatives (22.9 to 68.9 tons annually) because the proposed amount of decommissioned road is the same (Table 13).

The number of stream crossings would also be reduced by 27, as in Alternative 2 (Table 13). The same mitigative measures would be applied as in Alternative 2. Potential effects and mitigation measures would be the same as discussed in Alternative 2 (refer to Alternative 2 discussion for sediment and water quality and to the Project Design Features and Mitigation section).

Reductions in overall road density, road densities within 300 feet of streams, and road densities within Riparian Reserve areas would all be the same for the Ditch Gulch-Salt Creek and Upper Salt Creek-Hayfork Creek Watersheds (Tables 4–6).

Alternative 3 is also not expected to exacerbate the TMDL limited stream segment of the South Fork of the Trinity River, for the same reasons as under Alternative 2 (refer to page 29 of this report for the relevant discussion).

Municipal Watersheds

As under Alternative 2, there are no municipal watersheds within the project area; therefore there would be no direct or indirect effects.

Water Quantity

Alternative 3, like Alternative 2, proposes to treat less than 1% of the total area in both the Ditch Gulch-Salt Creek and Upper Salt Creek-Hayfork Watersheds. As a result, no measurable increases in water yield are expected.

Stream Channel Conditions

Alternative 3 is the same as Alternative 2, with no significant changes in flow volume or alteration to timing of peak flows expected related to timber harvest, due to the small percentage of the watershed being treated.

Potential effects to stream channel condition related to potential increases in road-related sediment and bedload would be slightly different between Alternatives 2 and 3. Under Alternative 3, no temporary road construction is proposed, but the amount of proposed reconstruction and decommissioning are the same (Table 9).

WEPP road modeling estimated that somewhere between 0.8 and 2.4 tons of sediment would be produced annually in association with the temporary roads. However, none of the temporary roads proposed under Alternative 2 would be located within Riparian Reserves and no new stream crossings would occur. Therefore, no influence on stream channel condition would be expected. As a result, the potential effects are the same between alternatives, though for different reasons.

The amount of road to be reconstructed and decommissioned is the same under Alternatives 2 and 3; hence, potential impacts are the same as Alternative 2. The same BMPs, project-specific resource protection measures, and site-specific riparian restrictions would be implemented under Alternative 3 as in Alternative 2. Consequently, no difference in the type and magnitude of effects is expected between alternatives. The same expectations for the effectiveness of BMPs, and other mitigation measures, are expected under Alternative 3. Alternative 3 would also be expected to result in improved stream channel condition as discussed in Alternative 2. Please refer to the corresponding section under Alternative 2 for the complete discussion of potential impacts, mitigations, and consequences.

Alternative 3 proposes 28 acres less of tractor site preparation and burn piles, 25 acres less of hand piling and burn piles, and 3 acres less of jackpot piling and burning of piles (Table 8). The differences in the amount of acreage treated are minimal between the two alternatives in terms of potential sediment generation. In addition, the same BMPs, project-specific resource protection measures and riparian restrictions would be in place for Alternative 3 as in Alternative 2. Consequently, no contributions of sediment related to these activities would be expected to channel morphology or aquatic habitat.

Riparian Reserves

Alternative 3 does not propose thinning in Riparian Reserves. No ground disturbance would be associated with tractor mechanical treatments, and there would be no disturbance associated with hand treatments. However, as discussed under Alternative 2, BMPs and project-specific resource protection measures would be implemented for that alternative. Given documented BMP effectiveness it would be assumed that any increased influence to associated drainages would be

within natural ranges of variability. As a result, no discernable difference between alternatives would be expected.

However, if treatments are not implemented stocking levels of vegetation would remain elevated. Existing lower levels of resistance to drought, insect attacks, and elevated susceptibility to fire would remain. Since it is impossible to predict fire severity at this time, the degree to which Riparian Reserves would be affected is unknown. The effects of a wildfire in the Riparian Reserves most certainly would be greater than effects discussed for Riparian Reserves under Alternative 2. After wildfire ground cover and canopy cover would be lost, resulting in much larger areas of exposed soil, thereby substantially increasing sediment.

Increased potential erosion could be transported into associated stream channels via surface runoff and overland flow. Degraded water quality conditions, increased water quantity, and alterations to stream channel morphology and aquatic habitat would be likely to occur after wildfire.

No activities will occur in the area of known springs and therefore there would be no direct effect to them.

Wetlands

Alternative 3 is the same as Alternative 2; there are no wetlands within the proposed project area; hence, there would be no direct or indirect effects under this alternative.

Floodplains

Alternative 3 is the same as Alternative 2; floodplain development within the project area is limited. Implementation of project-specific riparian restrictions, BMPs, and project resource protection measures would be expected to protect any of the very limited floodplain development within the project area. Hence, no direct or indirect effects to floodplains would be expected under this alternative.

Cumulative Effects

Overview

The cumulative effects boundary for this proposed project was based on two factors: the location of project activities and the use of the Equivalent Roaded Acres (ERA) model for analyzing potential cumulative effects. Project activities are proposed only in the Upper Salt Creek-Hayfork Creek and Ditch Gulch-Salt Gulch 7th level watersheds. The protocol direction for the model directs that analysis be conducted on 3,000 to 6,000 acres, which translates to the 7th level watershed size. As a result, the ERA model for cumulative effects was run only on the 7th level Upper Salt Creek-Hayfork Creek and Ditch Gulch-Salt Gulch Watersheds. No activities related to this project for either Alternative 2 or 3, are proposed in any other 7th level watersheds.

A key assumption for the ERA model was that all harvest would occur in 2009 with effects first realized in 2010. This was done because differing treatment types have differing coefficients, which relate to treatment type and the amount of associated ground disturbance. Since it was not possible to determine what treatments were going to happen when, and in what watershed, the decision was made to assume that all treatments would occur in the first year of project implementation. However, there is very little chance that this would occur. As a result of these assumptions it must be clear that the results documented in Table 14 represent a worse case scenario which has very little chance of occurring.

Past activities in both the 7th level Upper Salt Creek-Hayfork Creek and Ditch Gulch-Salt Gulch Watersheds include timber harvest (hazardous fuels reductions, clear cuts, salvage and thinning), grazing, transmission lines, pipelines, and fire.

Table 14: Equivalent roaded acres (ERA) for existing conditions and by alternative

7th Field Watershed	Total Acres	Existing ERA Acres	Existing ERA Percent (%)	Existing Percentage of TOC (%)	WCC
Upper Salt Creek- Hayfork Creek	9, 760	236.6	2.4	17	I
Ditch Gulch – Salt Gulch	5,077	191.1	3.8	27	I
Alternative 2 Proposed Action					
	Year	**# of Calculated ERA Acres**	**Calculated ERA Percent (%)**	**Calculated Percentage of TOC (%)**	**WCC**
Upper Salt Creek- Hayfork Creek	2010	274.4	2.8	20	I
Ditch Gulch – Salt Gulch	2010	321.7	6.3	45	II
Alternative 3					
Upper Salt Creek- Hayfork Creek	2010	269.6	2.8	20	I
Ditch Gulch – Salt Gulch	2010	306.8	6.0	43	II

In the Upper Salt Creek-Hayfork Creek Watershed, recorded timber harvest has occurred from 1968–2004, and site preparation occurred from 1982–1995. Grazing allotments within the project area include Salt Creek (3,435 acres), Post Creek (304 acres) and the Wildwood Allotment (50 acres). The Salt Creek Allotment has been vacant over 10 years. Watershed condition in the Salt Creek Allotment is thought to be good, as no fencing was done to protect Butter Creek. The southern half of the Post Creek Allotment, which is in the proposed project area, has also been vacant for at least 10 years. The Wildwood Allotment is active and is being grazed by horses.

Both the Post Creek and Wildwood Allotments were thought to be in good watershed condition (Wenham, 2008). In the Upper Salt Creek-Hayfork Creek Watershed, 101 acres were burned in 1987 in an unnamed fire. At the time this report was written, there was no information as to the fire's severity.

In the Ditch Gulch-Salt Gulch Watershed timber harvest occurred from 1981–2004 and site preparation occurred from 1982–1995. Included in the past fuel treatment activities are 509 acres of the Post Mountain Fuels Hazard Reduction Project. The Post Mountain Project, along with the proposed Salt Project, are part of a large scale overall watershed restoration project involving hazardous fuels reduction (see project file). Other projects include Gemmill, Knob Peak, Jones Thin, East Fork I and II, and Dubakella. Out of all these projects, only the Post Mountain Project is within the cumulative effects boundary.

There has been no recorded fire activity in the Ditch Gulch-Salt Gulch 7th level watershed since 1910. The Telephone fire burned in the Upper Salt Cree-Hayfork Creek watershed in 2008. No disturbed acreage was noted in regards to mining or cultural treatments in either watershed. Roads were built in support of past management activities.

Existing overall road density in the Upper Salt Creek-Hayfork Creek Watershed is 3.9 miles/square mile and 6.6 miles/square mile in the Ditch Gulch-Salt Gulch Watershed. Road densities with 300 feet of streams for the Upper Salt Creek-Hayfork Creek Watershed are 2.5 miles/square mile and 6.0 miles/square mile in the Ditch Gulch-Salt Creek Watershed. In riparian reserves the Upper Salt Creek-Hayfork Creek Watershed existing road densities are 2.4 compared to 6.2 for the Ditch Gulch-Salt Gulch Watershed (Table 11).

Foreseeable actions include the West Side Watershed Restoration Project, which overlaps the cumulative effects area of this project. This project is still in the conceptual phase and details are unknown; however, it will involve road decommissioning.

Discussion

For municipal watersheds, water quantity, wetlands, and floodplains, no direct and indirect effects would be expected. As a result, no change (either positive or negative) would be expected.

Existing levels of recreation and grazing would be expected to continue. Activities associated with transmission and pipeline maintenance would continue at existing levels.

To help assess project-related potential cumulative effects on watershed condition, ERA analysis was conducted on the Upper Salt Creek-Hayfork Creek and Ditch Gulch-Salt Gulch Watersheds. Analysis of equivalent roaded acres for the Upper Salt Creek-Hayfork Creek Watershed increased from an existing 2.4% to 2.8% for Alternative 2, and from 2.4% to 2.8 % under Alternative 3 (Table 14). This indicates that there is essentially the same cumulative effect in terms of watershed condition, assuming the project is entirely implemented in one year.

In the Ditch Gulch-Salt Gulch Watershed equivalent roaded acres increased from 3.8% to 6.3% under Alternative 2 (6.7% is 45% of the watersheds TOC). Under Alternative 3 the increase is slightly less, with the estimated ERA at 6.0%, which is 43% of the TOC. In both cases, the values of 45% and 43% would result in a change in watershed condition class from “I” to “II”, according to FSM 2521.1 (Tables 6, 14). The manual defines Watershed Condition Class (WCC) of II as “*Watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Portions of the drainage network may be unstable. Physical, chemical and biologic conditions suggest that soil, aquatic, and riparian systems are at risk in being able to support beneficial uses”*.

However, this change in watershed condition class assumes that the *entire* project would be implemented within one year, which results in modeling limitations because it is not known what would be harvested where and when. Discussions with the project logging engineer and silviculturist indicated that the project would most likely be implemented over a 3 to 4 year time period, so the relative difference in effects would be less than estimated (due to an overlap of recovering treated acres and just harvested acres). In both cases, watershed TOC values are less than 80% of TOC, which is the level at which concerns become critical (Mai, 2008a) (Figure 1).

As the amount of post-project implementation time increases, the percent TOC for both alternatives would likely decline, as watershed recovery increases. In the long term, fuels

reduction would reduce the potential for high severity wildfire, which could severely impact watershed conditions.

Under both action alternatives, a short-term increase in potential sediment would be expected, primarily due to road reconstruction and decommissioning (see Watershed Condition section, Direct/Indirect Effects). However, over the long term, watershed condition would be expected to improve, and existing levels of cumulative effects reduced, in both action alternatives, due to the decommissioning of roads. Watershed condition would be further improved, and long-term cumulative effects reduced, with the implementation of the West Side Watershed Restoration Project, which is expected to be implemented within the foreseeable future. This project, which overlaps the Salt Project area, would focus on road decommissioning. It is expected that existing road densities for the Upper Salt Creek-Hayfork Creek and Ditch Gulch-Salt Gulch 7th level watersheds would be reduced even further from what is predicted with project implementation (See Tables 8–11). These activities would also improve stream channel conditions over the long term.

With the short term increase in potential sediment, related to vegetation treatment, road reconstruction and decommissioning, there would be an associated potential increase for localized water quality impacts.

The potential for localized water quality impacts to the headwaters of the South Fork of the Trinity River, located within the Salt Creek-Hayfork Creek watershed, would be expected to be within the natural range of variability of sediment, due to the implementation and effectiveness of BMPs. Localized long-term improvements in water quality would be also be expected as road densities are decreased due to road decommissioning and road runoff and sedimentation impacts are eliminated (see Tables 8–11).

Compliance with Regulatory Direction

Implementation of BMPs, project specific resource protection measures, and site-specific riparian measures would result in the proposed activities being in compliance with the Shasta-Trinity Forest Plan, Forest Service handbook and manual direction, and with other guiding laws and regulations.

References

Burroughs, Edward R., Jr.; King, John G. 1985. Surface Erosion Control on Roads in Granitic Soils. Proceedings of Symposium Sponsored by Committee on Watershed Management, Irrigation and Drainage Division, ASCE, ASCE Convention, Denver, CO, April 30–May 1. p. 183-190.

Burroughs, Edward R., Jr.; King, John G. 1989. Reduction of Soil Erosion on Forest Roads, USDA Intermountain Research Station, General Technical Report INT 264.

Burroughs, Edward R., Jr. 1990. Predicting Onsite Sediment Yield from Forest Roads. Proceedings of Conference XXI, International Erosion Control Association, Erosion Control: Technology in Transition. Washington, DC, February 14-17. p. 223-232.

Custom Climate by PRISM. 2007. Run by J.Fryxell, TEAMS.

Elliot, William J.; [and others]. 2000. Disturbed WEPP (Draft 02/2000) WEPP Interface for Disturbed Forest and Range Runoff, Erosion and Sediment Delivery. Technical Documentation, USDA Forest Service, Rocky Mountain Research Station and San Dimas Technology and Development Center. http://forest.moscowfsl.wsu.edu/fswepp/docs/distweppdoc.html.

Foss, Jacqueline. 2008. Salt Timber Harvest and Fuel Hazard Reduction EIS, draft Soils Resource Report *(see project file).*

Fryxell, Jenny; Hermandorfer, Chad. 2008. Assumptions Used in WEPP Modeling for the Salt Project.

Grant, Gordon E.; Lewis, Sarah L.; Swanson, Frederick J.; Cissel, John H.; McDonnell, Jeffrey J. 2008. General Technical Report PNW-GTR-760, USDA Forest Service, Pacific Northwest Research Station, Portland, OR. 76 p.

Hermandorfer, Chad, 2007, Field Notes on Salt project area, Shasta Trinity National Forest.

Mai 2008. Shasta Trinity National Forest BMP Report to July 2008. Headquarters 3644 Avtech Parkway, Redding, California 96002.

Mai, Christine. 2008a. E-mail Regarding Bill Snavely Document, Attachment cwe_sheds_forest_jan05

Mai, Christine. 2008b. E-mail Regarding Monitoring

North Coast Regional Water Quality Control Board. 2007. Water Quality Control Plan for the North Coast Plan. 550 Skylane Blvd., Suite A, Santa Rosa, CA 95403, 707-576-2220.

Overland, Bill. 2008a. Email Regarding TOC Percent Discussion

Overland, Bill. 2008b. Equivalent Roaded Acre (ERA) Calculations for Cumulative Watershed Effects *(see project file).*

Ratcliff, Donald R. 2007. Draft Fisheries Biological Assessment/Evaluation, Salt Project, Hayfork Ranger District, Shasta-Trinity National Forest, USDA Forest Service Region 5, Klamath Province.

Schuler, Jamie L.; Briggs, Russell D. 2000. Assessing Application and Effectiveness of Forestry Best Management Practices in New York. National Journal of American Forestry 17(4): 125-134.

Seyedbagheri, Kathleen A. 1996. Idaho Forestry Best Management Practices: Compilation of Research on their Effectiveness. USDA Forest Service Intermountain Research Station, General Technical Report INT-GTR-339. 89 p.

URS Greiner Woodward Clyde. 2000. Middle Hayfork Creek and Salt Creek Watershed Analysis, Prepared for the Shasta-Trinity National Forest.

USDA Forest Service. 1990. Soil and Water Conservation Handbook, Region 5 Amendment 2, Effective 7/16/90.

USDA Forest Service. 1993. Forest Ecosystem management: An Ecological, Economic and Social Assessment, Report of the Forest Ecosystem Management Assessment TEAM, *known as the FEMAT report.*

USDA Forest Service. 1995. Shasta Trinity National Forest Land and Resource Management Plan.

USDA Forest Service. 1996. Monitoring and Evaluation Report, Pacific Southwest Region, Shasta-Trinity National Forest, Fiscal Year 1996.

USDA Forest Service. 1996b. Final Environmental Impact Statement. 1996 Revised Black Hills National Forest Land and Resource Management Plan: 1996 revision. Custer, SD.

USDA Forest Service.1997. Monitoring and Evaluation Report, Pacific Southwest Region, Shasta-Trinity National Forest, Fiscal Year 1997.

USDA Forest Service. 1998. Monitoring and Evaluation Report, Pacific Southwest Region, Shasta-Trinity National Forest, Fiscal Year 1998.

USDA Forest Service. 2000. Water Quality Management for Forest System Lands in California, Best Management Practices. Pacific Southwest Region, September.

USDA Forest Service. 2002. Best Management Practices Effectiveness Monitoring Report, Lolo National Forest. Compiled by Renee Hanna.

USDA Forest Service. 2004a. Attachment A to the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl *(commonly referred to as the Northwest Forest Plan).*

USDA Forest Service. 2004b. Watershed Protection and Management, Amendment 2500-2004-1, Effective May 26, 2004.

USDA Forest Service. 2004c. Monitoring and Evaluation Report, Pacific Southwest Region, Shasta-Trinity National Forest, Fiscal Year 2004.

USDA Forest Service. 2005. Monitoring and Evaluation Report, Pacific Southwest Region, Shasta-Trinity National Forest, Fiscal Year 2005.

USDA Forest Service. 2006. Monitoring and Evaluation Report, Pacific Southwest Region, Shasta-Trinity National Forest, Fiscal Year 2006.

USDA Forest Service. 2007. Road Analysis Report, Salt Trap, Shasta Trinity National Forest, South Fork Management Unit, September.

Wenham, Hide. 2008. Personal Communication on Watershed Condition in Grazing Allotments. Shasta Trinity National Forest Range Conservationist.

Ziemer, Robert R. 1986. Water Yields from Forests: An Agnostic View. California Watershed Management Conference, November 18-20, West Sacramento, CA.

Appendix A – Project Design Features for the Salt Project: Best Management Practices, General Project Design Measures, and Design Measures for Riparian Reserves (USDA Forest Service, 2000)

Practice 1.4 – Use of Sale Area Map for Designating Water Quality Protection Needs

The Contract would delineate the location of protection areas and insure their recognition and proper protection. Protection areas include, but are not limited to; stream courses, meadows, harvest unit boundaries, available water sources, and roads where hauling is restricted (Timber Sale Contract Provisions (TSCP) B1.1, B5.12, B6.5, C5.12 and C6.5).

Practice 1.5/5.6 – Limiting the Operating Period of Timber Sale Activities

The "Normal Operating Season" for planned commercial thinning activities would be between April 15 and October 15 (TSCP A16). Operations may occur outside of this period if conducted in accordance with the Shasta Trinity NF Wet Weather Operation Specifications (TSCP B6.66, C6.6). All landing, temporary road, and skid trail construction, and road reconditioning would be conducted during appropriate periods of weather and soil moisture (TSCP B6.6).

Practice 1.8 – Streamside Management Zone Designation

This practice would be best described as a tool with which to evaluate Riparian Reserve (RR) designations associated with the project. The ID team would designate the appropriate protection areas within the RRs where project activities could occur, to be included on the TSC Sale Area Map (TSCP B6.5, C5.421, and C6.5).

Criteria to evaluate BMP implementation and effectiveness would include: ground cover disturbance, canopy closure, disturbance to channel banks and sediment delivery as required in BMPEP T01 – Evaluation of Streamside Management Zones.

Practice 1.10 – Tractor Skidding Design

Skid trail layout patterns are designed minimize erosion and sedimentation as appropriate for specific terrain. The Forest Service would approve all skid trails prior to use by the Purchaser (TSCP B6.422 and C6.42).

On-site monitoring of this BMP occurs during administration evaluations conducted during implementation (BMPEP AE-1) during BMPEP T02- Skid Trails Evaluations).

Practice 1.11 – Suspended Log Yarding in Timber Harvesting

Skyline yarding systems would require at least one end of logs to be suspended during yarding operations. Areas requiring suspended yarding would be identified prior to implementation and included in the Contract and the Sale Area Map (TSCP B6.42 and C6.427).

Onsite evaluations for BMP implementation and effectiveness would be conducted using BMPEP T03: Suspended Yarding, the following winter after the completion of the project.

Practice 1.12 – Log Landing Location

The Purchaser and the Sale Administer must mutually agree upon landing locations. Designated locations must comply with the requirements for location as stated in the BMP. Monitoring would include an on-site evaluation (BMPEP AE-1) of Project area, which includes any temp roads and landings. BMPEP T04- Landings would be evaluated the following winter to assess effectiveness of BMP 1.12 and 1.16 (TSCP B6.422, B6.6, B6.63, C6.428, C6.6, C6.602, C6.603).

Practice 1.13 – Erosion Prevention and Control Measures During Timber Sale Operations

Equipment will not be operated when ground conditions are such that excessive damage will result. Erosion control work will be kept current. If a purchaser fails to perform seasonal erosion control work,, that Forest Service may assume responsibility and utilize unencumbered deposits as payment for the work (TSCP B6.6 and C6.6).

Onsite evaluations during operations may be monitored for administration using BMEP AE-1: Timber Sales and Roads). Further implementation and effectiveness are evaluated the following winter after the completion of the project using forms and protocol for BMPEP T05-Timber Sale Administration..

Practice 1.14 – Special Erosion Prevention Measures on Disturbed Land

Sale administration personnel select areas for treatment based on criteria specified by the interdisciplinary team. If specific areas of concern exist for these types of treatments it would be identified on the sale area map. Special erosion prevention measures include the spreading of slash, straw, or, by agreement, some other treatment. Incorporation (TSCP C6.602).

Practice 1.16 – Log Landing Erosion Control

Contract specifications require the Purchaser to install erosion control measures on landings. Erosion prevention and control measures would be designed to insure that landings have proper drainage. This may include ditching, outsloping, water barring, and ripping (TSCP B6.6, B6.63, C6.6, and C6.602).

Practice 1.17 – Erosion Control on Skid Trails

Contract specifications require the timber sale operator to install erosion control measures on skid trails. Skid trails from both tractor yarding systems and skyline cable yarding systems, where only one end is suspended, would be treated to prevent surface erosion. Closure work may include mulching, outsloping, water barring, ripping, removal of berms and road barrier construction (TSCP B6.442, B6.6, B6.66, C6.442, C6.602, and C6.64).

Implementation and effectiveness monitoring of this BMP are conducted using BMPEP T02: Skid Trail Forms and Protocol..

Practice 1.18 – Meadow Protection during Timber Harvesting

As a minimum, meadow protection requirements specified in the Forest Plan would be implemented. The Timber Sale Contract prohibits unauthorized operation of vehicular or skidding equipment in meadows or in protection zones designated on the sale area map and marked on the ground (TSCP B6.61.

Practice 1.19 – Streamcourse and Aquatic Protection

The interdisciplinary team doing the environmental analysis identifies the RRs requiring protection and the protection requirements. These requirements are included in the timber sale contract and sale area map. The RRs requiring protection would be marked on the ground prior to logging operations (TSCP B6.5 and C6.5).

Practice 1.20 – Erosion Control Structure Maintenance

During the period of the Timber Sale Contract, the Purchaser would provide maintenance of soil erosion control structures constructed by the Purchaser until they become stabilized, but not more than one year after their construction. (TSCP B6.6, B6.66, B6.67, and C6.6).

Practice 1.21 – Acceptance of Timber Sale Erosion Control Measures before Sale Closure

Onsite evaluations during operations would be monitored and documented (BMEP AE-1: Timber Sales and Roads) and the first winter after the completion of the project (BMPEP T05-Timber Sale Administration) (TSCP C6.6, B6.6, B6.63, B6.64, B6.65, and B6.66).

Practice 1.22 – Slash Treatment in Sensitive Areas

Special slash treatments may be prescribed in sensitive areas to facilitate slash disposal, without the use of mechanized equipment. Slash treatment methods would be designated on the sale area map. For this project, depending on the site-specific fuel hazards, slash in RRs would either be: (1) hand piled and left uncovered and unburned; or (2) burned during the wet season; or (3) lopped and scattered to within 18” of the ground [C6.7]. Effectiveness monitoring would be included with BMPEP T01: Streamside Management Zones (TSCP C6.7).

Practice 1.24 – Non-recurring “C” Provisions That Can Be Used for Water Quality Protection

If needed, Special “C” provisions would be identified for water quality protection where the standard “B” or “C” provisions are inadequate to protect watershed values.

Practice 1.25 – Modification of the Timber Sale Contract

The Timber Sale Contract can be modified or terminated if new circumstances or conditions indicate that the timber sale would damage soil, water, or watershed values (TSCP B8.32, B8.33, and B8.34).

Practice 2.2 – Erosion Control Plan

The Timber Sale Contract requires that a general plan of operations, including planned periods and methods of erosion control be developed by the purchaser and presented to the Forest Service (TSCP B6.311). This plan would set forth erosion control measures and discuss mitigation required by the Timber Sale Contract. Operations cannot begin until the Forest Service has given written approval of the plan.

Practice 2.3 – Timing of Construction Activities

The intent of this BMP is to minimize erosion by conducting road construction activities during minimal runoff periods. The purchaser would be required to schedule and conduct operations during the dry season or when rain and runoff are unlikely. Erosion control work would be kept as current as practicable on active road construction projects (TSCP B6.6, B6.61, and C6.6).

Practice 2.5 – Road Slope Stabilization Construction Practices

Stabilization methods would be designed to minimize erosion from road slopes and slope failure along roads. Methods would be identified during the environmental analysis and included in the project plan. The measures should be completed prior to the first winter rains (TSCP B6.6, B6.61, and C6.6).

Practice 2.6 – Dispersion of Subsurface Drainage from Cut and Fill Slopes

Subsurface drainage from cut and fill slopes would be provided where it is identified that subsurface moisture saturation is expected. Collected water would be dispersed in an area capable of withstanding increased flows.

Practice 2.7 – Control of Road Drainage

If there is a need identified in the project planning process, measures would be developed to minimize the erosive effects of water concentrated by road drainage features. Measures include such controls as construction of properly spaced cross drains, water bars or rolling dips, energy dissipaters, aprons, downspouts, debris racks, and armoring of ditches.

Practice 2.11 – Control of Sidecast Material during Construction and Maintenance

The Timber Sale Contract includes clause B6.62 that addresses temporary road maintenance specifications. This includes slide and slump repair, surface blading, and side casting during road maintenance. Generally, side casting of material would be avoided in areas where it can adversely impact water quality.

Practice 2.12 – Servicing and Refueling of Equipment

Purchasers are required to take all reasonable precautions to prevent pollution of air, soil, and water. Purchaser shall furnish oil absorbing mats for use under all stationary equipment or equipment being serviced. A Spill Prevention, Containment and Counter Measures Plan is required if the volume of oil or oil products fuel exceeds 1,320 gallons in containers of 55 gallons or greater (TSCP B6.34 and B6.341).

Practice 2.13 – Control of Construction and Maintenance Activities Adjacent to SMZs

This BMP is designed to protect water quality by controlling construction and maintenance actions within and adjacent to streamside management zone so that its functions are not impaired. Protected RRs would be identified in the planning process (TSCP 6.312, B6.5 and C6.5).

Practice 2.21 – Water Source Development Consistent with Water Quality Protection

Water source development is normally needed to supply water for road construction and maintenance, dust control, and fire control. At no time would downstream water flow be reduced to a level that would be detrimental to aquatic resources, fish passage, or other established uses (TSCP C5.36).

Practice 2.22 – Maintenance of Roads

Roads would be maintained in a manner that provides for water quality protection by minimizing rutting, failures, side casting, and blockage of drainage facilities. The purchaser and the Forest Service would agree to an Annual Road Maintenance Plan that outlines responsibilities and timing of maintenance. This would be done before the beginning of the operating season (TSCP B5.12, B5.3, C5.31 and C5.12).

Practice 2.23 – Road Surface Treatment to Prevent Loss of Material

Measures would be taken to minimize loss of road material when the need for such action is identified (TSCP B5.3, C5.31#, and B6.22).

Practice 2.24 – Traffic Control during Wet Periods

Roads that must be used during wet periods should have a stable surface and sufficient drainage provided to allow such use while at the same time maintaining water quality. Where wet season field operations are planned, roads may need to be upgraded or use restricted (TSCP B6.6, B6.66, and C6.6)..

Practice 2.25 – Snow Removal Controls to Avoid Resource Damage

When roads are used in the winter, snow removal would be done in a manner to protect roads and adjacent resources. Snow berms would be removed or breached to prevent concentration of snowmelt runoff on the road. The Purchaser and the Forest Service would agree to measures prior to snow removal activities (TSCP C5.34).

Practice 2.26 – Obliteration or Decommissioning of Temporary Roads

Contract specifications would include language that requires all temporary roads and landings to be decommissioned as soon as the purchaser has completed work and before the seasonal rain begins. Closure work may include mulching, outsloping, water barring, scarifying, removal of berms and road barrier construction (TSCP B6.63).

Monitoring and documentation would occur on-site during operations (BMPEP AE-1: Timber Sales and Roads) and the following winter (BMPEP E14- Temporary Roads) (TSCP C6.602 and C6.603).

Practice 5.2 – Slope Limits for Mechanical Equipment Operations

The project would be designed to allow tractors only where activities would not increase the probability of gully and sheet erosion and associated sediment production as a result of tractor use. Monitoring and documentation would occur on-site during operations (BMPEP AE-1: Timber Sales and Roads) and the following winter (BMPEP T02- Skid Roads).

Practice 5.6 – Soil Moisture Limitations for Mechanical Equipment Operations

The Contract shall require winter shutdown whenever the Forest Service determines that the soil moisture or physical conditions have become unsuitable for equipment operation on any area (TSCP B6.3, B6.31, B6.311, and B6.6).

Timber sale administration would document the physical conditions (BMPEP AE-1: Timber Sales and Roads.) BMPEP T05-Timber Sale Administration monitoring would occur the first winter following the completion of the project.

Practice 6.1 – Fire and Fuel Management Activities

Fuel management projects would have management requirements, mitigation measures, and multiple resource protection prescriptions documented in the project planning and decision documents.

Practice 6.3 – Protection of Water Quality from Prescribed Burning Effects

This BMP is designed to maintain soil productivity, minimize erosion, and minimize ash, sediment, nutrients, and debris from entering water bodies. Streamside management zones would be identified as part of the burn plan.

General Project Design Features

Resource Protection Measure	Units*	Alt.
Aquatics and Soils		
All applicable Best Management Practices	All units	2 & 3
No full bench skid trails would be constructed. Skid trails, when possible, would be located on ridge tops, flat benches, or existing skid trails to minimize soil displacement and enhance drainage.	All ground based units	2 & 3
For all ground-based operations skid trails the distance between skid trails will be a minimum of 100' measured center to center, except where converging. All material would be skidded with the leading end clear of the ground.	All ground based units	2 & 3
Access to skid trails that intersect Forest Roads would be blocked with available material (either large wood or boulders).	All ground based units	2 & 3
Excess activity created slash and existing surface fuels would be machined piled or masticated on slopes less than 35% and hand piled or lopped and scattered on slopes greater than 35%. All piles, except those designated for retention, would be burned.	Units where biomass will not be removed 4, 5, 11, 12, 17, 18, 20, 21, 22, 32, 33A, 33B, 33C, 36, 37, 40, 45	2 & 3
Track line machines generally restricted to slopes <35%. Endlining will be used in those areas where skid trails may exceed 35%. Skid trails located on small inclusions of steep areas exceeding 35% would be covered with woody material larger than 9" to divert flow off the trail [C6.602 or equivalent].	All ground based units.	2 & 3
Heavy equipment (such as mechanical harvesters) would generally be limited to slopes of 50% or less in order to minimize soil disturbance and subsequent erosion.	Unit 32	2 & 3
New or reconstructed landings would be shaped to disperse drainage and direct run-off away from watercourses at the time of construction. Rock armoring and/or silt fences with straw bales may be used as necessary to direct water to areas of suitable drainage and to capture sediment (all materials must be provided from weed-free sources). All new landing fill slopes and road fill slopes (>100 sq. ft) would be mulched and the mulch would be maintained throughout the life of the project [C6.602 or equivalent].	Landings	2 & 3

Resource Protection Measure	Units*	Alt.
Any landings used during wet weather would be adequately rocked to prevent erosion (See Shasta-Trinity National Forest Wet Weather/Winter Operating Procedures).	Landings	2 & 3
When heavy equipment such as a harvester is used off a designated skid trail in the specified units (due to fine textured soils), limit the number of passes to 1 and no more than 2 passes, over the same piece of ground.	9A, 14, 17, 18, 25A, 25B, 25C, 25E, 30A, 30B, 26 and 40	2 & 3
Riparian Reserves**		
Perennial and Non-perennial: No treatment or equipment within any of the riparian reserves.	All units	3
Perennial: No thinning and no equipment in perennial stream riparian reserves. Riparian reserves for perennial streams for this project are 300 feet for fish bearing streams and 225 feet for non-fish bearing streams.	1, 2C, 4, 5	2
Non-Perennial Streams: The non-perennial riparian reserve is defined for this project as a protection zone 150 feet wide measured along the slope from ▪ the high watermark up the hillslope. ▪ No landings would be located inside of RRs ▪ At least 60% of overstory canopy remains after thinning. ▪ Designate/approve Riparian Reserve crossings in coordination with the fisheries biologist and/or hydrologist. ▪ Equipment will be excluded from operating on active or potentially active landslides and thinning will be prescribed by a geoscientist. ▪ Selective commercial thinning within RRs, adjacent to EEZs, would be accomplished through a combination of mechanical operations and hand thinning. ▪ Hazard trees within RRs must be dropped and retained on site if > 16" dbh. Handpiles of thinned fuels would be placed outside of EEZs and burned in the riparian reserve in a manner that leaves at least 50% of the localized area unburned at any given time. In addition, hand piles would be placed in a checkerboard pattern whenever possible (not one pile directly above another). ▪ When fuels treatments involve area ignition, use backing fire in RRs. There would be no ignition within RRs associated with understory burning; however, fire would be allowed to creep into riparian areas.	1, 2A, 2B, 2C, 3, 4, 5, 7, 9B, 10, 11, 12, 13, 21, 25A, 26, 32, 33A, 36, 45	2
Equipment Exclusion Zone: No equipment and no thinning allowed within the equipment exclusion zone (EEZ). The EEZ is a portion of the riparian reserve defined for this project as the area that extends 50 feet (slope distance) from the high watermark on slopes >30% and extends 25 feet (slope distance) on slopes <30% OR extends to the inner gorge, which ever is greater.	All units	2
Erosion Control Measures		
Seed all appropriate decommissioned roads, temporary roads, landings, and primary skid trails with native grass seed and non-persistent cereal grains. Mulch all seeded areas with certified weed-free straw.	All units.	2&3
Dedicate no more that 15 percent of a harvest unit to primary skid trails and landings.	All units	2 & 3
Decommissioning of roads may include removing culverts, ripping road surfaces, out-sloping to maintain hill slope hydrology (hydrologic connectivity) as well as other measures to meet site-specific needs. The goal is to control surface runoff, erosion, and mass failure. Seed (with native grass seed and non-persistent cereal grains), and mulch on selected roads as needed.	Decommissioned roads	2 & 3
Minimize soil erosion by mulching primary skid trails with straw or fine slash (achieve 50 percent or more cover). Install waterbars at major breaks in slope and regular intervals along the trail.	All ground based units	2 & 3
At the end of project activities, a layer of ground cover should occur over at least 50% of the activity area.	All ground based units	2 & 3

Resource Protection Measure	Units*	Alt.
Rip (with winged subsoiler to 18 inches deep) and mulch, all temporary roads, skid roads and landings identified by the project soil scientist.	Temporary roads, skid roads and landings	2 & 3
Reuse existing primary skid trails and landings whenever possible.	All ground based units	2 & 3
Slash and existing surface fuels must be hand piled or lopped and scattered on slopes greater than 35 percent.	All ground based units	2 & 3
Ground-based mechanical equipment will only operate in these specified units (fine-textured soils, non-rocky) when the soils are dry down to 8 inches (from June 01 to October 15).	2A, 2B, 2C, 6, 7, 9A, 9B, 10, 11, 13, 14, 17, 18, 25A, 25B, 25C, 25D, 25E, 26, 30A, 30B, 40.	2 & 3
Geologically Sensitive Areas		
All geologically sensitive areas **including unstable or potentially unstable areas** have been field-verified by the project geologist and are excluded from proposed project activities through individual unit layout, prescription, and road location modification.	All units.	2 & 3

Project Design Features for Riparian Reserves

Riparian Reserves*		
Perennial and Non-perennial: No treatment or equipment within any of the riparian reserves.	All units	3
Perennial: No thinning and no equipment in perennial stream riparian reserves. Riparian reserves for perennial streams for this project are 300 feet for fish bearing streams and 225 feet for non-fish bearing streams.	1, 2C, 4, 5	2
Non-Perennial Streams: The non-perennial riparian reserve is defined for this project as a protection zone 150 feet wide measured along the slope from the high watermark up the hillslope. ▪ No landings would be located inside of RRs. ▪ At least 60% of overstory canopy remains after thinning. ▪ Designate/approve Riparian Reserve crossings in coordination with the fisheries biologist and/or hydrologist. ▪ Equipment will be excluded from operating on active or potentially active landslides and thinning will be prescribed by a geoscientist. ▪ Selective commercial thinning within RRs, adjacent to EEZs, would be accomplished through a combination of mechanical operations and hand thinning. ▪ Hazard trees within RRs must be dropped and retained on site if >16” dbh. Handpiles of thinned fuels would be placed outside of EEZs and burned in the riparian reserve in a manner that leaves at least 50% of the localized area unburned at any given time. In addition, hand piles would be placed in a checkerboard pattern whenever possible (not one pile directly above another). ▪ When fuels treatments involve area ignition, use backing fire in RRs. There would be no ignition within RRs associated with understory burning; however, fire would be allowed to creep into riparian areas.	1, 2A, 2B, 2C, 3, 4, 5, 7, 9B, 10, 11, 12, 13, 21, 25A, 26, 32, 33A, 36, 45	2
Equipment Exclusion Zone: No equipment and no thinning allowed within the equipment exclusion zone (EEZ). The EEZ is a portion of the riparian reserve defined for this project as the area that extends 50 feet (slope distance) from the high watermark on slopes >30% and extends 25 feet (slope distance) on slopes <30% OR extends to the inner gorge , which ever is greater.	All units	2