Soils and Water

Introduction

A healthy and functional watershed relies on an equilibrium, or balance, in the soil productivity, soil quality, water quantity, and water quality. The soil resource provides many essential functions for national Forest lands. It sustains plant growth that provides forage, fiber, wildlife habitat, and watershed protection. It absorbs precipitation, stores water for plant growth, and gradually releases surplus water which attenuates runoff rates. It sustains microorganisms which recycle nutrients for continued plant growth. The National Forest Management Act of 1976 and other acts recognized the fundamental need to protect, and where appropriate improve, the quality of soil.

Protection of water quantity and quality is an important part of the mission of the Forest Service (Forest Service Strategic Plan for 2007 to 2012, July 2007). Management activities on national Forest lands must be planned and implemented to protect the hydrologic functions of Forest watersheds, including the volume, timing, and quality of stream flow. The use of roads, trails, and other areas on national Forests for public operation of motor vehicles has potential to affect these hydrologic functions through interception of runoff, compaction of soils, and detachment of sediment (e.g., Foltz, 2006). Management decisions to eliminate cross-county motorized travel, add new routes and areas to the National Forest Transportation System (NFTS), and make changes to the existing NFTS must consider effects on watershed functions.

Analysis Framework: Statute, Regulation, Forest Plan, and Other Direction

Direction relevant to the Proposed Action as it affects the soil resource includes the following:

National Forest Management Act of 1976: Renewable Resource Program. "(C) recognize the fundamental need to protect and where appropriate, improve the quality of soil, water, and air resources."

National Soil Management Handbook: The Soil Management Handbook (USDA 1991) is a national soils handbook that defines soil productivity and components of soil productivity, establishes guidance for measuring soil productivity, and establishes thresholds to assist in Forest planning.

Region 5 Soil Management Handbook Supplement: The Forest Service Region 5 Soil Management Handbook Supplement (R5 FSH Supplement 2509.18-95-1) establishes regional soil quality analysis standards. The analysis standards address three basic elements for the soil resource: (1) soil productivity (including soil loss, porosity and organic matter), (2) soil hydrologic function, and (3) soil buffering capacity. The analysis standards are to be used for areas dedicated to growing vegetation. They are not applied to lands with other dedicated uses, such as developed campgrounds, administrative facilities, or in this case, the actual land surface authorized for travel by the public using various kinds of vehicles.

Regional Forester's Letter (dated Feb 5, 2007): This letter provided clarification to Forest Supervisors on the appropriate use of the R5 Soil Management Handbook Supplement (R5 FSH Supplement 2509.18-95-1). It states in part—

> Analysis or evaluation of soil condition is the intended use of the thresholds and indicators in R5 FSH Supplement 2509.18-95-1.They are not a set of mandatory standards or requirements. They should not be referred to as binding or mandatory requirements in NEPA documents. Standards and guidelines in

Forest Land and Resource Management Plans provide the relevant substantive standards to comply with NFMA.

The thresholds and indicators represent desired conditions for the soil resource. Use of the thresholds and indicators provides a consistent method to analyze, describe, and report on soil condition throughout the region.

Clean Water Act of 1948 (as amended in 1972 and 1987): establishes as Federal policy for the control of point and non-point pollution, and assigns the states the primary responsibility for control of water pollution. Compliance with the Clean Water Act by national Forests in California is achieved under state law (see below).

Non-point source pollution on national Forests is managed through the Regional Water Quality Management Plan (USDA Forest Service, Pacific Southwest Region, 2000), which relies on implementation of prescribed best management practices (BMPs). The Water Quality Management Plan includes one BMP for off-highway vehicle (OHV) use (4-7) and 28 BMPs related to road construction and maintenance (2-1 to 2-28) (See appendix G). All NFTS roads and trails open to OHV use are required to comply with these BMPs.

Of particular relevance for motorized travel management, BMP 4-7 requires each Forest to (1) identify areas or routes where OHV use could cause degradation of water quality, (2) identify appropriate mitigation and controls, and (3) restrict OHV use to designated routes. This BMP further requires Forests to take immediate corrective actions if considerable adverse effects are occurring or are likely to occur.

The California Water Code consists of a comprehensive body of law that incorporates all state laws related to water, including water rights, water developments, and water quality. The laws related to water quality (sections 13000 to 13485) apply to waters on the national Forests and are directed at protecting the beneficial uses of water. Of particular relevance for the Proposed Action is section 13369, which deals with non-point-source pollution and best management practices.

The Porter-Cologne Water-Quality Act, as amended in 2006, is included in the California Water Code. This act provides for the protection of water quality by the state Water Resources Control Board and the regional water quality control boards, which are authorized by the U.S. Environmental Protection Agency to enforce the Clean Water Act in California.

The Northwest Forest Plan (NWFP) Aquatic Conservation Strategy (ACS) includes standards and guidelines that apply to the six Forests included entirely or partially within the Northwest Forest Plan. The ACS standards and guidelines require that a watershed analysis be completed that determines the influence of each road on ACS objectives, and that roads be designed to minimize impacts on riparian and aquatic resources. Construction of new roads in wetlands is prohibited. Adding unauthorized routes to the NFTS in meadows or wetlands constitutes road construction, and should be avoided. Stream crossings are required to be designed to pass a 100-year flood and allow for passage of aquatic fauna.

The Sierra Nevada Forest Plan Amendment (SNFPA): The Record of Decision (ROD) for the 2004 SNFPA includes standards and guidelines that apply to the 10 Sierra Nevada Forests for construction and relocation of roads, and for management of riparian conservation areas (RCAs). These standards and guidelines require the Forest Service to avoid road construction, reconstruction, and relocation in meadows and wetlands (SNFPA S&G 70). Reconstructing unauthorized routes to bring them to NFTS standards in meadows or wetlands should therefore be avoided. Only routes that already meet NFTS standards in meadows and wetlands should be proposed for addition to the NFTS. SNFPA S&G 92 requires that the Forest Service evaluate new management activities within RCAs and critical aquatic refuges (CARS) during

environmental analysis to determine consistency with riparian conservation objectives (RCOs) at the project level and the Aquatic Management Strategy (AMS) goals for the landscape. Adding an unauthorized route to the NFTS is a new management activity and must comply with S&G 92. SNFPA S&G 100 requires the Forest Service to maintain and restore the hydrologic connectivity of streams, meadows, and wetlands by identifying roads and trails that intercept, divert, or disrupt flows paths and implementing corrective actions. SNFPA S&G 102 requires that the Forest Service determine if stream characteristics are within the range of natural variability prior to taking actions that could adversely affect streams.

There is a small portion of the Modoc National Forest covered by the NWFP ROD, as well as areas of the Forest that are exempt form the SNFPA ROD. Where that situation exists, the appropriate standard and guideline would be based on the Modoc National Forest (MDF) Land and Resource Management Plan (LRMP) prior to 2004.

The Modoc National Forest LRMP provides for standards and guidelines for management areas. The General Forest Management Area includes areas for multiple use and soil and water standards and guidelines have been developed. These S&Gs are as follows:

MDF LRMP Soils and Watershed Standards and Guidelines for General Forest

Soils

Maintain soil productivity by applying guidelines to areas where management prescriptions are applied.

Monitor for implementation and effectiveness. Areas not meeting guidelines will be rehabilitated. As a minimum, 85 percent of areas affected by soil disturbing activities will not exceed soil property thresholds.

- Soil porosity is at least 90 percent of its natural conditions.
- During wet soil conditions limit mechanical or heavy equipment and other soil disturbing activities to designated routes.
- The mineral organic matter in the upper 12 inches of soil should be at least 85 percent of its natural conditions.
- Design management activities not to exceed an average allowable soil loss of one ton per acre per year.
- During project planning, verify areas where soil productivity has been degraded.
- Complete an SRI Order 2 or field verify an SRI Order 3 during the planning phase of each site disturbing or vegetation manipulating project. [SRI order is the soil resource inventory. It describes the level of intensity of a soil survey. An SRI order of 3 is a broader-level soil survey than an SRI order 2.] Develop specific soil mitigation measures and soil conservation management practice for each project site as needed.

Water

1. Implement Best Management Practices (BMPs) to meet water quality standards and maintain and improve the quality of surface water on the Forest
2. Identify methods and techniques for applying BMPs during project-level analysis and incorporate into project plan.

3. Evaluate the effectiveness of BMPs in attaining standards and protecting beneficial uses through on-site inspection, field observation, and water data collection on a case-by-case basis.
4. To minimize the risk of off-site cumulative impacts from management activities on stream channel conditions and water quality, conduct a cumulative watershed effects analysis of each land-disturbing activity on the appropriate second- or third-order watershed prior to undertaking.

Effects Analysis Methodology

Direct and indirect effect analysis to soil and water quality was based on identifying areas of risk on the Modoc National Forest. This used GIS and completed and published Order 3 SRI. From the Order 3 SRI the topography, maximum erosion hazard rating (MEHR), water runoff potential (WROP), watershed sensitivity (WSS), and slope stability hazard were tabulated in a data sheet.

1. Overlaying the proposed routes from the Alternatives 1 through 5 over GIS coverage layers, a risk assessment of a adverse effect to soil and water quality was completed. The following is a description of the risk assessment:
2. When the MEHR for a soil was low or moderate and water runoff potential was very slow to moderate and watershed sensitivity was low to moderate and slope stability hazard was low to moderate, no field checking was completed.
3. When the above rating factors were exceeded, then the route was field checked and it was noted if the trail was eroding. If so, it is field determined if the erosion exceeds MDF LRMP standards and guidelines.
4. Determination of where on the Forest the land forms are present on the National Forest System (NFS) lands that would likely to become unstable from the addition of unauthorized OHV routes.
5. Determination by field checking the route to determine if the route in its current condition was consistent with BMP 1.17 (Erosion Control on Skid Trails), 1.19 (Stream course and Aquatic Protection), and 2.26 (Obliteration or Decommissioning of Roads).
6. All of the routes proposed within RCAs were field checked, and it was determined if there was a hydrologic connectivity to a perennial or seasonally flowing stream course.
7. All of the routes on soils with high to very high, or rapid to very rapid water runoff potential (WROP) within the Warner Mountain Ranger District, were field checked.
8. Bulk density samples were taken on the routes and immediately off-route, and the results compared at selected sites across the Forest to determine the level of disturbance. These sites were randomly selected across the Forest and the results disclosed in cumulative effects section of this report.

Cumulative effects analysis to soil and water quality was based on the percentage of sub-watershed (less than 5 percent) being affected by the proposed routes, whether the sub-watershed had the risk factors (slope stability hazard (SSH), water runoff potential (WROP), watershed sensitivity (WSS) and maximum erosion hazard rating (MEHR)) present that made it prone to sustain a adverse cumulative effect to soil or water quality.

1. Within a 6th Field HUC, when the high risk factors for the occurrence of a CWE (cumulative watershed effect) are not present, then a modified approach to cumulative effect was completed. It was determined by the Forest hydrologist that when 80 percent of the sub-watershed did not have a SSH High, WROP Rapid or greater, WSS of High or greater and MEHR of High or greater, and less then 5 percent of the 6th Field HUC was in roaded acres (combination of existing system roads and proposed additions to the transportation system) then soil bulk density samples were obtained on the route and off route for comparison

instead of completion of the ERA-TOC (equivalent roaded acres threshold of concern). Methodology as used in the R5 Cumulative Watershed Effects (CWE) Analysis.

2. When the sub-watershed had more then 20 percent of the sub-watershed had the high risk factors, then a detailed R5 CWE Analysis was completed, without regard to the percent of the 6th field HUC that contains roaded acres.

Second, there is the analysis of each alternative as a whole, which is informed by the site-specific route analysis noted above and other pertinent information, such as soil type or soil map unit, soil compaction, soil erosion potential and proximity of the route to water. The discussion of the direct, indirect, and cumulative effects of each alternative is in a summary form. For ease of documentation and understanding, the effects of the alternatives are described separately for five discreet actions and then combined to provide the total direct and indirect effects of each alternative (see below). The combination of these discreet actions is then added to the past, present, and reasonably foreseeable actions in the cumulative effects analysis. The three discreet actions common to all action alternatives are (1) The prohibition of cross-country motor vehicle travel; (2) The addition of facilities (unauthorized roads, trails, or areas) to the National Forest Transportation System (NFTS), including identifying seasons of use and vehicle class; and (3) Changes to the existing NFTS [this can include deletions of facilities and changing the vehicle class and season of use]. This discussion goes in Chapter 3 of the EIS, and is the focus of this Effects Analysis Methodology section.

Affected Environment and Environmental Consequences

Affected Environment

The Modoc National Forest is covered by three unique settings that have greatly influenced the development of the soils. These unique settings are as follows:

1. Basalt Plateau and lava fields: The soils over the majority of the Doublehead and Devils Garden Ranger Districts are derived of volcanic deposits. They are coarse-textured soils for the most part due to the high amount of surface and subsurface rock content with a low percentage of fine textured clays. For the most part, the slopes are relatively gentle (5 to 20 percent), the water runoff potential is very slow to moderate, maximum soil erosion hazard rating of low to moderate, and slope stability hazard/watershed sensitivity is low to moderate. The Tionesta area of the Devils Garden Ranger District is composed of moderately deep to deep volcanic overburden. These are very porous soils that are well drained, have rapid to extremely rapid permeability, and do not easily compact under a heavy load. The occasional presence of rock outcrop causes the water runoff potential to increase to rapid, but this accounts for generally less than 5 to 10 percent of the area.
2. Undulating hillsides: The soils over the majority of the Big Valley Ranger District are moderately deep soils with gentle to undulating slopes (5 to 25 percent), the water runoff potential is very slow to moderate, maximum soil erosion hazard rating is low to moderate, and slope stability hazard/watershed sensitivity is low to moderate. There are isolated patches of soils that have a high and very high maximum erosion hazard rating based on steeper hillsides. But this generally does not constitute more than 10 percent of the Big Valley Ranger District.
3. Steep mountainsides: the soils associated with the Warner Mountains are moderately deep, and fragile. The slopes of the Warner's are steeper than at any other location on the Forest, with more acreage of slopes greater 40 percent than on other two land forms. The erosion hazard rating is moderate to high and very high on approximately on 40 to 60 percent of the

soils, a water runoff potential of rapid to very rapid, and a slope stability/watershed sensitivity of moderate to high on more than 25 percent of the hillsides.

Table 3-34. Soils with High Risk Factors, by District

Ranger District	Acreage	Miles of Routes on Soils with High Risk Factors
BV	494,307	0
DG and DH	1166,638	0
WM	361,564	20.1
Totals	2,022,509	20.1

These same land forms have greatly influenced the water quantity and quality across the national Forest.

Doublehead and Devils Garden Ranger Districts

The Doublehead and Devils Garden Ranger Districts generally have a lack of hydrologic connectivity of its stream network. There are few if any perennial streams, but a relatively large amount of seasonally flowing streams that drain into a reservoir, stock pond, or other depression in the ground and act to recharge the groundwater table. The Basalt Plateau is a highly fractured substrate that is not prone to holding surface waters unless there is a subsurface hardpan present. These areas are up on the basalt plateau and over geologic time have been subject to lava flows. The reservoirs on the above-referenced districts have a tendency for seasonally wet bodies of water that have a tendency to dry out in August and September, with the exception of the larger bodies of water like Clear Lake and Big Sage Reservoirs.

Big Valley Ranger District

The Big Valley Ranger District has hydrologic connectivity of its stream network to the Pit River. These perennial streams (most notably Rush Creek, Ash Creek and a few lesser-known streams), and a relatively large amount of seasonally flowing streams, drain into the Pit River. In the northwestern portion of the district there are sizeable areas of lava flows, rock outcrops, and rubble lands there have depressions formed by the lava flows that seasonally store water that act to recharge basins for the groundwater table.

Lava tubes that have collapsed support riparian areas in the northwestern portion of the district in and around the Long Bell and Hollenbeck Butte area of the district. But generally these tubes do not have hydrologic connectivity to other streams and eventually the water either evaporates to the atmosphere or recharges the groundwater table in the late summer. The reservoirs on the above-referenced district have a tendency to be seasonally wet bodies of water that dry out in August and September.

The topography of the Big Valley Ranger District has gently sloping hillsides with moderately deep to deep soils. These hillsides are generally in the slope range of 5 to 25 percent with a noticeable lack of inner gorges, steep slopes, or unstable hillsides. The soils on these hillsides are a coarse-textured soil with a relatively high amount of rock content in the subsoil and on the surface. There is a general lack of soils that have either a high to very high MEHR or rapid to very rapid WROP.

Warner Mountain Ranger District

The Warner Mountain Ranger District has hydrologic connectivity of its stream network to the North and South Fork of the Pit River and Goose Lake (slope break westward) and Alkali Lakes (Upper, Middle and Lower) and Fort Bidwell Indian Reservation (slope break eastward). The district has largest amount of perennial streams on the Forest. They drain from the slope break of the Warner Mountains eastward (most notably Parker Creek, Joseph Basin Creek, Fitzhugh Creek, and a few lesser-known perennial streams) into North Fork of the Pit River. There are a series of seasonally flowing streams associated with the perennial streams on both sides of the slope break of the Warner Mountains. There are a series of fens, meadows and other special aquatic features all up and down on both sides of the slope break of the Warner Mountain Range.

Davis Creek, Lassen Creek, and a few lesser-know perennial streams located in the northeastern portion of the districts drain into Goose Lake. Goose Lake appears on the map to drain into North Fork of the Pit River, but in reality is a closed basin with no hydrologic connectivity or outlet and only adds water to the North Fork of the Pit River when it overtops its dam during an extremely wet year. In essence it is a giant sediment retention pond. In the southeastern portion of the district there is a perennial lake known as Blue Lake. It supports a year-round fishery, but is a closed basin.

Bidwell Creek, Cedar Creek, and Emerson Creek are the most notable perennial streams located on the east side of the slope break of the Warner Mountains. Bidwell Creek and its tributary flow into the Fort Bidwell Indian Reservation, into storage basins, then eventually into Upper Alkali Lake. Cedar Creek flows through the community of Cedarville, into irrigation ditches, then eventually into Middle Alkali Lake. Emerson Creek drains south of Eagleville into irrigation ditches, then eventually into Lower Alkali Lake.

The land forms of the Warner Mountains on both sides of the slope break have portions of steep, unstable hillsides with the presence of inner gorges and down-cut stream channels. Depending on which side of the slope break you are on, the soils associated with the Warner Mountains are moderately deep to deep, and fragile. On approximately 40 to 60 percent of the land base of the Warner Mountains, the MEHR is high to very high; the remaining acreage in the Warner Mountains is moderate. These soils within the Warner Mountains have a water runoff potential of rapid to very rapid, and a slope stability/watershed sensitivity of moderate to high on more then 25 percent of the hillsides.

The stream channels of the Warner Mountains sustained a disturbance from the warm rain on cold snowpack event in 1997. In many places across the district with Cedar Creek being the most notable, the main stems sustained elevated bulked stream flow of an event similar to a 100-year event. As a result, many streams that had a Pfankuch rating of good to excellent now have a rating of good to fair, with a few having a rating of poor. (The PFC Rating also went from fully functional—PFC rating of proper—to functional at risk). [Pfankuch rating is a standardized methodology used in the Forest Service to evaluate the hydrologic and geologic stability of stream courses.] These streams are recovering over time as the natural healing processes are occurring.

There are no known municipal watersheds located on the district or Forest. The Fort Bidwell Indian Reservation uses a sub-watershed located within T 46N, and Range 15/16E as a public water source. It is a capped well and not a surface water resource.

Environmental Consequences

Alternative 1: No Action

Under Alternative 1, no new routes would be added to the road system. There would be no seasonal closure of system roads and mixed use would be allowed only on existing level 2 roads. There would be no addition of unauthorized routes to the transportation system. The Boles road would not be closed, and the Pumice Mine roads would not be closed to OHV use. There would be no seasonal closures.

Under Alternative 1, since there would be no unauthorized routes added to the transportation system there would be no routes added on soils that had high to very high MEHR. No OHV trail monitoring (red-yellow-green) has been completed on the mixed use roads. (The red-yellow-green system establishes priorities for maintaining OHV routes.) Routes that were identified as having high to very high maximum erosion hazard were field checked to determine if they were actively eroding. It should be noted under Alternative 1, unauthorized routes on the Forest would continue and there would be no change to the potential for additional unauthorized routes to be created and there would be no ban on cross-country travel.

Mixed use of roads was not analyzed, as it was assumed that there would not be any additions to the NFTS. Therefore, existing routes would be subject to maintenance and erosion control as specified under BMPs 2.7 (Control of Road Drainage), 2.22 (Maintenance of Roads), 2.23 (Road Surface Treatment to Prevent Loss of Materials), and 2.24 (Traffic Control During Wet Periods).

No Riparian Conservation Area (RCA) Analysis was completed on Alternatives 1, as there was no action to analyze.

Conclusion: Under Alternative 1, no new routes would be added to the NFTS, and the only routes that would be used are already part of the transportation system. Since the above-referenced best management practices (BMPs) would be applied, it was determined that neither Alternative 1 nor 3 would result in a direct or indirect adverse effect to soil or water quality.

All of the existing unauthorized routes (491 miles) would still be available for use along with cross-country travel. It was determined by the Forest hydrologist that under Alternative 1, it is unlikely that the selection of Alternative 1 would result in an adverse direct, indirect, or cumulative effect to soil or water quality beyond what is occurring now.

Alternative 2 Proposed Action

Under Alternative 2, there are 1167 unauthorized routes that are proposed to be added to the transportation system. The average road length to be added would be less then a third of a mile long. These routes add approximately 339 miles and constitute approximately 616 acres of roadways with a disturbance coefficient of 110.9 to 166.4 compacted acres across the Modoc National Forest, or approximately 0.01 percent of the land base of the Modoc National Forest. This alternative has the largest number of miles and routes (the same as Alternative 5) to be added to the National Forest Transportation System (NFTS) on the Modoc National Forest. This alternative has the most ground-disturbed sites being added to the transportation system. A total of 6.3 percent of the number of routes (approximately 5.9 percent of the total miles) proposed to be added to the transportation system would have some form of seasonal closure. The Boles Road would be closed to all use and the Pumice road would be closed to OHV use.

- Approximately 78.9 percent of these additions to the transportation system are located on soils with a low to moderate MEHR, very slow to slow WROP, and low to moderate SSH and WSS.

- Approximately 20.1 percent of these additions to the transportation system are located on soils with a high to very high MEHR, rapid to very rapid WROP, and high or greater SSH and WSS. These are predominately located in the Warner Mountain Ranger District and were field checked by the Forest hydrologist during the summer of 2008.
- Approximately 0.3 percent of these additions to the transportation system are located within the RCAs for perennial streams and lakes. Approximately 5.1 percent are located within the RCAs for seasonally flow streams and seasonally wet lakes. These are predominately located in the Warner Mountain Ranger District and were field checked by the Forest hydrologist during summer of 2008.
- The routes in the Warner Mountains are predominately old skid trails or pre-existing temporary roads that have functional water bars, and are generally not actively eroding. These routes did not display either diversion potential or hydrologic connectivity to the stream courses. In addition, the routes near the higher elevations are generally located on very rocky ground with a high concentration of surface rock that is cobble sized.
- No OHV trail monitoring (red-yellow-green) has been completed on the mixed use roads. Those routes that were identified as having high to very high maximum erosion hazard were field checked to determine if they were actively eroding.
- It should be noted from past project level analysis across the Forest that the consistency of the MDF Order 3 Soil Survey has been field checked. The order 3 SRI has demonstrated a high level of accuracy.

Within the Warner Mountain Ranger District, approximately 40 to 60 percent of the land base contains soils that have a high to very high MEHR and rapid to very rapid WROP. This was estimated from review of the MDF Soil Survey and Home Camp Soil Survey Soil Map Units, and estimating the acres of soils and the range of slopes. This included both 1802 and 1808 HUCs.

During field visits, no evidence was observed of cross-country travel occurring. As discussed under Alternatives 1 and 3, the OHV use on the Forest is generally associated with other Forest recreational activities and predominately consists of ATVs and other OHVs, with a small percentage of motorcycles.

Currently there are approximately 491 miles of unauthorized routes that may be used for OHV travel. This alternative proposes to add 339 miles of those routes and 20 miles or 5.9 percent would receive seasonal closure for resource protection. Most routes were left over from timber harvest activities, stock drives, utility access roads, railroad and utility corridor access, cow trails, or cowboy trails. The most typical condition is the trail tread having a strip of grass on both sides with a strip in the middle. This is characteristic of use by ATVs or pickup trucks, rather than motorcycles. OHV use on the Forest is highest during hunting season.

Currently there are 3,761 miles of existing level 2 system roads designated for mixed use. This alternative proposes to change vehicle class to allow an additional 138 miles of Level 3 system roads for mixed use. The mixed use was not analyzed for direct, indirect or cumulative effects to soil or water quality because the mixed-use roads were already a part of the NFTS.

A high level of long-term, sustained OHV use is not expected as a result of adding unauthorized OHV routes to the NFTS. This is because near the population centers (i.e., towns and cities near the Lassen, Klamath, and Fremont-Winema national Forests and adjacent BLM lands), there are already OHV use areas. Occasionally there is OHV use on the Forest, but it is generally in association with other activities, (e.g., camping, woodcutting, hunting or other Forest recreational use). The typical OHV use on Forest is generally restricted to ATVs and other four-wheel-drive vehicles, with limited motorcycle use. These users tend to use system roads and skid trails or temporary roads.

The majority of the unauthorized routes existing on the Doublehead and Devils Garden (DH and DG) Ranger Districts are open year-round due to the nature of the landscape. In general terms, this area of the Forest has the tendency to receive rainfall rather than snowfall. During the field review, no evidence was observed that cross-country travel was occurring on the DH and DG Ranger Districts. On the Doublehead and Devils Garden Ranger Districts there are approximately seventy-seven 6th Field Sub-watersheds with approximately 1.2 million acres of NFS lands or 58 percent of the Modoc National Forest land base.

The soils in the Tionesta 6th Field sub-watershed are generally deep soils that consist of volcanic overburden that has a rapid permeability and does not have the tendency toward compaction even when wet. A long-term soil productivity (LTSP) study was completed on these soils, and the findings of their research report is incorporated into the analysis by reference (Powers, Robert and et al., The North American long-term soil productivity experiment: Findings from the first decade of research, Journal of Forest Ecology and Management 220 pages 31-50, 2005.). During 2008, BMPEP monitoring of skid trails, temporary roads and landings was completed on these soils. It was observed that even without the use of water bars, these temporary roads, skid trails and landings are not prone to surface runoff occurring. There was no evidence that these soils are prone to rilling, rutting or erosion from overland water movement or runoff.

Eastward from Cedar Pass to the Forest boundary (east side of the Warner Mountains) and north to the Oregon state line and south to the Forest boundary, there is a lack of a SRI Order 3 that identified maximum erosion hazard or slope stability. The land forms are steep with presence of inner gorges, down-cut channels and unstable slopes. These soils on the east side of the Warner Mountains are more sensitive, have a higher clay content, have less rock content, and are presumed to be more prone to higher erosion rates. Past land management activities have shown a lighter touch on the ground due to the sensitivity of these soils and the associated land forms.

For the purpose of this analysis it was presumed that on slopes greater than 30 percent the MEHR was high to very high, WROP was rapid to very rapid, and WSS and SSH was high or greater (basic assumption). This extends eastward approximately eastward from Cedar Pass campground to the Forest boundary. Approximately 20.1 miles of unauthorized routes that are proposed to be added to the transportation system are on soils with a high to very high MEHR and rapid to very rapid WROP.

The remaining routes are spread out across the Warner Mountain Ranger District (thirty six 6th Field Sub-watersheds with approximately 18 percent of the Modoc National Forest land base) and Big Valley Ranger District (fifty 6th Field Sub-watersheds with approximately 24 percent of the Modoc National Forest land base). However, these unauthorized routes are not consistent with BMP 2.26 (Obliteration or Decommissioning of Roads). While these unauthorized routes are made hydrologically stable, they have not been closed to low-level casual use, as identified under explanation of BMP 2.26 (page 80, Water Quality Management for Forest System Lands in California-Best Management Practices, USDA Forest Service, Pacific Southwest Region, September 2000).

The results of the field review done in 2008 showed that only one route on the Warner Mountain district was actively eroding. This was proposed route SS563. The remainder routes would receive a fully compliant with BMPEP T02 (Skid Trails) and E14 (Temporary Roads). Even the route that was actively eroding was only eroding from the water bar to the system road. The eroding treadway was less than 25 feet long and 15 feet wide. It was located on a steep pitch of the hillside, and the roadway of the system road was not hydrologically connected to a perennial or seasonally flowing stream. Under BMPEP T02 would have received a minor departure based on presence of rills but occurrence on less then 20% of the skid trail surface and no evidence of transport into the SMZ.

Mixed use of roads was not analyzed, as they were assumed not to be new additions to the NFTS and are subject to maintenance and erosion control as specified under BMPs 2.7 (Control of Road Drainage), 2.22 (Maintenance of Roads), 2.23 (Road Surface Treatment to Prevent Loss of Materials), and 2.24 (Traffic Control During Wet Periods).

Direct and Indirect Effects to Soil and Water Quality

Alternative 2 and 5 contain the largest amount of acreage of unauthorized routes to be added to the NFTS on NFS lands. Of approximately eighty 6th Field HUCs on the Modoc National Forest, only 9 or 11.5 percent have soils that have maximum erosion hazard (MEHR) of high or very high, and these are limited to the Warner Mountain Ranger District.

Big Valley Ranger District

While the Big Valley Ranger District (BVRD) has soils that have high to very high MEHR and WROP of rapid to very rapid, it has a very low number of routes that are proposed to be added. There are a total 39.1 miles of unauthorized routes that are proposed to be added to the transportation system across 494,307 acres or 0.14 percent of the BVRD. There were no routes that are proposed to be added on soils with a high or very MEHR, and none of these routes is hydrologically connected to perennial streams or lakes, or has diversion potential to streams or lakes. Approximately 90 percent of these routes are located in four 6th Field HUCs.

Since none of these routes is located soils that have either high to very high MEHR or high SSH, none of these routes was field checked. No RCAs were field checked by the Forest hydrologist; they were reviewed, however, by the field crew during sampling for bulk density. No erosion or stream diversion potential was identified during the field visits by the soil sampling crew.

Doublehead and Devils Garden Ranger Districts

Approximately 268.5 miles of the 339 miles are located on the Doublehead and Devils Garden Ranger Districts, or approximately 79 percent of the proposed routes on the Modoc National Forest. This accounts for approximately 0.04 percent of the NFS lands.

These are located on soils that have a low to moderate MEHR and a low to moderate SSH, and have either high rock content in the soil or rock on the surface. These routes are presumed to be compacted and are an average width of 15 feet with a disturbance coefficient of 0.18 to 0.27 acres per mile of unauthorized route. This is based on bulk density samples taken on 60-plus sites across the Forest. To put this in perspective, an acre of fully compacted soil would produce approximately 1.82 acres per mile and a cow trail would result in disturbance coefficient of 0.12 to 0.24 acres per mile of trail. A skid trail created by logging activity would, on the average, result in a disturbance coefficient 0.27 to 0.55 acres per mile. This, of course, is dependent on soil type (deep sandy soil versus clayey soil, and high rock content versus low rock content).

Since none of these routes is located on soils that have either high to very high MEHR or high SSH, none of these routes was field checked by the Forest hydrologist. Approximately 50 routes were sampled for bulk density, and there was no evidence of erosion or of inconsistency with BMPs or R5 SQS standards noted. The field review was completed by archaeological technicians that were trained by the Forest hydrologist on soil sampling. The routes visited were picked at random by the Forest hydrologist. RCA's were selected at random and field checked by the Forest Hydrologist. Not all RCA's were field checked by the Forest Hydrologist, selected sites picked at random were field reviewed by the field crew during sampling for bulk density. No erosion or stream diversion potential was identified during the field visits by the soil sampling crew.

Of the 268.5 miles, only 0.08 miles or 0.15 acres are located within the RCAs for perennial streams or lakes. There are approximately 32 acres within seasonally flowing RCAs created by

the proposed routes. None of these routes was identified as being hydrologically connected to the stream network or has diversion potential to streams or lakes.

Warner Mountain Ranger District

The Warner Mountain RD has soils that have high to very high MEHR and WROP of rapid to very rapid. However, it has a very low amount of routes that are proposed to be added. There are a total 31.4 miles of unauthorized routes that are proposed to be added to the transportation system across 361,564 acres, or 0.02 percent of the WMRD. Approximately 40 to 60 percent of the routes that are proposed to be added are on soils with a high or very high MEHR. The routes that are proposed to be added are old skid trails and temporary roads that have been made hydrologically stable by the installation of water bars. They are compacted, not eroding, and are consistent with BMP 1.17 (Erosion Control on Skid Trails) and BMP 2.26 (Obliteration of Temporary Roads), with the exception of access to the road or skid trail is blocked to low-level casual use.

All of the routes that are located on soils that have either high to very high MEHR or high SSH were field checked. The results of the field review show that only one small section of a trail within the Warner Mountain RD is actively eroding. The portion of the route that was eroding was on a steep pitch of the hillside (slope greater than 30 percent) and the eroding portion was less the 25 feet and was connected to a system road. The system road or route was not hydrologically connected to a perennial stream or lake and was not within the RCA.

There are 1.72 miles of authorized routes or 3.1 acres within RCAs for perennial stream or lakes. The largest concentration is associated with Lassen Creek (0.5 miles or less than 1 acre) and Northwest Shore Middle Alkali Lake (0.7 miles or 1.3 acres). While the routes are located within the RCAs for perennial streams and lakes, they are not hydrologically connected to the stream courses nor are they contributing sediment to the water column.

It is recommended that the following project design standards (PDS) would be applied to Alternative 2. These PDSs are as follows:

BMPs 2.7 (Control of Road Drainage), 2.22 (Maintenance of Roads) and 2.23 (Road Surface Treatment to Prevent loss of Materials)

While these BMPs were designed to prevent unacceptable levels of road runoff and erosion of system roads, the same principles should be applied to the routes added to the transportation system. These routes would be added as ML 2 roads and not as trails. These are mostly preventive measures, but a key component of this BMP is the development of an erosion control plan and maintenance of erosion control structures.

BMP 2.24 (Traffic Control during Wet Periods)

The application of this BMP is a preventive measure in nature, and is dependent on the changing effect of climate. As the authorized routes become saturated, the use of the roads should be restricted to times when rutting of the tread is not likely to occur. Under normal conditions, this is unlikely to occur except for a few times during the year. This should be accomplished by coordination between the OHV manager and the Forest hydrologist. The final decision will be made by the line officer.

BMP 4.7 (Water Quality Monitoring of OHV Use According to a Developed Plan)

Under this plan, the OHV Soil Monitoring Protocol (green-yellow-red) was developed in Region 5 as a standardized, region-wide trail-monitoring methodology, and should be implemented. (The green-yellow-red system establishes priorities for maintaining OHV routes.) It is expected that all trails with a distance greater then 0.5 miles in length would be monitored by the OHV manager or

his or her designated representative over the next ten years. The results of the monitoring would enable the OHV manager to prioritize the need for trail maintenance.

Conclusion

With the adoption of the above-referenced PDS, it is unlikely that Alternative 2 would result in a direct or indirect adverse effect to soil or water quality.

Cumulative Effects to Soil and Water Quality

Of the 120-plus 6th Field HUCs on the Modoc National Forest, approximately 80 sub-watersheds contain unauthorized routes that are proposed to be added to the transportation system under Alternative 2. Of these nearly eighty affected sub-watersheds, all but nine had over 80 percent of their land base acreage with low risk factors that would make them likely lead to the occurrence of a cumulative effect to soil or water quality. These risk factors are as follows:

- Maximum Erosion Hazard Rating (MEHR) of high to very high
- Slope Stability Hazard Rating (SSH) of high to very high
- Water Runoff Potential (WROP) of rapid to very rapid
- Watershed Sensitivity (WSS) of high to very high
- Slopes greater than 40 percent

The nine 6th Field sub-watersheds that have more then 20 percent of the land base with the above-referenced risk factors are located within the Warner Mountain Ranger District and are included in both the 1802 and 1808 HUCs. These 1802 HUCs or sub-watersheds drain predominately into Goose Lake with little or no hydrologic connectivity to the Pit River. The 1808 HUCs drain into the alkali lakes to the east of the Forest boundary and do not have hydrologic connectivity to perennial waters downstream.

Modified CWE Process

The modified CWE process stipulated that when a 6th Field sub-watershed contains less than 20 percent occurrence of high risk factors and less than five percent of the land base would be compacted from the transportation system and proposed routes, then soil bulk density samples would be obtained, and the results compared instead of the traditional ERA-TOC Methodology.

Of the 120-plus 6th Field HUCs on the Modoc National Forest, approximately 80 sub-watersheds contain unauthorized routes that are proposed to be added to the transportation system under Alternative 2. All of these affected sub-watersheds contain less than five percent of its land base that would be compacted from the existing transportation system plus addition of proposed routes.

Of these nearly eighty affected sub-watersheds, all but nine had more than 80 percent of their land base acreage with low risk factors that would make them likely to lead to the occurrence of a cumulative effect to soil or water quality. Soil bulk density samples were taken at random across the 80 affected sub-watersheds to compare the amount of compaction that was occurring on the routes, versus the amount of compaction occurring adjacent to the routes.

Bulk density is a direct field measurement that includes air space, as well as soil volume; thus, these measurements are related to soil porosity. Excessive trampling by grazing animals, use of heavy machinery, and intensive recreational use or disturbance while soils are wet will increase bulk density, particularly of finely textured soils (Pritchett, William L., Properties and management of Forest Soils, John Wiley and Sons, 1979). The change of bulk density shows how the roadway has changed or altered the soil porosity.

It is expected that on the Big Valley, Devils Garden and Doublehead Ranger Districts, there would be a relatively low amount of change of the bulk density (0 to 15 percent) of the OHV routes. This is due to the low amount of fines (clay content) in the soil, and the high amount of coarse material (rock, gravel and cobbles on the soil surface and in the subsoil) in the soil. Within the Warner Mountain Ranger District, there should be a relatively higher amount of change in the bulk density (15 to 30 percent) of the soil in the OHV Routes, mainly due to the higher amount of fines (clay content) and a lower amount of coarse material in the soil and subsoil.

Bulk density was sampled across the Modoc National Forest on sites that were picked at random that sampled a wide range of soils and watershed conditions.

- The results of the sampling across the Modoc National Forest show that, of the 62 routes that were sampled, 23 routes or 37.1 percent showed no discernable change in soil compaction on the routes, as compared to the undisturbed areas of the Forest. Twenty-five routes had less than 20 percent increase in soils compaction of the undisturbed adjacent area, or 40.3 percent. Only 14 routes showed a soil compaction increase of 20 to 40 percent or 22.6 percent over undisturbed areas of the national Forest.
- Of the routes that showed an increase in soil compaction greater then 20 percent over the undisturbed areas, five samples were obtained in the Lassen Creek, Ross Creek and Willow Creek sub-watersheds. The Lassen and Ross Creek had more than 20 percent of the land base with high risk factors and were analyzed under the R5 CWE TOC-ERA methodology. Willow Creek sub-watershed did not have more then 20 percent high risk factors. Less than five percent of the affected sub-watershed had roaded acres, it was analyzed under the modified CWE approach.

Assuming the worst-case scenario that 22.6 percent of the routes would have increased soil compaction over undisturbed areas by 20 to 40 percent, this would equate to approximately 113 to 225 roaded acres that would have some form of soil compaction, but not be fully compacted. These acres are spread out across approximately 80 sub-watersheds with less than one percent of the land base that would have an increase in the potential runoff. Since the routes are disconnected from stream crossings and these soils has either rapid permeability or a high percent of rock on the surface or rock content in the soil profile, this small increase of runoff would not adversely affect the sub-watershed process. These sub-watersheds have less than five percent of the land base in roaded acres, and do not have the high-risk factors present.

Conclusion

None of the sub-watersheds, with the exception of the nine affected sub-watersheds within the Warner Mountain Ranger District, has a high risk factor of WROP, SSH, or WSS. The routes are not hydrologically connected to perennial or seasonally flowing stream network, and the runoff potential increased by the soil compaction levels of the routes is generally less then 1 percent over adjacent undisturbed areas. Based on these facts, it has been determined that under Alternative 2, the addition of the proposed routes to the NFTS is unlikely to result in an adverse cumulative effect to soil or water quality.

Region 5 Cumulative Watershed Effect Process

Nine of the 80 identified 6th field sub-watersheds (see following table) were analyzed under the ERA-TOC methodology. Threshold of Concern (TOC) was developed by determining the amount of acreage in each sub-watershed of the above referenced high risk factors. The identified TOC was established at 12 percent, and ERAs for the sub-watersheds were identified based on ground disturbing activities that have occurred over the past 30 years. The proposed routes were originally skid trails and pre-existing temporary roads associated with past harvest activities. The

ERAs created by them were originally incorporated as an infrastructure associated with harvest activities, and part of the disturbance coefficient.

The following are the result of the ERA-TOC Methodology CWE Analysis completed on the nine affected sub-watersheds that are not covered under the Modified CWE Process. Please refer to Table 3-35, below.

Table 3-35. Summary of Results of ERA-TOC CWE Analysis

6th Field HUC #	6th Field HUC Name	2008 % TOC	2013 % TOC	2018 % TOC
180200010305	Lassen Creek	32.4	27.4	24.3
180200010306	Ross Creek	28.5	26	24.8
180200010307	Davis Creek	31.1	27.9	25.4
180800010102	Bidwell Creek	21.9	21.5	21.3
180800010103	Upper West Shore Upper Alkali Lake	27.4	23.1	20.2
180800010104	Lower West Shore Upper Alkali Lake	28.3	25.2	22.3
180800010201	Northwest Shore Middle Alkali Lake	42.2	40.4	33.7
180800010202	West Shore Middle Alkali Lake	15.4	14.2	13.1
180800010303	Bare Creek	23.2	20.1	17

The results of the ERA-TOC R5 CWE methodology displayed above show that none of the sub-watersheds above are approaching 80 percent of TOC. Over the next 10 years, the 6th Field sub-watersheds will recover and the percent of TOC will drop into the 20 to 30 percent range. In addition, the routes are hydrologically stable and are not connected to perennial or seasonally flowing stream courses. Therefore, it has been determined that under this action alternative, it is unlikely that an adverse cumulative effect to soil or water quality would occur.

Reasonably Foreseeable Actions

Devils Garden and Doublehead Ranger Districts: Over the next 10 years, fuels reduction and plantation thinning are proposed to be implemented across the Devils Garden Ranger District. At this point in time there little is known of a site-specific nature on the acres to be treated by mechanical activities. But one could presume that approximately 1,000 to 2,000 acres could be potentially treated by hand and the same amount of acres could be treated mechanically. This would most likely occur in the Taylor Creek 5th Field sub-watersheds (1802000211) Since these sub-watersheds do not have the occurrence of high risk factors, it is not likely that they would add to the risk of a cumulative effect. These projects would be analyzed for direct, indirect, and cumulative effects to soil and water quality during a separate NEPA process. The effects to soil and water quality would be minimized through the application of MDF LRMP S&G, BMPs and R5 SQSs.

Big Valley Ranger District: A fuels reduction project is being analyzed in the Ash Creek 5th Field Watershed. However, there are no unauthorized routes proposed within its affected sub-watershed. These projects would be analyzed for direct, indirect, and cumulative effects to soil and water quality in a separate NEPA process. The effects to soil and water quality would be minimized through the application of MDF LRMP S&G, BMPs and R5 SQSs.

Warner Mountain Ranger District: At this time, the Lassen Creek and Cedar Pass projects are being planned. The Lassen Creek fuels reduction encompasses areas of Lassen Creek, Willow Creek, Davis Creek, and Ross Creek. This project is most likely to contain mechanical activity

that could create additional soil compaction. At this point in time, the Lassen Creek project is a 2010-and-beyond project. Little is known on the exact treatment acres, but the history has been incorporated into the CWE-ERA-TOC analysis for the FEIS. The guidance to the silviculturist is to develop acres and treatment plans based on not exceeding 80 to 82 percent TOC. Once project-level activities become defined, it will be analyzed under the R5 CWE analysis. Any ERAs created by this project will be incorporated into the CWE analysis for Lassen Creek.

Project-level analysis for the Cedar Creek Fuels Reduction Project has been completed and the EA has been signed. This project contains mechanical activity that could create additional soil compaction. The results of project-level CWE analysis were incorporated into the Travel Management DEIS.

At this time, no other projects are known that could create additional soil compaction. Both of the above-referenced projects would be consistent with MDF LRMP standards and guidelines, BMPs, and R5 SQS.

Alternative 3

Under Alternative 3, no new routes would be added to the road system. There would be no seasonal closure of system roads, and mixed use of approximately 3,764 miles of Maintenance Level 2 (ML 2) would continue. The Boles Road would not be closed and the Pumice Mine Roads would not be closed to OHV use. There would be no additional seasonal closures.

No OHV trail monitoring (red-yellow-green) has been completed on the mixed-use roads. There would be no change of vehicle class on level 3 roads that would result in a change of mixed use. It should be noted that under Alternative 3, cross-country travel would be banned and there would be a decrease in the potential for additional unauthorized routes to be created.

Since only the existing road system would be used for motorized use and these routes would meet the identified BMPs as identified under Alternative 1, it is unlikely that a direct, indirect or cumulative effect to soil or water quality would occur.

Alternative 4

Under Alternative 4, a total of 1,025 unauthorized routes are proposed to be added to the transportation system. The average road length to be added would be less then a third of a mile. These routes would add approximately 286 miles and constitute approximately 521 acres of roadways with a disturbance coefficient of 110.9 to 166.4 compacted acres across the Modoc National Forest. The Boles Road would be closed to all vehicles, and the Pumice Mine Road would be closed to OHV use. There are more seasonal closures on the transportation system under this action alternative than all of the other Alternatives.

This alternative has fewer miles and number of routes to be added to the National Forest Transportation System (NFTS) on the Modoc National Forest than does Alternative 2. There are no routes proposed to be added to the transportation system that were not analyzed under Alternative 2. The analysis that was completed for Alternative 2 is incorporated here by reference.

Direct and Indirect Effects to Soil and Water Quality

There are fewer routes, acres of NFS lands disturbed, and miles of routes across the Modoc National Forest under Alternative 4 than Alternative 2 (286 miles versus 339). No routes are being added that were not analyzed under Alternative 2.The same project design standards would be applied as discussed under Alternative 2. Therefore, it is unlikely that this action alternative would result in an adverse direct or indirect effect to soil or water quality.

Cumulative Effects to Soil and Water Quality

There are fewer acres of NFS lands disturbed under Alternative 4 than Alternative 2 (521 versus 617). No routes are being added that were not analyzed under Alternative 2, and the same project design standards would be applied as discussed under Alternative 2. Therefore, it is unlikely that this action alternative would result in an adverse cumulative effect to soil or water quality.

Alternative 5

Under Alternative 5, there are 1,168 unauthorized routes that are proposed to be added to the transportation system, which is the same as Alternative 2. The average road length to be added would be less then a third of a mile long. These routes would add approximately 339 miles and constitutes approximately 617 acres of roadways with a disturbance coefficient of 110.9 to 166.4 compacted acres across the Modoc National Forest. The Boles Road would be closed to all vehicles and the Pumice Mine Roads would be closed to OHV use. The seasonal closures to the transportation system under this action alternative, are the same as Alternative 2, with the exception that there are two versus four different closure dates. There are nearly four times as many miles of mixed use (Alternative 5-531 miles versus Alternative 2-138 miles).

These routes would add approximately 339 miles and constitute approximately 616 acres of roadways with a disturbance coefficient of 110.9 to 166.4 compacted acres across the Modoc National Forest, or approximately 0.01 percent of the land base of the Modoc National Forest.

This alternative has same amounts of miles and routes to be added to the National Forest Transportation System (NFTS) on the Modoc National Forest as Alternative 2. There are no routes proposed to be added to the transportation system that were not analyzed under Alternative 2. The analysis that was completed for Alternative 2 is incorporated here by reference

Direct and Indirect Effects to Soil and Water Quality

Since there are the same number of routes, acres of NFS lands disturbed and miles of routes across the Modoc National Forest under Alternative 5 then Alternative 2, no routes are being added that were not analyzed under Alternative 2, and the same project design standards to be applied as discussed under Alternative 2, it is logical to determine that it is unlikely that this action alternative would result in an adverse direct or indirect effect to soil or water quality.

Cumulative Effects to Soil and Water Quality

There are the same number of routes, acres of NFS lands disturbed, and miles of routes across the Modoc National Forest under Alternative 5 as under Alternative 2. No routes are being added that were not analyzed under Alternative 2, and the same project design standards would be applied as discussed under Alternative 2. Therefore, it is unlikely that this action alternative would result in an adverse cumulative effect to soil or water quality.