3.10 Water Resources

3.10.1 Introduction

Protection of water quantity and quality are an important part of the mission of the Forest Service (USDA-FS 2007). Management activities on National Forest System lands must be planned and implemented to protect the hydrologic functions of forest watersheds, including the volume, timing and quality of streamflow. The use of transportation facilities 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 (Foltz 2006). Management decisions to eliminate cross-county motorized travel, add facilities to the NFTS must consider effects on watershed functions.

Analysis Framework: Statute, Regulation, LRMP and Other Direction

Direction relevant to the alternatives as it affects water resources includes:

Clean Water Act of 1948 (as amended in 1972 and 1987) establishes as Federal policy 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 California Water Code and Porter-Cologne Water-Quality Act, below).

Non-point source pollution on National Forests is managed through the Regional Water Quality Management Plan (USDA-FS 2000), which relies on implementation of prescribed Best Management Practices (BMPs). The Water Quality Management Plan includes one BMP for OHV use (4-7) and 28 BMPs related to road construction and maintenance (2-1 to 2-28) (See Appendix H for a listing of the BMPs applicable to this project). All NFTS roads and trails open to OHV use are required to comply with applicable BMPs.

Of particular relevance for OHV 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 facilities. 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 alternatives is section 13369, which deals with non point-source pollution and BMPs.

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 Sierra Nevada Forest Plan Amendment (SNFPA) (USDA-FS 2004a). The Record of Decision (ROD) for the 2004 SNFPA includes standards and guidelines (S&G) that apply to the ten Sierra Nevada National Forests for construction and relocation of roads and for management of Riparian Conservation Areas (RCAs). Applicable standards and guidelines include:

- S&G 70 requires the Forest Service to avoid road construction, reconstruction and relocation in meadows and wetlands. 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.
- S&G 92 requires that the Forest Service evaluate new management activities within riparian conservation areas (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.
- 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.
- 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.

The compliance of each alternative with the S&Gs for RCAs is evaluated and discussed in a separate report (Appendix J).

The SNF Land and Resource Management Plan (LRMP) (USDA-FS 1991). The direction for the management of riparian and hydrologic resources related to motorized use includes:

69. Give primary management emphasis in riparian areas to protect and enhance the riparian ecosystem, riparian vegetation, water quality, soils, fish and wildlife resources.

70. Riparian area protection and Streamside Management Zone (SMZ) determination will be based on methods described in FSH 2509.22, Sierra Supplement 1, which gives specific direction for width determinations.

75. Maintain or enhance productivity of Forest meadows to accommodate wildlife and range resources.

76. In stream reaches occupied by fish, any activity that results in trampling and chiseling of stream banks should not exceed 20 percent of any given stream reach. Controls such as re-routing trails, relocating dispersed campsites and/or fencing of areas will be used to manage activities and improve riparian conditions in identified areas not meeting this standard.

77. Protect streamside zones by locating new roads outside of riparian areas, except at stream crossings.

78. Avoid constructing new roads within the perimeter of meadows and other riparian areas where opportunities exist to relocate or obliterate existing roads.

79. When existing routes through riparian areas and meadows are not compatible with riparian dependent resources, consider re-routing.

120. Preclude the impacts of cumulative watershed effects (CWE) by applying appropriate BMPs and mitigation measures during project implementation. Utilize regional CWE methodology when refined for application within the Forest to assess each project for potential to incur cumulative effects.

123. Avoid development in floodplains, wetlands and riparian areas, except where alternatives will not meet essential management objectives or purposes. This includes bridges, approaches, water diversion structures and boat ramps.

124. BMPs will be implemented to meet water quality objectives and maintain and improve the quality of surface water on the SNF. Methods and techniques for applying BMPs will be identified during project level environmental analysis and incorporated into the associated project plan and implementation documents.

128. Apply appropriate erosion prevention measures (FSH 2409.23) on high erosion hazard soils under the following conditions:

a. When exposed soils from an average of several 500-ft linear transects:

i. Exceed 150 feet on slopes of 15-35 percent,

ii. Exceed 75 feet on slopes of 35-65 percent or

iii. Exceed 25 feet on slopes over 65 percent;

b. On linear disturbances, such as skid trails and firelines, cross-drain at the following intervals:

Percent Slope	HEHR	VHEHR
0-15	150	125
15-35	75	45
35-65	35	20
>65	15	15

129. Road construction on areas with High (H) and Very High (VH) Erosion Hazard Ratings (EHR) will follow standards in FSH 2509.22, Sierra Supp. No. 1, which gives direction concerning soil stabilization and road surface drainage. … (See Appendix H).

210. Controlled use of the road system including road closures may be triggered by: … b. snow or adverse weather; … g. protection of sensitive resources.

Effects Analysis Methodology

This section describes resource-specific assumptions, sources of information used to support the analysis, indicators used in the analysis including the rationale as to why they were chosen, timeframes (short-term and long-term), the spatial boundary of the analysis and impacts relevant to water resources. For a map and description of the analysis units, refer to Chapter 1, Figure 1-2 and Table 1-1.

Assumptions specific to the water resources analysis:

1. Adverse effects of route use by motor vehicles include long-term damage to soil and water resources due to soil compaction, alteration of drainage patterns and destruction of vegetation.
2. Without active restoration, these effects will persist for periods of years to decades (depending on soil type, slope, etc.) following the prohibition of public motor vehicle use in the SNF.
3. Sediment production from motor vehicle use of native-surface NFTS facilities is increased by higher levels of traffic and is reduced by maintenance of drainage features (culverts, waterbars, ditches). While some research (Forsyth and others 2006, Luce and Black 1999) has shown that maintenance temporarily increases sediment yield from

roads, maintenance has been shown to be key to preventing chronic erosion of road surfaces (Gucinski and others 2001).

4. The only changes being made to the NFTS that have the potential to affect water resources are the changes in use period. Allowing or prohibiting traffic when road surfaces are wet has effects on the amount of sediment generated from the road surface and on the stability / life of road drainage structures that function to control erosion. Roads that are closed year-round are more likely to establish vegetation on their surface, which would reduce the effects of the road on runoff as well. While the effects of various vehicle types (passenger cars, four-wheel drive trucks, ATVs and motorcycles) have been examined in some studies, the differences in the impacts of their use on existing roads and trails are not well documented in the literature. Because the changes in vehicle type are being made on the NFTS and none of the changes involve motorcycles (motorcycles being the most different vehicle type in terms of impacts), changes in vehicle class between highway-legal vehicles, all vehicles and vehicles less than 50" are assumed to have no effect on the impacts of the NFTS and will not be considered in the water resources analysis.

5. The spatial boundary for the direct effects analysis is the project area boundary encompassed by the analysis units. Within this boundary, the specific areas requiring analysis include hydrologically sensitive areas (described below), unauthorized routes and NFTS facilities for which changes in season of use or vehicle class are proposed. Indirect effects and CWEs are analyzed at the Hydrologic Unit Code 8 (HUC8) subdrainage scale (generally 500 to 3000 acres, although some are outside of this size range; HUC7s have not been delineated on the SNF). Some of the HUCs extend outside of the analysis unit boundaries, so the boundary for this analysis is slightly larger than the boundary for direct effects. In areas where CWE concerns are identified at the HUC8 scale, they are also considered at the HUC6 scale (generally 10,000 to 50,000 acres). Although the analysis was conducted within watersheds, the discussion is structured around analysis units.

6. Hydrologically sensitive areas include all designated riparian protection areas including RMAs, SMZs, RCAs and CARs, as defined in the LRMP (USDA-FS 1991) and SNFPA ROD (USDA-FS 2004a). Examples of hydrologically sensitive areas include streams, springs, lakes, reservoirs, fens, meadows and marshes, and their specified buffer areas. All areas of perennial and seasonal standing or running surface water and areas of perennially or seasonally saturated soil are included within these areas. RMAs and SMZs are contained within RCAs, which comprise the area used for GIS analysis of hydrologically sensitive areas. RCAs have been delineated as described in the Affected Environment section, and displayed in Table 3- 67.

Data Sources

The types of information utilized for the analysis are listed in Table 3- 66. All of the data is on file at the SNF and the project-specific field data is available in the project record.

Table 3- 66. Data Sources Used in the Analysis of Effects to Water Resources

Data Type		Source	Use in Analysis
1	Route Inventories (Step 1) and associated tabular data	Field data collected for this project	Baseline information about existing motor vehicle use
2*	Route condition and stream crossing characteristics	California State OHV Soil Loss Monitoring (Red-Yellow-Green monitoring) and stream crossing observations collected for this project by Soils, Hydrology and Aquatics personnel	To determine actions needed prior to opening and to determine effects of adding routes to system
3	GIS analysis of hydrologically sensitive areas and interactions with routes and areas	SNF GIS layers; 2005 and 2006 NAIP (aerial photo) 1m digital imagery	To characterize the potential for unauthorized routes and areas to have an effect on water resources; implications for CWEs.
4	GIS analysis of changes in seasonal road closures	SNF GIS layers; TIS transportation database for each alternative	To characterize the effects of the changes in the road closure plan on water resources.
5	Stream channel data (SCI; PFC; Pfankuch stability ratings; etc)	Field data from the SNF Watershed and Aquatic Species program files	To describe the known characteristics of streams and their sensitivity to disturbance
6	Information regarding recovery from disturbances across the SNF	Documented in the Soil Resources section of this chapter (Rojas 2008)	To characterize the expected passive recovery of routes that are not added to the system
7	Records of previous management activities and other disturbances	FACTS database, GIS	To account for other known disturbances in the ERA analysis of Cumulative Watershed Effects

*Each route was screened in GIS to determine whether a site visit was necessary for the water resources analysis. Routes were identified for a field visit if any of the following were identified: the route crossed a channel of any stream order (including Order 1 / 0), entered an RCA, was located in an over threshold HUC8, or located on sensitive soils. In a few instances, NAIP imagery was used to eliminate a route from a site visit. For example, GIS indicated the route was located on a map unit containing sensitive soils, but imagery showed that the specific location was actually a granite outcrop. In a few cases, documentation provided by another resource area was used to conclude that there was no stream channel, erosion, etc occurring on the route, and therefore, a site visit for water resources data collection was not necessary. The rationale for each route meeting the criteria for a site visit that was eliminated using imagery or other information is contained in the project record.

Water Resources Analysis Methodology

The analysis methodologies for each of the four actions that make up the alternatives and for cumulative watershed effects are described below.

1. Direct and indirect effects of the prohibition of cross-country motor vehicle travel.

Indicators:

1. Miles of unauthorized routes in RCAs and number of stream crossings available for motor vehicle use (data sources 1 and 3);

2. Acres in RCAs open to cross-country motor vehicle use (data source 3).

Short-term timeframe: 1 year.

Long-term timeframe: 30 years (consistent with the established timeframe for evaluating CWEs on the SNF).

Spatial boundary: All SNF system lands with the exception of designated wilderness and special areas identified in the LRMP (e.g. Kings River Special Management Area, research natural areas), as contained in the AUs

Methodology: GIS analysis of unauthorized routes and open areas and interpretation based on observations and literature review.

Rationale: In a study of cross-country ATV impacts, Foltz and Meadows (2007) looked at the degree of disturbance based on leaf litter and vegetation cover, trail width (both tread and displaced material) and ATV rut depth. Tests showed that as little as 120 passes of an ATV along a cross-country route could result in what they called “high” disturbance (i.e., >60 percent loss of ground cover, trail width of greater than 72 inches and ruts exceeding 6 inches in depth). The study concludes that ATV traffic adversely affects natural resources and that all of the vehicles tested contributed to those effects regardless of the type of ATV or tire type.

The relevance of vehicle type is that a trail design that protects against erosion for one vehicle type may not work well for another vehicle type. Examples of this include hardened trail segments where the hardened tread width is narrower than the tread width of vehicles that use it, resulting in rutting alongside the improvement; or use of gravel to harden OHV trails, which may stay in place with four-tire vehicle use but is extremely susceptible to being displaced by motorcycle tires spinning out and flinging the gravel particles. Vehicle type is displayed in the route specific data shown in Appendix A.

Taylor (2001) reviewed studies that document impacts of motor vehicle use on erosion, water resources and riparian and aquatic habitats, including studies in Texas that found statistically significant effects from motor vehicle use on benthic macroinvertebrates, water quality in pools and disturbed vs. non-disturbed riffles.

Chin and others (2004) conducted a study on the effects of ATVs on stream dynamics that evaluated the amount of pool filling by fine sediment (i.e., the reduction of pool volume and depth) as compared to control watersheds where ATV use was not occurring. They found that the watersheds impacted by ATV use showed a reduction of mean pool volume by as much as 50 percent.

Impacts to stream channels, riparian areas and water quality are possible where this use occurs in RCAs. The RCA widths in the SNFPA (USDA-FS 2004a), were prescribed to protect both physical and biological components of the riparian system, including sediment and nutrient delivery, large woody debris recruitment and habitat occupancy and use by various species. (Outside of RCAs, disturbances that result from motor vehicle use would be less likely to affect water and sediment reaching streams, meadows or other hydrologically sensitive areas.)

Permitting four-wheel drive, ATV and motorcycle use only on designated routes will reduce the extent of impacts. While impacts on designated routes may be more severe than those that occur from more dispersed use, they can be effectively managed and mitigated. Restricting cross-country travel will minimize the number of stream crossings and riparian impacts and limit them to known areas that can be monitored and maintained.

2. Direct and indirect effects of adding facilities (unauthorized routes and/or areas) to the NFTS, including identifying seasons of use and vehicle class.

Indicators:

1. Miles of routes added in RCAs (data source 3);
2. Number of stream crossings added (data source 3);
3. Sum of route miles with documented erosional features (data source 2);
4. Numbers of locations where routes divert or have potential to divert streamflow (data source 2).

Short-term timeframe: 1 year.

Long-term timeframe: 30 years (consistent with the established timeframe for evaluating CWEs on the SNF).

Spatial boundary: All SNF system lands with the exception of designated wilderness and special areas identified in the LRMP (e.g. Kings River Special Management Area, research natural areas), as contained in the AUs

Methodology: GIS analysis of the added features, combined with field data (California State OHV Soil Loss Monitoring protocol, additional data collected at stream crossings) and known information about the affected environment (stream channel sensitivity, etc). Interpretation based on observations and literature review.

Rationale: Many published studies have documented that roads are a major disturbance in managed watersheds (Trombulak and Frissell 2000; Switalski and others 2004). Studies have consistently shown that roads produce more sediment than other forest management practices (Robichaud and others 2010). Unsurfaced roads and trails (such as the routes being analyzed for addition to the NFTS) contribute much more sediment than surfaced roads. For example, Coe's study (2006) on the El Dorado National Forest found that native surface roads produced 10 to 25 times more sediment than rocked roads. Surface erosion was also dependent on soil type, road surface type, road grade, cross slope, age of the road, traffic volumes and the effectiveness and spacing of drainage structures. In the South Fork Platte River, Welsh and others (2006) found that the mean sediment production from motor vehicle trails was 5 times higher than the mean from unpaved road segments.

When roads concentrate surface flow and deliver it to streams via surface flow paths, they are termed 'hydrologically connected' and they functionally increase the drainage density (Wemple and others 1996). Surface runoff can be delivered directly into streams via stream crossings or gullies formed at culvert outlets. In general, the greatest impacts from the transportation network come from the portions that are hydrologically connected. Roads and trails whose runoff drains onto hillsides where water infiltrates without reaching streams have fewer impacts on hydrology and water quality. In a study of forest road segments on the Eldorado NF, Coe (2006) found that 25 percent of the road segments surveyed were hydrologically connected. A local study in the Kings River Experimental Watershed (KREW) area in DNK analysis unit found that 13 percent of the road length in the study area was hydrologically connected (Korte and MacDonald 2005). Robichaud and others (2010) note that studies in the western U.S. have found between 23 and 75 percent hydrologic connectivity of roads.

Roads concentrate overland flow and generate more runoff than undisturbed areas and hydrologically connected roads deliver that runoff to streams more quickly and efficiently than undisturbed areas. Studies of the effects of roads on streamflows have had varied results, including that roads increased peak flows, decreased peak flows and had no detectable effect (Gucinski and others 2001). Several studies (Bowling and Lettenmaier 1997, Ziegler and others 2007) have attributed the majority of the increases in streamflows on roads intercepting subsurface flow at cutbanks. Since very few of the unauthorized routes have cut and fill construction, interception of subsurface flow is likely to be less prevalent on these routes than on roads. However, the unauthorized routes still concentrate surface flow and may be more likely to deliver it via hydrologically connected segments than NFTS roads due to the lack of maintenance they receive. Jones and Grant (1996) found that roads shifted the timing of peak flows to be slightly earlier and also increased the peak flows slightly, though the increase was not statistically significant due to the variability of the events. There is more agreement that roads do not appear to affect annual water yield (Gucinski and others 2001).

While the effects of roads on the stream network of an area depend strongly on local factors, road density is an indicator of the road system's relative potential for affecting streams; the higher the road density, the greater the risk of significant impacts. A measure such as the length of hydrologically connected roads would provide a better indication of this potential (Gucinski and others 2001), but the data is generally not available across the SNF. Focusing on routes within RCAs should highlight those segments that are more likely to be hydrologically connected.

Stream crossings in particular have the potential to deliver increased runoff and sediment from the road, destabilize streambanks and affect channel function. Schnackenberg and MacDonald (1998) found that fine sediment in stream channels in Colorado was more strongly correlated with the number of road crossings than with the Equivalent Clearcut Area (similar to the Equivalent Roaded Acres used in this analysis, but indexed to the effects of clearcuts rather than to roads) in the watershed.

Roads can directly affect physical channel dynamics when they encroach on floodplains or restrict channel migration. Roads can also affect meadows and wetlands directly by encroachment and indirectly by altering surface and subsurface flow paths. Alteration of the hydrologic flow paths can indirectly affect meadow and wetland function, with the effects extending far beyond the area road itself. The effects can include erosion and/or lowering of the water table. Effects such as these would only be possible if routes are located within RCAs.

The potential for water to run down roads or trails is termed 'diversion potential'. When this occurs, streamflow diversions can be a major cause of road-related erosion (Best and others 1995; Furniss and others 1997). This is not a widespread occurrence on the SNF.

3. Changes to the NFTS (changing vehicle class, season of use and opening or closing roads). Changing vehicle class between highway-legal vehicles, all vehicles and vehicles less than 50" is assumed to have no effect on the impacts of the NFTS and will not be considered in the water resources analysis (see assumptions in section 3.10.1).

Indicators:

1. Miles of roads with changes (increases/decreases) in the length of the winter season closure period (data source 4);
2. Miles of roads in RCAs and number of stream crossings open year-round (data source 4);
3. Miles of roads in RCAs and number stream crossings closed year-round (data source 4);

Short-term timeframe: 1 year.

Long-term timeframe: 30 years (consistent with the established timeframe for evaluating CWEs on the SNF).

Spatial boundary: All SNF system lands with the exception of designated wilderness and special areas identified in the LRMP (e.g. Kings River Special Management Area, research natural areas), as contained in the analysis units.

Methodology: GIS analysis of changes to seasonal restrictions and year-round prohibitions. Interpretation based on observations and literature review.

Rationale: Traffic on native surface roads generally results in elevated sediment production, particularly if it occurs during the wet season. Road erosion rates increase with increased traffic and if traffic is removed, the sediment concentration in road runoff decreases over time (Robichaud and others 2010). Ziegler and others (2001) found that motorcycle passes during rainfall simulation caused elevated sediment production; they also cite another study that found a more marked result from truck traffic. They attribute the increased sediment production to the amount of loose material on the road surface that is available for transport, because the spike in sediment transport gets smaller with each successive vehicle pass; however, they note that if the new routes had become incised by flowing water, the erosion would have been more persistent.

Forsyth and others (2006) found that high traffic levels on a gravel road during wet weather created ruts that increased erosion. Even in coarse-grained soils that do not develop rutting as a result of wet-weather use, more subtle surface deformation occurs that eventually renders the design shape of the road (crowning, drainage dips, etc) ineffective and leads to increased road surface erosion.

In order to reduce surface deformation and minimize sediment production from roads, Forest Service direction began incorporating the closure of native surface roads during wet periods 20 years ago in the Northern and Intermountain Regions (USDA-FS 1988). In California, the practice was incorporated into the published BMPs (USDA-FS 2000) that are accepted by the State Water Quality Control Board.

Focusing on roads in RCAs and stream crossings should highlight those segments that are more likely to have impacts to streams and riparian areas.

4. Non-Significant LRMP Amendments.

As explained in section 3.1.1 the non-significant LRMP amendments do not have unique effects when compared to the other actions analyzed in this FEIS. The amendment changing the language of S&G 17 pertaining to the management of ML1 roads updates the direction in the LRMP to be consistent with national direction. The potential for impacts to water resources results from the management status of individual roads, which have been analyzed under Action 3, Changes to the NFTS. Similarly, the potential impacts to water resources from the amendment regarding ROS class results from specific management actions that are made possible by the updated direction about where motorized use may occur. The only such action currently known is the addition of facilities to the NFTS, which are analyzed under Action 2, Adding facilities to the NFTS. Any future management actions that are facilitated by the change in ROS class are not yet foreseeable and cannot be analyzed at this time.

For these reasons, the environmental consequences of these amendments will not be discussed further in the water resources section.

Cumulative Effects

Indicator(s): For the Baseline CWE Assessment, ERAs was the indicator (data sources 1 and 7).

For the detailed CWE Assessment, which was conducted for areas affected by the addition of a facility to the NFTS in one or more alternatives and where the Baseline ERA or other information indicated a concern that required additional evaluation, the following indicators were used:

1. Number of stream crossings on routes that would be added to the NFTS (data source 1) and condition of those crossings (data sources 2 and 3);
2. Stream channel condition information (data source 5).

Timeframe: 30 years (the established timeframe for evaluating CWEs on the SNF).

Spatial boundary: The cumulative effects analysis for water resources was conducted by watershed areas. Each HUC8 that contains documented unauthorized routes and/or areas within the AUs was included in the analysis. (The SNF does not have complete watershed delineation at the HUC7 scale and instead uses the HUC8 for CWE analysis.) The HUC8s that are over their Threshold of Concern (TOC) are also discussed at the HUC6 scale in order to provide consideration for the possible downstream accumulation of effects from multiple HUC8s that are over TOC.

Methodology: Following the direction in FSH 2509.22, the CWE analysis has two components consisting of the R5 Baseline and Detailed CWE Assessments. The Baseline Assessment was conducted using the ERA model to determine if the ERAs in any HUC8s are currently at or over their lower TOC. In the ERA model, the percent ERA in a HUC8 is used as an index of watershed disturbance and the risk of impacts to watershed health. Each acre of activity is multiplied by a coefficient to express its level of disturbance to watershed function. Disturbance activities included roads and OHV trails, as well as past, present, and foreseeable vegetation management and logging activity, grazing, and land development (private and federal government) (see Gallegos, 2009 for more details on CWE analysis). The coefficients and ERA values for vegetation management and logging activities are determined by silvicultural prescription, logging system, and soil types. ERAs for vegetation management and logging are prorated by their age, assuming that 95 percent recovery occurs over 30 years (USDA-FS 1990: Chapter 20). The 95 percent recovery, as opposed to a 100 percent recovery, takes into account major skid roads and landings, which can take up to 50 years to recover. The coefficients and ERA values for roads and OHV routes are determined by their widths. Arterial, collector and local roads were calculated at 24 ft, 18 ft, and 13 ft wide, respectively and 24-inch motorcycle trails, 24 to 50-inch OHV trails, and over 50-inch trails/roads were calculated at 2 ft, 5 ft and 13 ft, respectively. All known disturbances that occurred within the past 30 years and all reasonably foreseeable disturbances are included in the ERA analysis. The HUC8s that are over their lower TOC (or where other information, particularly stream channel condition, indicated reason for concern about CWEs) and that would have facilities added to the NFTS were carried forward into a Detailed CWE Assessment. Those HUC8s that are over the lower TOC only in Alternatives 1 and/or 3 were not included in the Detailed Assessment, because none of the actions that would be taken in those alternatives would commit to perpetuating those ERAs. In those alternatives, unauthorized routes would either continue to be used by the public without mitigation by the agency (Alternative 1) or would cease to be used but still would have no additional mitigation (Alternative 3). Unauthorized OHV routes in Alternative 3 were assumed to passively recover over time (Rojas and others, personal communication, 2008; also see the Soils section for discussion of passive recovery of unauthorized OHV routes). The Detailed Assessment focused on those HUC8s where actions taken by the agency would have an effect on these routes that could have implications for CWEs. Effects in other HUC8s are evaluated using the results of the Baseline Assessment. Refer to the CWE Report (Gallegos 2009) for more information.

The Detailed CWE Assessment includes interpretation of the risk of CWEs in the over TOC subdrainages, based on data sources 2, 3 and 5. This assessment is summarized in Table 3- 110.

Rationale: The ERA model was developed as a way to evaluate the accumulation of impacts from different activities through time. The SNF has established two TOCs for ERAs: a lower TOC, which is either 4, 5 or 6 percent, based on a determination of the natural sensitivity of the subdrainage, and an upper TOC, which is 14 percent for all subdrainages. Local observations support that CWEs are generally not observed in HUC8s where ERAs are below the lower TOC and that they are most frequently observed in HUC8s where the ERAs are above the upper TOC. Management actions are generally planned to prevent ERAs from exceeding 14 percent; however, in very small HUC8s, even a small amount of disturbance can result in greater than 14 percent ERA. In addition, events such as wildfires can result in much higher ERA values. In the range between the two thresholds, Detailed Assessments are used to identify if a particular action is expected to alter the risk of CWEs.

There are limitations to the ERA model, including: ERAs are only an indicator and cannot be used to estimate quantitative changes in stream channel conditions; the higher risk associated with near-stream disturbance (as opposed to disturbance far from any stream channel) is not factored into the analysis; and the method does not account for site specific BMPs (i.e., all roads are weighted the same, regardless of their management and condition).

The Detailed Assessment allows for more specific knowledge of the area, including the position of the disturbances relative to the drainage network, whether BMPs are in place and the sensitivity and condition of stream channels, to be factored into the final determination of the risk for CWEs.

3.10.2 Affected Environment – Forestwide

As described in the Analysis Methodology/Rationale sections above, transportation facilities can affect stream channels, riparian areas and water quality. While erosion and localized changes to surface runoff can occur across the landscape, the risks of effects to streams, riparian areas and surface water quality are low if the use is far from hydrologically-sensitive areas. On the SNF, surface water and riparian areas are protected by RCAs. This analysis for water resources and therefore the affected environment focuses on RCAs.

Table 3- 67 describes how RCAs were delineated for this project. RCAs were delineated as directed in the SNFPA ROD (USDA-FS 2004a), based on the SNF GIS layer for streams. The SNF GIS layer for streams includes ‘blue line’ features (streams shown on USGS 7.5-minute quadrangle maps) and features that were added to the layer based on topography, from which the presence of a stream channel was inferred. All streams were then assigned a ‘stream order’ (Strahler 1957) based on their location in the drainage network. The smallest streams at the top of the network are labeled Order 1. Where two Order 1 segments join, they form an Order 2; where two Order 2 segments come together, they form an Order 3, and so on. The inferred streams are mapped as Order 1. These inferred streams have not been field verified, and their density varies across the Forest.

Field observations indicated that many Order 1 streams depicted on the stream layer are not present as scoured stream channels on the ground, but rather are unscoured swales (technically, ‘Order 0’). Although they do sometimes carry concentrated surface runoff, unscoured swales are not seasonal streams, and are not required to have RCAs. Where mapped Order 1 streams do support scoured channels, there is generally no associated riparian area and they tend to be dominated by upland / colluvial processes. To account for this, RCAs have been delineated only for those Order 1 stream segments that are associated with a lake, spring, or meadow, since these are more likely to have a scoured channel with at least seasonal / intermittent flow and, and are also more likely to support a riparian area. RCAs have also been delineated for all Order 1 streams within Critical Aquatic Refuges (CARs), in order to ensure maximum consideration and protection of the aquatic systems in those areas.

Ephemeral channels and unscoured swales that flow in direct response to precipitation or snowmelt can, however, transport sediment downstream through the channel network, so even though some Order 1 channels on the stream layer are not included for the purpose of delineating RCAs, all are included in the numbers of stream crossings presented later in this section.

Table 3- 67. Comparison of Feature Type, Stream Order, Flow Regime Classification and RCA Widths Delineated for this Project

Feature Type	Corresponding GIS Stream Order or Layer	RCA Width (feet)
Perennial streams	Order 4+	300 ft
Seasonally flowing streams	Order 2 - 3	150 ft
Ephemeral streams	Order 1	150 ft if associated with lake, spring or meadow or if in CAR; otherwise none
Streams in inner gorge	Stream order varies	To top of inner gorge (at least 300 ft)
Special Aquatic Features (fens, bogs, springs, seeps, lakes, ponds, wetlands, etc)	Corresponding GIS layer or identified in the field	300 ft
Perennial streams with riparian conditions extending more than 150 feet from edge of streambank	Either mapped as 'meadows' or identified in the field	300 ft
Seasonally flowing streams with riparian conditions extending more than 50 feet from edge of streambank	Either mapped as 'meadows' or identified in the field	300 ft

Table 3- 68 displays the length of Order 1 streams in the GIS layer that are within the delineated RCAs and the length outside of the RCAs.

Table 3- 68. Miles of Order 1 Stream Channels that Lie Within And Outside of the RCAs Delineated for this Project

Analysis Unit	Total Order 1 Streams (mi)	Order 1 Streams Within RCAs (mi / % of total)	Order 1 Streams Outside of RCAs (mi / % of total)
SFM	781	246 / 32%	535 / 68%
WES	873	269 / 31%	604 / 69%
GLO	758	298 / 39%	460 / 61%
GAG	885	247 / 28%	638 / 72%
MAM	650	299 / 46%	351 / 54%
SSB	765	219 / 29%	546 / 71%
EKP	74	22 / 30%	52 / 70%
JCH	527	349 / 66%	178 / 34%
TAD	879	393 / 45%	486 / 55%
DNK	1659	531 / 32%	1128 / 68%
TOTAL:	7851	2874 / 37%	4977 / 63%

As explained above in Data Sources, with few exceptions, the locations where a surveyed route crossed any type of channel shown on the GIS layer were evaluated in the field for impacts, RCO consistency and improvement needs.

The miles of perennial, intermittent and ephemeral streams, acres of meadows, and total acres of RCAs in each analysis unit are displayed in Table 3- 69. These RCAs include areas around streams, meadows, lakes, ponds and springs. The proportion of each analysis unit that falls within the RCA is also shown in Table 3- 69. These areas are important because they are more sensitive to disturbance, and certain specific S&Gs apply here. The analysis of effects to water resources will focus on RCAs, as described in the Analysis Methodology (3.10.1 Introduction, page. 3-177).

Table 3- 69. Miles of Stream and Acres of Meadows and RCAs in each Analysis Unit

Analysis Unit (AU)	Streams (mi)			Riparian Areas		
	Perennial (order 4+)	Intermittent (order 2-3)	Ephemeral[1] (order 1)	Meadows (ac)	RCAs (ac)	Percent of AU in RCA
SFM	102	380	781	678	22150	31
WES	113	441	873	918	26780	32
GLO	142	391	758	1545	31899	35
GAG	89	404	885	459	24970	29
MAM	97	281	650	136	21776	40
SSB	104	337	765	563	22868	27
EKP	18	33	74	174	3432	26
JCH	56	229	527	20	21444	46
TAD	141	467	879	1475	36398	32
DNK	223	826	1659	887	48291	31
TOTAL:	1084	3789	7851	6854	260,008	33

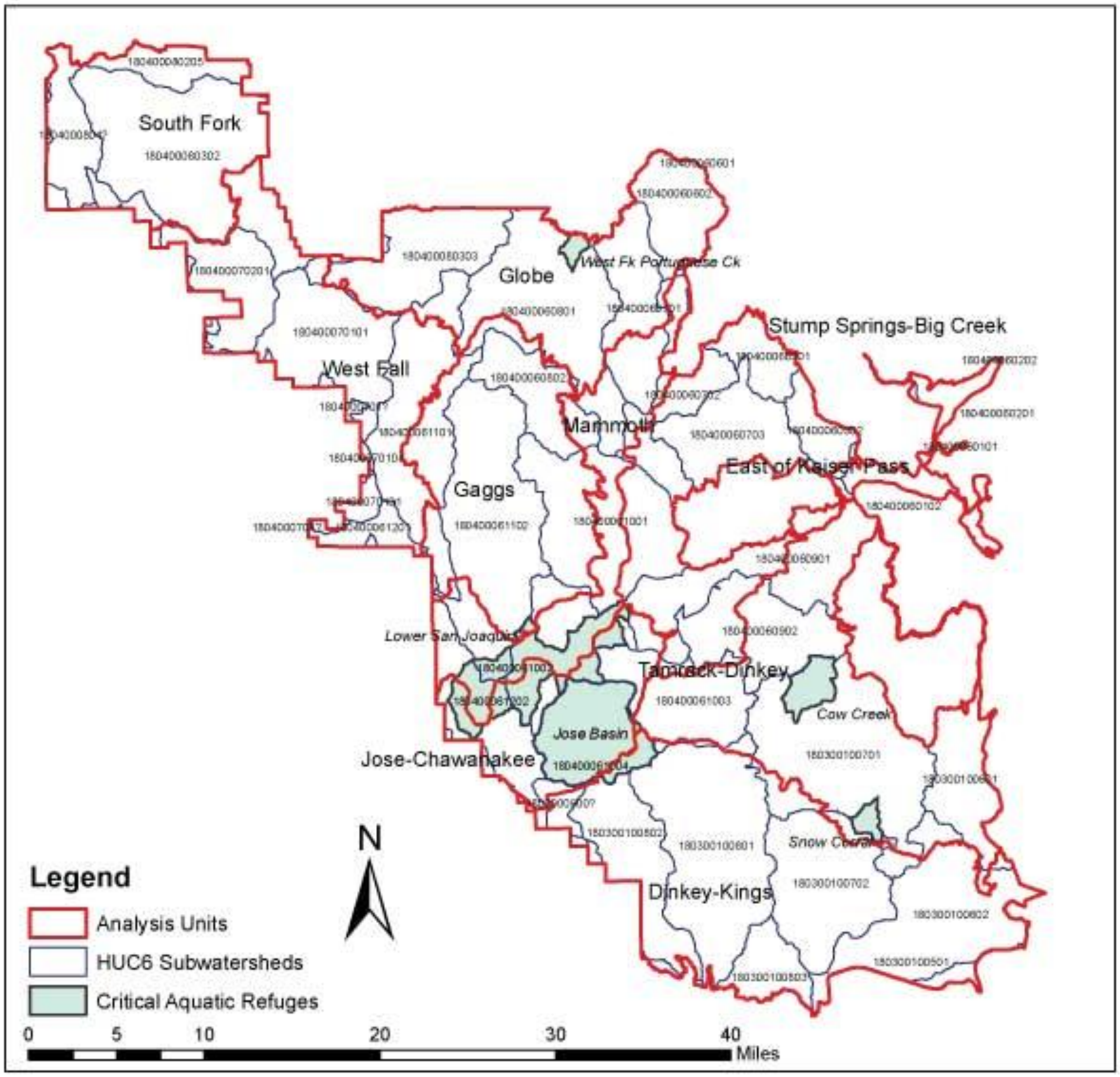
[1]The miles of order 1 streams presented here as ‘ephemeral streams’ includes a large component of unscoured swales, which are technically ‘order 0’ and are not stream channels; therefore, these numbers over-estimate the actual number of miles of ephemeral stream channels across the project area. Only those Order 1 streams associated with a lake, spring, or meadow, or within a CAR, have RCAs delineated around them. The lengths of perennial and intermittent streams are more accurate.

CARs are important because they are specifically identified as areas where aquatic species habitat is to be protected for a special status species. Certain S&Gs apply only within CARs. The location of the CARs in the project area with respect to analysis units is shown in Figure 3- 12 and acreages are displayed in Table 3- 70. The percentages shown in the table indicate the proportion of the CAR that is contained in the respective analysis unit. For example, the Cow Creek CAR is completely (100 percent) within TAD. The West Fork Portuguese Creek CAR extends outside of the analysis units, but the area outside of the analysis unit is upstream, so no impacts from within the project area will affect stream channel conditions in that portion.

Table 3- 70. Critical Aquatic Refuges by Analysis Unit; Acres within Analysis Unit, Percent of Total CAR Acres in the Project Area

Analysis Unit	Acres of CARs in analysis unit (ac)	CAR Name				
		Cow Creek ac / %	Jose Basin ac / %	Lower San Joaquin ac / %	Snow Corral ac / %	West Fork Portuguese ac / %
SFM	0					
WES	0					
GLO	1199					1199 / 100%
GAG	478			478 / 2%		
MAM	10632			10632 / 52%		
SSB	5			5 / 0%		
EKP	0					
JCH	26350		16847 / 87%	9502 / 46%		
TAD	6135	4403 / 100%	148 / 1%		1584 / 100%	
DNK	2352		2352 / 12%			
TOTAL:	**47151**	**4403**	**19347**	**20618**	**1584**	**1199**

Figure 3- 12. HUC6 Subwatersheds and Critical Aquatic Refuges (CARs) within the Analysis Units



A table showing the complete listing of HUC6s and HUC8s by analysis unit is contained in Appendix 4 of the full watershed report (Gott 2010), located in the project record.

During the course of the analysis, it became clear that the Miami area (in WES) is a focus area for watershed concerns. This is because there is a concentration of unauthorized routes in this area, which also has known CWE concerns that affect aquatic habitat conditions in Miami Creek. Because of this, the Miami area will be discussed in more detail than most other areas on the forest.

Streamflow

The U.S. Geological Survey has established a network of stream flow gauging stations around the country. Some stations have been in continuous operation for decades, but many have only limited stream flow records. Data are available in continuous real time, daily, statistical mean daily, monthly or hourly and peak flow. Currently, there are few gauging stations on the SNF that collect real time-continuous flow data. There are, however, several records of historic peak and statistical flow data for the forest. Mean monthly stream flow data with at least 10 years of record are available to summarize general discharge characteristics for streams within each analysis unit. Monthly mean is an arithmetic average of all the flow data recorded for a particular month for the period of record. These data are presented in Table 3- 71. This project is not expected to measurably affect streamflow. Future streamflow data can be compared to previous flow records such as those displayed in Table 3- 71 to verify this.

Table 3- 71. Available Mean Monthly Stream Flow Records

Some of these are regulated streams. The listed stations have at least a 10 year period of record, within approximately 20 years of present. The period of record is shown by the date ranges. The eight digit numbers are the USGS gage identifier.

Analysis Unit	Station	Monthly Mean Streamflow, cubic feet per second (cfs)											
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
WES	NF Willow Cr Near Sugar Pine CA (1965-2007) 11242400	29	29	40	51	78	50	17	5.7	4.1	4.6	9.3	14
WES	Miami Cr Near Oakhurst CA (1960-1980) 11257100	16	17	18	18	13	6.4	3.1	1.8	1.4	1.6	3.6	7.1
GLO	Granite Cr Near Cattle Mtn (1921-1986) 11228500	20	31	89	239	501	393	148	22	13	14	26	30
GAG	Browns Cr CN at Bass Lake CA (1986-2007) 11243300	20	32	48	52	39	18	6.6	1.6	0.60	1.2	4.2	10
SSB	MF Balsam Cr Below Balsam M FB Near Big Creek CA (1989-2006) 11238270	0.76	0.77	0.87	0.94	0.86	1.3	1.3	1.3	1.3	0.87	0.80	0.78
SSB	Big Cr Near Mouth Near Big Creek CA (1986-2007) 11238500	43	23	35	39	82	62	21	6.1	5.3	8.1	33	45
EKP	Bear Cr Near Lake Thomas Edison CA (1921-2007) 11230500	24	24	34	87	259	348	202	64	27	15	15	20
JCH	Stevenson Cr at Shaver Lake CA (1986-2007) 11241500	15	22	43	65	81	124	89	12	3.7	11	3.4	2.9
TAD	Eastwood PP Above Shaver Lake Near Big Creek CA (1987-2007) 11238250	266	243	240	380	780	931	700	557	469	304	256	281
TAD	NF Stevenson Cr at Perimeter Rd Near Big Creek CA (1989-2007)	11	10	16	35	31	22	8.2	5.9	5.8	5.6	7.0	6.7
DNK	Dinkey Cr at Dinkey Mdw Near Shaver Lake CA (1921-1987) 11217000	61	97	137	292	421	268	58	8.9	10	13	33	42
DNK	NF Kings River Below Dinkey Cr Near Balch Camp CA (1960-2007) 11218400	252	284	380	636	1040	854	288	59	48	50	87	134

Water Quality

Water quality is managed under the Central Valley Basin Plan for the San Joaquin and Sacramento River Basins (Central Valley Regional Water Quality Control Board 2009) and the Tulare Lake Basin (CVRWQCB 2004). These plans designate the beneficial uses to be protected, water quality objectives and an implementation program for achieving objectives. Table 3- 72 shows the designated beneficial uses for some of the major perennial drainages within project area. Descriptions of the beneficial use codes follow the table. Water bodies tributary to these major perennial drainages also fall under the same beneficial use criteria (i.e. the 'Tributary Rule'). Assuming that the water quality currently meets or exceeds water quality standards, the water is subject to the Anti-degradation Policy, which requires that wherever existing water quality is better than the established objectives, the existing quality will be maintained (CVRWCB 2004, 2009).

Table 3- 72. Designated Beneficial Uses for the Major Perennial Drainages of the Project Area

Water Bodies	Analysis Units	MUN	AGR	POW	REC1	REC2	RARE	WARM	COLD	MIGR	SPWN	FRSH	WILD
San Joaquin River	MAM/SSB/ JCH	X	X	X	X	X		X	X	X	X		X
Fresno River	WES	X	X		X	X		X	X				X
Chowchilla River	WES				X	X		X	X				X
Merced River	SFM	X	X	X	X	X		X	X				X
Kings River at Pine Flat	DNK			X	X	X		X	X			X	X
Dinkey Creek	TAD/ DNK			X	X	X	X	X	X		X	X	X
Big Creek	DNK			X	X	X		X				X	X

Municipal and Domestic Supply (MUN) - Uses of water for community, military or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) - Uses of water for farming, horticulture or ranching including, but not limited to, irrigation (including leaching of salts), stock watering or support of vegetation for range grazing.

Hydropower Generation (POW) - Uses of water for hydropower generation.

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing or use of natural hot springs.

Non-contact Water Recreation (REC-2) - Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing.

Rare, Threatened or Endangered Species (RARE) - Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under State or Federal law as rare, threatened or endangered.

Warm Freshwater Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

Migration of Aquatic Organisms (MIGR) – Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction and/or Early Development (SPWN) – Uses of water that support high quality habitats suitable for reproduction and early development of fish.

Freshwater Replenishment (FRSH) – Uses of water for natural or artificial maintenance of surface water quantity or quality.

Wildlife Habitat (WILD) - Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates) or wildlife water and food sources.

Central Valley Water Quality Control Board (CVRWQCB) Water Quality Objectives

Water Quality Objectives are narrative or numeric limits designed to protect beneficial uses of water. The parameters with specified objectives in the Central Valley Basin Plan include ammonia, bacteria, biostimulatory substances, chemical constituents, color, dissolved oxygen, floating material, methyl mercury, oil and grease, pH, pesticides, radioactivity, salinity, sediment, settleable material, tastes and odors, temperature, toxicity and turbidity. The parameters that this project has the greatest potential to affect are dissolved oxygen (DO), sediment, turbidity, chemical constituents and oil and grease. The other parameters are not likely to be affected by this project.

Dissolved Oxygen

DO is an important water quality parameter because aquatic organisms need oxygen. DO levels can range from 0 – 18 mg/l; levels of 5-6 mg/l are stressful for organisms and lower can be fatal. DO is related to water temperature; generally, cooler water has higher DO. Turbulence increases DO as oxygen from the air gets mixed into the water. Other factors that exert a control on DO include photosynthesis, respiration and decomposition of plant material. Photosynthesis only occurs during the day and it increases DO. Respiration and plant decomposition occur around the clock and deplete DO.

The applicable CVRWQCB (Regional Water Board) water quality objective for dissolved oxygen (DO) states:

> "For surface water bodies outside the legal boundaries of the Delta, the monthly median of the mean daily DO concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75 percent of saturation. The DO concentrations shall not be reduced below the following minimum levels at any time: WARM 5.0mg/l; COLD 7.0mg/l; SPWN 7.0 mg/l."

A specific objective has been developed for the Kings River upstream of Pine Flat Dam, where the minimum DO is 9.0 mg/l.

Sediment

Sediment is the primary threat to water quality in the project area. The indicator used to measure sediment on the SNF is V* (“V-Star”), which is the fraction of scoured pool volume that is occupied by fine sediment (Lisle and Hilton 1992, Hilton and Lisle 1993). This is thought to be a good index of variations in fine sediment supply. Lisle and Hilton (1999) show that V* correlates with annual sediment yield in systems with abundant sandy sediment and that changes in V* correspond to changes in the balance between sediment supply and sediment transport.

The CVRWQCB water quality objective for sediment states:

> “The suspended sediment load and suspended sediment discharge rate of waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.”

The CVRWQCB water quality objective for settleable material sates:

> “Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.”

Turbidity

Turbidity is a measure of the amount of fine material suspended in the water. Water with higher turbidity is cloudier than water with low turbidity. Turbidity varies naturally and is often higher during rainfall runoff, especially during large storms. It is often higher when stream flow is rising than when stream flow is falling. Chronically increased turbidity can result in increased temperature because solar warming has a greater effect on water carrying fine sediment particles. Fine sediment particles can also be associated with nutrients and more nutrients can increase aquatic production, which in turn depletes DO. In the analysis area, erosion could carry fine sediment to streams and cause an increase in turbidity.

The applicable CVRWQCB water quality objective for turbidity states:

> “Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:
>
> - Where natural turbidity is less than 1 Nephelometric Turbidity Unit (NTU), controllable factors shall not cause downstream turbidity to exceed 2.
> - Where natural turbidity is between 1 and 5 NTUs, increases shall not exceed 1 NTU.
> - Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.
> - Where natural turbidity is equal to or between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
> - Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

“In determining compliance with the above limits, the Regional Water Board may prescribe appropriate averaging periods provided that beneficial uses will be fully protected.”

Chemical Constituents and Oil and Grease

Motor vehicle use results in the introduction of chemical constituents, including oil and grease, into the environment. Chemical constituents include a variety of substances including organic chemicals, inorganic chemicals and other contaminants such as metals. The chemical constituents that have the potential to be affected by this project are chemicals contained in motor vehicle fluids and/or exhaust.

The applicable CVRWQCB water quality objective for chemical constituents states:

> "Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses."

The applicable water quality objective for oil and grease states:

> "Waters shall not contain oils, greases, waxes or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses."

Chemical constituents may not exceed numeric levels set in Maximum Contaminant Loads (MCLs) in drinking water. For the protection of aquatic life, the maximum allowable levels are defined in National Ambient Water Quality Criteria, which have limits for acute exposures and for chronic exposures. These limits are specific to the constituent and to the organisms of interest and are contained in tables that are hundreds of pages in length.

There are no data that suggests there is a problem with chemical constituents, including oil and grease, affecting beneficial uses on the SNF. There have been known instances where an oil or gas spill has occurred and substances have entered surface water. Often these are small spills that are not reported, but are observed some time after their occurrence by personnel working in or near streams. There are also concerns with certain ford crossings, where vehicles drive through water that is deep enough to wash oil and grease off of the vehicle and directly into the water. The impacts of these types of chemical inputs is most likely to occur as acute (short-term, as opposed to chronic) toxicity to local aquatic species. These impacts are addressed in the Aquatic Species analysis.

For this project, based on the assumption that prohibiting cross-country use and confining motor vehicle use to designated routes will not significantly change the total amount of motor vehicle use that occurs, there is not expected to be much effect on the introduction of chemical constituents, oil and grease. While the introduction of these substances would become concentrated in and along NFTS facilities rather than occurring in more dispersed locations, there is not enough information regarding their occurrence or effects to determine the change in water quality impacts that would result. For this reason, chemical constituents, oil and gas will only be addressed generally.

Existing Water Quality Data

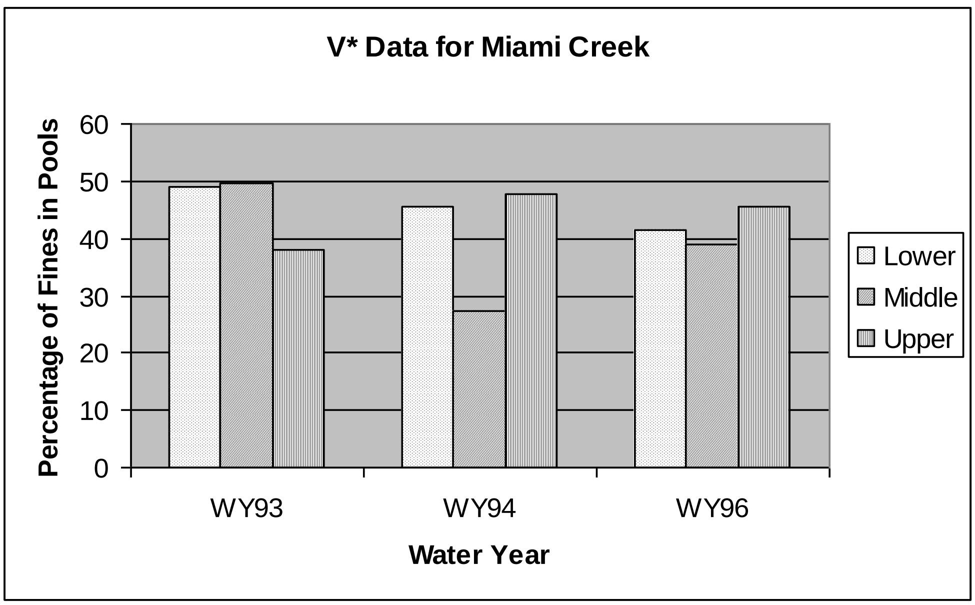
To date, limited water quality sampling has been conducted on the SNF. Between 1979 and 1983, water chemistry data was collected in thirteen streams throughout the forest. Data included dissolved oxygen, turbidity, physical properties (i.e., temperature, pH and conductance), major ionic constituents and nutrients. Although limited, this data serves as a general indicator of the water quality in these watersheds.

Since 1999, water quality data has been collected as part of Stream Condition Inventory (SCI) assessments and aquatic species-specific surveys. This information includes macroinvertebrate samples (an indicator of water quality, which is described in the Affected Environment of the Aquatic Biota section (section 3.14.2).

V* data has been collected in limited areas on the Forest, namely in the Miami Motorcycle Area (Miami Creek) and the Kings River project area (Big Creek, Dinkey Creek, and tributaries).

In 1992, a watershed improvement field study in the Miami area found unstable and degraded channel conditions and compromised aquatic habitat in Miami Creek (USDA-FS 1992). Since excess sediment delivery to Miami Creek was identified as the primary impact, a quantitative sediment study was conducted in 1996 using V*. V* measurements were repeated in 10 pools in Miami Creek between water years 1993 and 1996 (the flow was too high in Miami Creek in 1995 to safely conduct the surveys so no data were collected that year). The Desired Condition (DC) for pool habitat in Miami Creek includes a V* value of 0.30 or less (i.e., 30 percent or less of the pool volume is filled with fine sediment). However, the 1993 data indicates a V* value of 0.55, and in 1996, 0.44. Pools were grouped in the lower, middle and upper sections of the survey reach for display and comparison (Figure 3- 13). The data shows that, even with the elevated flows in 1995 that had adequate capacity to move sand-sized sediment downstream, enough fine sediment entered the Miami Creek system to replace what had moved downstream, resulting in the continued loss of pool function and fish habitat in all three reach segments in 1996. The report (Adams 1996) recommended that ‘approved’ motorized trails in the Miami area be formally added to the NFTS and that all trails (unauthorized routes) within the SMZ that were not part of the NFTS be given high priority status for restoration / obliteration. These trails discussed in the 1996 Adams report are not currently part of the NFTS, although some of the recommended restoration has been accomplished.

Figure 3- 13. Percentage of fines in pools by water year



Source: Adams 1996

Although V* has not been measured in Miami Creek since 1996, a recent inspection of lower Miami Creek by a hydrologist, geologist, and fisheries biologist found most of the pools still contain accumulations of fine sediment. The overall aquatic habitat quality was characterized as poor (Strand 2008). The channel in upper Miami Creek is unstable (Pfankuch rating of Poor) and is still contributing sediment to the system. There is little comparative data to show a conclusive trend in channel condition and aquatic habitat, but a 1978 aquatics survey of Miami Creek (Bazlen 1978) describes the creek as “high quality” fish habitat with channel conditions ranging from good to fair and channel depth ranging from an average of 1 foot to 10 feet with 40% of the survey reach occupied by pools. These conditions were not observed (i.e., no fish, fewer pools, pools filled with sediment, and further degraded channel conditions) in 2008 (Strand 2008).

These observations show a clear deviation from DC and strongly suggest a downward trend in conditions since 1978.

The apparent cause of the degraded channel conditions is CWE. In the past, increased runoff and sediment delivery to the system triggered stream channel adjustments that have continued to the present time. A 1991 Soil and Watershed Monitoring Report (Roath 1991) identified direct impacts near the stream channel and its tributaries and sediment delivery from the road system as the major sources of sediment affecting Miami Creek. This monitoring effort found 30 plugged road culverts, many roadside drainage ditches filled with sediment, and common road erosion resulting from these problems.

The reports dating from the 1990s (Roath 1991, USDA-FS 1992, Adams 1996) and recent field observations (e.g., Strand 2008) suggest that near-channel disturbances such as timber harvests, roads and motorized trails, and streamside campsites are the main sources of the impacts to Miami Creek. These areas concentrated runoff and sediment, and delivered them to stream channels. The increases in streamflows and sediment delivery resulted in stream channel erosion in both low-order ephemeral channels and in the main Miami Creek channel. The ephemeral channels became incised and transported the additional sediment to Miami Creek, where lower gradients resulted in deposition of the excess sediment. The Miami Creek channel was undergoing a similar process, enlarging itself to accommodate greater volumes of water. The sediment deposition was creating a shallower channel, and acting in opposition to the enlarging process. In order to create a larger channel, the stream widened. Banks were destabilized and mature trees became undermined and fell into the channel. The falling trees resulted in additional bank erosion and further reduced bank stability. The erosion of the banks contributes even more sand to the system, and is probably another major source of sediment.

This feedback loop in channel condition has continued even though the original sources of the increased runoff have been identified and mitigated over time: compacted areas have recovered, widespread improvements have been made to the NFTS roads, and many miles of OHV trails have been improved or closed and restored. Continued work is needed to maintain these improvements so that they continue to function and prevent runoff and erosion from affecting streams. Some unauthorized routes have never been improved and are documented to have erosion and sediment delivery concerns of varying degrees. (This is discussed in the environmental consequences section (3.10.4).)

In the Kings River Project Area, V* was collected in 1995, 1996, 1997, 2003 and 2004 in the Big Creek and Dinkey Creek subwatersheds to quantify existing fine sediment storage. The desired condition (DC) for sediment in pools in Big Creek, based on watershed potential considering the geology, soils and channel types, is a maximum of 30 percent. In the 1990s, V* was measured in 20 reaches in Big Creek, above and below tributary channels and in selected tributary channels to determine if significant amounts of sediment were being transported from the tributaries. Forty (40) percent of the sampled areas had V* values that exceeded the DC. The 2003-2004 data in Big Creek (see Table 3- 73) shows that both sampled reaches in Big Creek are above the DC. The reach in Summit Creek just above the confluence with Big Creek meets the DC. The reaches in Big Creek above (519.0012-1) and below Summit Creek (519.0057-1) have V* values of .36 and .62, which indicates that a high amount of sediment may be contributed by Summit Creek.

The desired condition for sediment in pools in the Dinkey Creek watershed is a maximum of 20 percent. This is lower than the DC in Big Creek due to differences in soils and channel types. Twenty-four stream reaches were measured in Dinkey Creek in the 1990s, from the headwaters of Dinkey Creek and including several tributaries. Eighty-three (83) percent of these sampled areas met the DC. The reaches in upper (520.1002-1) and lower Bear Meadow Creek (520.1051-1 and 520.1051-2) are noteworthy because the measured V* values were approximately 80 percent, far higher than the DC. The reach in Oak Flat Creek (520.1151-1), tributary to Bear Meadow Creek, slightly exceeded the DC.

Table 3- 73. V* Reach Data 2003-2004

(Reaches beginning with 519 are located in the Big Creek subwatershed. Reaches numbered 520 are in Dinkey Creek.)

Stream Name	Reach Number	Number of Pools	Mean V*
Big Cr	519.0012-1	10	0.68
Big Cr	519.0057-1	10	0.40
Summit Cr	519.4051-1	10	0.18
Dinkey Cr	520.0056-1	3	0.04
Glen Meadow Cr	520.0017-1	10	0.16
Oak Flat Cr	520.1151-1	8	0.45
Oak Flat Cr	520.1151-2	10	0.61

Source: Morales 2004

The 2003-2004 data in Dinkey Creek shows that surveyed reaches in Dinkey and Glen Meadow Creeks meet the DC. Both surveyed reaches in Oak Flat Creek clearly exceed the DC.

303(d) Listed Waterbodies – 'Water Quality Limited Segments'

A water body or segment of a water body (e.g., a fresh stream, river or lake) that does not meet (or is not expected to meet) water quality standards may be considered a "Water Quality Limited Segment" (WQLS). WQLS are added biennially by the CVRWQCB to the Clean Water Act Section 303(d) list of impaired waters. There are two WQLS on the SNF.

A segment of Willow Creek (MAM AU) was added to the 303(d) list in 2006 for failing to meet the water temperature objective. The listed segment is 6.2 miles long and is located downstream of the confluence of the North and South Forks of Willow Creek. The source of impairment is restricted (regulated) flow and excess fine sediment causing an increase in stream temperature. The Total Maximum Daily Loads (TMDLs) is scheduled to be completed by 2019.

The Fresno River (downstream of WES and of the SNF) was added to the 2008 303(d) list for failing to meet the dissolved oxygen (DO) objective. The listed segment is 30 miles long and is located between the confluence of Lewis Fork and Nelder Creeks and the Hensley Reservoir. The source of the impairment is unknown. Dissolved oxygen levels in the Fresno River could be influenced by the water quality (particularly sediment, turbidity, nutrients and temperature) of contributing waters from Miami, Lewis Fork, and Nelder Creeks. The TMDL is scheduled to be completed by 2021.

Stream Channel Data

Stream Condition Inventory (SCI), Proper Functioning Condition (PFC) and Pfankuch Stability surveys have been conducted on numerous streams forestwide (Table 3- 74, Table 3- 75 and Table 3- 76). None of these protocols are designed to specifically monitor the effects of roads or motor vehicle use. However, this data is useful for understanding stream channel condition, sensitivity to disturbances (including motor vehicle use), and the risk of channels exhibiting the effects of CWEs (unstable channels are more vulnerable to CWEs than stable channels, for example), as well as for tracking changes over time.

Stream Condition Inventory (SCI)

The purpose of the Pacific Southwest Region SCI is to collect intensive and repeatable data from stream reaches to document existing stream condition and make reliable comparisons over time within or between stream reaches. SCI is therefore an inventory and monitoring protocol. It is designed to assess the effectiveness of management actions on streams in managed watersheds (non-reference streams), as well as to document stream conditions over time in watersheds with little or no past management or that have recovered from historic management effects (Frazier and others 2005).

SCI consists of stream features or attributes that are useful in classifying channels, evaluating the condition of stream morphology and aquatic habitat and making inferences about water quality. Attributes are collected at selected reaches on streams of interest. Reaches are monumented to reduce variability when survey measurements are repeated. Macroinvertebrates were collected as part of the survey and have been submitted to Utah State University's Logan Bug Lab for processing (see the Aquatic Biota section for a full discussion of biotic conditions). In addition to aquatic insects, particle distribution and channel geometry information, large woody debris, bank configuration, shade, channel stability and limited water chemistry information was collected. Table 3- 74 lists the reaches where SCI has been conducted.

Table 3- 74. Stream Segments and/or Tributaries that have had SCI Surveys Conducted

Analysis Unit	Number of SCI Reaches	Locations
SFM	0	ND
WES	5	Lewis Fork (upper), Lewis Fork (Red Rock), Lewis (Westfall Trib), Nelder Cr, California Cr
GLO	6	Jackass Cr, Big Cr (Big Sandy Trib), Big Creek, White Chief Branch, West Fork Portuguese Cr, South Fork Willow Cr
GAG	3	South Fork Willow Cr (Trib), Camino Cr, Grizzly Cr
MAM	0	ND
SSB	0	ND
EKP	0	ND
JCH	1	Jose Creek
TAD	6	Glen Meadow Cr, Trib to Glen Meadow Cr, Laurel Cr, West Fork Cow Cr, South Fork Tamarack Cr (Trib), Snow Corral Meadow Cr
DNK	17	Big Cr (5), Trib to Big Cr, Summit Cr, Rush Cr, Oak Flat Cr, Bull Cr, Cottonwood Springs Cr, Duff Cr, Providence Cr, Bear Meadow Cr (2), East Fork Deer Cr, Deer Cr (a small portion of this reach is in TAD)
TOTAL	**38**	

SCI survey data are available in the project record. ND = No Data.

Proper Functioning Condition (PFC)

The PFC protocol was developed as a qualitative method for assessing the condition of riparian-wetland areas. A stream reach is in PFC when physical processes are providing resilience to disturbances and characteristics are present to: dissipate energy during high flows (reducing erosion); filter sediment; improve flood-water retention and groundwater recharge; develop root masses that protect streambanks from erosion; provide habitat for fish, wildlife and support other beneficial uses; and support biodiversity (USDI 1998). An area can function properly and still not meet its potential or its Desired Condition. Systems that are less resilient are "functioning at risk"

(FAR). FAR stream reaches have a high probability of degradation resulting from a high flow event. In these systems, it is important to determine whether the condition is improving ("upward trend") or degrading ("downward trend"). If there is insufficient information to determine a trend, it is labeled "trend unknown". Some systems are so unstable that they are classified as "non-functional". Non-functional systems 'clearly lack' the elements described for PFC and are likely to suffer from erosion and degradation during even a moderate flow event. None of the assessed segments in the project area have rated non-functional. Table 3- 75 lists the stream segments where PFC surveys have been completed.

Table 3- 75. PFC Assessments by Analysis Unit

Analysis Unit	Total Number of PFC Assessments	PFC[1]	FAR-UT[2]	FAR-TU[3]	FAR-DT[4]
SFM	0	0	0	0	0
WES	1	1	0	0	0
GLO	5	1*	2	1	1
GAG	6	3*	3*	0	0
MAM	5	3*	1	1	0
SSB	0	0	0	0	0
EKP	0	0	0	0	0
JCH	2	1	0	1*	0
TAD	2	0	1	1*	0
DNK	10	7	1	2	0
TOTAL	**31**	**16**	**8**	**6**	**1**

[1] PFC= "Proper Functioning Condition";
[2]FAR-UT= "Functioning at Risk – Upward Trend";
[3]FAR-TU= "Functioning at Risk – Trend Unknown";
[4]FAR-DT= "Functioning at Risk – Downward Trend";

Six of the PFC assessments noted impacts from roads or unauthorized motor vehicle use. Those are marked with a '*' in Table 3- 75 and more information is presented below.

In GLO, the assessment of the Properly Functioning reach at Boggy Meadow identified unauthorized motor vehicle use impacting the channel upstream of the evaluated reach, causing localized bank erosion and contributing sediment to the channel. The FAR-downward trend rating occurred in the Long Meadow assessment, which cited grazing impacts to the already destabilized channel as the likely cause of the rating; motor vehicle use was not implicated.

In GAG, PFC evaluations at Peckinpah and Benedict Meadows noted that hydrologic connectivity of roads was a major contributing factor in previous channel degradation, though these roads did not seem to be having continuing impacts. Sand Creek (Gaggs tributary) had motor vehicle use in the channel, which was affecting bank stability and contributing some sediment in a localized area.

In MAM, the PFC assessment in Saginaw Cr describes excess sedimentation impacts of NFTS roads, but the reach still rated PFC.

In JCH, a PFC assessment in 523.3004 found that a small gully entered the stream from an NFTS road and contributed to the FAR condition.

In TAD, the FAR reach adjacent to Boneyard Meadow has multiple OHV crossings. The FAR rating is attributed to channel incision which is unrelated to the motorized use. However, the crossings create more disturbance and erosion due to the tall, steep, unstable banks and it impedes bank stability and vegetation growth.

Pfankuch Stability Ratings and Channel Sensitivity

The Pfankuch channel stability rating (USDA-FS 1975) was developed to evaluate the stream channel condition and stability from within the floodplain and stream channel. This method takes into account a total of 15 attributes from the upper banks, lower banks and channel bottom. Each attribute is assigned a numeric value based on observations made in the field. When the individual attribute scores are tallied, they are categorized into three different ratings: good, fair or poor. The total score of these ratings can range from 15 to 152 (USDA-FS 1975). Rosgen (1996) accounted for the effect of stream channel type on the attribute scores and developed a modified conversion matrix that uses channel type and numeric score to assign the Pfankuch stability rating. This information illustrates the expected sensitivity of streams to disturbances.

Since 1989, 561 miles of the major perennial drainages and their tributaries on the SNF have had channel typing and sensitivity analysis conducted. A complete list of the streams surveyed is available in the project record. Table 3- 76 summarizes the existing reach sensitivity data, based on Rosgen channel type (Rosgen 1996), and the associated Pfankuch rating for stream reaches with moderate or high sensitivity ratings. The stability ratings of low sensitivity reaches, for example, bedrock and boulder-controlled channels, are not included in this table because these channels are not sensitive to the effects that are evaluated in this report. The categories that are the most likely to respond negatively to disturbances – Moderate sensitivity/Poor stability and High Sensitivity/Fair or Poor stability - are marked with an asterisk in the table heading. The data is expressed as percentages of the total miles of streams surveyed, by AU. For example, in SFM, 6.3 miles of streams were surveyed, which were 29% Low sensitivity reaches and 71% High sensitivity reaches. There were no Moderate sensitivity reaches. The 71% High sensitivity reaches can be broken down into stability categories as follows: 60% of the total surveyed streams in SFM were High sensitivity channels with Good stability, and 11% were High Sensitivity channels with Fair stability.

Table 3- 76. Summary of Channel Sensitivity Ratings by Mile for Each of the Analysis Units, Including Pfankuch Stability Ratings

Analysis Unit	Total mi Surveyed	Rosgen Sensitivity (% of total surveyed)			Modified Pfankuch Ratings Moderate sensitivity reaches (% of total mi surveyed)			Modified Pfankuch Ratings High sensitivity reaches (% of total mi surveyed		
		Low	Moderate	High	Good	Fair	Poor *	Good	Fair *	Poor *
SFM	6.3	29	0	71	0	0	0	60	11	0
WES	51.3	49	12	39	2	1	9	23	11	4
GLO	160.1	50	18	31	5	7	6	22	8	1
GAG	125.4	48	21	31	2	5	15	21	7	3
MAM	37.6	48	8	44	0	1	6	19	22	3
SSB	30.1	57	13	29	2	1	11	10	15	4
EKP	0.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
JCH	15.4	81	5	14	0	1	4	13	1	0
TAD	71.3	65	12	22	5	3	4	9	7	7
DNK	63.8	66	3	30	1	2	1	15	7	9
TOTAL /AVERAGE	**561.0**	**54**	**14**	**31**	**3**	**4**	**8**	**19**	**9**	**4**

NFTS Facilities and Unauthorized Motorized Routes

The NFTS facilities, roads managed under other jurisdictions and unauthorized routes that are currently present in the project area are an important component of the context needed to fully understand the effects of each of the alternatives being analyzed for this project. Although the effects of NFTS facilities and other roads are not included in the direct or indirect effects of these alternatives, they are relevant to the affected environment (and to cumulative effects, since their effects are similar to the effects of the actions being considered).

As explained in the Analysis Methodology section above, road density is often used as an indicator of the risk for roads to impact hydrology and water quality, though the actual relationship between roads and effects is much more complex than the road density alone reflects. Table 3- 77 displays the densities of roads and trails, unauthorized motor vehicle routes and the total motorized route density (the sum). Table 3- 78 shows the densities within RCAs.

Table 3- 77. Miles and Density of Motor Vehicle Use (Roads and Trails / Unauthorized Routes / Total) by Analysis Unit

Analysis Unit	Roads & Trails* Miles (mi) / Density (mi/mi^2)	Unauthorized Routes Miles (mi) / Density (mi/mi^2)	Total Miles (mi) / Density (mi/mi^2)
SFM	156 / 1.42	23 / 0.20	179 / 1.62
WES	382 / 2.89	113 / 0.85	495 / 3.74
GLO	353 / 2.48	65 / 0.46	418 / 2.94
GAG	327 / 2.40	83 / 0.61	410 / 3.01
MAM	182 / 2.15	39 / 0.46	221 / 2.60
SSB	322 / 2.41	18 / 0.14	340 / 2.55
EKP	45 / 2.18	21 / 1.02	66 / 320
JCH	193 / 2.65	22 / 0.30	215 / 2.95
TAD	413 / 2.34	109 / 0.62	522 / 2.96
DNK	551 / 2.29	59 / 0.25	610 / 2.54
TOTAL / AVERAGE	**2924 / 2.34**	**552 / 0.44**	**3476 / 2.78**

*These include NFTS Roads and Trails and roads under other jurisdictions, i.e., private roads, roads managed under Special Use Permit, etc.

Table 3- 78. Miles and Density of Motor Vehicle Use in RCAs (Roads and Trails / Unauthorized Routes / Total) by Analysis Unit

Analysis Unit	Within RCAs		
	Roads & Trails* Miles (mi) / Density (mi/mi^2)	Unauthorized Routes Miles (mi) / Density (mi/mi^2)	Total Miles (mi) / Density (mi/mi^2)
SFM	47 / 1.36	7 / 0.21	54 / 1.58
WES	134 / 3.19	36 / 0.85	170 / 4.05
GLO	134 / 2.19	27 / 0.53	161 / 3.22
GAG	104 / 2.67	24 / 0.62	128 / 3.29
MAM	64 / 1.89	17 / 0.51	81 / 2.40
SSB	91 / 2.55	4 / 0.12	95 / 2.67
EKP	17 / 3.17	8 / 1.49	25 / 2.67
JCH	92 / 2.76	10 / 0.31	102 / 3.07
TAD	149 / 2.61	31 / 0.54	180 / 3.16
DNK	176 / 2.34	15 / 0.28	191 / 2.53
TOTAL / AVERAGE	**1008 / 2.48**	**179 / 0.44**	**1187 / 2.92**

*These include NFTS Roads and Trails and roads under other jurisdictions, i.e., private roads, roads managed under Special Use Permit, etc.

Another factor that is relevant to the affected environment is the prevalence of roads and other motor vehicle routes crossing streams (called 'stream crossings' or 'crossings'). Since crossings are locations where the route is likely to be hydrologically connected to the drainage network, as well as where there is a risk of contributing sediment directly to the drainage network, the number of crossings is a good indicator for potential effects (see the rationale for this indicator). Similar to road densities, numbers of crossings do not factor in whether the crossing has appropriate BMPs that prevent negative impacts or not, so the numbers are useful only for perspective. The numbers of stream crossings made by roads, trails and unauthorized routes are displayed in Table 3- 79. These numbers include crossings of all stream orders, from major perennial streams to unscoured swales. Even unscoured swales will eventually deliver sediment stored in them to downstream reaches, which is why they are included in these totals.

Table 3- 79. Stream Crossing Numbers and Densities (Roads and Trails/ Unauthorized Routes / Total) by Analysis Unit

Analysis Unit	Roads & Trails*		Unauthorized Routes		Total	
	Number of crossings (#)	Crossing Density (# / mi^2)	Number of crossings (#)	Crossing Density (# / mi^2)	Number of crossings (#)	Crossing Density (# / mi^2)
SFM	717	6.5	134	1.2	851	7.7
WES	1,884	14.3	573	4.3	2,457	18.6
GLO	1,666	11.7	265	1.9	1,931	13.5
GAG	1,787	13.1	395	2.9	2,177	16.0
MAM	910	10.8	236	2.8	1,146	13.5
SSB	1,596	12.0	65	0.5	1,661	12.4
EKP	211	10.3	89	4.3	300	14.6
JCH	1,033	14.2	108	1.5	1,141	15.6
TAD	1,687	9.6	406	2.3	2,093	11.9
DNK	3,125	13.0	223	0.9	3,348	13.9
TOTAL / AVERAGE	**Total 14,611**	**Average 11.7**	**Total 2,494**	**Average 2.0**	**Total 17,105**	**Average 13.7**

*These include NFTS Roads and Trails and roads under other jurisdictions, i.e., private roads, roads managed under Special Use Permit, etc.

Note that the crossing densities in WES, JCH and GAG are the highest, while densities in SFM are relatively low.

Table 3- 80 displays the extent of sensitive soils, total motorized road / route density, and total stream crossing density by analysis unit. The highest potential for erosion and sediment delivery exist where high densities of sensitive soils and motorized routes converge. The WES AU has the highest amount of sensitive soils and the third highest density of motorized routes on sensitive soils. The percentage of sensitive soils in GLO, MAM, SSB and DNK AUs are not high, but the motorized route and stream crossing densities on those soils are high. JCH and GAG AUs also present concerns. Although the percentage of sensitive soils in SFM AU is high, the motorized route and crossing densities are low. EKP AU does not present concerns based on sensitive soils.

Table 3- 80. Comparison of Extent of Sensitive Soil by AU Relative to Road/Route and Drainage Crossing Density

Analysis Unit	Square Miles of Sensitive Soil[1]	Percentage of analysis unit (%)	Total Motorized Route Stream Crossing Density on Sensitive Soils (# /mi²)	Total Road and Route Density on Sensitive Soils (mi/mi²)
SFM	61 mi²	56%	9.5	2.3
WES	90 mi²	68%	16.8	3.9
GLO	4 mi²	3%	12.4	4.3
GAG	44 mi²	32%	15.7	3.1
MAM	12 mi²	15%	24.3	4.3
SSB	12 mi²	9%	27.1	4.5
EKP	0.01 mi²	0.04%	0	0
JCH	31 mi²	43%	20.6	3.6
TAD	0.4 mi²	0.2%	0	0
DNK	60 mi²	21%	18.5	3.5

[1]Sensitive soils include Holland and *Ultic Haploxeralf* families. A complete list of sensitive soil types can be found in the project record.

Managed Areas, Parking and Staging Areas

The SNF manages approximately 124 acres of areas, parking, and staging areas. Table 3- 81 displays the portion of these existing areas that lie within RCAs. The majority of the acreage lies in TAD and is associated with the Bald Mountain Route.

Table 3- 81. Acres of Managed Areas and Acres in RCAs

Analysis Unit	Managed Areas (ac)	Managed Areas in RCA (ac)
SFM	0	0
WES	2.7	1.4
GLO	3.5	1.4
GAG	0.1	0
MAM	1.0	0.1
SSB	0	0
EKP	0	0
JCH	0	0
TAD	114.7	21.1
DNK	1.7	1.7
TOTAL:	**123.7**	**25.8**

Seasonal Closures and Year-round Prohibitions on NFTS Roads and Trails

The season of use of roads and trails is related to their potential watershed impacts. Unsurfaced roads that are open year-round have a higher potential for erosion and sediment delivery because the action of the wheels on the wet road surface detaches sediment particles, and can create road surface deformation that channels water in the tire tracks and renders drainage features such as drain dips ineffective. There is also an increased likelihood for precipitation and runoff to carry the detached sediment to a stream, and to cause further erosion in the tire tracks. Roads or trails that are closed year-round are not subject to mechanical erosion from motor vehicle traffic. They are more likely to have vegetation and other ground cover, which further limits runoff and erosion. Roads that are open to motor vehicle use but are closed in the wet season are not as likely to have vegetation and groundcover as roads closed year-round, but are also not as likely to have use during the periods when precipitation makes the surface deformable and carries detached sediment to streams.

There are currently winter restrictions on 454 miles of roads. There are year-round prohibitions on 257 miles of roads, 80 miles of which are in RCAs. There are 1824 miles of roads with no prohibition on winter traffic and 774 miles of these are in RCAs. Table 3- 82 shows the miles open and closed in RCAs and the numbers of stream crossings on those roads and trails.

Table 3- 82. Miles of NFTS Roads and Motorized Trails Open Year-round in RCAs, Miles of Roads and Motorized Trails Closed Year-round in RCAs and Numbers of Stream Crossing on those Roads and Trails

Analysis Unit	NFTS Roads and Motorized Trails Open Year-round in RCA (mi)	Crossings Open Year-round (# in RCA / # outside RCA / total #)	NFTS Roads and Motorized Trails Closed Year-round in RCA (mi)	Crossings Closed Year-round (# in RCA / # outside RCA / total #)
SFM	32	296 / 290 / 586	1	2 / 2 / 4
WES	118	874 / 694 / 1568	6	30 / 14 / 44
GLO	141	812 / 509 / 1321	3	16 / 2 / 18
GAG	79	542 / 597 / 1139	5	29 / 22 / 51
MAM	51	277 / 250 / 527	11	51/ 10 / 61
SSB	63	343 / 275 / 618	11	77 / 56 / 133
EKP	15	56 / 18 / 74	0.1	0 / 1 / 1
JCH	63	349 / 97 / 446	6	26 / 21 / 47
TAD	82	538 / 256 / 794	18	131 / 23 / 154
DNK	131	950 / 538 / 1488	19	158 / 122 / 280
TOTAL:	**774**	**5037 / 3524 / 8561**	**80**	**520 / 273 / 793**

Note that there are almost 10 times as many miles in RCAs (9.7 times) open year-round as closed year-round. There are also almost 11 times as many stream crossings open year-round as closed year-round.

3.10.3 Baseline (Current Condition) Cumulative Watershed Effects Analysis

The baseline ERA calculations indicated that there are unauthorized routes or areas present in 96 HUC8s that are over their lower TOC. The maximum ERA contribution from unauthorized features is 2.37 percent, which occurs in HUC8#503.0003, in the Miami area (WES).

Of these 96 HUC8s, seven are over the upper TOC of 14 percent. In these seven HUC8s, the ERA contribution from unauthorized features ranges from 0.03 percent to 1.25 percent. The highest contribution from unauthorized features occurs in HUC8#504.2251, in the Whiskers Campground / Central Camp area along North Fork Sand Creek (in GAG).

Twenty-five (25) of these 96 HUC8s analyzed in the Baseline CWE Assessment that would be affected by the action alternatives were carried forward into a Detailed CWE Assessment. The remainder of the over TOC HUCs were not carried forward into the Detailed Assessment they were only affected by Alternative 1 (No Action Alternative) and the information contained in the

Baseline Assessment is adequate to discuss the effects. In the action alternatives, ERAs would decrease in these HUC8s due to recovery of the unauthorized routes and areas and would not be affected by changes in the NFTS. Figure 3- 14 shows the location of the 96 HUC8s that contain unauthorized routes and/or areas that were determined to be over their lower TOC and the 25 of those that were carried forward into the Detailed Assessment.

Figure 3- 14. Subdrainages (HUC8s) Containing Unauthorized Routes and/or Areas that were Determined to be over their Lower TOC, based on the Baseline ERA Calculations for this Project

The 25 HUC8s that were carried forward in the Detailed Assessment are shaded darker.

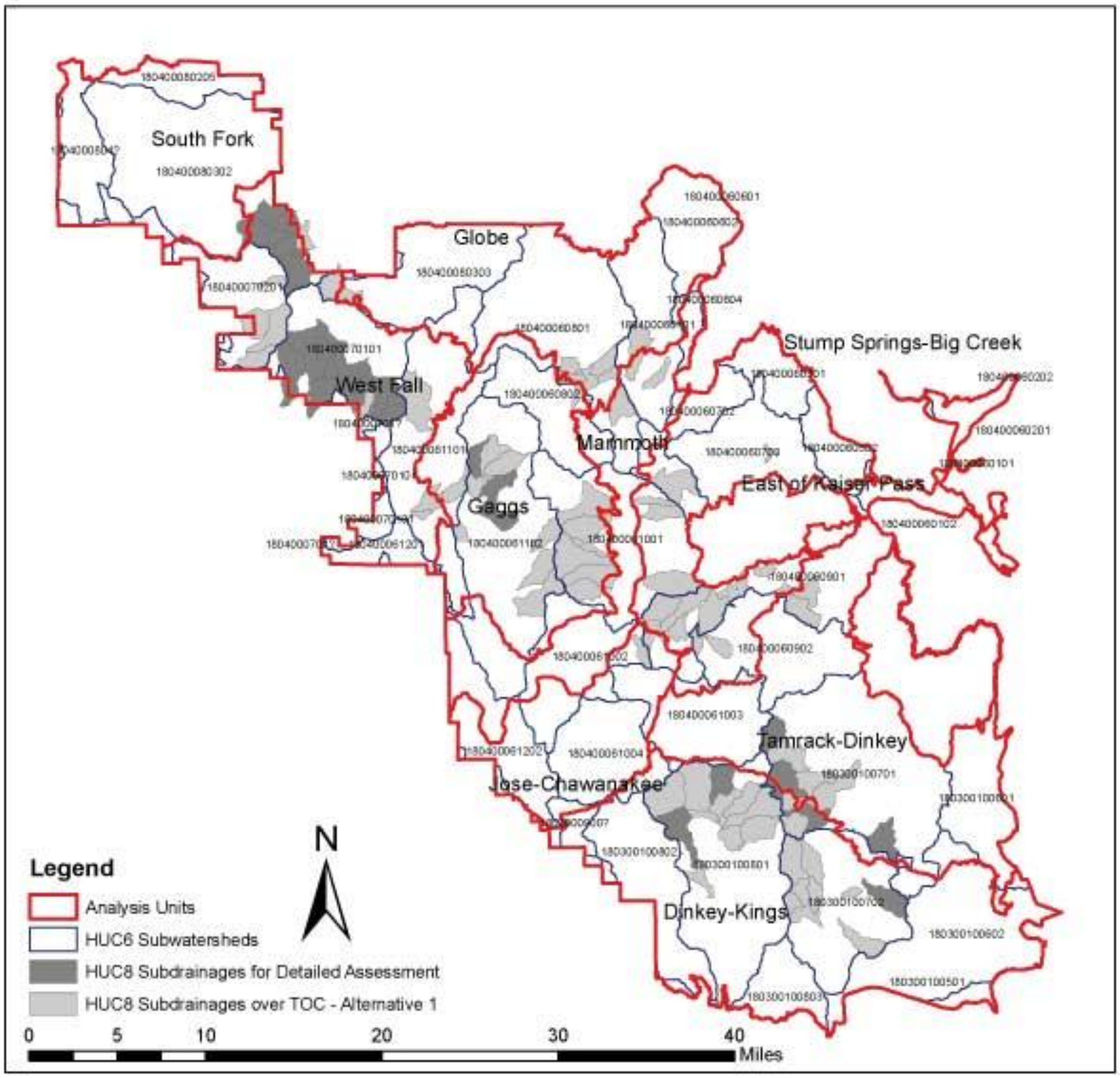


Table 3- 83 lists the 25 HUC8s that were included in the Detailed Assessment. The number of stream crossings on unauthorized routes and existing stream channel condition information (stream sensitivity, stream channel stability, V* and other observations) were considered in order to make the determinations of the risk of CWEs. This information is displayed in the CWE Report (Gallegos 2009). The evaluation concluded that the existing risk of incurring CWEs in 14 of these HUC8s is low. The risk was determined to be low to moderate in one HUC8, moderate in

five and high in five (three of these in the Miami area). In the Miami area, CWEs are currently occurring, as discussed in the Existing Water Quality section above. The information used to reach these conclusions is summarized for each of the 25 HUC8s following the table. Where HUC8s cluster inside larger HUC6 subwatersheds, the implications for the HUC6 are also discussed.

Table 3- 83. HUC8s Evaluated in a Detailed Assessment, Including the HUC6 they are within, their Existing ERAs and the Determination of the Existing Level of Risk of CWEs

HUC8	HUC8 Size (ac)	HUC6	Analysis Unit	Lower TOC (ERA%)	Existing ERA percent	Existing Risk of CWE
501.0023	1035	180400080302	WES	4	11.7	Low
501.4002	2947	180400080302	WES / SFM	4	7.7	Low
501.4003	857	180400080302	WES	4	8.4	Moderate
501.5101	1958	180400080302	WES	4	11.6	Low
503.0002	410	180400070101	WES	4	4.2	Moderate
503.0003	335	180400070101	WES	5	5.5	Moderate
503.0006	692	180400070101	WES	4	6.4	Low
503.0011	645	180400070101	WES	5	5.1	Low
503.0052	2291	180400070101	WES	4	6.4	High
503.0053	1602	180400070101	WES	4	3.1*	High
503.0054	2412	180400070101	WES	4	5.4	High
503.0055	2563	180400070101	WES	4	8.6	Low
503.0056	1211	180400070101	WES	4	10.8	Low
503.3051	1484	180400070101	WES	4	14.0	Moderate
504.2008	1014	180400061102	GAG	4	5.3	Low
504.2102	714	180400061102	GAG	4	5.2	Low
504.2151	711	180400061102	GAG	4	7.1	Low
504.2251	850	180400061102	GAG	5	23.5	High
519.3053	2083	180300100801	DNK	5	9.3	High
519.4051	1402	180300100801	DNK	4	9.8	Low
520.0017	1952	180300100701	TAD / DNK	4	7.1	Low
520.0056	1209	180300100701	DNK / TAD	5	14.1	Low/Mod
520.3002	1661	180300100702	DNK	5	7.4	Low
520.3003	1591	180300100701	TAD	4	4.6	Moderate
520.5001	1194	180300100701	TAD	5	5.8	Low

*Although the ERAs are not over the lower TOC, other information indicates that this HUC8 has CWE concerns, so it was included in the Detailed Assessment.

Subdrainages in the West South Fork Merced River HUC6 (180400080302)

501.0023 contains Squirrel Creek and its tributaries, which drain into the South Fork Merced River. This HUC8 has a High CWE sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 11.7 percent, including a total of 479 acres of treated timberlands of which 371 acres was commercially thinned in 2007. There are approximately 5.1 miles of roads. Unauthorized routes total 0.9 miles, with no channel crossings. Resident trout were observed in Squirrel Creek. Stream survey data indicates that 41 percent of the surveyed length has a naturally unstable channel system and none has a Poor stability rating. Available field data indicates that there is a low potential that CWE are occurring.

501.4002 contains Rush Creek and a main tributary. This HUC8 has a high CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 7.7 percent, including 761 acres of treated timber lands of which 404 acres was commercially thinned in 2007. There are approximately 13.4 miles of road. Unauthorized routes total 4.1 miles, with 32 channel crossings. Resident trout were observed in Rush Creek, where 41 percent of the surveyed stream length is naturally unstable channel types and 8 percent is naturally sensitive. Eight (8) percent of the surveyed channel has a Poor stability rating. Available field data indicates that there is a low potential that CWE are occurring.

501.4003 contains a tributary to Rush Creek. This HUC8 has a high CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 8.4 percent, including 225 acres of treated timber lands of which 153 acres was commercially thinned in 2007 and 2008. There are approximately 6.4 miles of road. Unauthorized routes total 2.6 miles, with 7 channel crossings. Resident trout were observed in the lower reaches of this tributary. Stream surveys found that 47 percent of the stream is a naturally unstable channel type and 38 percent is naturally sensitive. Thirty-eight percent of the channel system has a poor stability rating. Available field data indicates that there is a moderate potential that CWE are occurring.

501.5101 contains Laurel Creek, which drains into the South Fork Merced River. This HUC8 has a high CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 11.6 percent, including 710 acres of treated timber lands of which 696 acres was commercially thinned in 2007. There are approximately 5.8 miles of road. Unauthorized routes total 0.7 miles, with 5 channel crossings. Approximately 237 acres of private land has some disturbance, most likely related to logging activity. Resident trout were observed in Laurel Creek. Stream surveys indicate that 73 percent of the stream length has a naturally unstable channel and 12 percent is naturally sensitive. Five percent has a poor stability rating. Available field data indicates that there is a low potential that CWE are occurring.

These four subdrainages are tributary to the West South Fork Merced HUC6. In a recent snorkel survey of the South Fork Merced River, channel condition and aquatic habitat condition was reviewed. Water clarity was very good. There was very little fine sediment in pools and the channel bottom was found to be mostly bedrock, cobble and gravel. The West South Fork Merced River HUC6 has very little disturbance other then roads in the upper watershed areas and a few old mine sites. Most of the watershed has chaparral vegetation with very little timbered lands. The lower 2/3 of the channel is designated as a Wild and Scenic River. Available data for the South Fork Merced River indicates that the river is in good condition and CWEs are not evident.

Subdrainages in the Miami Creek HUC6 (180400070101): Carter Creek Drainage

503.0052 contains Carter Creek. The upper half of this HUC8 is on NFS lands, with the downstream half on private land. Carter Creek is tributary to Miami Creek. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 6.4 percent, including a total of 592 acres of treated timberlands, of which 163 acres was commercially thinned in 2006 and 2008. There are approximately 12.8 miles of roads. Unauthorized routes total 9.0 miles, with 52 channel crossings. Disturbances on the privately-owned portion are unknown. Current channel and aquatic conditions are unknown in Carter Creek; however, resident trout have been observed. The creek is similar to Miami Creek and has similar motorized use patterns as the main Miami area, including 52 unauthorized route channel crossings. Available data indicates that there is a high potential that CWE are occurring. Increased flows and sediment loads enter Miami Creek downstream of the SNF and may be contributing to a CWE response in that portion of Miami Creek.

Subdrainages in the Miami Creek HUC6 (180400070101): Miami Creek Drainage

503.0002 contains a tributary to Miami Creek. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 4.2 percent, including 85 acres timber lands that were treated between 1980 and 1986. There are approximately 3.1 miles of road, including 0.6 miles of road 6S15 which parallels the main channel. Unauthorized routes total 1.6 miles, with 5 channel crossings. Resident trout have been observed in the lower reaches of the intermittent stream. Site specific stream condition data is not available. Available field data indicates that there is a moderate potential that CWEs are occurring in this subdrainage; however, sediment generated here is contributing to downstream CWEs in Miami Creek (503.0053).

503.0003 contains a small tributary to Miami Creek. This HUC8 has a moderate CWE sensitivity and a corresponding lower TOC value of 5 percent ERA. The existing ERA value is 5.5 percent, including 40 acres of timber lands that were treated in 1986. There are approximately 2.8 miles of road. Unauthorized routes total 4.5 miles, with 26 channel crossings. Macro-invertebrates are the only aquatic species that have been observed in this intermittent stream. Site specific stream condition data is not available. Available field data indicates that there is a moderate potential that CWEs are occurring in this subdrainage; however, sediment generated here is contributing to downstream CWEs in Miami Creek (503.0054 and 503.0053).

503.0053 contains a reach of Miami Creek (the lowest reach on NFS lands) and several small tributaries. This HUC8 has a high CWE sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 3.1 percent, including 188 acres of timber lands that were commercially thinned between 1980 and 1986. There are approximately 6.1 miles of road. Unauthorized routes total 7.1 miles, with 68 channel crossings. Resident trout were observed in this reach of Miami Creek. Stream surveys indicate that 82 percent of the stream length has a naturally unstable channel and 7 percent is naturally sensitive. Thirty-nine (39) percent of the channel has a poor stability rating.

503.0054 contains an upstream reach of Miami Creek (the highest reach on NFS lands). This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 5.4 percent, including 476 acres of treated timber lands of which 400 acres was commercially thinned between 1986 and 1989. There are approximately 16.2 miles of road. Unauthorized routes total 13.8 miles, with 55 channel crossings. Resident trout were observed in this reach of Miami Creek. Stream surveys indicate that 21 percent of the stream has a naturally unstable channel and 6 percent is naturally sensitive. Six (6) percent has a poor stability rating.

Review of a stream survey conducted in Miami Creek in 1978 described the channel bottom as mostly bedrock and rubble, but also containing boulders, rocks, gravel, sand and silt (Bazlen 1978). This survey occurred prior to extensive use of the Miami area for motor vehicle recreation. Sediment monitoring in 1996 estimated V* at 44 percent (Adams 1996). A Watershed Assessment completed in the early 1990s focused on identifying sources of sediment. In that report, 51 percent of the identified sites needing restoration in the Miami Basin were associated with OHV trails, and another 10 percent with roads (USDA-FS 1992). However, this assessment did not establish a ‘sediment budget’ to determine the relative contribution of sediment from each of these identified watershed improvement needs. Since that assessment, watershed restoration projects have been implemented, trails and landings have been closed and stabilized, and roads have been surfaced with gravel. However, a recent review of the channel estimated that 76 percent of the pools were filled with fine sediment (Gallegos 2009), still far above the Desired Condition of 30 percent. This review concluded that the stream channel is showing signs of equilibrium upstream of Middle Bridge. However, aquatic habitat in Miami Creek overall remains in poor condition, primarily due to accumulation of sediment (Strand 2008). Data collected on the unauthorized routes in the Miami Creek drainage in 2008 (available in project record) shows that gullies up to 3 feet deep are common on routes with slopes greater than approximately 20%, and some routes are delivering sediment directly to stream channels. A report on soils monitoring of the Miami OHV trail network (Roath 2000) has shown that an active OHV trail maintenance program is needed in order to prevent deterioration of trail condition. Available field data indicates that there is a high potential that CWE are occurring in Miami Creek in both 503.0053 and 503.0054.

Subdrainages in the Miami Creek HUC6 (180400070101): Lewis Fork Drainage

503.0006 contains tributaries to Lewis Fork and part of the Cedar Valley community. This HUC8 has a high CWE sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 6.4 percent, including 232 acres of timber lands that were commercially thinned in 2008 under the Cedar Valley Fuels Reduction Project. There are approximately 1.2 miles of road. There is 0.07 mile of one unauthorized route located along the ridge top, with no channel crossings. Macro-invertebrates are the only aquatic species that have been observed in this intermittent stream. Site specific stream condition data is not available. This subdrainage was assessed in the analysis for the Cedar Valley Project, when it was determined that there is some risk that a CWE response could occur if an above normal precipitation event occurs during the first 3 years after the Cedar Valley Project is implemented (Gallegos 2006). Available data indicates that there is a low potential that CWE are occurring.

503.0011 contains a tributary to Lewis Fork, including the stream at the Westfall Picnic Area. This HUC8 has a Moderate CWE Sensitivity and a corresponding lower TOC value of 5 percent ERA. The existing ERA value is 5.1 percent, including 91 acres of treated timber lands (of which 27 acres are proposed for treatment in the 2009 Sugar Pine Fuels Reduction Project) and the 2008 Westfall wildfire, which resulted in 26 ac of moderate severity burn and 50 ac of low severity burn in this HUC8. There are approximately 7.5 miles of road. Unauthorized routes total 2.25 miles, with 8 channel crossings. Resident trout have been observed in the lower reaches of the perennial stream. This subdrainage was assessed for the Sugar Pine Fuels Reduction Project (Gallegos 2008). Site specific stream condition data is not available. Available data indicates that there is a low potential that CWE are occurring.

503.0055 contains Lewis Fork between Sugar Pine and Cedar Valley and small tributaries. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 8.6 percent, including 1049 acres of treated timber lands, of which 130 acres were commercially thinned in 2008, under the Cedar Valley Project. There are approximately 12.2 miles of road. Unauthorized routes total 9.5 miles, with 60 channel crossings. This segment of Lewis Fork is a high gradient, bedrock controlled transport stream that is stable and has a limited probability of sediment deposition. Riparian vegetation (alder) is common in streamside areas. Habitat diversity and complexity are good, with a wide variety of observed habitat, abundant cover and woody debris. Stream temperatures meet Desired Conditions (Strand 2008a). Two ponds are located in the main stem of Lewis Fork Creek in the Sugar Pine private property (just upstream of this HUC8). These ponds collect the sediment from the upstream portion of the drainage. This subdrainage was assessed for both the 2007 Cedar Valley Project and the 2008 Sugar Pine Project. It was determined that there is some risk that a CWE response could occur if an above normal precipitation event occurs during the first 3 years after the Cedar Valley Project is implemented (Gallegos 2006). Available data indicates that prior to the Cedar Valley Project being implemented last year that there was a low potential that CWE were occurring. Precipitation events over the next several years will determine whether CWEs will occur as a result of the Cedar Valley and/or Sugar Pine Projects.

503.0056 contains a tributary of Nelder Creek on the south side of Sivils Mountain. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 10.8 percent, including 461 acres of treated timber lands, of which 104 acres were commercially thinned in 2008 under the Cedar Valley Project. There are approximately 5.1 miles of road. Unauthorized routes total 3.4 miles, with 20 channel crossings. This sub-watershed was evaluated in the field for the Detailed CWE Assessment for the Cedar Valley Project (Gallegos 2006, Strand 2006). Channel conditions were good and evidence of accelerated channel erosion was not observed. Pools had 10 percent to 20 percent of their depth filled with fine sediment, which meets the Desired Condition. There is a depositional reach that also appears to be in good condition. Available data indicates that prior to the Cedar Valley Project being implemented last year, there was a low potential that CWE were occurring. It was also judged unlikely that a CWE response would occur as a result of the Cedar Valley Project (Gallegos 2006).

503.3051 contains the lower reaches of Nelder Creek, between California Creek and the confluence with Lewis Fork. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 14.0 percent, including 1653 acres of treated timber lands, of which 598 acres are proposed to be commercially thinned under the Cedar Valley Project. Several areas were logged in 1974 and 1975 and should be completely recovered - some of these same areas are proposed to be commercially thinned under the Cedar Valley Project. There are approximately 7.8 miles of road. Unauthorized routes total 4.9 miles, with 28 channel crossings. This subdrainage was assessed in 2007 for the Cedar Valley Project. It was determined that there is some risk that a CWE response could occur if an above normal precipitation event occurs during the first 3 years after the Cedar Valley Project is implemented (Gallegos 2006). Surveys of channel conditions determined that 100 percent of this portion of Nelder Creek is naturally sensitive. Available data indicates that prior to the Cedar Valley Project being implemented last year, there was a low potential that CWE were occurring. Precipitation events over the next several years will determine whether CWEs will occur as a result of the Cedar Valley Project.

The three distinct drainages in the Miami Creek HUC6 do eventually converge: Carter Creek is tributary to Miami Creek, which flows into the Fresno River about 8 miles downstream of the confluence of Lewis Fork with the Fresno River. There is a potential for CWEs to be propagated downstream from these distinct areas and result in accumulation of effects in the Fresno River. Channel conditions downstream of the SNF boundary in Carter Creek, Miami Creek, Lewis Fork and the Fresno River are unknown.

Subdrainages in the South Fork Willow HUC6 (180400061102)

504.2008 is a tributary of South Fork Willow Creek that enters between Sand Creek and Browns Creek. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 5.3 percent, including 12.7 acres of timber lands that were treated in 1994. There are approximately 3.8 miles of road. Unauthorized routes total 1.2 miles, including 3 channel crossings. Other then macro-invertebrates, aquatic species have not been observed in the intermittent stream. Existing data indicates that 28 percent of the stream length is naturally unstable and 12 percent is a naturally sensitive channel type. Twelve percent of the channel system has a stability rating of poor. Available field data indicates that there is a low potential that CWE are occurring in this HUC8.

504.2102 is tributary to Browns Creek. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 5.2 percent, including 122 acres of timber lands that were treated in 1997 and 1999. There are approximately 5.0 miles of road. Unauthorized routes total 0.7 miles, with five channel crossings. Resident trout were observed in the lower reaches of the main channel. Current channel and aquatic conditions are unknown in this creek. Available data indicates that there is a low potential that CWE are occurring in this HUC8.

504.2151 contains the lower reach of Browns Creek and several small tributaries. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 7.1 percent, including 114 acres of timber lands that were treated between 1999 and 2001. There are approximately 1.5 miles of road. Unauthorized routes total 2.8 miles, with 12 channel crossings. Resident trout were observed in Browns Creek, where 90 percent of the stream reach is naturally stable. Approximately 10 percent of the surveyed stream reach has a sensitive channel type and none has a Poor stability rating. Available field data indicates that there is a low potential that CWE are occurring in this HUC8.

504.2251 contains the lower reach of North Fork Sand Creek. This HUC8 has a Moderate CWE Sensitivity and a corresponding lower TOC value of 5 percent ERA. The existing ERA value is 23.5 percent, including 518 acres of timber lands of which 430 acres were treated between 2001 and 2008. This is well above the upper TOC value of 14 percent ERA. There are approximately 4.2 miles of road. Unauthorized routes total 3.1 miles, with 35 channel crossings. Approximately 1.7 miles of unauthorized routes (including BP35, BP43, BP62, BP72 and BP73) are located parallel to North Fork Sand Creek within the RCA. Resident trout were observed in this stream reach, where 10 percent of the reach is naturally unstable and 28 percent is a naturally sensitive channel type. Seventeen percent of the surveyed reach has a Poor stability rating, most likely occurring in the sensitive reaches. Available field data indicates that there is a high potential that CWE are occurring in this HUC8. The high number of stream crossings on unauthorized routes and the high amount of routes located near the creek make it likely that these routes are contributing to the observed CWEs.

Subdrainages in the Upper Dinkey HUC6 (180300100701)

520.0017 contains Glen Meadow Creek and all of its tributaries. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 7.1 percent, including 829 acres of timber lands, of which 365 acres are proposed to be treated in KRP. Without the disturbance associated with KRP, this HUC8 would not exceed the lower TOC. An additional 380 acres of timber land were treated in 1975 and should be fully recovered. There are approximately 12.0 miles of road. Unauthorized routes total 5.3 miles, with 30 channel crossings. Resident rainbow and brown trout have been observed in Glen Meadow Creek, where 91 percent of the surveyed stream length has a naturally stable channel and none is sensitive. The lower ½ mile of Glen Meadow Creek has a low gradient (<3 percent), B channel, with pool/riffle ratio of 1:1 and instream cover provided by terrestrial vegetation, boulders and undercut banks. Main channel pool habitat was the dominant pool type. Deposition of sand was noted in several pools and was ascribed to moderate recreation and grazing impacts in this reach. The middle reach of Glen Meadow Creek is a steep cascade with step pool habitat. Some sand was observed in some of the pools in this middle reach. The upper reach of Glen Meadow Creek is a steep cascade with step pool habitat and some lower gradient, B type channels, with Good to Fair stability (USDA-FS 1995c). A 1997 survey estimated V* at 14 percent, which meets the Desired Condition for this area. Available field data indicates that channel and aquatic habitat conditions are good and there is a low potential that CWE are occurring.

520.0056 contains the main stem of Dinkey Creek from about 0.3 miles downstream of Dinkey Fisherman to the confluence with Bear Creek and includes small streams draining the side slopes of this reach. It contains several meadows up to 12 acres in size. This HUC8 has a Moderate CWE Sensitivity and a corresponding lower TOC value of 5 percent ERA. The existing ERA value is 14.1 percent, including 637 acres of timber lands, of which 602 acres are proposed to be treated in the Kings River Project (KRP). (KRP was considered to be a future foreseeable action for this analysis, although it is currently unknown whether the project will be implemented. Without the 602 acres of disturbance associated with KRP, ERA values are well below the upper TOC.) There are approximately 11.5 miles of road. Unauthorized routes total 1.9 miles, with 4 channel crossings. Yosemite toad and resident trout have been observed in meadow habitats. All of the surveyed stream reaches have naturally stable channels, with no sensitive channel types. Dinkey Creek at the confluence with Bear Creek is dominated by cobble and rubble with an 11 percent sand/silt component. Just upstream of the Bear Creek confluence, the aquatic habitat consists of 34 percent pools, 17 percent riffles, 46 percent runs and 9 percent cascades. A 1995 survey estimated residual pool filling (V*) at 2 percent. Available field data indicates that channel and aquatic habitat conditions are good and there is a low potential that CWE are occurring. Implementation of KRP would result in a Moderate potential for CWEs to occur in this HUC8.

520.3003 is the Snow Corral CAR, which was designated to protect Mountain yellow-legged frog habitat and also contains Yosemite toads. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 4.6 percent, including 375 acres of timber lands that were treated between 1985 and 1998. There are approximately 7.0 miles of road. Unauthorized routes total 1.4 miles, with three channel crossings. A 1995 survey of Snow Corral Creek estimated V* at 21-49 percent, which is higher than expected in these channel types. The stream channel in Snow Corral Meadow and Trouble Meadow has knickpoints that are migrating upstream and could imperil stream habitat and the meadow hydrology necessary to protect the aquatic species present in the CAR. Previous stream channel restoration work has had limited success. Available data indicates that there is a moderate potential that CWE are occurring.

520.5001 contains the main tributary to Rock Creek and much of the Bald Mountain OHV Route. This watershed has a moderate CWE Sensitivity and a corresponding lower TOC value of 5 percent ERA. The existing ERA value is 5.8 percent, including 47 acres of managed areas. There are approximately 6.2 miles of road. Unauthorized routes total 6.2 miles, with 32 channel crossings. Aquatic species surveys in this area indicate that the stream channels are ephemeral and intermittent and no suitable aquatic habitat was identified. A recent review of Rock Creek, downstream of subdrainage 520.5001 and above the bridge at 9S09 (Gott 2008), found a boulder/cobble substrate with very few fines and stable gravel bars vegetating with riparian species. Channel banks appeared stable with no indicators of recent scour or deposition. Resident trout been observed in Rock Creek. Pfankuch channel stability ratings for most reaches were good. Channel substrate was mainly boulders and bedrock and channels are inherently stable. Available data indicates that there is a low potential that CWE are occurring in this subdrainage and downstream in Rock Creek.

Channel condition and aquatic habitat data is not available for the Upper Dinkey Creek HUC6. Given Dinkey Creek’s steep, bedrock-controlled channel, it is unlikely that stream channel instability or sediment deposition attributable to CWEs would occur in the main stem of Dinkey Creek.

Subdrainages in the Lower Dinkey HUC6 (180300100702)

520.3002 contains Bull Creek and its tributaries. This HUC8 has a Moderate CWE Sensitivity and a corresponding lower TOC value of 5 percent ERA. The existing ERA value is 7.4 percent, including 807 acres of timber lands, of which 420 acres are proposed to be treated in KRP. Without the disturbance associated with KRP, ERA values would be below the TOC. There are approximately 13.6 miles of road. Unauthorized routes total 1.6 miles, with one channel crossing. This subdrainage was assessed in KRP and is one of the Kings River Experimental Watersheds. Extensive data is available for this subdrainage from the Pacific Southwest Research Station, Fresno Lab. Yosemite Toad has been observed in meadows in the lower reaches of Bull Creek. Of surveyed stream reaches, 26 percent are naturally unstable channel types and none are sensitive. Twenty-one percent of the channel system has a poor stability rating, most likely occurring in the naturally unstable reaches. Available field data indicates that channel and aquatic habitat conditions are good and there is a low potential that CWE are occurring.

Subdrainages in the Kings Big Creek HUC6 (180300100801)

519.3053 contains the middle reach of Rush Creek. This HUC8 has a Moderate CWE Sensitivity and a corresponding lower TOC value of 5 percent ERA. The existing ERA value is 9.3 percent, including 1087 acres of timber lands, of which 467 acres were treated in 2004 under the South of Shaver Project, including whole tree yarding and tractor piling of logging slash and 60 acres are proposed to be treated in the Kings River Project (KRP). (KRP was considered to be a future foreseeable action for this analysis, although it is currently unknown whether the project will be implemented.) There are approximately 13.9 miles of road. Unauthorized routes total 2.6 miles, with 2 channel crossings. Resident trout and Western Pond Turtles have been observed in this reach of Rush Creek. This HUC8 was assessed in 2005 as part of the field review for KRP. The assessment determined that Rush Creek has stable stream banks and a large volume of fine sediment throughout the low gradient reaches. Pool filling with fine sediment (V*) is estimated at 70-90 percent. A 4 foot measurement rod often could not reach the bottom of the sand deposits. The channel bottom consisted of bedrock and boulders with a continuous bed of fine sediment. Thick deposits of fine sediment were observed along the entire stream segments surveyed. The assessment determined that CWEs were occurring in Rush Creek (Hopson 2005). Available field data indicates that there is a high potential that CWE are occurring.

519.4051 contains Summit Creek and its tributaries. This HUC8 has a High CWE Sensitivity and a corresponding lower TOC value of 4 percent ERA. The existing ERA value is 9.8 percent, including 1042 acres of timber lands, of which 190 acres were treated in 1998 under the 10S18 Project and 359 acres are proposed to be treated in KRP. There are approximately 5.4 miles of road. Unauthorized routes total .75 miles, with two channel crossings. This HUC8 was assessed in 2005 as part of the field review for KRP. It contains mostly stable stream reaches. Measurements of residual pool filling (V*) in a reach at the confluence of Summit Creek and Big Creek indicated V* of 12 percent in 1995 (Gallegos 2004) and 18 percent in 2004 (Morales 2004). A channel analysis survey in 2004 indicated about 50 percent sands occupying the first perennial tributary to Summit Creek. Watershed improvement need inventories (WINI) collected between 1995 and 2004 indicate eight erosion sites are present. Each site is channel erosion initiated or influenced by culverts at road/stream crossings, including gully headcuts. Aquatic species found during surveys between 1990 and 2003 include the Western pond turtle and Relictual slender salamander (Forest Service sensitive species), garter snakes and unidentified trout species (Rainbow, Eastern Brook and Brown trout are Management Indicator Species for the SNF). These sightings occurred within approximately the first 850 meters (first ½ mile) of Summit Creek (Sanders and Hopson 2005). Available field data indicates that currently there is a low potential that CWE are occurring in this subdrainage.

Stream channel and aquatic habitat conditions for the Kings Big Creek HUC6 (180300100801) subwatershed have been assessed and monitored over the years and are documented in the Big Creek Watershed Analysis (Gallegos 2004) and described in the Affected Environment section, (see Table 3- 73 and discussion). Available data indicates that Big Creek is not meeting desired conditions for water quality and aquatic habitat. The major issue in Big Creek is the amount of sediment occupying pools in the low gradient response reaches. This excessive sediment is affecting the quality of aquatic habitat and is a limiting factor for a healthy, productive aquatic ecosystem. Available data indicates there are elements of CWE occurring in the Kings Big Creek HUC6 (180300100801) subwatershed.

3.10.4 Environmental Consequences – Forestwide

See the effects analysis methodology section, above, for information about how this analysis was conducted.

Alternative 1 – No Action

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

Allowing continued cross-country travel outside of closed areas would mean that the impacts of the motor vehicle use occurring on the unauthorized routes would continue (see Table 3- 84), in addition to impacts from more occasional, dispersed travel over the landscape.

The effects of continued cross-country motorized travel and route proliferation on water resources include increased sediment loads and possible peak flow increases due to compacted and unvegetated route surfaces and detachment of sediment by vehicles. Essentially, the unauthorized routes function like native surface roads that receive no maintenance. As described in the Methodology ‘Rationale’ sections (3.10.1), studies have found that maintenance of native surface roads is an important factor for reducing their impacts on streamflows and sedimentation, particularly on roads that receive vehicle traffic when soils are wet. This means that the unauthorized routes are likely to impact streamflows and sedimentation.

Impacts to stream channels, riparian areas and water quality would be possible where this use occurs in RCAs. (Outside of RCAs, any resulting disturbance would be far enough away from sensitive areas that they would be less likely to be affected.) Stream crossings in particular have the potential to deliver increased runoff and sediment from the road, destabilize streambanks and affect channel function. The miles of routes in RCAs and the number of stream crossings are listed by analysis unit in Table 3- 84. This table shows how many of the existing routes and stream crossings would remain open to motor vehicle use in Alternative 1, as well as how many fall within closed areas and would therefore not be available for motor vehicle use. The largest number of acres of RCAs open to use would be in DNK, although much of that area is steep, brushy ground that would not actually be used. The highest number of miles of existing routes in RCAs are in WES, GAG, GLO, TAD and DNK. Those analysis units and MAM also have high numbers of stream crossings on unauthorized routes that would be open to use. For these reasons, peak flow increases and sediment delivery related to cross-country use are the most likely to occur in WES, GAG, GLO, MAM and TAD. These areas would also be the most likely to experience other water quality impacts, including possible decreases in DO resulting from increased sediment delivery and the introduction of chemical constituents including oil and gas, especially at stream crossings.

Continued cross-country motor vehicle travel would have marked effects in WES, especially in the Miami area, because the easily erodible soils and steep slopes cannot maintain stability when the vegetation layer is lost as new routes are created. The existing density of unauthorized routes (0.85 mi/mi^2) indicates that these impacts would continue to be widespread. Peak flows and water quality in Miami Creek and North Fork Willow Creek would continue to be affected as a result. Sediment inputs would likely continue and could increase in Miami Creek, and sediment in pools (V*) would continue to exceed the DC. Because of concentrated use near the North Fork Willow Creek, the reaches with poor stability and high sediment loads would recover the most slowly in this alternative.

Even though the density of unauthorized routes is lower in DNK (0.25 mi/mi^2), V* values would also be likely to remain above DC in Big Creek, due to similar issues with erodible soils on steep slopes.

In spite of ongoing efforts to curtail it, the observed motor vehicle use of Boneyard Meadow in TAD would likely continue to occur, which could cause recovery of the FAR stream reach to occur more slowly or could even cause the condition of the reach to deteriorate further.

Table 3- 84. Open and Closed Acres and Unauthorized Routes in RCAs

Analysis Unit	Acres within RCAs Open (ac) / Closed (ac)	Unauthorized Routes within RCAs Open (mi) / Closed (mi)	Stream Crossings on Unauthorized Routes Open (#) / Closed (#)
SFM	14486 / 7664	7.4 / 0	134 / 0
WES	26780 / 0	35.7 / 0	573 / 0
GLO	21340 / 10559	21.7 / 4.8	220 / 45
GAG	24970 / 0	24.3 / 0	395 / 0
MAM	21767 / 9	17.6 / 0	236 / 0
SSB	17105 / 5763	3.4 / 0.8	54 / 11
EKP	0 / 3432	0 / 8.4	0 / 89
JCH	21444 / 0	10.4 / 0	108 / 0
TAD	18345 / 18053	20.7 / 9.4	308 / 98
DNK	42255 / 6036	14.9 / 0	223 / 0
TOTAL	**208492 / 51516**	**156.1 / 23.4**	**2251 / 243**

Under existing regulations, cross-country motor vehicle use is permitted only when resource damage does not occur. This means that in Alternative 1, it would still be unauthorized for motor vehicles to cause deep rutting, direct streambank disturbance or other obvious damage to resources. Soil moisture conditions are variable and a key factor in whether or not resource damage occurs in a given location. For example, a vehicle may be able to drive across a meadow in September without causing resource damage (this would be allowed in Alternative 1), but may become stuck in mud in the same meadow in May. In May, motor vehicle use in such a meadow would be prohibited under this alternative.

Cross-country use would continue in most of the CARs. A portion (72 percent) of the Cow Creek CAR is in the area where cross-country travel would be prohibited, but the other CARs would be open to cross-country motor vehicle use. Table 3- 85 shows the acres in CARs, the number of miles of unauthorized routes in CARs and the numbers of stream crossings on the unauthorized routes in CARs that would continue to be open to use. The Lower San Joaquin River CAR (in MAM and JCH) and the Jose Basin CAR (in JCH) have the most unauthorized routes and crossings. The only unauthorized routes that would be closed in CARs are 0.7 mi with three stream crossings in the Cow Creek CAR. It would be difficult to ensure that impacts from this use are minimized, as required within CARs by the SNFPA ROD (USDA-FS 2004a).

Table 3- 85. Acres and Miles of Unauthorized Routes in CARs that would be Open to Continued Motor Vehicle Use

Analysis Unit	Acres within CARs Open (ac) / Closed (ac)	Unauthorized Routes within CARs Open (mi) / Closed (mi)	Crossings on Unauthorized Routes within CARs Open (#) / Closed (#)
SFM	0 / 0	0 / 0	0 / 0
WES	0 / 0	0 / 0	0 / 0
GLO	1199 / 0	0.6 / 0	2 / 0
GAG	478 / 0	0.2 / 0	0 / 0
MAM	10632 / 0	15.5 / 0	119 / 0
SSB	5 / 0	0 / 0	0 / 0
EKP	0 / 0	0 / 0	0 / 0
JCH	26350 / 0	14.6 / 0	68 / 0
TAD	2982 / 3153	2.8 / 0.7	6 / 3
DNK	2352 / 0	0 / 0	0 / 0
TOTAL	**43,998 / 3153**	**33.7 / 0.7**	**195 / 3**

In the long term, permitting cross-country motor vehicle use would likely lead to the proliferation of additional miles of unauthorized routes in those portions of the SNF currently open to cross-county use (see Chapter 1, Figure 1-3). We have seen changes in the unauthorized routes between the time they were mapped in 2005 and in 2008, with some routes apparently being abandoned and new routes developing. As the number of people participating in motorized recreation continues to increase, along with the capability of motor vehicles, the rate of development of new routes could even increase. We cannot accurately project the rate or the effects of route proliferation in the long term.

In conclusion, continued cross-country travel would have adverse effects to water resources including increased sediment loads, possible peak flow increases, streambank destabilization, and occasional oil and gas deposition into streams and riparian areas, due to the large number of miles of routes, stream crossings, and acres of area open to motor vehicle use in RCAs and CARs.

Additions to the NFTS

There would be no facilities added to the NFTS under this alternative, therefore there would be no direct or indirect effects to water resources.

Changes to the NFTS (changing vehicle class, season of use and opening or closing roads)

There would be no changes to the existing use periods of NFTS roads and trails; therefore there would be no direct effects to water resources. However, there would be indirect effects due to not making any changes, because the existing road restriction plan has many problems that have been identified over the years but have never been adequately addressed. These problems include specific roads that have been identified for restriction periods that are not currently included in the 1998 Road Closure Plan, as well as broader issues, such as that the Plan neglects to adequately reflect the actual accessibility of roads in the winter. Many roads that are not accessible in the winter because of snow are shown as open, so calculations of miles open in winter do not reflect roads that are actually travelable. Because the current plan assumes that many roads where winter travel is undesirable are not travelable and therefore not used, it is difficult to prevent undesirable use from occurring. Users trying to travel native surface roads into the fall when the roads are wet but not yet snowed under or in early season when the roads are still partially snow covered and/or soft can cause extensive damage that increases maintenance needs and erosion. Combined with maintenance shortfalls, this means that erosion and sediment delivery result from this Plan. This would continue to occur over the long term, with chronic impacts to streams from increased peak flows and sediment delivery.

There are roads that should have restrictions in order to address specific resource concerns that have been identified through project planning (for example, roads identified to be contributing to watershed degradation during timber sale planning). These concerns would also not be addressed under this alternative.

The existing Road Restriction Plan would continue to provide year-round access to the Miami Motorcycle Area (in WES) on roads maintained for wet weather use. The use of these roads during the wet season produces some sediment, but is compliant with BMPs.

Use of the Bald Mountain NFTS motorized trail (in TAD) during the spring snowmelt period results in rutting of the road surface when tires break through melting snow and contact saturated soils. This is thought to increase the movement of sediment along the route and possibly also increases sediment delivery to streams. There is a location along the Bald Mountain motorized trail (route PK-01zd) where the route has captured streamflow and a gully has formed. The estimated volume of material eroded from the gully and delivered to an adjacent stream channel is 60 yd^3 (the gully is approximately 100 ft long and averages 4 ft wide and 4 ft deep). A rehabilitation project was completed in 2008 to address this area. In order to prevent continued erosion of the gully and delivery of sediment to the channel, stream flow must be prevented from flowing down the route. The presence of a ford crossing, relatively flat terrain and proximity of the channel to the route makes it challenging to prevent stream capture by the route at this location.

Cumulative Effects

For the analysis of cumulative effects, the direct and indirect effects of this alternative were considered in combination with the past, present, and reasonably foreseeable actions listed in Appendix E, including grazing, timber management (Sugar Pine, Fish Camp, Dinkey North, Dinkey South, KREW Providence and KREW Bull, plantation maintenance and roadside hazard reduction), management and maintenance of NFTS facilities, continuing permitted special uses, and public recreation.

Cross-country use, including the use of unauthorized routes and areas, would continue and could expand in 96 HUC8s that are over the lower TOC, including seven that are over the upper TOC of 14 percent. Some of these are located in the Lower San Joaquin River CAR.

The risk of incurring a CWE response in the 25 HUC8s that were analyzed in detail would be the same as described in the Affected Environment section (see Table 3- 83). In the Miami area, NFTS roads that are open in the winter would provide wet-weather access to unauthorized routes, where use during wet soil conditions would render maintenance ineffective (as documented by the soils and watershed resources data collected for this project, available in the project record), and result in widespread erosion and sediment delivery. In Miami Creek, where CWEs are currently observed, channel condition would likely remain the same, with sediment filling pools and degrading aquatic habitat (the impacts on habitat are described more fully in the Aquatic Species section).

In considering the effects of this alternative in combination with the effects of past, present, and foreseeable actions, the cumulative effects are adverse, particularly in the eight HUC8s where the risk of CWEs is identified in Table 3- 83 as High or Moderate.

Compliance of Alternative 1 with the LRMP and Other Direction

This alternative does not comply with the LRMP (including RCOs) and other direction. Water quality and riparian/aquatic habitat would not be maintained or enhanced and BMPs would not be implemented. The number of miles of routes throughout the Forest, including in CARs, combined with the lack of maintenance and continuing traffic, would be likely to generate sediment that would be delivered to stream channels and affect water quality and stream channel condition. Meadows, streams and other hydrologically sensitive areas would be at risk for direct damage from cross-country motorized use. Roads with known impacts to watershed resources would continue to be managed without appropriate seasonal restrictions to minimize those impacts, in violation of standards and guidelines. Unmitigated use of unauthorized routes would continue to occur in 96 HUC8 watersheds that are over the lower TOC, seven of which are over the upper TOC. Some of these HUC8s (i.e., in Miami) have known CWEs occurring to which this use contributes. The analysis of this alternative was based on consideration of the best available science, including applicable peer-reviewed studies and local data.

The complete RCO Consistency Analysis is contained in Appendix J.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

Prohibiting cross-country motorized use in the areas shown as ‘open’ to such use under the Direct / Indirect Effects of Alternative 1 (Table 3- 84) would mean that the entire SNF would allow motorized use only on designated routes and in designated areas. The acres, miles of unauthorized routes, and stream crossings in CARs shown in Table 3- 85 would also be closed, which is consistent with the management emphasis on aquatic species habitat protection in the CARs.

Impacts from motor vehicle use in RCAs would be only slightly reduced in the short term, since the unauthorized routes will still be present on the landscape and will not receive maintenance, rehabilitation or other work to reduce their impacts on streamflows and sedimentation. The effect of removing traffic could slightly reduce the amount of sediment generated from the routes and delivered to streams and would limit the deposition of chemical constituents from motor vehicles, including oil and grease, in these areas. Over time as the routes establish vegetation and other groundcover (duff, litter), runoff and erosion will diminish further. On some routes, recovery will achieve conditions similar to undisturbed areas within 5 to 30 years (see the Soils section). However, routes with severe erosion on steep slopes and erodible soils could continue to modify runoff and erosion patterns even in the long term. Although a complete inventory of route conditions has not been conducted on every unauthorized route, based on the routes that were visited (approximately 200 miles, or 36 percent of the total miles of routes), the majority of routes with severe erosion of this type appear to be in WES. JCH also contains some eroding routes that are of concern due to their potential impacts to the Jose Basin CAR.

There is a considerable benefit to water resources from the prohibition of cross-country travel.

Additions to the NFTS

The miles of routes and acres of areas added in RCAs and the number of added stream crossings are shown in Table 3- 86. Due to the addition of unauthorized routes, the increase in the density of NFTS facilities in the RCA and in stream crossings would be the greatest in WES, where the increases are double those in any other analysis unit. The only area added in this alternative is in

TAD. Approximately half of the area is located in the RCA. However, field evaluations documented that the area does not appear to be impacting the adjacent riparian areas nor is it in conflict with RCOs.

Table 3- 86. Number and Density of Routes in RCAs and Stream Crossings and Acres of Added Areas in RCAs

These metrics are based on GIS analysis. Stream crossings include perennial, intermittent and ephemeral streams, some of which are actually unscoured swales

Analysis Unit	Routes Added in RCA (mi)	Added route density in RCA (mi / mi^2)	Added crossings (#)	Added crossing density (# / mi^2)	Added Areas in RCA (ac)
SFM	0	0	8	0.0	0
WES	4.4	0.10	136	1.0	0
GLO	0.4	0.01	7	0.05	0
GAG	0.9	0.02	11	0.08	0
MAM	0	0	0	0	0
SSB	0	0	0	0	0
EKP	0	0	0	0	0
JCH	0.6	0.02	3	0.04	0
TAD	3.2	0.05	68	0.4	3.1
DNK	0.3	0.00	2	0.0	0
TOTAL / AVERAGE	**9.7**	**0.02**	**235**	**0.2**	**3.1**

Comparing the information presented in Table 3- 86 to the existing condition (which also represents the effects of Alternative 1) presented in Table 3- 78 and Table 3- 79, the miles of routes added in RCAs would increase the miles of NFTS roads and trails in RCAs by less than 1 percent and would increase the number of stream crossings on NFTS roads and trails by 1.6 percent (there are currently 1008 miles of NFTS roads and trails in RCAs, and 14,611 stream crossings on NFTS roads and trails). There are 170 miles of unauthorized routes in RCAs and 2259 stream crossings on unauthorized routes that would not be added to the NFTS in this alternative.

Field visits were made to each added route in an RCA or with a stream crossing. The prescriptive actions specified in Appendix A address every concern that was identified. Since these actions must be completed before these segments can open to public use, the impacts to surface water and riparian areas will be minimized prior to the addition of these routes. The specified improvements ensure consistency with direction, including RCOs.

Using the field data, the cumulative length/area of erosion features identified and needing repair were estimated and are displayed in Table 3- 87. The eroding length/area are compared to the total length/area being added to the NFTS to determine the percentage of erosion occurring. As shown in the table, 28 percent of the added roads, 34 percent of the added trails and none of the added areas are currently eroding. Most of the erosion will be remedied with the construction of appropriate surface drainage structures (see prescriptive actions for issue codes SW-2, SW-3, and SW-4 in Appendix A). Other common needs include the repair of surface erosion (SW-14) and improvement of stream crossings (SW-8 and SW-9). The prescriptive actions are expected to minimize the concentration of runoff, erosion, sediment delivery and impacts to riparian areas and stream channels.

Table 3- 87. Miles of Routes and Acres of Areas with Known Erosion Features Added to the NFTS in Alternative 2

Analysis Unit	Added Roads total mi / eroding mi / % eroding	Added Trails total mi / eroding mi / % eroding	Added Areas total ac / eroding ac / % eroding
SFM	0.9 / 0.8 / 80%	0.7 / 0.3 / 38%	0 / 0 / 0%
WES	0 / 0 / 0%	24.2 / 9.2 / 38%	0 / 0 / 0%
GLO	0.3 / 0 / 0%	1.9 / 0.8 / 42%	0 / 0 / 0%
GAG	0 / 0 / 0%	2.3 / 0.7 / 29%	0 / 0 / 0%
MAM	0 / 0 / 0%	0 / 0 / 0%	0 / 0 / 0%
SSB	0.03 / 0 / 0%	0 / 0 / 0%	0 / 0 / 0%
EKP	0 / 0 / 0%	0 / 0 / 0%	0 / 0 / 0%
JCH	0 / 0 / 0%	1.9 / 1.6 / 84%	0 / 0 / 0%
TAD	2.8 / 0.3 / 12%	10.9 / 1.4 / 13%	6.1 / 0 / 0%
DNK	0.6 / 0.2 / 34%	0.3 / 0.2 / 52%	0 / 0 / 0%
TOTAL/AVERAGE%	**4.6 / 1.3 / 28%**	**42.2 / 14.2 / 34%**	**6.1 / 0 / 0%**

The field data was also used to identify locations where stream channels are diverted along the route or have the potential to be diverted along the route in the near future. Table 3- 88 shows that there are two locations on trails added in this alternative where stream channel diversions are occurring, as well as two locations on added roads and two on added trails with the potential to divert streams in the near future. The prescriptive actions specified in Appendix A address these locations, so that when these routes are added to the system there will be no diversions occurring and the potential for new ones will be minimized.

Table 3- 88. Number of Documented Stream Channel Diversions and Potential Diversion Locations Added to the NFTS in Alternative 2.

Analysis Unit	Added Roads diversions / potential	Added Trails diversions / potential
SFM	0 / 1	0 / 0
WES	0 / 0	2 / 2
GLO	0 / 0	0 / 0
GAG	0 / 0	0 / 0
MAM	0 / 0	0 / 0
SSB	0 / 0	0 / 0
EKP	0 / 0	0 / 0
JCH	0 / 0	0 / 0
TAD	0 / 0	0 / 0
DNK	0 / 1	0 / 0
TOTAL	**0 / 2**	**2 / 2**

Some routes have more unique needs; those that are crucial for consistency with the LRMP and other direction are listed here: there are two routes that need measures in addition to standard drainage and crossing improvements to prevent the delivery of sediment to perennial streams (WES); one that needs to have a crossing relocated to avoid impacts to the riparian area (GAG); one that needs measures to prevent traffic into a meadow (TAD); and one that needs measures to prevent the deposition of sediment in a meadow (DNK).

The adverse effects of adding these routes and areas to the NFTS is very small compared to the total effect of the entire NFTS and to the benefit gained from prohibiting cross-country travel.

Changes to the NFTS (changing vehicle class, season of use and opening or closing roads).

Changing vehicle class between highway-legal vehicles, all vehicles and vehicles less than 50" are assumed to have no effect on the impacts of the NFTS and are therefore not considered in the water resources analysis (see Assumptions in section 3.10.1).

Seasonal closures during the winter period would be increased on 793 mi and decreased on 192 mi of NFTS roads. The types of changes are characterized in Table 3- 89 to show the number of days the closure periods would change. Roads characterized as having a 'winter closure' are restricted from 15-Dec (or earlier) through 1-Apr (or later). Roads that are closed year-round are included in these figures; for example, a road that was previously prohibited year-round that is now open for part of the year would show up in the 'Modified >30 days shorter' category.

Other than the miles of roads appearing in the 'Removed' column, all of these roads are closed from at least 15-Dec (many close earlier) to at least 1-Apr (many remain closed until later). The changes that are less than 15 days were generally made only to improve the manageability of the closure plan – the ranges were consolidated to allow for more consistency and fewer different days when roads open and close. Changes between 16 and 30 days were generally modifications to better reflect the snowmelt and/or moisture conditions of the roads and to provide opening dates in the spring that are appropriate for the area. Changes that are more than 30 days were made when winter closures were combined with closures for wildlife, which were either added or removed based on a complete review of roads with respect to the LRMP and other direction for wildlife protection (see the Wildlife 3.13. and Aquatic Biota 3.14. for more information on wildlife restrictions) or when roads were previously closed year-round and would be open for part of the year under this alternative.

The overall effects of these changes would provide increased protection against sediment generated by traffic on wet roads, rutting of the road, and the breakdown of the road surface drainage improvements that minimize sediment production and hydrologic connectivity. All of the changes, except for the 5.4 miles where the closures would be removed, provide minimum protection from road surface deformation, sediment generation, and sediment delivery associated with wet weather use. Longer closures also protect against early season storms and provide a longer window for roads to dry prior to opening in the spring.

The 5.4 miles that have had a winter restriction removed include 2.1 miles of paved or graveled roads and 3.3 miles of native surface roads. Paved and graveled roads are designed for wet weather use and generally withstand deformation and erosion such as occurs on native surface roads. About half of the miles of native surface roads shown as having a winter closure removed in this alternative would not be accessible during the winter due to restrictions on the roads that access them. Of the roads that would be accessible, 1.1 miles are located outside of RCAs and therefore have a moderate risk of delivering sediment to streams. The change that could result in increased impacts to watershed resources due to the removal of the winter closure is the removal of the winter restriction on a segment of 9S06, which is located in the RCA of the Jose Basin CAR. Motor vehicle use of this road during the wet season could result in road surface deformation, increased erosion, and increased sediment delivery into the adjacent stream, which is tributary to Jose Creek. This road would require surfacing, which is scheduled to occur in 2010, in order to meet BMPs and to be consistent with RCOs.

Table 3- 89. Miles of Changes to Winter Season Road Restrictions, Including Roads Closed Year-round in Alternative 2

Analysis Unit	Change in Winter Closure Period								
	New (mi)	Modified </= 15 days longer (mi)	Modified 16 - 30 days longer (mi)	Modified >30 days longer (mi)	Modified </= 15 days shorter (mi)	Modified 16 - 30 days shorter (mi)	Modified >30 days shorter (mi)	Removed (mi)	Total Changes (mi)
SFM	17.9	0	0	0	0	0	1.5	0	19.4
WES	14.5	0	0	7.2	0	0	6.7	0.2	28.6
GLO	0.1	0	0	9.8	0	0	14.0	0.5	24.4
GAG	9.2	0.3	0	6.1	0	0	4.3	1.4	21.3
MAM	2.4	0	0	12.4	0	0	7.4	0.9	23.1
SSB	7.3	0	0.2	134.1	0	9.1	47.6	1.0	199.3
EKP	0	0	0	51.5	0	0	0.7	0	52.3
JCH	13.5	0	0	34.4	0	0	8.4	0.4	56.7
TAD	47.1	0	2.8	181.0	0.7	21.2	23.5	0.7	276.9
DNK	67.7	0	17.0	156.0	7.0	2.2	31.9	0.3	282.1
TOTAL	**179.8**	**0.3**	**20.0**	**592.5**	**7.7**	**32.5**	**146.0**	**5.4**	**984.2**

New = road was previously not restricted in winter; Modified, longer = restriction period is being extended; modified, shorter = restriction period is being shortened; Removed = road was previously restricted in winter, would be opened during that time.

Year-round restrictions would be changed on 209 miles of roads, with 5.5 miles of previously closed roads being opened seasonally and 204 miles of roads previously open at least part of the year being prohibited year-round.

Table 3- 90 shows the total miles of NFTS roads and motorized trails in RCAs that would be open year-round and closed year-round and the numbers of stream crossings on roads and motorized trails open year-round and closed year-round. The stream crossings are displayed to indicate the number inside the RCA and those outside the RCA. Refer to the discussion of the delineation of RCAs in section 3.10.2 for clarification.

Table 3- 90. Alternative 2 – Miles of NFTS Roads and Motorized Trails Open Year-round in RCAs, Miles of Roads and Motorized Trails Closed Year-round in RCAs and Numbers of Stream Crossing on those Roads and Motorized Trails

Analysis Unit	NFTS Roads and Motorized Trails Open Year-round in RCA (mi)	Crossings Open Year-round (# in RCA / # outside RCA / total #)	NFTS Roads and Motorized Trails Closed Year-round in RCA (mi)	Crossings Closed Year-round (# in RCA / # outside RCA / total #)
SFM	23	177 / 275 / 452	6	48 / 16 / 64
WES	79	549 / 655 / 1204	11	80 / 49 / 129
GLO	125	747 / 449 / 1196	14	85 / 78 / 163
GAG	53	420 / 477 / 897	13	78 / 121 / 199
MAM	30	147 / 213 / 360	6	35 / 59 / 94
SSB	5	31 / 11 / 42	9	61 / 31 / 92
EKP	0.4	2 / 2 / 4	0.3	0 / 0 / 0
JCH	12	59 / 45 / 104	10	35 / 12 / 47
TAD	6	64 / 16 / 80	27	178 / 39 / 217
DNK	36	250 / 194 / 444	32	285 / 72 / 357
TOTAL:	**370**	**2446 / 2337 / 4783**	**129**	**885 / 477 / 1362**

Comparing Table 3- 90 (Alternative 2) to Table 3- 82 (existing conditions) note that the miles of roads and motorized trails in RCAs that would be open year-round is less than half as many as are currently open (370 miles in Alternative 2, 774 miles currently in Alternative 1).The miles in RCAs that would be closed year-round (129 miles) is about 60 percent greater than what is currently closed (80 miles). The numbers of stream crossings open year-round would be reduced by almost 50 percent, from 8561 to 4783, while the number of crossings closed year-round would increase 40 percent, from 793 to 1362. This means that the overall potential for erosion and sediment delivery will be greatly reduced. There would be a beneficial effect on water resources due to greater protection of roads when wet, since the miles of roads with winter restrictions and miles of roads prohibited year-round both increase under this alternative. However, there would be no change in the year-round use of the Bald Mountain OHV Route and the impacts to the segment near PK-01zd would continue to affect both erosion of the route and water quality of the adjacent stream.

Cumulative Effects

For the analysis of cumulative effects, the direct and indirect effects of this alternative were considered in combination with the past, present, and reasonably foreseeable actions listed in Appendix E, including grazing, timber management (Sugar Pine, Fish Camp, Dinkey North, Dinkey South, KREW Providence and KREW Bull, plantation maintenance and roadside hazard reduction), management and maintenance of NFTS facilities, continuing permitted special uses, and public recreation. The ERA model also accounted for the disturbances of past, present, and reasonably foreseeable future actions in each subdrainage.

Thirteen HUC8s that are either over the lower TOC or have stream channel conditions that indicated concern for CWEs were evaluated in the Detailed CWE Assessment for Alternative 2. The Detailed CWE Assessment concluded that there would be a Low risk of CWEs in nine HUC8s, a Moderate risk in two and a High risk in two. The determination of risk for each subdrainage assumes that the specified design features have been implemented. The Moderate and High risk subdrainages are in the Miami HUC6 subwatershed. Table 3- 91 compares the risk of CWEs in this alternative to the risk in Alternatives 1 and 3.

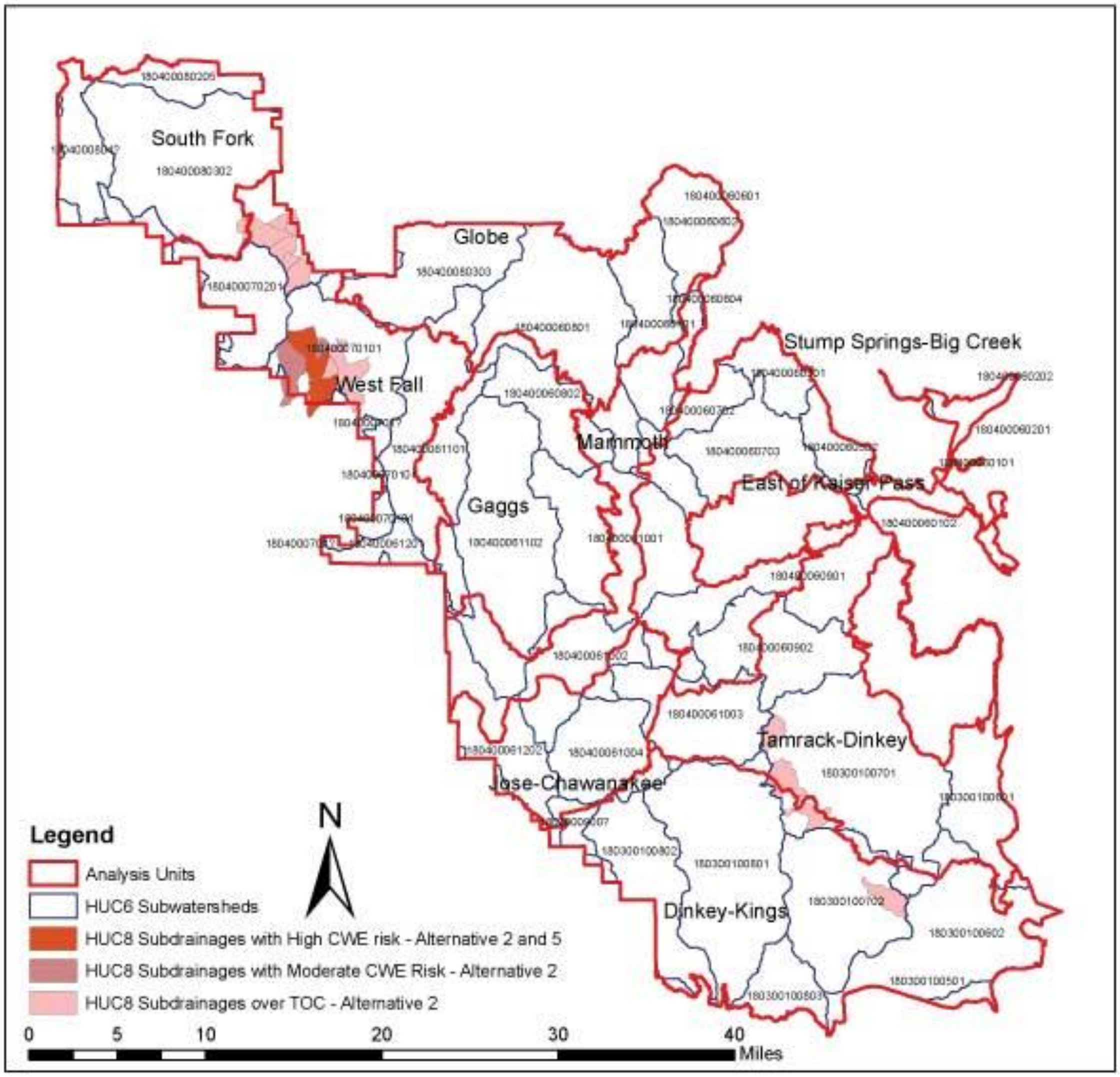
Because the risk of CWEs in Alternative 1includes continued cross-country vehicle travel, while Alternative 3 does not allow cross-country travel and adds no facilities to the NFTS, these two alternatives define the greatest risk of CWEs (Alternative 1) and the lowest risk (Alternative 3). Comparing Alternative 2 to these alternatives shows where the effects of this alternative differ from these reference points. In the subdrainages where the risk is the same for Alternatives 2 and 3, this indicates that the routes and areas added in Alternative 2 do not substantially increase the risk of CWEs over the risk that exists when adding none. There are four subdrainages (503.0003, 503.0052, 503.0053, and 503.0054) where the risk of CWEs is elevated when compared to Alternative 3 (adding no routes or areas); in three of these, the risk is similar to the risk for Alternative 1. For example, subdrainage 503.0003 has a Moderate risk in Alternatives 1 and 2, but a Low risk in Alternative 3. However, in 503.0052, the risk is High in Alternative 1, Moderate in Alternative 2, and Low in Alternative 3, which indicates that there is a benefit from prohibiting cross-country travel but an impact from the specific unauthorized routes proposed to be added in that subdrainage in this alternative. There are four subdrainages (501.4003, 503.0002, 503.0052, and 519.3053) where the risk of CWEs in this alternative are lower than for Alternative 1, and nine where the risk is the same. There are also nine subdrainages where the risk is the same for Alternative 2 and Alternative 3.

Table 3- 91. HUC8 Subdrainages Evaluated in the Detailed Cumulative Watershed Effects Assessment that have Additions to the NTFS in Alternative 2 – Risk of CWEs Compared to Alternatives 1 and 3

Analysis Unit	HUC8 #	Risk of CWEs		
		Alt 1	Alt 2	Alt 3
WES	501.4002	Low	Low	Low
	501.4003	Moderate	Low	Low
	501.5101	Low	Low	Low
	503.0002	Moderate	Low	Low
	503.0003	Moderate	Moderate	Low
	503.0052	High	Moderate	Low
	503.0053	High	High	Moderate
	503.0054	High	High	Moderate
	503.0055	Low	Low	Low
TAD	520.0017	Low	Low	Low
	520.3002	Low	Low	Low
	520.5001	Low	Low	Low
DNK	519.3053	High	Low	Low

Figure 3- 15. Subdrainages (HUC8s) containing routes or areas included in Alternative 2 that were evaluated in the Detailed Assessment

Those determined to have a High risk of a CWE response are shaded darker.



The HUC8s evaluated in the Detailed CWE Assessment are listed in Table 3- 92 and the HUC6 subwatersheds that they are within are also displayed. If there are features being added to the NFTS that, based on field data, are contributing sediment to stream channels in these HUC8s (which is contributing to the potential for CWEs), they are also identified.

Table 3- 92. Subdrainages with Additions to the NTFS in Alternative 2 that were Evaluated in the Detailed CWE Assessment

Analysis Unit	Subdr #	Lower TOC ERA%	Alt 2 ERA %	Risk of CWEs	Alt2 stream crossings	Contributing Routes and /or Areas[1]	HUC6
WES	501.4002	4	7.5	Low	20	TH-41y, TH-67y, TH-68z	180400080302 W SFk Merced
	501.4003	4	8.0	Low	4	TH-67z, TH-68z	
	501.5101	4	11.6	Low	2	none	
	503.0002	4	3.1	Low	0	none	180400070101 Miami
	503.0003	5	3.6	Moderate	13	PK11a, PK24, PK25	
	503.0052	4	5.6	Moderate	9	none	
	503.0053	4	2.2	High	40	PK-5, SR-21z	
	503.0054	4	4.4	High	16	JM-7ay, SR-35z, SR-92	
	503.0055	4	8.0	Low	23	JM-2y, JM-20y, JM-21y, SV31	
TAD	520.0017	4	6.7	Low	2	none	1803001007001 Upper Dinkey
	520.3002	5	7.3	Low	1	none	
	520.5001	5	5.0	Low	10	none	
DNK	520.0056	5	13.9	Low	0	none	180300100702 Lower Dinkey

[1]Routes and areas located within these subdrainages that are either not eroding or do not have potential to deliver eroded material to the stream network, based on field observations, are not listed here.

The routes listed in Table 3- 92 each have actions specified (Appendix A and project record) that are designed to bring the routes to standard and to achieve consistency with RCOs. Several routes being added in the West South Fork Merced HUC6 need work to prevent them from delivering excess sediment to stream channels. Based on stream channel conditions and the work specified for the routes in these areas, the risk of CWEs resulting from the addition of these routes was determined to be low. Although routes are being added in HUC8s that are over TOC in TAD and DNK, none of the routes were found to be contributors to potential CWEs.

The Miami HUC6 is the area with the most added routes contributing to potential CWEs. The work specified in Appendix A for these routes may be costly and challenging to achieve for all of the routes in 503.0003, 503.0053, 503.0054, and 503.0055. Based on existing information about the condition of Miami Creek and documented erosion and sediment delivery from these trails, there are CWEs currently occurring in Miami Creek itself, and these trails are likely contributors. The amount that the routes are contributing to CWEs has not been determined. However, by taking actions to bring them to standards, their contribution of runoff and sediment will be decreased in this alternative, relative to their present condition and relative to Alternative 1.

Considering past, present, and reasonably foreseeable actions, this alternative would not result in an increased risk of CWEs, and no cumulative adverse impacts, compared to Alternative 1. The overall cumulative effect would be beneficial due to the direct and indirect benefits resulting from the prohibition of cross-country motor vehicle travel and the changes to the NFTS. In the Miami Creek area, the beneficial effect is slightly lower than it is in Alternative 3 due to the location and condition of several of the motorized trails being added to the NFTS in this alternative.

Compliance of Alternative 2 with the LRMP and Other Direction

This alternative complies with the LRMP (including the SNFPA) and other direction. The prohibition of cross-country motor vehicle use would reduce the amount of sediment generated on unauthorized routes. Unauthorized routes would recover over the long term. Meadows, streams and other hydrologically sensitive areas would have a reduced risk for direct damage in the absence of cross-country motor vehicle use and because unauthorized routes and areas that impact meadows and other riparian areas would cease to be used and would recover over time. See the Soil Resource section for a discussion of passive recovery of unauthorized routes. Only selected routes would be added to the system and these would be brought up to standards, including the application of BMPs to minimize their effects to peak flows and sediment delivery and made consistent with RCOs. No routes in meadows or CARs would be added to the NFTS. The season of use of more roads would be consistent with BMPs and would provide protection against road surface deformation, flow concentration, erosion and sediment delivery. There is 0.4 mile of 9S06, located in the RCA of the Jose Basin CAR, where winter season use will not be consistent with BMPs or RCOs until this road segment is graveled, which is scheduled to occur in 2010. Direction in the SNFPA to identify restoration opportunities (S&G #122) has been applied to the routes that were inventoried, but active restoration would not occur as a result of this alternative.

The analysis of this alternative was based on consideration of the best available science, including applicable peer-reviewed studies and local data.

The complete RCO Consistency Analysis is contained in Appendix J.

Alternative 3

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The effects of prohibiting cross-country motor vehicle travel would be the same as described under Alternative 2.

Additions to the NFTS

There would be no routes or areas added to the NFTS. The number of miles of eroding routes added, the number of routes added in RCAs and the number of stream crossings added would all be zero, and there would be no direct or indirect effects to water resources.

Changes to the NFTS (changing vehicle class, season of use and opening or closing roads)

There would be no changes to the NFTS. The effects would be the same as described for Alternative 1.

Cumulative Effects

For the analysis of cumulative effects, the direct and indirect effects of this alternative were considered in combination with the past, present, and reasonably foreseeable actions listed in Appendix E, including grazing, timber management (Sugar Pine, Fish Camp, Dinkey North, Dinkey South, KREW Providence and KREW Bull, plantation maintenance and roadside hazard reduction), management and maintenance of NFTS facilities, continuing permitted special uses, and public recreation. The ERA model also accounted for the disturbances of past, present, and reasonably foreseeable future actions in each subdrainage.

Cumulative watershed effects will be reduced by the prohibition of cross-country travel, which will result in the elimination of unauthorized routes. No facilities would be added in any HUC8 subdrainage. The unauthorized routes will naturally recover over time as they become revegetated and soil cover is established. See the soil section for a discussion of passive recovery of unauthorized routes. Sediment will be reduced and channel conditions, including aquatic habitat conditions, will improve. The ERA values in the 96 HUC8s that are over their respective lower TOC ERA values would be reduced by 0.01 percent to 2.37 percent in the long term. Some of these subdrainages will continue to have a potential for CWEs to result from other activities. The Miami Creek HUCs including 503.0002, 503.0003, 503.0052, 503.0053 and 503.0054 will be the most affected from natural recovery of unauthorized routes. However, some of the unauthorized routes have resulted in severe gully erosion of up to 3 feet deep. These routes will require watershed restoration in order to return them to full productivity and reduce erosion and sedimentation into the Miami Creek channel system.

The risk of CWEs would be low in 21 HUC8s, moderate in three and high in one. The HUC8 with a high risk of CWEs is 504.2251, where the ERA value in Alternative 3 would be 22.25 percent. These high ERAs result from other disturbances in the area and are not attributable to this project. The risk of CWEs under this alternative is compared to the risk determined for Alternative 1 in Table 3- 93, which shows that the risk in this alternative would be reduced relative to Alternative 1 in nine HUC8s. In 16 of the 25 HUC8s analyzed in the Detailed Assessment, the risk of CWEs would be essentially the same as the risk for Alternative 1. This indicates that the unauthorized routes (which would be open in Alternative 1 but closed in Alternative 3) in those 15 subdrainages do not substantially contribute to the risk of CWEs. Because the risk of CWEs in Alternative 1includes continued cross-country vehicle travel, while Alternative 3 does not allow cross-country travel and adds no facilities to the NFTS, these two alternatives define the greatest risk of CWEs (Alternative 1) and the lowest risk (Alternative 3).

Table 3- 93. HUC8 Subdrainages Evaluated in the Detailed Cumulative Watershed Effects Assessment that have Additions to the NTFS in Alternative 3 – Risk of CWEs Compared to Alternative 1

Analysis Unit	HUC8 #	Risk of CWEs	
		Alt 1	Alt 3
WES	501.0023	Low	Low
	501.4002	Low	Low
	501.4003	Moderate	Low
	501.5101	Low	Low
	503.0002	Moderate	Low
	503.0003	Moderate	Low
	503.0006	Low	Low
	503.0011	Low	Low
	503.0052	High	Low
	503.0053	High	Moderate
	503.0054	High	Moderate
	503.0055	Low	Low
	503.0056	Low	Low
	503.3051	Moderate	Low
GAG	504.2008	Low	Low
	504.2102	Low	Low
	504.2151	Low	Low
	504.2251	High	High
TAD	520.0017	Low	Low
	520.0056	Low/Mod	Low
	520.5001	Low	Low
DNK	520.3002	Low	Low
	520.3003	Moderate	Moderate
	519.3053	High	Low
	519.4051	Low	Low

Considering past, present, and reasonably foreseeable actions, this alternative would not result in an increased risk of CWEs, and no cumulative adverse impacts. The overall cumulative effect would be beneficial due to the direct and indirect benefits resulting from the prohibition of cross-country motor vehicle travel.

Compliance of Alternative 3 with the LRMP and Other Direction

This alternative is consistent with the LRMP and other direction, including RCOs. Discontinuing cross-country use across the SNF would prevent ongoing impacts from continued motor vehicle use on the unauthorized routes as well as across the landscape and would reduce the risk of damage to riparian areas and stream channels from cross-country use. No facilities would be added to the NFTS. The season of use of all NFTS roads would remain unchanged. Direction in the SNFPA to identify restoration opportunities has been applied to the routes that were unauthorized, but active restoration would not occur.

The analysis of this alternative was based on consideration of the best available science, including applicable peer-reviewed studies and local data.

Alternative 4

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The effects of prohibiting cross-country motor vehicle travel would be the same as described under Alternative 2.

Additions to the NFTS

The miles of routes added in RCAs, acres of areas added in RCAs and the number of added stream crossings are shown in Table 3- 94. The additions, in comparison to the existing condition / effects of Alternative 1, are very similar to Alternative 2. Adding 11.2 miles in RCAs is very small, compared to the 1008 miles of NFTS roads and trails currently in RCAs, and compared to the total of 179 miles of unauthorized routes in RCAs (168 miles of which would not be authorized in this alternative). The added densities in RCAs are less than 0.1 mi/mi^2 in all analysis units. The largest increases in both RCA density and stream crossing density would occur in GAG and WES. Areas would be added in the RCA in TAD and DNK, and 3.3 acres would be added to the 25.8 acres of Open Areas, parking and staging areas already in the NFTS. The areas in DNK could contribute to flow increases and sediment delivery to Summit Creek. Motor vehicle use would not be permitted within 100 ft of the creek (see Appendix A) and the area would be monitored in order to determine whether additional measures are needed. In Table 3- 94, the metrics are based on GIS analysis. Stream crossings include perennial, intermittent and ephemeral streams, some of which are actually unscoured swales.

Table 3- 94. Number and Density of Routes in RCAs and Stream Crossings and Acres of Added Areas in RCAs

Analysis Unit	Routes Added in RCA (mi)	Added route density in RCAs (mi / mi^2)	Added crossings (#)	Added crossing density (# / mi^2)	Added Areas in RCA (ac)
SFM	0.8	0.02	14	0.1	0
WES	3.2	0.07	53	0.4	0
GLO	1.5	0.03	18	0.1	0
GAG	3.1	0.08	56	0.4	0
MAM	0	0	0	0	0
SSB	0.1	0	3	0	0
EKP	0.1	0	1	0	0
JCH	0	0	0	0	0
TAD	2.0	0.03	43	0.2	3.2
DNK	0.3	0	0	0	0.1
TOTAL / AVERAGE	**11.2**	**0.03**	**188**	**0.2**	**3.3**

As shown in Table 3- 95, 17 percent of the added roads, 21 percent of the added trails and 1 percent of the added areas are currently eroding. Most of the erosion will be remedied with the construction of appropriate surface drainage structures (see prescriptive actions for issue codes SW-2, SW-3, SW-4 in Appendix A). Other common needs include the repair of surface erosion (SW-14) and improvement of stream crossings (SW-8 and SW-9). The prescriptive actions are expected to minimize the concentration of runoff, erosion, sediment delivery and impacts to riparian areas and stream channels.

Table 3- 95. Miles of Routes and Acres of Areas with Known Erosion Features Added to the NFTS in Alternative 4

Analysis Unit	Added Roads total mi / eroding mi / percent eroding	Added Trails total mi / eroding mi / percent eroding	Added Areas total ac / eroding ac / percent eroding
SFM	0.3 / 0.02 / 6 %	2.2 / 0.3 / 12 %	0 / 0 / 0 %
WES	2.4 / 0.5 / 22 %	11.0 / 3.4 / 31 %	24.9 / 0.2 / 1 %
GLO	0 / 0 / 0 %	4.8 / 1.3 / 28 %	0 / 0 / 0 %
GAG	1.9 / 0.2 / 10 %	13.1 / 2.2 / 17 %	0.5 / 0 / 0 %
MAM	0.1 / 0 / 0 %	1.0 / 0.1 / 10 %	0 / 0 / 0 %
SSB	0.7 / 0 / 0 %	0 / 0 / 0 %	0 / 0 / 0 %
EKP	0.8 / 0 / 0 %	0 / 0 / 0 %	0.3 / 0 / 0 %
JCH	0 / 0 / 0 %	0 / 0 / 0 %	0 / 0 / 0 %
TAD	1.7 / 0.6 / 36 %	12.4 / 1.9 / 15 %	9.6 / 0 / 0 %
DNK	0.2 / 0 / 0 %	0.3 / 0.1 / 52 %	0.3 / 0 / 0 %
TOTAL/AVERAGE%	**8.2 / 1.4 / 17 %**	**44.7 / 9.3 / 21 %**	**35.6 / 0.2 / 1 %**

Table 3- 96 shows that there are five locations on trails added in this alternative where stream channel diversions are occurring, as well as one location on added trails and three on added roads with the potential to divert streams in the near future. The prescriptive actions specified in Appendix A will address these locations, so that when they are added to the system there will be no diversions occurring and the potential for new ones will be minimized.

Table 3- 96. Number of Documented Stream Channel Diversions and Potential Diversion Locations Added to the NFTS in Alternative 4

Analysis Unit	Added Roads diversions / potential	Added Trails diversions / potential
SFM	0 / 0	0 / 1
WES	0 / 0	0 / 0
GLO	0 / 0	0 / 0
GAG	0 / 0	3 / 0
MAM	0 / 0	0 / 0
SSB	0 / 0	0 / 0
EKP	0 / 0	0 / 0
JCH	0 / 0	0 / 0
TAD	0 / 2	2 / 0
DNK	0 / 1	0 / 0
TOTAL	**0 / 3**	**5 / 1**

The effects of these additions of roads, trails and areas to the NFTS are slightly adverse to neutral, given the small magnitude in relation to the total NFTS, and the prescriptive actions that will be implemented.

Changes to the NFTS (changing vehicle class, season of use and opening or closing roads)

Changing vehicle class between highway-legal vehicles, all vehicles and vehicles less than 50" are assumed to have no effect on the impacts of the NFTS and are therefore not considered in the water resources analysis (see Assumptions in section 3.10.1).

Seasonal closures during the winter period would be increased on 1687 miles and decreased on 150 miles of NFTS roads, as shown in Table 3- 97. The effects of these changes would be similar to the effects described for Alternative 2, except that in this alternative, more miles of roads have longer closures which provide added protection against the impacts of wet weather road use on more miles of roads. All of these roads, except for the Bald Mountain OHV Route and the 0.7 miles with the closure removed, provide a minimum closure period of 15-Dec to 1-April, which will provide some protection against road damage and resulting erosion and sedimentation. The closure periods for each road were developed in consideration of the expected time that the roads become saturated and the time that they become dry in the spring, in addition to other resource needs. The reasons for modifying opening and closing dates are the same as described in Alternative 2.

Of the 0.7 miles with the winter closure removed, 0.3 mi is an aggregate surface road that lies within RCA and accesses private property. While there is a risk of some sediment generation due to wet season traffic in the RCA, the aggregate surfacing minimizes this risk and meets BMPs. The remaining 0.4 mi is a segment of road 9S06, which is a native surface road located in the RCA of the Jose Basin CAR. Opening this road segment to wet season traffic will increase the risk of road erosion and sediment introduction into the adjacent stream, which is tributary to Jose Creek. Until this road segment is surfaced (i.e., graveled) in 2010, this action is not compliant with BMPs or consistent with RCOs.

The increased closures also include a spring snowmelt closure that would be added to the Bald Mountain OHV Route (a NFTS motorized trail), which would be restricted from 1-April to 20-May. This would protect the route from damage that occurs when tires break through melting snow and rut the saturated road surface, while still providing for over-snow recreation until 1-April. This is expected to reduce the amount of sediment movement along the route and into stream channels, including ephemeral channels, and also to minimize stream bank deformation and the risk of stream capture at the diversion / gully location near PK-01zd. (Although much of the Bald Mountain Route lies on granite, it is not possible to protect the portions on soils while still allowing use of the granite areas.)

It is noteworthy that opening road 11S051 (in DNK) from 15-June to 15-October could have potential negative impacts on water resources. This road has been closed year-round for resource reasons. Current information on road condition, erosion and sediment delivery to streams is not available. Any increase in erosion and sediment delivery due to the addition of traffic would be minimized by maintaining the winter season closure.

Table 3- 97. Miles of Changes to Winter Season Road Restrictions in Alternative 4, Including Roads Closed Year-round

Analysis Unit	Change in Winter Closure Period								
	New (mi)	Modified >/= 15 days longer (mi)	Modified 16 - 30 days longer (mi)	Modified >30 days longer (mi)	Modified </= 15 days shorter (mi)	Modified 16 - 30 days shorter (mi)	Modified >30 days shorter (mi)	Removed (mi)	Total Changes (mi)
SFM	23.5	4.0	0	0	0	0	1.5	0	29.0
WES	53.9	0	0	95.0	0	0	2.4	0	160.5
GLO	55.7	0	0	293.5	0	0	3.8	0	353.0
GAG	44.9	0	0	136.2	0	0	3.0	0.3	184.5
MAM	24.7	0	0	66.8	0	0	0.5	0	92.0
SSB	20.0	37.5	4.2	135.5	0	9.1	43.7	0	250.0
EKP	2.7	0	0	54.0	0	0	0.2	0	56.9
JCH	15.6	12.1	0	33.4	0	0	8.4	0.4	69.9
TAD	55.7	23.6	2.8	188.3	0	7.7	18.3	0	296.4
DNK	82.1	25.5	26.5	160.0	1.3	3.2	46.4	0	345.0
TOTAL	**378.8**	**111.8**	**33.5**	**1162.8**	**1.3**	**20.0**	**128.1**	**0.7**	**1836.9**

New = road was previously not restricted in winter; Modified, longer = restriction period is being extended; modified, shorter = restriction period id being shortened; Removed = road was previously restricted in winter, would be opened during that time

Table 3- 98 shows the miles of roads and motorized trails in RCAs and the associated stream crossings that would be open all year or closed all year.

Table 3- 98. Alternative 4 – Miles of NFTS Roads and Motorized Trails Open Year-round in RCAs, Miles of NFTS Roads and Motorized Trails Closed Year-round in RCAs and Numbers of Stream Crossing on Those Roads and Motorized Trails

Analysis Unit	NFTS Roads and Motorized Trails Open Year-round in RCA (mi)	Crossings Open Year-round (# in RCA / # outside RCA / total #)	NFTS Roads and Motorized Trails Closed Year-round in RCA (mi)	Crossings Closed Year-round (# in RCA / # outside RCA / total #)
SFM	21	165 / 273 / 438	8	60 / 18 / 78
WES	38	283 / 384 / 667	20	114 / 44 / 158
GLO	3	5 / 5 / 10	20	118 / 85 / 203
GAG	4	53 / 82 / 135	16	95 / 123 / 218
MAM	11	44 / 44 / 88	9	9 / 67 / 116
SSB	0	6 / 8 / 14*	14	92 / 35 / 127
EKP	0	0 / 0 / 0	1	0 / 0 / 0
JCH	12	59 / 45 / 104	10	35 / 10 / 45
TAD	1	8 / 2 / 10	32	192 / 32 / 224
DNK	30	194 / 181 / 375	37	304 / 47 / 351
TOTAL	**120**	**817 / 1024 / 1841**	**167**	**1059 / 461 / 1520**

* These stream crossings are on road 8S008, which forms the boundary between SSB and JCH. In the GIS analysis for this table, the miles of roads open year-round in RCA were tallied with JCH, but the stream crossing points were tallied with SSB. This is why the number of miles open in RCAs in SSB is zero, even though the presence of stream crossings indicates that there are some open roads.

Compared to the existing condition (also the effects of Alternative 1), this alternative would result in about 84 percent fewer miles of road and motorized trail being open year-round in RCAs, and about twice as many miles in RCAs being closed year-round (refer to Table 3- 82 for the existing condition). The number of stream crossings on roads and motorized trails open year-round would be about 75 percent less than in Alternative 1, while the number of crossings closed year-round would almost double compared to Alternative 1. The net result would be the greatest reduction in the overall potential for erosion and sediment delivery from the NFTS produced by any alternative. There would be a beneficial effect on water resources due to greater protection of roads when wet, since the miles of roads with winter restrictions and miles of roads prohibited year-round would both increase.

Cumulative Effects

For the analysis of cumulative effects, the direct and indirect effects of this alternative were considered in combination with the past, present, and reasonably foreseeable actions listed in Appendix E, including grazing, timber management (Sugar Pine, Fish Camp, Dinkey North, Dinkey South, KREW Providence and KREW Bull, plantation maintenance and roadside hazard reduction), management and maintenance of NFTS facilities, continuing permitted special uses, and public recreation. The ERA model also accounted for the disturbances of past, present, and reasonably foreseeable future actions in each subdrainage.

Routes and/or areas would be added to the system in 18 HUC8 subdrainages that were evaluated in the Detailed CWE Assessment. The HUC8s that were evaluated in the Detailed Assessment for Alternative 4 are shown in Figure 3- 16 and are listed in Table 3- 99 and Table 3- 100. Table 3-

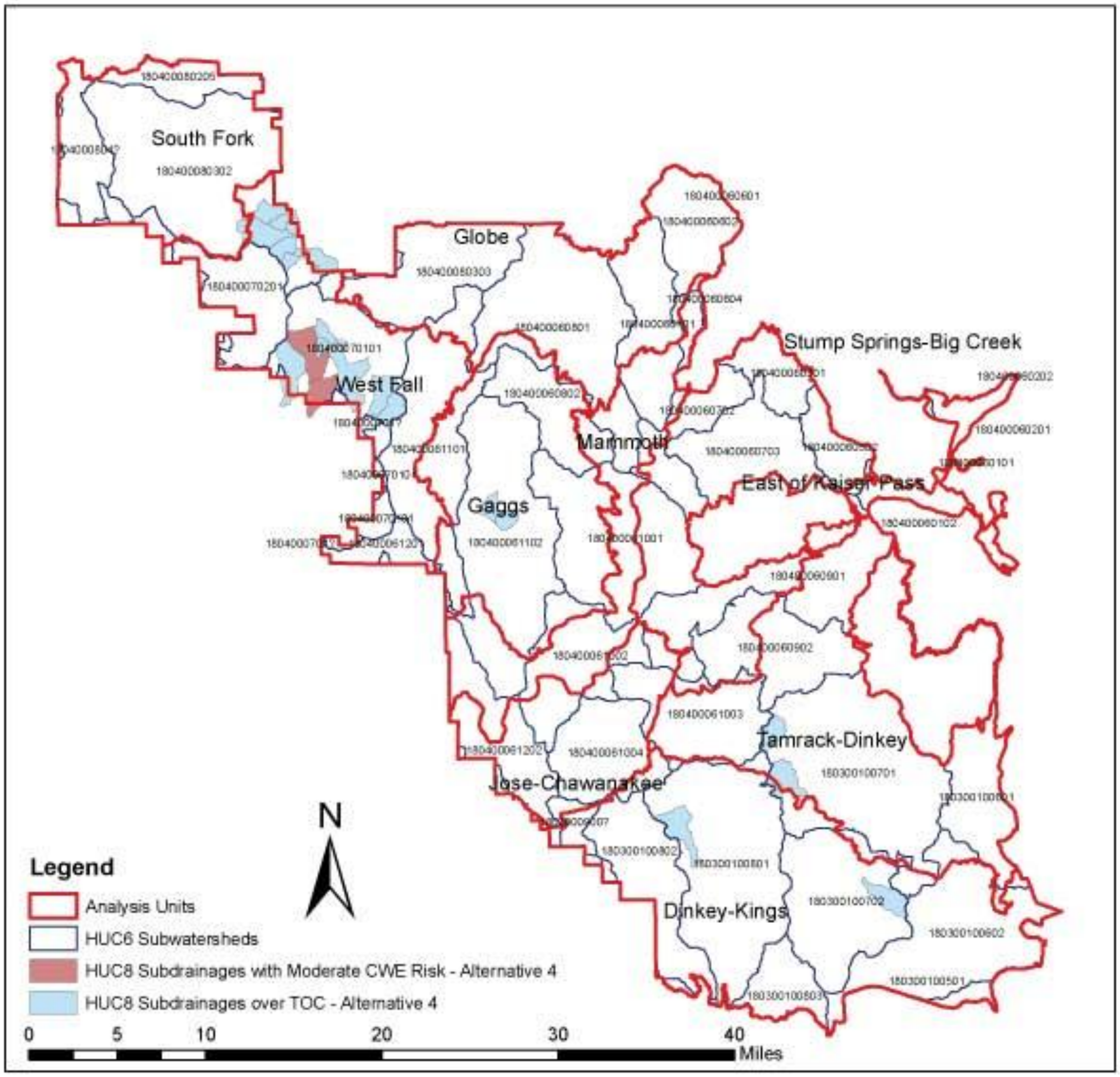
99 shows that the risk of CWEs in this alternative are the same as the risk under Alternative 3, and are reduced from the Alternative 1 risk in seven HUC8s. Because the risk of CWEs in Alternative 1includes continued cross-country vehicle travel, while Alternative 3 does not allow cross-country travel and adds no facilities to the NFTS, these two alternatives define the greatest risk of CWEs (Alternative 1) and the lowest risk (Alternative 3). Comparing Alternative 4 to these alternatives shows where the effects of this alternative differ from these reference points. The risk is the same for Alternatives 3 and 4 in each of the subdrainages, which indicates that the routes and areas added in Alternative 4 do not substantially increase the risk of CWEs over the risk that exists when adding none. There are seven subdrainages where the risk of CWEs in this alternative are lower than for Alternative 1, and 11 where the risk is the same (Low).

Table 3- 99. HUC8 Subdrainages Evaluated in the Detailed Cumulative Watershed Effects Assessment that have additions to the NTFS in Alternative 4 – Risk of CWEs compared to Alternatives 1 and 3

Analysis Unit	HUC8 #	Risk of CWEs		
		Alt 1	Alt 3	Alt 4
WES	501.0023	Low	Low	Low
	501.4002	Low	Low	Low
	501.4003	Moderate	Low	Low
	501.5101	Low	Low	Low
	503.0003	Moderate	Low	Low
	503.0011	Low	Low	Low
	503.0052	High	Low	Low
	503.0053	High	Moderate	Moderate
	503.0054	High	Moderate	Moderate
	503.0055	Low	Low	Low
	503.0056	Low	Low	Low
	503.3051	Moderate	Low	Low
GAG	504.2102	Low	Low	Low
	504.2151	Low	Low	Low
TAD	520.0017	Low	Low	Low
	520.5001	Low	Low	Low
DNK	520.3002	Low	Low	Low
	519.3053	High	Low	Low

Figure 3- 16. HUC8 subdrainages that were evaluated in the Detailed CWE Assessment for Alternative 4

In this alternative, no subdrainages were determined to have a High risk of CWEs. The determination of risk for each subdrainage assumes that the specified design features have been implemented.



In this alternative, 16 of the HUC8s were determined to have a Low risk of CWEs and two have a Moderate risk. There are no HUC8s that were determined to have a High risk of CWEs. The routes that would be added to the NFTS in the Miami area are limited to those with little or no potential for contributing to CWEs. As use of other routes ceases to occur and these areas recover over time, the existing CWE impacts in this area (increased sediment filling pools and unstable stream channel conditions in Miami Creek) may be reduced. Unauthorized routes with severe gullies will not fully recover without active restoration, but the amount of sediment they deliver to the stream network will be reduced once the mechanical erosion from motor vehicle traffic ceases to occur.

Table 3- 100. HUC8 Subdrainages Evaluated in the Detailed Cumulative Watershed Effects Assessment that have Additions to the NTFS in Alternative 4

Analysis Unit	Subws #	Lower TOC (%)	Alt 4 (%) ERA	Risk of CWEs	Alt 4 stream crossings	Contributing Routes and /or Areas[1]	HUC6
WES	501.0023	4	11.6	Low	0	none	180400 080302 W SFk Merced
	501.4002	4	7.6	Low	15	TH-41y, TH-67y	
	501.4003	4	8.0	Low	0	TH-60z	
	501.5101	4	11.6	Low	2	none	
	503.0003	5	3.5	Low	1	PK11a	180400 070101 Miami
	503.0011	5	4.6	Low	0	none	
	503.0052	4	5.5	Low	4	none	
	503.0053	4	2.1	Moderate	2	none	
	503.0054	4	4.3	Moderate	1	none	
	503.0055	4	8.0	Low	4	SR-4z	
	503.0056	4	10.5	Low	9	TH-04, TH-12	
	503.3051	4	13.5	Low	4	TH-01	
GAG	504.2102	4	5.1	Low	3	none	180400 061102 SFk Willow
	504.2151	4	6.7	Low	3	JSM56	
TAD	520.0017	4	6.8	Low	6	none	180300 100701 Upper Dinkey
	520.5001	5	5.1	Low	7	none	
DNK	520.3002	5	7.3	Low	0	KD-197	180300 100702 Lower Dinkey
	519.3053	5	9.1	Low	0	none	

[1]Routes and areas located within these subdrainages that are either not eroding or do not have potential to deliver eroded material to the stream network are not listed here.

HUCs 503.0003 and 503.0011 are currently above their lower TOC of 5 percent and under this Alternative would see a reduction in ERAs to below the TOC. This alternative has overall the same risks of CWEs as Alternative 3, because additions to the NFTS were avoided in High risk subdrainages, and because the design features minimize adverse impacts of the added facilities.

Considering past, present, and reasonably foreseeable actions, this alternative would not result in an increased risk of CWEs, and no cumulative adverse impacts, compared to Alternative 1. The overall cumulative effect would be beneficial due to the direct and indirect benefits resulting from the prohibition of cross-country motor vehicle travel and from the changes to the NFTS. In each HUC8 evaluated in the Detailed Assessment, including the Miami Creek area, the beneficial effect is essentially the same as it is in Alternative 3 because none of the facilities proposed to be added to the NFTS in this alternative contribute to the risk of CWEs.

Compliance of Alternative 4 with the LRMP and Other Direction

This alternative complies with the LRMP (including the SNFPA) and other direction. The prohibition of cross-country motor vehicle use would reduce the amount of sediment generated on unauthorized routes, which would recover over the long term. Meadows, streams and other hydrologically sensitive areas would have a reduced risk for direct damage in the absence of cross-country motorized use. Only selected routes would be added to the system and these would be brought up to standards to minimize their effects to peak flows and sediment delivery through implementation of BMPs and other specified measures and would be made consistent with RCOs. No routes in CARs or meadows would be added to the NFTS. The season of use of more roads would be consistent with BMPs and would provide protection against road surface deformation, flow concentration, erosion and sediment delivery – with the notable exception of 0.4 mile of 9S06, located in the RCA of the Jose Basin CAR, where winter season use is not consistent with BMPs or RCOs until this road segment is graveled (scheduled for 2010). Direction in the SNFPA to identify restoration opportunities (S&G #122) has been applied to the routes that were inventoried, but active restoration would not occur.

The analysis of this alternative was based on consideration of the best available science, including applicable peer-reviewed studies and local data.

The complete RCO Consistency Analysis is contained in Appendix J.

Alternative 5

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The effects of prohibiting cross-country motor vehicle travel would be the same as described under Alternative 2.

Additions to the NFTS

This alternative would add almost 22 miles of routes in RCAs, including 0.1 mi in the Jose Basin CAR. As shown in Table 3- 101, the added density in RCAs would be the highest in WES and GAG, which would also have the most stream crossings added. There would also be 6.7 ac of areas added in RCAs, including 0.4 ac in the Jose Basin CAR. There would be 157 miles of unauthorized routes in RCAs and 2133 stream crossings that would not be added to the NFTS in this alternative. The total number of miles of NFTS that would lie in RCAs as a result of this alternative would be increased by about 2 percent (1008 plus 21.7 miles), as would the total stream crossings on NFTS roads and trails. Open Areas, parking, and staging areas in RCAs would increase by about 25 percent.

Table 3- 101. Number and Density of Routes in RCAs and Stream Crossings and Acres of Added Areas in RCAs

These metrics are based on GIS analysis. Stream crossings include perennial, intermittent and ephemeral streams, some of which are actually unscoured swales.

Analysis Unit	Routes Added in RCA (mi)	Added route density in RCA (mi / mi^2)	Added crossings (#)	Added crossing density (# / mi^2)	Added Areas in RCA (ac)
SFM	1.7	0.05	25	0.2	0
WES	8.3	0.19	161	1.2	0
GLO	1.5	0.03	18	0.1	0
GAG	3.9	0.10	71	0.5	0
MAM	0.2	0.01	6	0.1	0
SSB	0.1	0	3	0	0
EKP	0.1	0	1	0	2.0
JCH	0.7	0.02	2	0	0.4
TAD	4.2	0.06	66	0.4	3.2
DNK	1.0	0.01	8	0.03	1.1
TOTAL / AVERAGE	**21.7**	**0.05**	**361**	**0.3**	**6.7**

As shown in Table 3- 102, 18 percent of the added roads, 30 percent of the added trails and 2 percent of the added areas are currently eroding. Most of the erosion will be remedied with the construction of appropriate surface drainage structures (see prescriptive actions for issue codes SW-2, SW-3, SW-4 in Appendix A). Other common needs include the repair of surface erosion (SW-14) and improvement of stream crossings (SW-8 and SW-9). The prescriptive actions are expected to minimize the concentration of runoff, erosion, sediment delivery and impacts to riparian areas and stream channels.

Table 3- 102. Miles of Routes and Acres of Areas with Known Erosion Features Added to the NFTS in Alternative 5

Analysis Unit	Added Roads total mi / eroding mi / percent eroding	Added Trails total mi / eroding mi / percent eroding	Added Areas total ac / eroding ac / percent eroding
SFM	1.6 / 0.1 / 6%	2.2 / 0.3 / 12%	0 / 0 / 0%
WES	3.1 / 0.7 / 22%	29.2 / 11.9 / 41%	26.4 / 0.2 / 1%
GLO	0 / 0 / 0%	4.8 / 1.3 / 28%	0 / 0 / 0%
GAG	3.5 / 0.6 / 17%	17.0 / 3.4 / 20%	71.9 / 0 / 0%
MAM	0.1 / 0 / 0%	1.3 / 0.4 / 28%	0 / 0 / 0%
SSB	0.8 / 0 / 0%	0 / 0 / 0%	0 / 0 / 0%
EKP	0.8 / 0 / 0%	0 / 0 / 0%	2.3/ 0.2 / 9%
JCH	0.9 / 0.2 / 18%	1.6 / 1.6 / 95%	0.7 / 0.03 / 5%
TAD	2.4 / 0.7 / 29%	15.6 / 2.8 / 18%	9.6 / 0 / 0%
DNK	1.1 / 0.4 / 37%	2.8 / 0.5 / 18%	5.8 / 2.3 / 40%
TOTAL/AVERAGE%	**14.3 / 2.6 / 18%**	**74.6 / 22.1 / 30%**	**116.6 / 2.8 / 2%**

Table 3- 103 shows that there are 12 locations on trails and 2 on roads added in this alternative where stream channel diversions are occurring, as well as 4 locations on added roads and 4 on added trails with the potential to divert streams in the near future. The prescriptive actions specified in Appendix A will address these locations, so that when they are added to the system there will be no diversions occurring and the potential for new ones will be minimized.

Table 3- 103. Number of Documented Stream Channel Diversions and Potential Diversion Locations Added to the NFTS in Alternative 5

Analysis Unit	Added Roads diversions / potential	Added Trails diversions / potential
SFM	0 / 0	0 / 1
WES	0 / 0	3 / 2
GLO	0 / 0	0 / 0
GAG	0 / 0	6 / 1
MAM	0 / 0	1 / 0
SSB	0 / 0	0 / 0
EKP	0 / 0	0 / 0
JCH	0 / 0	0 / 0
TAD	1 / 2	2 / 0
DNK	1 / 2	0 / 0
TOTAL	**2 / 4**	**12 / 4**

Changes to the NFTS (changing vehicle class, season of use and opening or closing roads)

Changing vehicle class between highway-legal vehicles, all vehicles and vehicles less than 50" are assumed to have no effect on the impacts of the NFTS and are therefore not considered in the water resources analysis (see Assumptions in section 3.10.1).

Seasonal closures during the winter period would be increased on 1632 mi, decreased on 168 mi and not changed on 1124 mi of NFTS roads. The types of changes are characterized in Table 3-104 to show the number of days the closure periods would change. Except for the Bald Mountain OHV Route (a NFTS motorized trail in TAD), the roads characterized as having a 'winter closure' are restricted from 15-December (or earlier) through April 1 (or later). Roads that are closed year-round are included in these figures; for example, a road that was previously prohibited year-round that is now open for part of the year would show up in the 'Modified >30 days shorter' category.

Table 3- 104. Miles of Changes to Winter Season Road Restrictions in Alternative 5 (Includes Roads Closed Year-round)

Analysis Unit	Change in Winter Closure Period								
	New (mi)	Modified >/= 15 days longer (mi)	Modified 16 - 30 days longer (mi)	Modified >30 days longer (mi)	Modified </= 15 days shorter (mi)	Modified 16 - 30 days shorter (mi)	Modified >30 days shorter (mi)	Removed (mi)	Total Changes (mi)
SFM	21.5	4.0	0	2.0	0	0	1.5	0	29.0
WES	36.7	9.2	0	99.6	0	0	3.9	0	149.3
GLO	16.1	0	0	295.8	0	0	5.5	0	317.4
GAG	12.1	18.6	0	164.0	0	0	6.6	0.3	201.6
MAM	9.2	0	0	64.4	0	0	6.2	0	79.8
SSB	19.8	37.5	4.2	135.7	0	9.1	44.1	0	250.4
EKP	2.7	0	0	54.0	0	0	0.2	0	56.9
JCH	13.0	12.1	0	36.0	0	0	8.4	0.4	69.9
TAD	50.5	23.6	2.8	193.5	0	7.7	21.4	0	299.5
DNK	75.3	26.5	26.5	164.9	1.3	3.2	48.7	0	346.4
TOTAL	**256.9**	**131.4**	**33.5**	**1209.9**	**1.3**	**20.0**	**146.4**	**0.7**	**1800.0**

New = road was previously not restricted in winter; Modified, longer = restriction period is being extended; modified, shorter = restriction period is being shortened; Removed = road was previously restricted in winter, would be opened during that time.

Overall, these changes would provide the necessary protection from the impacts of wet weather use on all of the miles shown, except for the 0.7 miles with the closures removed. These are the same road segments described in Alternative 4. Of the 0.7 miles with the winter closure removed, 0.3 mi is an aggregate surface road that lies within RCA and accesses private property. While there is a risk of some sediment generation due to wet season traffic in the RCA, the aggregate surfacing minimizes this risk and meets BMPs. The remaining 0.4 mi is a segment of road 9S06, which is a native surface road located in the RCA of the Jose Basin CAR. Opening this road segment to wet season traffic will increase the risk of road erosion and sediment introduction into the adjacent stream, which is tributary to Jose Creek. In the short term, this action is not compliant with BMPs or consistent with RCOs. However, the segment is scheduled to be surfaced (i.e., graveled) in 2010, and surfacing will bring it into compliance by minimizing erosion and sedimentation associated with wet weather use.

The increased closures also include a spring snowmelt closure that would be added to the Bald Mountain OHV Route, which would be restricted from 1-April to 20-May. This would protect the route from damage that occurs when tires break through melting snow and rut the saturated road surface, while still providing for over-snow recreation until 1-April. This is expected to reduce the amount of sediment movement along the route and into stream channels, including ephemeral channels and also to minimize stream bank deformation and the risk of stream capture at the diversion / gully location near PK-01zd. (Although much of the Bald Mountain Route lies on granite, it is not possible to protect the portions on soils while still allowing use of the granite areas.)

Table 3- 105. Alternative 5 – Miles of NFTS Roads and Motorized Trails Open Year-round in RCAs, Miles of Roads and Motorized Trails Closed Year-round in RCAs and Numbers of Stream Crossing on those Roads and Trails

Analysis Unit	NFTS Roads and Motorized Trails Open Year-round in RCA (mi)	Crossings Open Year-round (# in RCA / # outside RCA / total #)	NFTS Roads and Motorized Trails Closed Year-round in RCA (mi)	Crossings Closed Year-round (# in RCA / # outside RCA / total #)
SFM	21	165 / 273 / 438	7	55 / 9 / 64
WES	43	316 / 413 / 729	15	77 / 12 / 89
GLO	23	116 / 55 / 171	8	49 / 10 / 59
GAG	5	102 / 139 / 241	6	37 / 8 / 45
MAM	17	56 / 78 / 134	4	22 / 10 / 32
SSB	0.3	6 / 8 / 14	14	92 / 33 / 125
EKP	0	0 / 0 / 0	1	0 / 0 / 0
JCH	13	64 / 49 / 113	9	35 / 12 / 47
TAD	2	8 / 2 / 10	30	183 / 19 / 202
DNK	30	194 / 181 / 375	36	299 / 33 / 332
TOTAL	**155**	**1027 / 1198 / 2225**	**131**	**846 / 146 / 995**

Table 3- 105 shows that the roads open year-round in RCAs would be reduced by about 80 percent from the existing condition (see Table 3- 82). This is a slightly smaller reduction than would result from Alternative 4 (see Table 3- 98). There would be 60 percent more miles of roads in RCAs closed year-round in Alternative 5 compared to the existing condition. The number of stream crossings open to traffic year-round would be reduced by 74 percent compared to the existing condition, while the number closed year-round would increase by 25 percent, from 793 to 995. The net effect would be a greatly reduced potential for erosion and sediment delivery

from the NFTS. The reduction is slightly smaller than the reduction achieved by Alternative 4, but greater than the reduction under Alternative 2.

Cumulative Effects

For the analysis of cumulative effects, the direct and indirect effects of this alternative were considered in combination with the past, present, and reasonably foreseeable actions listed in Appendix E, including grazing, timber management (Sugar Pine, Fish Camp, Dinkey North, Dinkey South, KREW Providence and KREW Bull, plantation maintenance and roadside hazard reduction), management and maintenance of NFTS facilities, continuing permitted special uses, and public recreation. The ERA model also accounted for the disturbances of past, present, and reasonably foreseeable future actions in each subdrainage.

Routes and/or areas would be added to the system in 22 HUC8 subdrainages that were evaluated in the Detailed CWE Assessment. Table 3- 106 displays the risk of CWEs for each subdrainage in this alternative compared to the risk in Alternative 1 and Alternative 3. Because the risk of CWEs in Alternative 1 includes continued cross-country vehicle travel, while Alternative 3 does not allow cross-country travel and adds no facilities to the NFTS, these two alternatives define the greatest risk of CWEs (Alternative 1) and the lowest risk (Alternative 3). Comparing Alternative 5 to these alternatives shows where the effects of this alternative differ from these reference points. The risk is the same for all three of these alternatives in 12 of the subdrainages, which indicates that the routes and areas present in these HUC8s do not substantially affect the risk of CWEs. There are four subdrainages where the risk of CWEs in this alternative are the same as for Alternative 1, and one (503.0052) where the risk is lower than the risk for Alternative 1 but higher than for Alternative 3. Overall for this alternative, 17 HUC8s were determined to have a low risk of CWEs, three have a moderate risk, and two have a high risk. The determination of risk for each subdrainage assumes that the specified prescriptive actions in Appendix A have been implemented.

Table 3- 106. HUC8 Subdrainages Evaluated in the Detailed Cumulative Watershed Effects Assessment that have Additions to the NTFS in Alternative 5 – Risk of CWEs Compared to Alternative 1 and Alternative 3

Analysis Unit	HUC8	Risk of CWE		
		Alt 1	Alt 3	Alt 5
WES	501.0023	Low	Low	Low
	501.4002	Low	Low	Low
	501.4003	Moderate	Low	Moderate
	501.5101	Low	Low	Low
	503.0002	Moderate	Low	Low
	503.0003	Moderate	Low	Moderate
	503.0011	Low	Low	Low
	503.0052	High	Low	Moderate
	503.0053	High	Moderate	High
	503.0054	High	Moderate	High
	503.0055	Low	Low	Low
	503.0056	Low	Low	Low
	503.3051	Moderate	Low	Low
GAG	504.2008	Low	Low	Low
	504.2102	Low	Low	Low
	504.2151	Low	Low	Low
TAD	520.0017	Low	Low	Low
	520.0056	Low/Mod	Low	Low
	520.5001	Low	Low	Low
DNK	520.3002	Low	Low	Low
	519.3053	High	Low	Low
	519.4051	Low	Low	Low

Figure 3- 17 displays the HUC8s that were included in the Detailed CWE Assessment for Alternative 5, and Table 3- 107 shows a summary of the assessment.

Figure 3- 17. HUC8 Subdrainages that were Evaluated in the Detailed CWE Assessment for Alternative 5

Those with a high risk of CWEs are shaded darker.

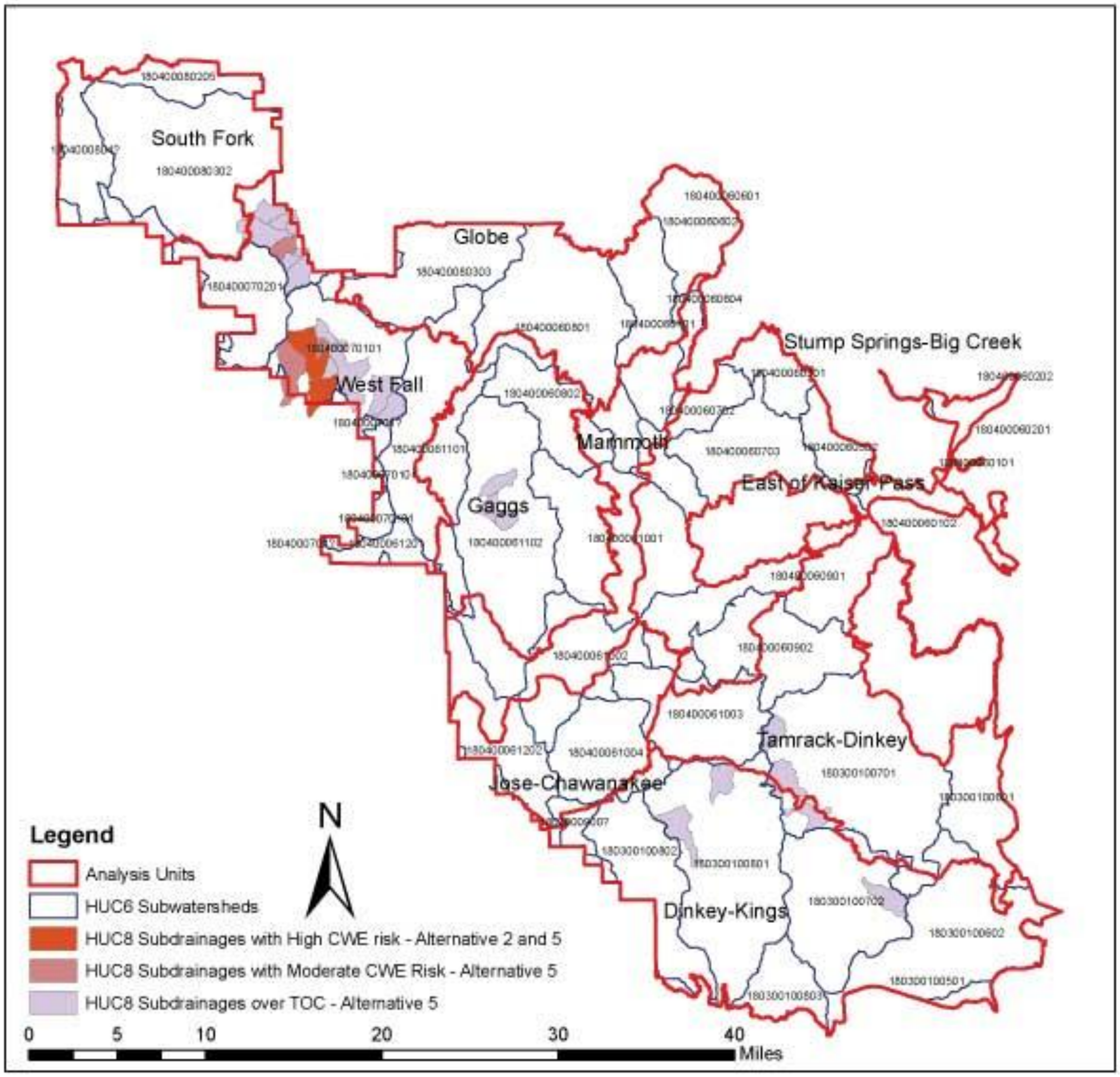


Table 3- 107. Subdrainages with Additions to the NTFS in Alternative 5 that are Over the Lower TOC

Analysis Unit	Subws #	Lower TOC (%)	Alt 5 percent ERA	Risk of CWEs	Alt5 stream crossings	Contributing Routes and /or Areas[1]	HUC6
WES	501.0023	4	11.6	Low	0	none	18040008 0302 W SFk Merced
	501.4002	4	6.7	Low	20	TH-41y, TH-67y, TH-68z	
	501.4003	4	8.2	Moderate	6	TH-60z, TH-67z, TH-68z	
	501.5101	4	11.6	Low	2	none	
	503.0002	4	3.1	Low	0	none	18040007 0101 Miami
	503.0003	5	4.5	Moderate	16	PK11a, PK24	
	503.0011	5	4.7	Low	0	none	
	503.0052	4	5.8	Moderate	13	none	
	503.0053	4	2.7	High	21	SR-21z, SV16	
	503.0054	4	4.6	High	8	SR-92	
	503.0055	4	8.1	Low	28	JM-2y, JM-21y, SR-4z, SV31	
	503.0056	4	10.6	Low	14	TH-04, TH-12	
	503.3051	4	13.6	Low	12	TH-01, TH-02	
GAG	504.2008	4	5.2	Low	0	RCKCRKSP R391	18040006 1102 SFk Willow
	504.2102	4	5.1	Low	3	none	
	504.2151	4	6.7	Low	3	JSM56	
TAD	520.0017	4	6.8	Low	6	none	18030010 0701 Upper Dinkey
	520.0056	5	13.9	Low	0	none	
	520.5001	5	5.2	Low	4	none	
DNK	519.3053	5	9.1	Low	0	none	18030010 0702 Lower Dinkey
	520.3002	5	7.3	Low	0	none	
	519.4051	4	9.8	Low	0	AE-23, BLUCYN4, BLUCYN6	18030010 0801 Kings Big Cr

[1]Routes and areas located within these subdrainages that are either not eroding or do not have potential to deliver eroded material to the stream network are not listed here.

This alternative would add the most routes in HUC8s that were evaluated in the Detailed CWE Assessment and has more routes needing work to limit the potential for CWEs than any other alternative. In the Miami HUC6, where CWEs are currently occurring and which continues to be at high risk in this alternative, there would be a total of 112 stream crossings on added routes. Fourteen (14) routes would be added that have been identified as potentially contributing to CWEs. The work specified in Appendix A will minimize their contribution and these routes will be maintained as necessary to limit their contribution in the future.

Considering past, present, and reasonably foreseeable actions, this alternative would not result in an increased risk of CWEs, compared to Alternative 1. The overall cumulative effect would be beneficial due to the direct and indirect benefits resulting from the prohibition of cross-country motor vehicle travel and the changes to the NFTS. In four of the five subdrainages at Moderate or High risk, including three in the Miami Creek area, the risk of CWEs would not be substantially reduced compared to Alternative 1, due to the location and condition of some of the trails proposed to be added to the NFTS in this Alternative.

Compliance of Alternative 5 with the LRMP and Other Direction

This alternative complies with the LRMP (including the SNFPA) and other direction. The prohibition of cross-country motor vehicle use would reduce the amount of sediment generated on unauthorized routes, most of which would recover over the long term. Meadows, streams and other hydrologically sensitive areas would have a reduced risk for direct damage in the absence of cross-country motorized use. Only selected routes would be added to the system and these would be brought up to standards to minimize their effects to peak flows and sediment delivery, including the implementation of BMPs and would be made consistent with RCOs. There would be one route and one area (SR-36 and area SGRLFHL223) added to the NFTS in the Jose Basin CAR; however, field evaluation determined that these features do not have effects on the aquatic or riparian areas in the CAR and these additions to the NFTS are therefore consistent with RCOs for the CAR. No routes would be added in meadows. The season of use of more roads would be consistent with BMPs and would provide protection against road surface deformation, flow concentration, erosion and sediment delivery. There is 0.4 mile of 9S06, located in the RCA of the Jose Basin CAR, where winter season use will not be consistent with BMPs or RCOs until this road segment is graveled, which is scheduled to occur in 2010. Direction in the SNFPA to identify restoration opportunities (S&G #122) has been applied to the routes that were inventoried, but active restoration would not occur as a result of this alternative.

The analysis of this alternative was based on consideration of the best available science, including applicable peer-reviewed studies and local data.

The complete RCO Consistency Analysis is contained in Appendix J.

Compliance with the Travel Management Rule

With the implementation of the prescriptive actions specified in Appendix A, Alternatives 2-5 would be in compliance with the Travel Management Rule for minimizing effects to watershed resources.

Summary of the Forestwide Effects Analysis across All Alternatives

The following tables contain summaries of the Forestwide discussion of the environmental consequences of the alternatives. Table 3- 108 displays a summary of the indicators used in the discussion. Table 3- 109 shows the conclusions from the Detailed CWE Assessment. Table 3- 110 displays the indicators that were used in the Detailed CWE Assessment.

Table 3- 108. Summary of Forestwide Environmental Consequences

Indicator	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Unauthorized miles open in RCA	156	0	0	0	0
Unauthorized miles open in CAR	33.7	0	0	0	0
Miles added in RCA	0	9.7	0	11.2	21.7
Miles added in CAR	0	0	0	0	0.1
Acres of areas added in RCA	0	3.1	0	3.3	6.7
Acres of areas added in CAR	0	0	0	0	0.4
Number of stream crossings on unauthorized routes added to NFTS or open to use	2251	235	0	188	361
Miles of eroding routes added	0	15.5	0	10.7	24.7
Number of diversions/potential diversions added	0	2 / 4	0	5 / 4	14 / 8
Miles with new winter closure added	0	180	0	379	257
Miles with winter closure removed	0	5	0	1	1

Table 3- 109. Summary of the Detailed Assessment Conclusions Regarding the Risk of Cumulative Watershed Effects by Alternative

Indicator		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Baseline CWE Analysis: Number of HUC8s (with motor vehicle use on open or added routes) that are over the lower TOC		96	13	0	18	22
Detailed CWE Assessment: Number of HUC8s (with motor vehicle use on open or added routes) with CWE potential:	Low	15	9	21	16	17
	Moderate	5	2	3	2	3
	High	5	2	1	0	2

Table 3- 110. Summary of Detailed CWE Assessment – Risk of CWEs for each Alternative

HUC8 ID	Lower TOC	Alternative 1			Alternative 2			Alternative 3		Alternative 4			Alternative 5		
		Total ERA percent	Stream Crossing	Risk of CWE	Total ERA percent	Stream Crossing	Risk of CWE	Total ERA percent	Risk of CWE	Total ERA percent	Stream Crossing	Risk of CWE	Total ERA percent	Stream Crossings	Risk of CWE
501.0023	4%	11.68	0	Low	-	-	-	11.54	Low	11.59	0	Low	11.59	0	Low
501.4002	4%	7.74	32	Low	7.53	20	Low	7.48	Low	7.59	15	Low	6.71	20	Low
501.4003	4%	8.44	7	Moderate	7.96	4	Low	7.93	Low	7.96	0	Low	8.16	6	Moderate
501.5101	4%	11.61	5	Low	11.56	2	Low	11.55	Low	11.59	2	Low	11.59	2	Low
503.0002	4%	4.18	5	Moderate	3.05	0	Low	3.02	Low	-	-	-	3.06	0	Low
503.0003	5%	5.53	26	Moderate	3.55	13	Moderate	3.16	Low	3.49	1	Low	4.46	16	Moderate
503.0006	4%	11.87	0	Low	-	-	-	11.85	Low	-	-	-	-	-	-
503.0011	5%	5.13	8	Low	-	-	-	4.48	Low	4.64	0	Low	4.69	0	Low
503.0052	4%	6.43	52	High	5.56	9	Moderate	5.5	Low	5.54	4	Low	5.77	13	Moderate
503.0053	4%	3.08	68	High	2.21	40	High	1.99	Moderate	2.09	2	Moderate	2.7	21	High
503.0054	4%	5.42	55	High	4.37	16	High	4.23	Moderate	4.32	1	Moderate	4.55	8	High
503.0055	4%	8.59	60	Low	7.95	23	Low	7.90	Low	7.97	4	Low	8.09	28	Low
503.0056	4%	10.77	20	Low	-	-	-	10.33	Low	10.51	9	Low	10.62	14	Low
503.3051	4%	13.98	28	Moderate	-	-	-	13.46	Low	13.5	4	Low	13.62	12	Low
504.2008	4%	5.34	3	Low	-	-	-	1.49	Low	-	-	-	5.16	0	Low
504.2102	4%	5.2	5	Low	-	-	-	5.05	Low	5.14	3	Low	5.14	3	Low
504.2151	4%	7.1	12	Low	-	-	-	6.18	Low	6.68	3	Low	6.68	3	Low
504.2251	5%	23.5	35	High	-	-	-	22.25	High	-	-	-	-	-	-
519.3053	5%	9.27	2	High	-	-	-	9.07	Low	9.07	0	Low	9.07	0	Low
519.4051	4%	9.8	2	Low	-	-	-	9.72	Low	-	-	-	9.76	0	Low
520.0017	4%	7.12	30	Low	6.71	2	Low	6.7	Low	6.76	6	Low	6.76	6	Low
520.0056	5%	14.14	4	Low/Mod	13.89	0	Low	13.89	Low	-	-	-	13.89	0	Low
520.3002	5%	7.4	1	Low	7.26	1	Low	7.25	Low	7.29	0	Low	7.29	0	Low
520.3003	4%	4.55	3	Moderate	-	-	-	4.42	Moderate	-	-	-	-	-	-
520.5001	5%	5.76	32	Low	5.03	10	Low	4.94	Low	5.13	7	Low	5.19	4	Low

Missing values (“-“) indicates that the subdrainage was not involved in the alternative