3.9 Geological Resources

3.9.1 Introduction

National Forest management activities, including development of geologic resources, can result in ecosystem damage when the activity's location, design, construction or implementation is not based on an understanding of geologic conditions and geomorphic processes.

Geological resources affect all aspects of NFS lands. Geological resources include cave management, paleontological resources, geological special interest areas and groundwater management. Geological hazards can impact public safety on NFS lands. Hazards can include rock falls, debris flows, slope stability issues and public health concerns.

Geology determines watershed morphology, soils types and other essential functions for NFS lands. Groundwater is a valuable resource that may be affected by project planning. Mining and minerals management is included in the management of NFS lands could be affected by the proposed project.

Mining related hazards are a concern for public safety as the National Forests have potentially dangerous abandoned mine shafts and hazardous products in the areas of the proposed action.

The proposed action could potentially impact geological resources. Geologic and mining related hazards could be impacted which could result in a threat to public health and safety.

Analysis Framework: Statute, Regulation, LRMP and Other Direction

The following statutory authorities govern geologic resources and services activities essential to Forest Service programs:

1. **Watershed Protection and Flood Prevention Act of August 4, 1954, as Amended (68 Stat. 666; 16 U.S.C. 1001). (FSM 2501.1.)** This act authorizes the Secretary of Agriculture to share costs with other agencies in recreational development, groundwater recharge and water-quality management, as well as the conservation and proper use of land.

2. **Federal Water Pollution Control Act of July 9, 1956, as Amended (33 U.S.C. 1151) (FSM 2501.1); Federal Water Pollution Control Act Amendments of 1972 (86 Stat. 816) (FSM 2501.1) and Clean Water Act of 1977 (91 Stat. 1566; 33 U.S.C. 1251). (FSM 2501.1, 7440.1.)** These acts are intended to enhance the quality and value of the water resource and to establish a National policy for the prevention, control and abatement of water pollution. Groundwater information, including that concerning recharge and discharge areas and information on geologic conditions that affect groundwater quality are needed to carry out purposes of these acts.

3. **National Forest Roads and Trails Systems Act of October 13, 1964 (78 Stat. 1089; 16 U.S.C. 532-538). (FSM 7701.1.)** This act provides for the construction and maintenance of an adequate system of roads and trails to meet the demands for timber, recreation and other uses. It further provides that protection, development and management of lands will be under the principles of multiple use and sustained yield of product and services (16 U.S.C. 532). Geologic conditions influence the final selection of route locations.

4. **Mining and Minerals Policy Act of December 31, 1970 (84 Stat. 1876; 30 U.S.C. 21a).** This act provides for the study and development of methods for the disposal, control and reclamation of mineral waste products and the reclamation of mined lands. This requires an evaluation of geology as it relates to groundwater protection and geologic stability.

5**. Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 (RPA) (88 Stat. 476; 16 U.S.C. 1600-1614) as Amended by National Forest Management Act of October 22, 1976 (90 Stat. 2949; 16 U.S.C. 1609). (FSM 1920 and FSM 2550.)** This act requires consideration of the geologic environment through the identification of hazardous conditions and the prevention of irreversible damages. The Secretary of Agriculture is required, in the development and maintenance of land management plans, to use a systematic interdisciplinary approach to achieve integrated consideration of physical, biological, economic and other sciences.

6. **Surface Mining Control and Reclamation Act of August 3, 1977 (SMCRA) (30 U.S.C. 1201, 1202, 1211, 1221-43, 1251-79, 1281, 1291, 1309, 1311-16, 1321-28)**. This act enables agencies to take action to prevent water pollution from current mining activities and also promote reclamation of mined areas left without adequate reclamation prior to this act.

7. **Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA) (94 Stat. 2767; 42 U.S.C. 9601, et seq).** This act provides authority to the Environmental Protection Agency and to other Federal agencies, including the United States Department of Agriculture, to respond to release of hazardous substances, pollutants and constituents. It also provides for joint and several liability to potentially responsible parties (PRPs) for cleanup costs of existing water contamination. See also FSM 2160.

8. **Federal Cave Resources Protection Act of 1988 (102 Stat. 4546; 16 U.S.C. 4301 et seq)**. This act provides that Federal lands be managed to protect and maintain, to the extent practical, significant caves.

9. **FSM-2880.12 - Executive Orders.** The following Executive Orders provide direction for geologic resources and services activities on National Forest System lands:

> **Executive Order 12113, Independent Water Project Review, January 5, 1979.** This Executive Order requires an independent water project review by the Water Resources Council on preauthorization reports and preconstruction plans for Federal and Federally assisted water and related land resource plans. The technical review will evaluate each plan for compliance with the Council's principles and standards, agency procedures, other Federal laws and goals for public involvement.

10. **LRMP Soils Standards and Guidelines for General Forest.** The LRMP identifies three areas as Special Interest Areas for geological resources. There are: Kings Cavern Geological Area (388 acres), Courtright Intrusive Contact Zone and Geological Area (11 acres) and Dinkey Creek Roof Pendant Geological Area (640 acres).

Methodology

The geologic assessment conducted for the travel management project included potential hazards from abandoned mine lands (AML), potential hazards from Natural Occurring Asbestos (NOA), potential hazards from landslides, potential impacts to groundwater and groundwater dependent ecosystems and potential impacts from OHV use in Geologic Special Interest Areas.

Abandoned Mine Lands

Assessment for hazards associated with abandoned mine lands (AML) was conducted at the forest scale using two databases and GIS. A database of unauthorized routes was analyzed for proximity to AML sites in two public databases; see “Data Sources” for more information. Four categories of distance were used: unauthorized routes intersecting AML sites, those routes within

a 200 ft radius, those greater than 200 ft to and less than 0.25 mile radius and those greater than 0.25 mi. and less than 0.50 mile radius to AML sites in the database.

Assumptions

1. Significant mining operations appear in at least one of the databases used in this assessment. Mining operation sites not included in one of these databases were not considered. Unmarked sites may exist in the forest.

2. Where a precise location is recorded in the source documentation for a mine site, that location is reported in the Mineral Resource Data System (MRDS) (Schweitzer 2009).

3. All vehicle class types (both greater than and less than 50" vehicle types) result in the same effects.

4. 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. Therefore the environmental consequences have been analyzed and will not be discussed further in the geologic resources section.

Data Sources

1. TOMS (Topographically Occurring Map Symbols) database, available from California Department of Conservation. The TOMS database is an inventory of mining features located on USGS 7.5 minutes topographic quadrangles.

2. MRDS (Mineral Resource Data System) database, available from the United States Geological Survey (USGS).

Recommended AML Assessment Priorities

1. As there are no AML sites within 200 feet of any proposed motorized trail or road in the action alternatives (Alternative, 2, 4 and 5) proposed roads or motorized trails identified within a 0.25 mile radius of an AML site are recommended as first priority AML sites to be analyzed by the Forest AML program. These would be open to the public.

2. Proposed roads or motorized trails identified within a 0.50 mile radius of an AML site are recommended to become the second priority AML sites to be analyzed by the Forest AML program. These would be open to the public.

Natural Occurring Asbestos (NOA)

Natural occurring asbestos was evaluated and is documented in the air quality section of the EIS. See air quality section for further discussion of NOA.

Landslide Hazards

Landslide hazards were evaluated and determined not to be a concern for potential impacts to the general public. Field review and assessment identified one unauthorized route, SR21z, with a slope stability concerns. This unstable area is approximately 80 ft long and is located at an approach to a channel crossing. This section of trail will have to be reconstructed and stabilized prior to opening up the trail. Landslide hazards will not be addressed any further in the geology section of this FEIS.

Groundwater and Groundwater Dependent Ecosystems

The presence and use of motor vehicle facilities was determined not to be a concern to groundwater and not to be in any violation of LRMP direction. Potential impacts to groundwater dependent ecosystems, such as meadows and springs were assessed and addressed in the aquatics and water section of the EIS. See aquatics and water sections for further discussion on groundwater dependent ecosystems.

Geologic Special Interest Areas

The SNF has three Geologic Special Interest Areas, including the Kings River Geological Area, the Dinkey Creek Roof Pendant Geological Area and the Courtright Intrusive Zone Geologic Area. Unauthorized routes are not located within the Kings River Geological Area and the Courtright Intrusive Zone Geologic Area. Unauthorized routes KD-248 and KD-249 are located in the Dinkey Creek Roof Pendant Geological Area. These unauthorized routes are included only in Alternative 1 and are currently being used. It is unknown if they are causing resource damage. There has been reported damage in the Courtright Intrusive Zone Geologic Area by unauthorized motor vehicle use. Barriers have been installed in an attempt to keep motor vehicle use out of this area. In summary, the Alternatives 2, 3, 4, 5 will have no effect to Geologic Special Interest Areas on the SNF. Geologic Special Interest Areas will not be addressed any further.

3.9.2 Affected Environment – Abandoned Mine Lands

Table 3- 61 summarizes the number of unauthorized routes or proposed facilities contributing to AML accessibility and exposure by alternative and distance.

Table 3- 61. Summary of Unauthorized Routes or Proposed Facilities Contributing to AML Accessibility and Exposure

	Alt 1		Alt 2		Alt 3		Alt4		Alt 5	
Distance	Unauthorized Routes	Use Areas	Proposed Trails	Use Areas	Proposed Trails	Use Areas	Proposed Trails	Use Areas	Proposed Trails	Use Areas
Intersect	2	0	0	0	0	0	0	0	0	0
200 ft	16	0	0	0	0	0	0	0	0	0
0.25 mi	157	0	11	0	0	0	1	0	5	0
0.5 mi	437	0	22	0	0	0	2	1	13	1

3.9.3 Environmental Consequences-Abandoned Mine Lands

Alternative 1

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The direct effect of cross-country motorized travel is that 605,000 acres of SNF lands are open to exposure and accessibility to AML sites and associated hazards. There are 612 unauthorized

routes within half mile of known AML sites. Table 3- 62 summarizes this data for Alternative 1. See Abandoned Mine Land Report for list of those within 0.5 miles of AML.

Table 3- 62. Alternative 1 – Unauthorized Routes by Distance and Database

Distance	Unique Routes	Areas	Number of Routes	Number of Mines
Intersect	2	0		
			2	1
200 feet	15	0		
			5	4
			11	8
			2	1
>200ft. - <0.25 mi	157	0		
			119	50
			84	37
			3	1
>0.25mi - <0.5 mi	437	0		
			479	111
			243	75
			14	3

Additions to the NFTS

No facilities are proposed to be added to the NFTS in this alternative, there are no direct or indirect effects of this action.

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

There are no changes to the NFTS in Alternative 1; therefore there are no direct or indirect effects.

Cumulative Effects

Alternative 1 would have the greatest potential for causing adverse cumulative effects to public safety because when added to the past, present and reasonably foreseeable actions, the probable proliferation of motorized access to lands adjacent to AML sites on the SNF would increase accessibility to these hazards. There will be 612 unauthorized routes within 0.5 miles of AML, which could be accessed by motor vehicle users.

Alternative 2

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The direct effect would be beneficial to public safety because prohibition of motorized cross county travel would restrict public accessibility and exposure to AML sites. SNF visitors would be unable to use motor vehicles to purposefully search for most of the inventoried AML sites.

The indirect effect of prohibiting cross-country motorized travel is decreased accidental exposure of AML sites. Accidental exposure could occur from a user following an abandoned access trail to a mine site.

Additions to the NFTS

Compared to Alternative 1 the direct and indirect effects of adding facilities are decreased access and exposure to AML sites and associated hazards such as unstable adits and shafts with collapse potential, drop-offs, pits, contaminated tailings and trapped gas. Alternative 2 has 34 proposed facilities within 1/2 mile from a known AML (Table 3- 63). OHV Route JM-36 was identified as being within 200 feet of an AML. This AML site was assessed and deemed safe from mining related hazards.

Table 3- 63. Alternative 2 – Facilities by Distance and Database

Distance	Unique Facilities	Areas	Number of Facilities	Number of Mines
Intersect	0	0		
			0	0
200 feet	1	0		
			1	1
			0	0
			0	0
>200ft. - <0.25 mi	11	0		
			9	9
			2	2
			0	0
>0.25mi - <0.5 mi	22	0		
			18	20
			4	5
			0	0

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

Changes of vehicle class and season of use for the existing NFTS are not expected to have a direct or indirect effect on public safety due to exposure to AML sites.

Cumulative Effects

Cumulative effects include direct and indirect effects under the prohibition action, adding facilities and changing facilities. These effects will be added to the current effects from the NFTS. Thirty-four proposed motorized trails would be within 0.5 miles of AML, which could be within walking distance of users of the trails. See Table 3- 61 for summary information of the number of routes contributing to AML accessibility and exposure by alternative and distance. When compared to Alternative 1, accessibility and exposure to AML sites is reduced in Alternative 2.

Alternative 3

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The direct effect would be beneficial to public safety because prohibition of motorized cross county travel would restrict public accessibility and exposure to most of the inventoried AML sites. Forest visitors would be unable to use motor vehicles to purposefully search for AML sites. The indirect effect of prohibiting cross-country motorized travel is decreased accidental exposure of AML sites. Accidental exposure could occur from a user following an abandoned access trail to a mine site.

Additions to the NFTS

No facilities are proposed to be added to the NFTS in alternative, there are no direct or indirect effects of this action.

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

There are no changes to the NFTS in Alternative 3; therefore there are no direct or indirect effects.

Cumulative Effects

When added to the past, present and reasonably foreseeable actions, it is likely there would be a beneficial cumulative effect from prohibiting cross-country travel in Alternative 3. The positive cumulative effect would be benefit public safety because prohibition of motorized cross county travel would restrict public accessibility and exposure to most of the inventoried AML sites. OHV users would not be able to access these sites and place themselves at risk from hazards associated with AML, without walking from NFTS roads and trails.

Alternative 4

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The direct effect would be beneficial to public safety because prohibition of motorized cross county travel would restrict public accessibility and exposure to most of the inventoried AML sites. SNF visitors would be unable to use motor vehicles to purposefully search for AML sites. The indirect effect of prohibiting cross-country motorized travel is decreased accidental exposure of AML sites. Accidental exposure could occur from a user following an abandoned access trail to a mine site.

Additions to the NFTS

Compared to Alternative 1 the direct effects of adding facilities are decreased access and exposure to AML sites and associated hazards such as unstable adits and shafts with collapse potential, drop-offs, pits, contaminated tailings and trapped gas. Alternative 4 have three proposed facilities and one proposed area within 1/2 mile from a known AML sites (Table 3- 64).

Table 3- 64. Alternative 4 – Facilities by Distance and Database

Distance	Unique Facilities	Areas	Number of Facilities	Number of Mines
Intersect	0	0	0	0
200 feet	0	0	0 0 0	0 0 0
>200ft. - <0.25 mi	1	0	0 1 0	0 1 0
>0.25mi - <0.5 mi	2	1	1 1 0	1 1 0

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

Changes of vehicle class and season of use for the existing NFTS are not expected to have a direct or indirect effect on public safety due to exposure to AML sites.

Cumulative Effects

Cumulative effects include direct and indirect effects under the prohibition action, adding facilities and changing facilities. These effects will be added to the current effects from the NFTS. Three proposed motorized trails would be within 0.5 miles of AML, which could be within walking distance of the trails. See for summary information of the number of routes contributing to AML accessibility and exposure by alternative and distance. See Abandoned Mine Land Report for list of those within 0 .5 miles of AML. Public exposure to AML sites within0 .5 miles of the proposed facilities are minimal and will be short term (less than 5 years) until the AML site is assessed and the hazards are reduced. When compared to Alternative 1, accessibility and exposure to AML sites is reduced in Alternative 4.

Alternative 5

Direct and Indirect Effects

Cross-country Motor Vehicle Travel

The direct effect would be beneficial to public safety because prohibition of motorized cross county travel would restrict public accessibility and exposure to most of the inventoried AML sites. SNF visitors would be unable to use motor vehicles to purposefully search for AML sites. The indirect effect of prohibiting cross-country motorized travel is decreased accidental exposure of AML sites. Accidental exposure could occur from a user following an abandoned access trail to a mine site.

Additions to the NFTS

Compared to Alternative 1 the direct effects of adding facilities are decreased access and exposure to AML sites and associated hazards such as unstable adits and shafts with collapse potential, drop-offs, pits, contaminated tailings and trapped gas. Alternative 5 have 18 proposed facilities and 1 proposed area within 0.5 mile from known AML sites (Table 3- 65). Route JM-36 was identified as being within 200 feet of an AML. This AML site was assessed and deemed safe from mining related hazards.

Table 3- 65. Alternative 5 – Facilities by Distance and Database

Distance	Unique Facilities	Areas	Number of Facilities	Number of Mines
Intersect	0	0		
			0	0
200 feet	0	0		
			1	1
			0	0
			0	0
>200ft. - <0.25 mi	5	0		
			4	3
			1	1
			0	0
>0.25mi - <0.5 mi	13	1		
			13	4
			1	1
			0	0

Changes to the NFTS (this includes changing season of use, changing vehicle class, and opening or closing roads).Changes of vehicle class and season of use for the existing NFTS are not expected to have a direct or indirect effect on public safety due to exposure to AML sites.

Cumulative Effects

Cumulative effects include direct and indirect effects under the prohibition action, adding facilities and changing facilities. These effects will be added to the current effects from the NFTS. The addition of trails to the existing NFTS will increase accessibility and exposure to AML sites. However, there will be 18 NFTS trails and one area within 0.5 miles of AML, which could be within walking distance of the trail. See Table 3- 61 for summary information of the number of routes contributing to AML accessibility and exposure by alternative and distance. See Abandoned Mine Land Report for list of those within 0.5 mile of AML. Public exposure to AML sites within 0.5 miles of the proposed facilities are minimal and will be short term (less than 5 years) until the AML site is assessed and the hazards are reduced. When compared to Alternative 1, accessibility and exposure to AML sites is reduced in Alternative 5.